KNOCK MONITOR PRO V4

Advanced Knock Detection

COMPLETE USER GUIDE

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WARNING: Be sure to follow the instructions below. Also, be sure you check the voltages of the wires before probing with the 5V inputs. The RPM signal can sustain only up to 16V.

Be sure to avoid running wires along fans, pulleys and belts.

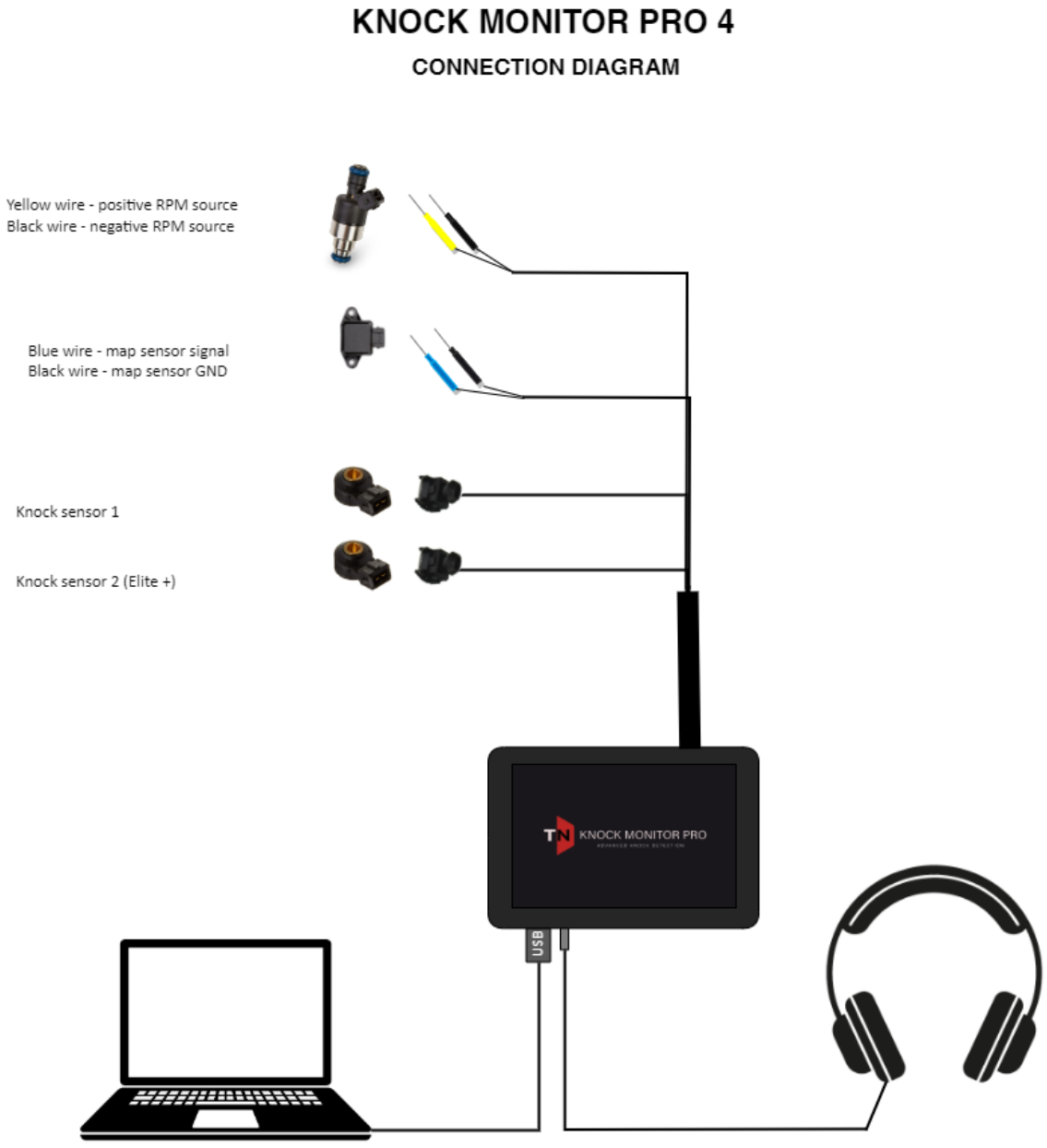
PLEASET NOTE: The wire harness has multiple connections under heat shrink insulation. Do not bend or twist this section, as doing so over time will compromise the connections.

