MS1-Extra MS2-Extra and MS3

Knock Detection

Knock (or detonation) is the sound of uncontrolled burning of the air/fuel mix causing the pressure to suddenly increase within the cylinder. Many factors can cause this, air temperature, coolant temperature, air/fuel mix, air density, etc.

A knock sensor can be used to detect this sound, but it can be very hard to setup or tune as most manufacturers will have spent a lot of time and effort tuning their sensor for a specific frequency. For example the sensor on the Corvette (GM PN 1997562, 1997699) is designed to pick up around 5.2Khz and operates around 4800 - 5600 RPM. So just by bolting a sensor to your engine block you are not necessarily going to detect any harmful knocks.

The best option as far as tuning goes, is to use a pair of air defenders without any wadding in them. Simply get a piece of copper pipe (brake pipe) and flatten one end of it enough to bolt it to the cylinder head. Then attach a piece of plastic tube (fish tank air pipe) on the other end of the copper pipe. Drill a small hole in one of the ear pieces and push the other end of the pipe into it. Now any knock you will be able to hear clearly whilst tuning.

Please note that the MS2 PnP ECUs for MX5's already have this conditioner built in. So simply connect the 2 wires, in the mini loom I provide, to the knock sensor and away you go. Adjustment for sensitivity is inside the ECU.

ExtraEFI Knock Conditioner:

2 Knock Sensor Inputs with Isolated Band Pass Filters - designed to work within the frequency range of most OEM sensors.
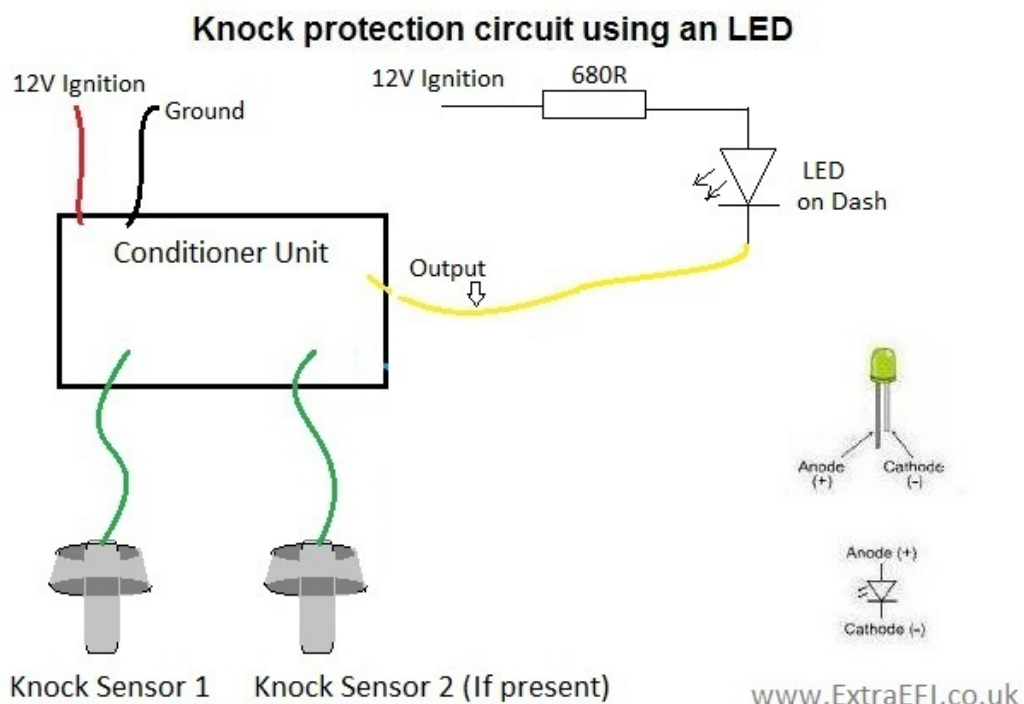
Adjustable Sensitivity - The conditioner can be adjusted to ensure it triggers at the desired voltage level.

LED indication - The case has a built in LED to show when knock has been detected.

