KNOCK DETECTIVE (GEN 2)

USER MANUAL

(Updated Mar 22, 2026)

DISCLAIMER! READ THIS BEFORE INSTALLATION:

The installation of this device requires some basic wiring skills. If you aren't confident in this area, please consult a professional to ensure safety and reliability when installing. The use of this device also carries some risk as it is up to you to interpret the signals and modify your calibration accordingly. FWLRtuning holds no responsibility for any damage, or personal harm caused while using this device.

The Knock Detective is a device which helps monitor knock levels to ensure engine safety while driving, as well as aid in tuning. This device requires calibration to each vehicle which will be outlined in this document. The logging feature is extremely useful in setting up your timing tables and determining when and where the engine is experiencing knock. Although there is no replacement for a dynamometer, in most knock-limited fuel applications you can set up your whole tune based on the readings from a high-quality wideband oxygen sensor and the Knock Detective. Another benefit to hearing the exact sound your engine is making is being able to determine if your ECU's knock readings are reflecting real knock or some other sound made by things such as a rattly exhaust or loose bolt. Besides engine use, you can also bolt the knock sensor to drivetrain components, suspension components or anything that vibrates and be able to listen directly to it like an electronic stethoscope.

Parts Included in the box:

Knock Detective gauge
Pigtail cable + Sensor Cable(s)
Wide Band knock sensor(s)
M8x1.25 bolt(s) & M10x1.25 thread insert
FWLRtuning Stickers (worth 6.9 horsepower each)
FWLRtuning Keychain

Knock Detective pin out

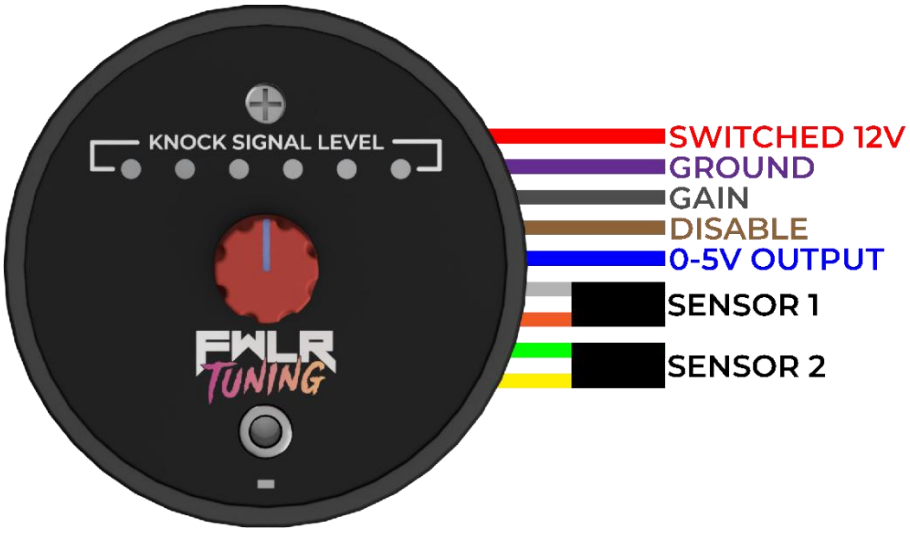
Red – Switched 12V Supply (through a 5A fuse)
Dark Purple – Chassis Ground
Grey – Gain (disconnected = high gain, ground = low gain)
Brown – Disable (grounding this wire disables the knock detection)
Blue – Knock Level Output (0-5V)
White / **Orange** – Knock Sensor 1 (**Signal** / **Ground**)
Green / **Yellow** – Knock Sensor 2 (**Signal** / **Ground**)

Knock Sensor Installation Process:

If installing on an inline engine, locate an unused bolt hole on the engine as close to the top of the cylinders and as close to the middle of all cylinders as possible to mount the knock sensor. If installing on a V-style engine, you can place one knock sensor on each bank as close to the top of the cylinder and as centered as possible. The placement isn't extremely crucial, but the further away from the top of the cylinders you place the sensor(s), the more background noise from things such as the power steering pump or transmission will be present. Torque the knock sensor(s) down to approximately 15 ft-lb (20Nm). Connect the sensor's 8ft shielded cable(s) and run it into the cabin, securing it from getting too close to hot parts such as turbochargers as well as moving parts.