1 HARDWARE INSTALLATION

Your Knock Monitor Pro V4 should have the following components:

- Knock Monitor Pro V4 device.
- Knock sensor(s).
- USB cable.
- Wire harness.

1.1 CONNECTION DIAGRAM



Use this diagram to connect your Knock Monitor Pro

Some things to note while installing:

- Your RPM source can be a coil on-plug trigger wire or fuel injector. Can also be the dedicated tachometer wire. For coil on plug, place the yellow on the trigger and the black into the ground of the connector.
- For knock windowing to work you will need to use coil on-plug/distributor trigger wire.
- Avoid running the wire near moving parts like pulley wheels, belts, chains and fans. This can be catastrophic to your hardware if the wire gets tangled.

1.2 KNOCK SENSORS

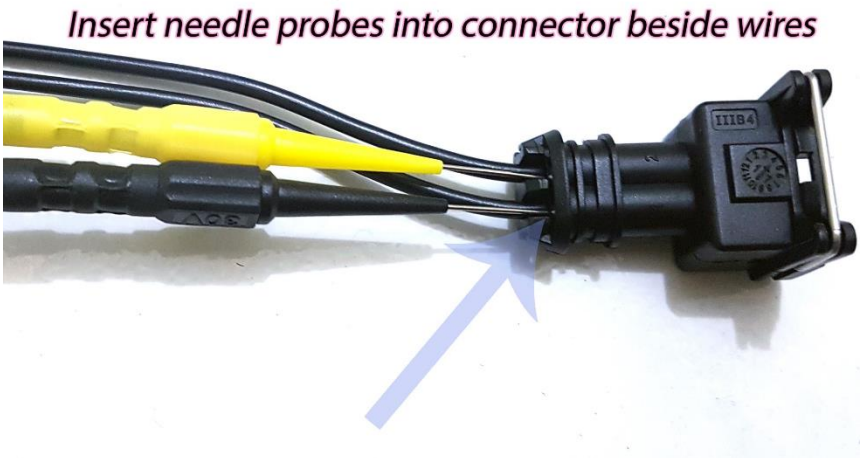
Your device is equipped with at least 1 knock sensor that is expected to be bolted on the engine. We've ranked various locations on the motor where a knock sensor can be bolted.

1. Engine block, factory position
2. Engine block, other location
3. Intake manifold (if metallic)
4. At the gearbox, transmission, bellhousing
5. At the valve cover.

1.3 NEEDLE PROBES

We have included needle probes with your Knock Monitor Pro for seamless connection to RPM sources, as well as map and other sensors. To ensure proper usage of the probes, it is recommended to employ a simple technique known as 'back-probing.'

When using the probes to access signals, back-probing into connectors is more secure. The following example illustrates the process of back-probing the RPM needle probes into an injector connector.



2 GRAPHICAL USER INTERFACE

2.1 MENU TREE

This menu tree represents the screen menu items on the Knock Monitor Pro 4.

- Home Menu
  - Switch View
  - Settings
    - Engine
      - Bore Size
      - RPM Multiplier
      - Min RPM
      - Max RPM
      - # of Cylinders
    - Sound
      - Amplifier
      - Low Freq. cut-off
      - High Freq. cut-off
      - Filter Q
      - More
        - Combine L+R
        - Auto gain reduction
        - Frequency X2
        - Filter headphones
    - Sensors
      - Knock sensor
        - Low RPM Tolerance
        - High RPM Tolerance
      - Map sensor
        - Scalar
        - Offset
    - Advanced
      - Flash Screen if Knock
      - Knock Window Enabled
      - Analog Output Mode
      - Spark Trigger Edge
    - Format SD
    - Reset
    - Threshold (drawn)
  - Logs
  - Record

3 HOME MENU

By tapping on the right half of the screen the home menu will be displayed. This menu will show buttons to:

1. Switch view (display mode)
2. Change Settings
3. Open Logs
4. Record a log

The **Clear** button clears the screen of all real-time generated objects.