MS ECU compatable output - The output is regulated to 5V making it compatable to directly wire to an MS ECU. This can also be used to trigger an external LED (dash board mounted) if needed.
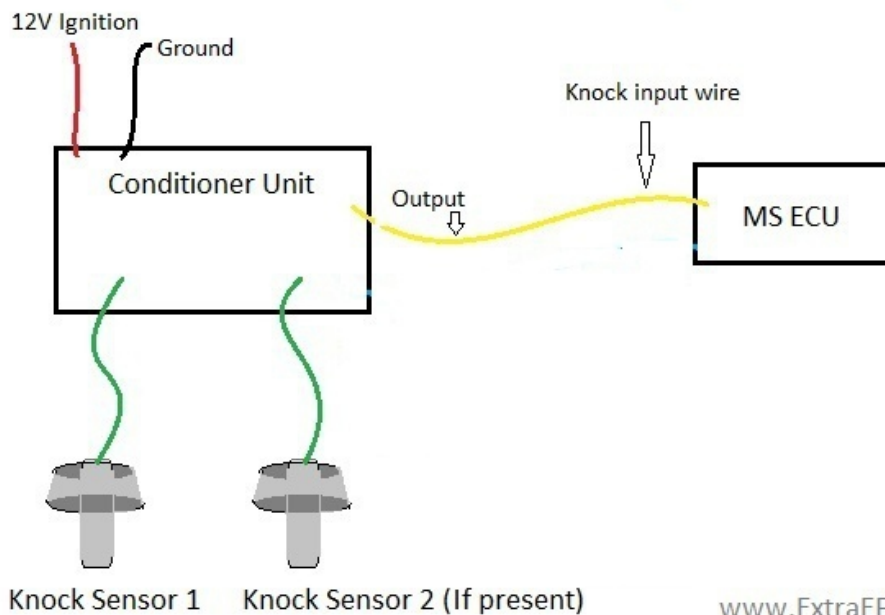
Please remember that this is not a magic pill, if you have detonation then you have issues you need to address and cure!
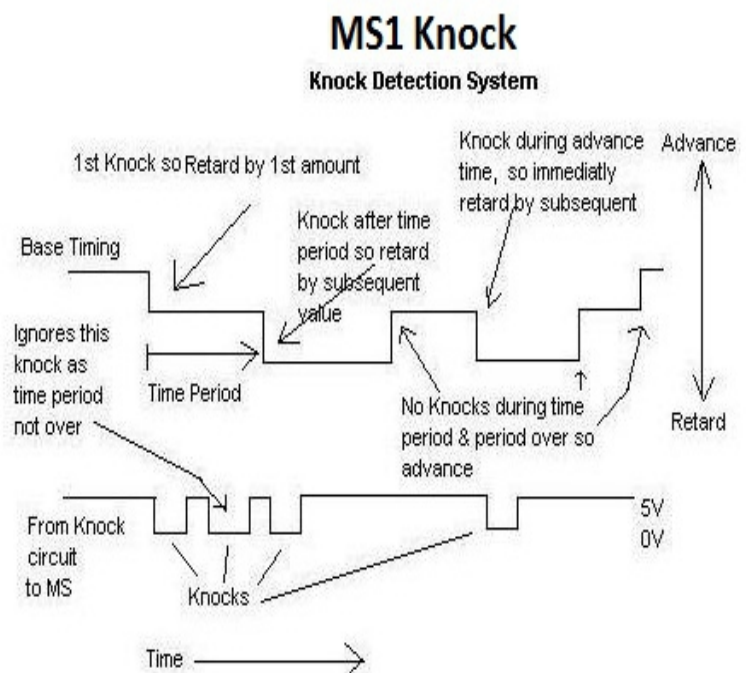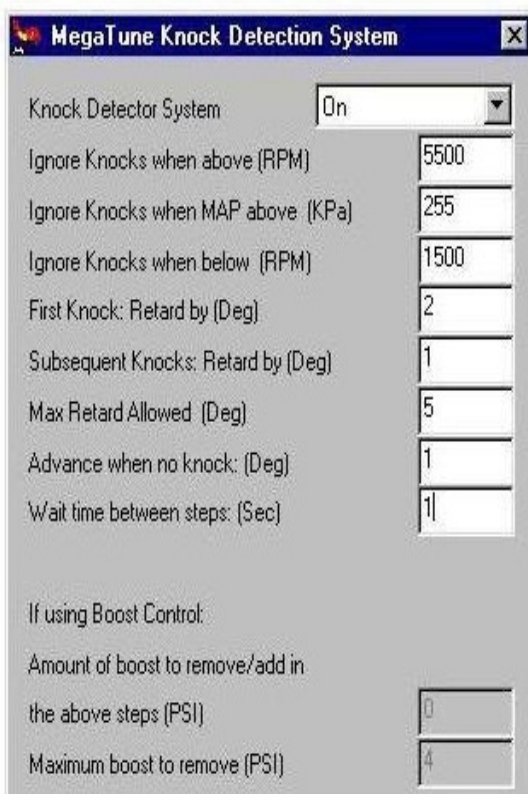
1) LED on Dashboard Wiring:

Knock protection circuit using an LED

2) MS ECU Wiring:

Knock Conditioner Unit wiring

12V Ignition
Ground
Knock input wire
Conditioner Unit
Output
MS ECU
Knock Sensor 1   Knock Sensor 2 (If present)
www.ExtraEFI.co.uk

The ECU's I supply are ready to work with the conditioner unit we sell, if you
requested a knock input, although they may not have the programmable output.
This is an option if you wish to add it.