Wiring The Knock Detective

- I recommend using crimps and heat shrink to make connections (Molex 0192939384)
- Connect the **RED** wire through a 5A fuse to a switched 12V supply that receives power only when the key is on. The Knock Detective draws between 10mA and 60mA of current.
- Run the **DARK PURPLE** wire to a chassis ground.
- Connect the **BROWN** wire to an ECU output if using **Disable** feature. Leave it disconnected if not used. *More on this in the next section*
- By default, the gauge is in High Gain mode which will work for most engines. Connecting the **GREY** wire to ground will put the gauge in Low Gain mode which will half the input strength. This affects the headphone output as well as the knock detection circuitry. Leave it disconnected if not used. *More on this in the next section*
- If you want to datalog the signal, connect the **BLUE** wire to your 0-5V analog input. The output should only be connected a high impedance input such as a datalogger or an ECU input pin. Make sure that if your ECU has an option for a pull-up or a pull-down, you disable it.
- Connect the sensor cable(s) to the sensor input connector(s). Either sensor inputs can be used as they are just added together inside the gauge.
- If there are unused wires, cover the ends in heat shrink to avoid accidental shorts.



Optional functions

The Knock Detective has two optional functions – **Disable** and **Gain**.

The **Disable** function allows you to cut the signal before it hits the knock detection circuitry. This is useful when using an aggressive ignition cut on functions such as a rev limiter or launch control. In some applications, when a hard ignition cut is used, the explosions happening in the exhaust manifold are loud enough to trigger the knock detection circuitry resulting in LED/output activity. When the **Disable** wire is left disconnected or pulled high, the gauge is fully active. When it is pulled low (0V/ground), the signal is removed from the detection circuitry. When the wire is no longer pulled low, the knock detection is reactivated after 0.25 seconds.

A very simple way to use this would be to configure an output from your ecu as a shift-light to pull the **Disable** wire to ground a little bit before your rev limiter (I have found 200RPM works well). More complicated logic within your ECU can be used to disable the gauge during flatshifts / antilag / launch control / decel pops. This will prevent the LEDs and output from reflecting these conditions as knock. You can connect this wire through a switch to ground if you'd like to enable/disable the gauge manually. You can also connect it to a clutch switch (at the top of the clutch travel that pulls to ground when the clutch is depressed) to disable the gauge when on a launch limiter. When the knock detection circuitry is disabled, the status LED on the bottom of the gauge will change from **GREEN** to **YELLOW**, indicating the knock detection has been disabled. The headphone output is not affected by the **Disable** function and remains active any time the gauge is powered.

The **Gain** function allows you to control the input gain from the knock sensor(s) before it reaches the gauge. This means it will affect both the LED/output as well as the audio output. Leaving the **Gain** wire disconnected or connecting it to a positive voltage will set the gain as high. Connecting the **Gain** wire to ground will cut the input signal in half. High gain will work for most applications, but if you find the audio is distorting or you have to turn the sensitivity way down when calibrating, you may want to try the low gain setting. Start with high gain, and use low gain if needed.

Knock Detective Gauge Installation Process:

The Knock Detective is a standard 52mm gauge. After removing the threaded collar from the back of the gauge, slide it into your gauge holder, and secure it using the collar. Alternatively, you can place a couple layers of electrical tape around the gauge body to make it a friction fit. Make sure you are able to run a headphone cord comfortably from your seat, you are able to clearly see the 6 LEDs and are able to get a small Philips screwdriver in the calibration hole to set the sensitivity.

NA/NB Miata owners can download my **free print files** which provides a clean install as seen below:

Website: http://FWLRtuning.com
Email: nick@FWLRtuning.com

Sensitivity Calibration Process:

Each gauge is shipped with the sensitivity level turned all the way up. **You WILL see activity at this level regardless of if the motor is knocking or not. This is intentional.** The LEDs display the analog **Output** signal and adjusting the sensitivity will affect both.

The LEDs and analog **Output** reflect the signal spikes caused by detonation. Once you hear knock and see how the LEDs react, you can watch for that same behavior. *Take care to not push or turn the pot too hard when adjusting.*

After installing the Knock Detective and configuring it in high gain, plug in a set of headphones. Use the volume control (knob in the middle) to set your headphone volume to a comfortable level. Next, if you are able to retard the timing to ensure no knock will occur do that. Have someone safely do a pull to redline while you are in the passenger seat listening for knock. If the pull was clean and no knock was heard, lower the sensitivity until only the first LED barely flickers during the pull. Repeat this process a few times turning the sensitivity down each time until you just barely see a single LED flicker during any normal operating conditions.