3.1 SWITCH VIEW

Menu » Switch View

Your Knock Monitor Pro 4 has 3 display modes. Tap the **Switch View** button to cycle between views.

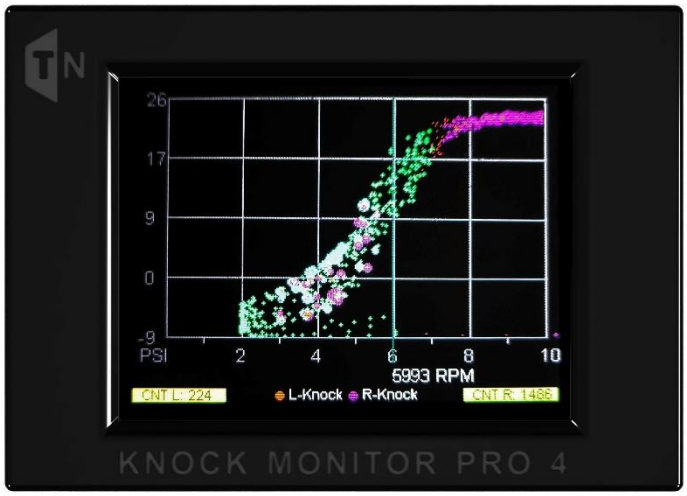
- **Waveform view**
  - This displays a graphical sound wave as it happens in real-time.
  - Knock can be identified with the waveform spikes protruding the red threshold line.
  - Left channel is displayed on top half of screen, while right channel is below.

- **Knock vs RPM view**
  - This shows the amplitude of each pulse vs the engine speed with a green dot.
  - Knock will register as red dots (left sensor) or pink dots (right sensor)
  - This view allows the user to draw a manual threshold for filtering knock.
  - Threshold is not required, but can be drawn using a stylus or any pointy object that's neither sharp nor arbaisive.

- **Knock vs Map vs RPM**

  This view adds a third dimension: the manifold pressure, or boost. The user is now able to see all three data points plotted on a single graph.

  While the threshold can be set on the knock vs RPM view, all three views use the same threshold, whether it is set manually or auto-threshold.
  You may also start a recording from any of the three views.



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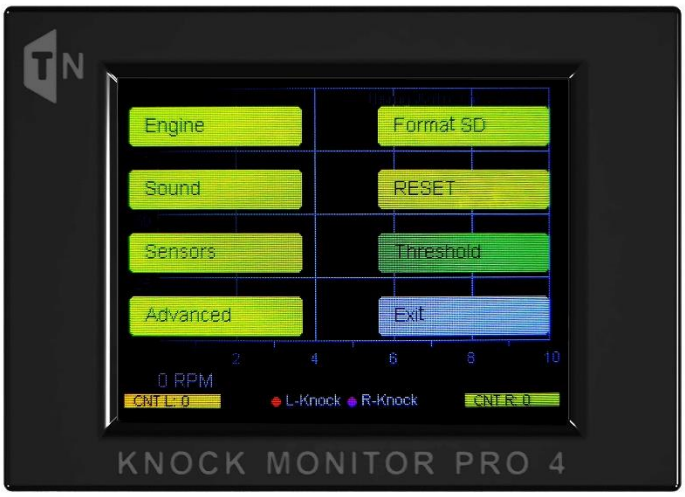
3.2 SETTINGS

Menu » Settings

In this menu, users can modify the fundamental settings of the device. These include configurations for the engine, sound, sensors, advanced settings, formatting storage, and resetting. The settings persist to the device's internal storage memory and will be there even after shutting down.



3.2.1 Engine

Menu » Settings » Engine

The engine menu allows the user to configure the device to peculiarities of the engine being monitored. Touching either the "-" or the "+" buttons will change the values accordingly.