MS1 Settings:

MegaTune Knock Detection System

Setting	Value
Knock Detector System	On
Ignore Knocks when above (RPM)	5500
Ignore Knocks when MAP above (KPa)	255
Ignore Knocks when below (RPM)	1500
First Knock: Retard by (Deg)	2
Subsequent Knocks: Retard by (Deg)	1
Max Retard Allowed (Deg)	5
Advance when no knock: (Deg)	1
Wait time between steps: (Sec)	1

If using Boost Control:

Amount of boost to remove/add in
the above steps (PSI)   0

Maximum boost to remove (PSI)   4

MS1 Knock
Knock Detection System

1st Knock so Retard by 1st amount

Knock during advance time, so immediatly retard by subsequent   Advance

Base Timing

Knock after time period so retard by subsequent value

Ignores this knock as time period not over

Time Period

No Knocks during time period & period over so advance

Retard

From Knock circuit to MS

Knocks

5V
0V

Time

As long as the engine speed is below the Ignore Knock RPM setpoint and the MAP Kpa is below the Ignore Knock setpoint then the code will control the advance in the following manor:

If a knock is detected (The input goes switches to ground) the ignition will be retarded by the "First Knock" retard value. Any more knocks are then stored until the timer "Wait time between steps" has passed. If any more knocks where seen then the ignition is retarded by the "Subsequent Knock" value. This allows a big first step then smaller steps after that if knock continues.

If no knocks are then seen after the wait period it will advance the ignition by the "Advance when no knock" value (this should be smaller than the retard value). After the wait period is over, as long as no knocks are seen, it will advance again until it runs the same advance as the main ignition map.

If a knock is seen whilst its advancing then the timer is reset and the ignition is retarded immediately and the whole process starts over.

There is also a limit to how much retard can be applied.

The boost can also be linked into this system if using boost control.

MS2 / MS3 Settings:
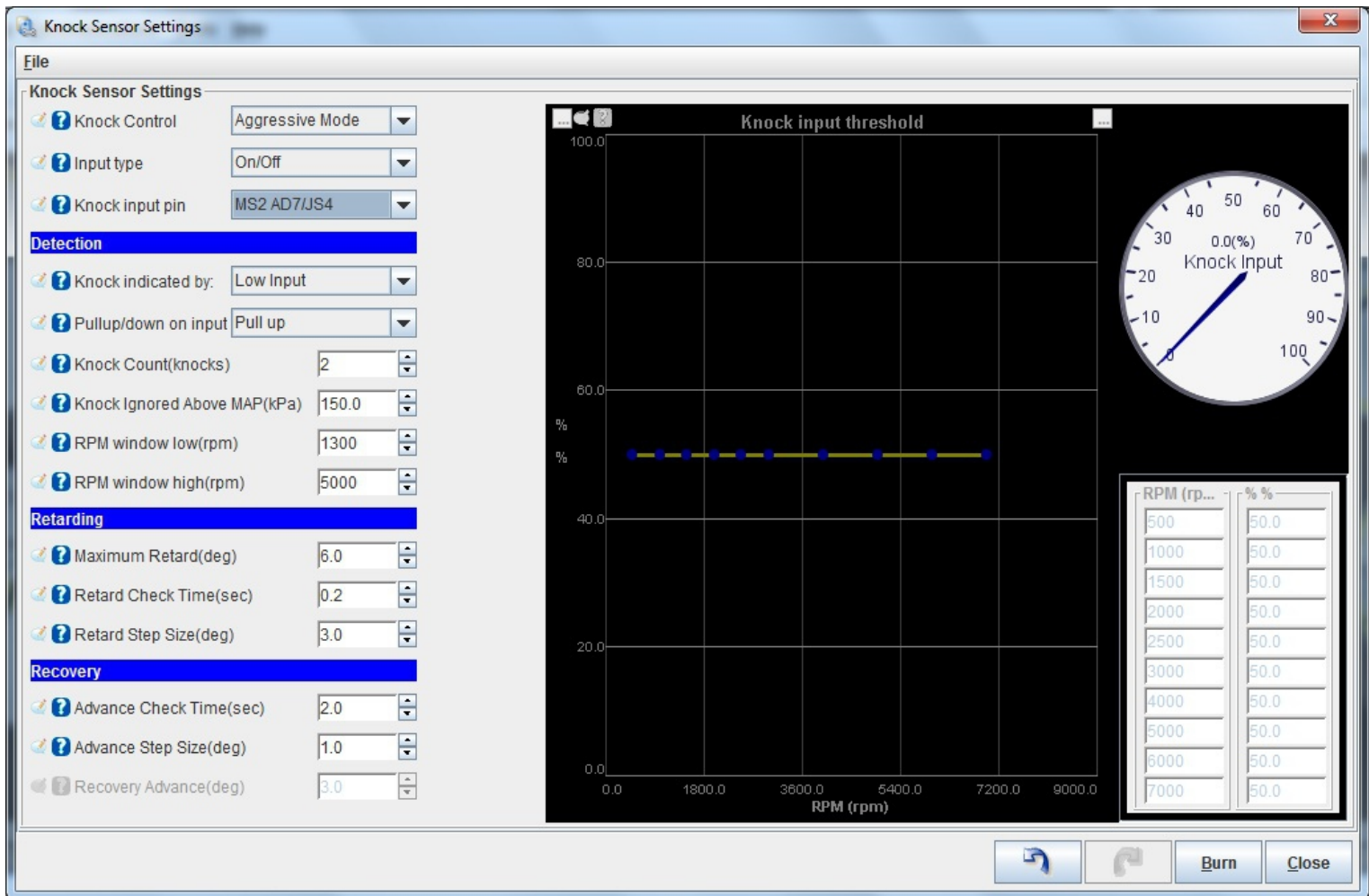
Knock Control:

Disabled: do not use knock feedback for ignition advance control.

Safe Mode:

use knock retard, but keep the advance below that which caused knock. This backs the advance 1 small step back and leaves it at that until TPS or MAP changes - or knock comes back. This is "safe mode" scheme is the safest thing for a DIY set-up.

Input Type:

On / Off is for use with conditioner units where the signal for knock is a ground or 5V signal in.

Analogue is when a special filtering circuit is used and this is directly fed back to the ECU, so the level of input before knock is detected, can vary depending on RPM.

Aggressive Mode:

use knock retard, but keep advance at threshold of knock occurring. That is, the program advances (up to the timing table value) if it doesn't see knock, and retards if does see knock. The difference from safe mode is that the timing can be advance all the way to the table value after knock, not just up to one step below knock. This may result in the knock returning, in which case the timing is retarded again, then advanced slowly, and so on.

Knock Input Pin:

This is set depending on what pin is used on the main board. For ExtraEFI boards I use JS4, but check on the bottom of the ECU for details.

Knock Indicated by:

This sets whether MegaSquirt recognizes a knock with a low signal or a high, for most conditioners this should be set to low (Input goes to ground for a knock).

Pull Up/Down on Input:

The input pin can be held high (5V), Low (0V) or left floating (None) using the microprocessors internal circuit. This setting is dependant on how your conditioner works, measure the output voltage of the conditioner when it is powered up but not connected to the MS ECU. If it measures nearly 0V then select Held High, if it measures 5V then select None, if it measures 12V then DO NOT connect it directly to the MS ECU, see the above circuits!! The knock conditioner units need this set to "Pull up"

Knock Count

(knocks): number knock detects required for valid detection.

No Knock Above MAP

(kPa): no knock retard is implemented above this MAP.

No Knock Below RPM

(rpm): no knock retard is implemented below this rpm.

No Knock Above RPM

(rpm): no knock retard is implemented above this rpm, which may be desirable if valve train noise triggers the knock sensor when knock isn't actually occurring.

Maximum Retard

(deg): maximum total retard when knock occurs. This can be useful to prevent timing from being excessively retarded (avoiding potential overheating issues) if the senor malfunctions or there are other problems with the knock sensing system.

Retard Check Time

(sec): this is the time between knock retard corrections, allows short time step to quickly retard.

Retard Step Size

(deg): ignition retard step size when 1st knock or after stopped, make it large to quickly retard the timing and stop knock.

Advance Check Time

(sec): this is the time between knock advance correction (I.e., timing return to 'normal').

Advance Step Size

(deg): ignition advance steps after knock has stopped.

Recovery Advance

(deg): this is the change in table advance required to restart advance until knock or reach table value (0 knock retard) process. This only applies in 'Safe Mode'.