The next step needs to be done carefully as it involves inducing some light knock and taking note of how the LEDs react. Dial in some extra timing in the low RPM range of your timing map. I typically add a few degrees in the 3000RPM / 0 PSI range for this test. Get into some light load for brief moments at a time, adding timing until you hear the engine begin to knock. Every engine is different and some fuels like E85 may not want to knock regardless of timing. Don't go crazy with the additional timing - even if the fuel doesn't detonate, you may still put stress on the bearings from increased cylinder pressure at low RPM. Observe the LED activity as well as the sound. If you're datalogging you should see spikes in the output level. Short bits of light knock should not hurt your engine, however don't allow the engine to knock for long periods of time. Most forged pistons can take a lot of abuse, but some cast pistons are quite intolerant to knock. Go slow, ease into it, and **DO THIS AT YOUR OWN RISK!**

For examples of what knock sounds like, visit the Knock Recording section on my website. It typically sounds like marbles rattling on glass or sharp snapping sounds. Kind of like a Geiger counter that is louder and more irregular than the normal engine sounds. The goal is to set the sensitivity adjustment so that the normal engine noise only flickers one LED, leaving the other LEDs to display knock activity.

Although any serious knock will be obvious on the display, very light knock can be hard to distinguish using the LEDs alone. I recommend always dialing in your tune with headphones, and using the LEDs as a warning for the driver.

Using The Knock Detective Headphone Output:

The headphone output is the most powerful feature of this device. It can be used to distinguish between real knock and false knock. Maybe that loose exhaust hanger, or large piston to wall clearance is causing the knock signal to spike. The sound of these things would be vastly different than real knock though. Modern ECU's knock control strategies are very complex, but still pale in comparison to your ears and brain. I like to push the engine into some short-term, light load detonation in a controlled environment each time I'm tuning a car in order to learn where the knock threshold is and tune accordingly. Do this at your own risk and avoid causing knock for sustained periods as this will beat your bearings out and potentially cause more serious engine damage. The headphone output has no audio filtering on it as I find it easier to listen to the full range of frequencies.

Note: The volume adjustment and sensitivity adjustment have no effect on one another.

Using The Knock Detective's Display And Output:

The knock detection used for the LEDs and output is quite sophisticated allowing you to rely on visual cues anytime you're pushing your engine into load. After following the calibration process, normal engine operation should only flicker a single LED. When light to moderate knock occurs, you will see the other LEDs light up. When the heavy knock occurs, the LEDs will all light up bright red and stay lit up for approximately 5 seconds. Below is a table explaining how the LEDs relate to the output voltage.

LEDS	CONDITION	OUTPUT
6	Very Heavy Knock	3.3V and above
5	Heavy Knock	2.7V
4	Moderate Knock	2.2V
3	Likely Knock	1.6V
2	Normal	1.1V
1	Normal	0.5V

The Knock Detective's output signal (**BLUE** wire) will range from 0-5V. When you datalog this signal, you should scan through your logs and look for any voltage spikes indicating a potential knock event. Tracing these events to certain cells in your timing/fuel tables will help identify problem areas in your tune. It's normal to see small amounts of signal activity during a normal clean pull. When knock occurs there will be large spikes that are easily distinguishable from normal engine noise. It's important to note that the strength of this signal is affected by your sensitivity and gain settings.

Troubleshooting:

PROBLEM	SOLUTION
No power, lights, or audio	Check that there is 12V across the **RED** and **DARK PURPLE** wires when key is on.
Status light indicates power (**GREEN**), knock signal lights react to tapping sensor with screwdriver, but no audio output.	Try a different set of headphones. If your headphones have more than 3 contacts on the jack (TRS), or require an adapter, they may not be compatible with the Knock Detective's output. A simple set of cheap headphones without volume control on the cable should work.
Status light indicates power (**GREEN**), but knock signal lights do not react to tapping sensor, and no audio output.	Check the wiring from the gauge to the knock sensor. Ensure the connectors are pushed all the way in and cannot be pulled apart without pushing the connector's release.
Status light indicates power (**GREEN**), audio output is functional, but knock signal lights do not react to tapping sensor.	Check that you do not have the sensitivity turned all the way down.
Status light indicates disabled (**YELLOW**) anytime the gauge is powered.	Check that the **DISABLE** wire isn't shorting to ground. If you have it connected to an ECU output, ensure the output is active low, and that your conditions are set properly. (for example: RPM>7400 and not RPM<7400)
ECU input connected to the **BLUE** wire does not reflect activity seen on the gauge's lights.	Check to make sure pull-up/pull-down options are disabled on the ECU's input. You should see around 0V until you tap the sensor with a screwdriver. With the sensitivity all the way up. after giving it a good smack, you should see a voltage spike of around 4.5V.
Lights light up **RED** intermittently without any knock.	Since the LEDs light up **RED** when the gauge is first powered on, this can be caused by an intermittent power supply. Make sure your 12V or Ground wire isn't poorly connected.

Customer service is something I take a lot of pride in. If you still have issues after trying these steps, feel free to reach out to me: nick@FWLRtuning.com.