Bore size changes the size of the bore. This is important in knock frequency determination.

RPM Mult will change the RPM speed in multiples of the figure shown here.

Min RPM will set the minimum RPM that knock will be reported.

Max RPM will set the maximum RPM that the graph will display.

# of Cylinders is the number of cylinders in this engine.

* As it relates to RPM sources, common sources are fuel injectors (non-direct injection), coil on plug trigger wire, distributor RPM wire.
DO NOT CONNECT TO HIGH VOLTAGE WIRE!

3.2.2 RPM Jitter Filter

Menu » Settings » Engine » More

The Knock Monitor is designed to work with a wide range of engine electronics. Because of this, the RPM signal quality can vary. Some engines provide a clean signal, while others may produce an unstable one that jumps around.

This menu option lets you apply filtering to stabilize the RPM signal. Increasing the filter value smooths out the signal but reduces response speed, and at higher settings it may also limit the ability to read very high RPM accurately.

3.2.3 Sound Settings

Menu » Settings » Sound

The sound menu provides users with the ability to fine-tune the sound filter applied to the knock sensor signal.

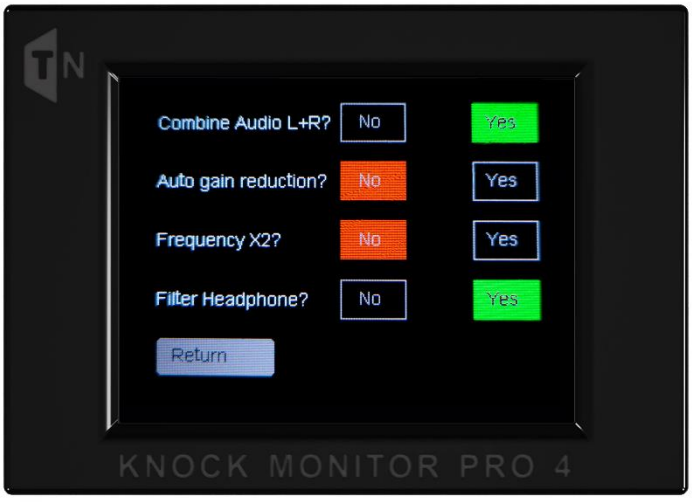
Amplifier sets the amplitude of the sound. Auto gain reduction, if enabled, will reduce the value seen here whenever the signal is too loud.

Low Freq. Cut-off determines the frequency below which the system will be less sensitive to the incoming sound signal.

High Freq. Cut-off determines the frequency above which the system will be less sensitive to the incoming sound signal.

Filter Q sets the sharpness of the cut-off frequencies. Higher values tends to boost sound in the band being filtered. The band is determined by the signals between high and low cutoffs.

More: tap this button to view more sound settings such as combining the audio of left and right signals and filtering the headphone signal.



Combining Audio L+R will merge the signals of both knock sensors. If only 1 sensor is being used you will hear it on both left and right headphone speakers

Auto gain reduction reduces the sound if it's too loud.

Frequency X2 will have the filter target sounds in the 2nd order harmonics – target frequency will be twice

Filter Headphone option should be enabled if the user wishes to apply the sound filters to the headphone output. Disabling this will pass the raw engine sound to the headphone.

3.2.4 Sensors

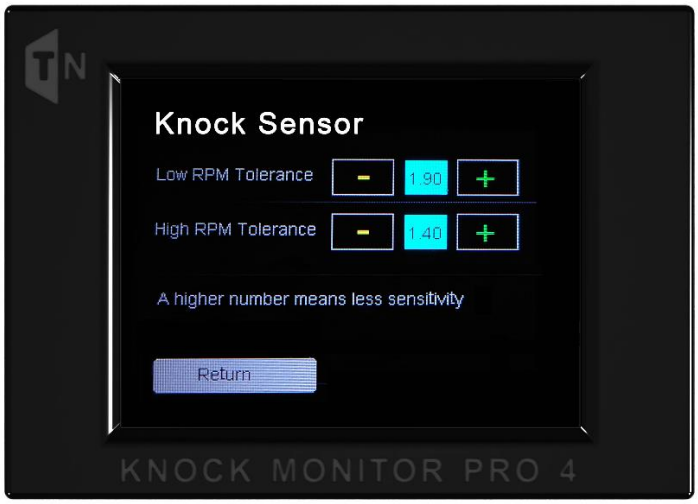
Menu » Settings » Sensors

Knock sensor and map sensor can be configured in this menu.

3.2.4.1 Knock Sensor

Menu » Settings » Sensor » Knock Sensor

Low RPM tolerance and **High RPM tolerance** dictates how sensitive the algorithm is during either end of the rev range. The rev range is set in the **Engine** menu by setting the minimum and maximum RPM. A higher number means less sensitivity. Reducing the value makes it more sensitive.



3.2.4.2 Map Sensor

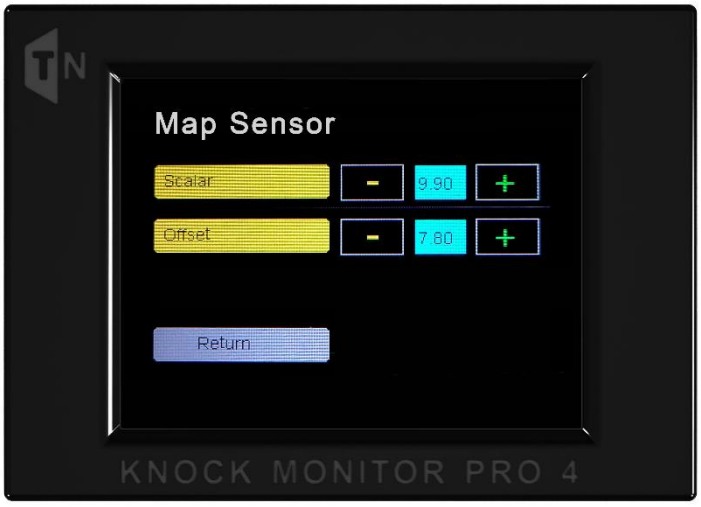
Menu » Settings » Sensor » Map sensor

Knock Monitor Pro 4 can read manifold pressure sensors and plot the knock signal vs RPM on a graph. You will see what boost and RPM the car is detonating.

Scalar otherwise known as the multiplier, is the value for each voltage unit read by the sensor.

Offset is a correction value applied to get the final reading.

You will need to refer to the manufacturer's specifications of the sensor to configure these settings.

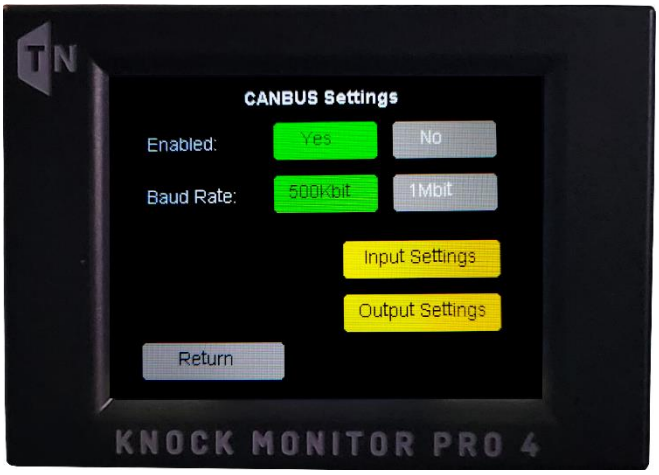


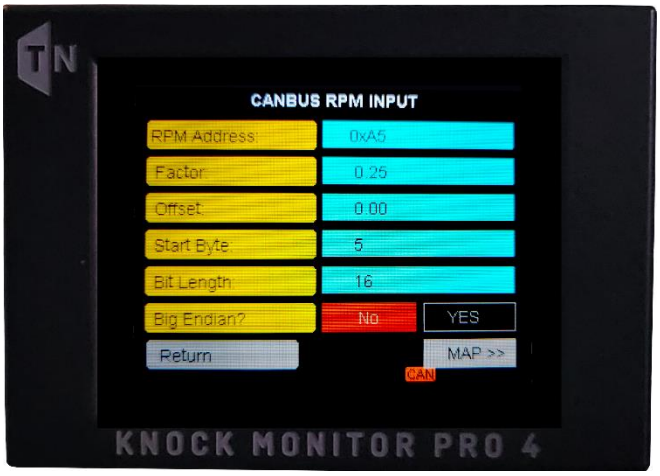
3.2.5 CAN bus

Menu » Settings » Sensor » Canbus

Some Knock Monitor Pro 4 variants can read and transmit CAN bus signals.

This is an advanced means of communicating data between the device and the ECU/dyno.





By using CAN bus, you can:

- Integrate with ECUs: Many standalone ECUs (Haltech, Link, AEM, MS3, etc.) can read custom CAN streams. When Knock Monitor Pro is used to output knock over CAN, the ECU can use it for safety strategies (retard timing, trigger fail-safe).
- Display integration: You could send knock info to digital dashes (e.g., AIM, AEM CD7, MoTeC C125) so the driver sees warnings without an extra gauge. It can also be used on a Dyno.
- Data logging: CAN output makes it simple to combine knock information into existing CAN logs.

Refer to the documentation of the other device for the required CAN bus address information.

3.2.6 Advanced settings

Menu » Settings » Advanced

The "Advanced" menu unveils a range of options, including knock windowing, screen flashing upon knock detection, and analog output settings.

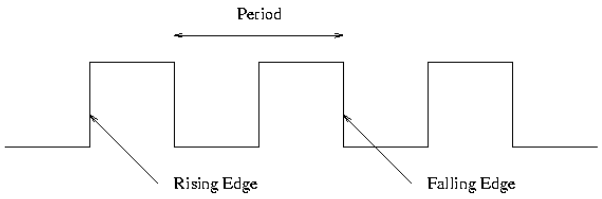
Flash screen if knock will flash the entire display white whenever knock is detected.

Knock Window when enabled, will only validate knock if the detected spike falls within the specified degrees of window. IT should be mentioned that this knock windowing uses the number degrees after spark event. The device software calculates the approximate spark event for the other cylinders. For this to work:

- Coil on plug, or distributor as rpm source
- Setting the correct spark trigger edge type (rising vs falling)

Analog Output can be useful as an input into ECU for logging knock/sensor voltage. There is a small wire tucked at the end of the harness (where it branches off) that will provide this output.

Knock will output a pulse only when there is detonation.
All will provide a constant output from this wire.



Spark Trigger Edge is required to be correctly specified if the knock window option is enabled. A falling edge means that the signal wire that is probed will fall from high to low on the event of triggering a spark. A rising edge means the opposite, the wire will show an increase in voltage the moment the spark is fired.

3.2.7 Format Storage

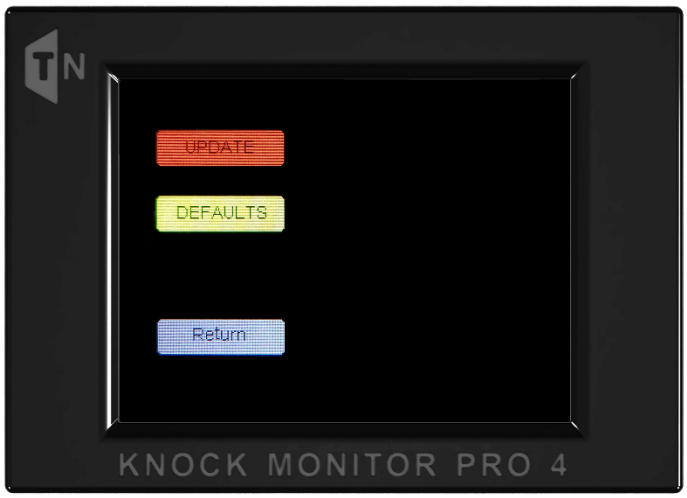
Menu » Settings » Format SD

Sometimes it may be necessary to clean all files from the storage. This will not affect the device settings, only the recorded logs.

3.2.8 Reset

Menu » Settings » Reset

Use this menu to either update the firmware or reset the device back to factory settings.

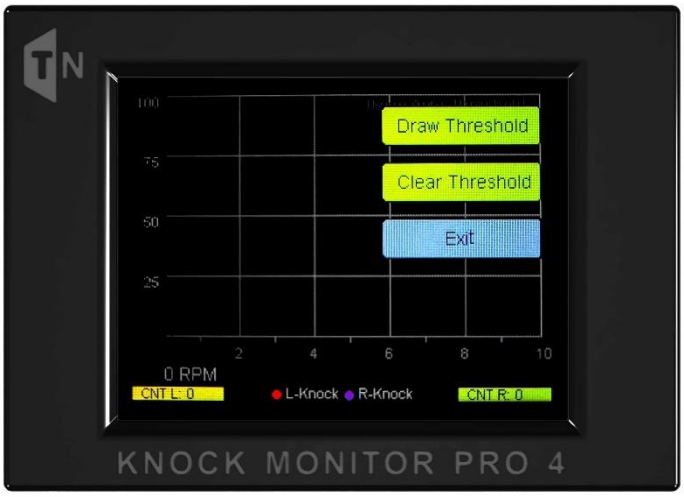


3.2.9 Threshold (drawn)

Menu » Settings » Threshold

The option to **draw a threshold** line is only available in the **Knock Vs RPM** view. The user has the option to manually draw their own threshold instead of relying on the device's dynamic calculation.
To accurately create this threshold line, it is recommended to use a stylus or pen and draw it slowly on the screen, just below the estimated safe noise level. It is advisable to take approximately 12 seconds to complete this drawing for optimal results. A threshold line drawn too fast will look jagged and inaccurate.

Clearing the threshold will revert to the device calculating the knock threshold automatically.



3.3 LOGS

Menu » Logs

The logging system of KMP4 records settings, sound, rpm, map and knock details into a re-playable file.

Logs are listed in reversed numerical order. This means that the latest recorded log will appear first.

Logs are recorded at a maximum duration of 2:30 seconds. A rollover occurs once the file reaches 2:30 seconds. That is, a new file is automatically created.

Tapping on a file will lead to a screen asking what to do with the file. Your options are:

Open – open the log and start playing.

Delete – permanently delete the log from the device.

Xfer – transfers the log to Knock Monitor Pro PC Software.

The transfer requires the software to be running and also connected to the device via USB.

4 TUNING WITH KNOCK MONITOR PRO 4

While this guide does not provide comprehensive instructions for tuning your car, it serves as an illustration of the safe tuning practices using Knock Monitor Pro 4. The guide highlights how the tool can be effectively utilized to ensure a safer tuning procedure.

This section also assumes that you already have connected the probes, sensors and powered up the device.

4.1 PRE-SETUP

The device must be configured for the engine you are about to tune. Enter the bore size and other parameters under the **Engine** menu. The user should also determine if screen-flash alert will be used, knock windowing, and other features of the tool.

The user should also start the engine, ensure RPM is present and sound is sufficiently audible.

4.2 SETTING A BASELINE RUN

The first step is to set a baseline run. This is done using safe engine parameters, such as retarded timing and slightly richer than optimal fueling. Your boost should also be minimal. To record this run, tap the right side of the screen to bring up the main menu and hit **Record**. When the log is complete you may tap the screen again and hit **Stop**

Examine this baseline and ensure the sound was sufficiently loud, RPM is working, and all other operations seem nominal. You should also replay this log to ensure the engine didn't exhibit any audible detonation.

4.3 OPTIONAL THRESHOLD

The user may optionally switch to the Knock vs RPM view and manually draw a threshold over the dotted patterns that was deemed safe, and not detonating. If the dots disappeared by switching views, simply replay the log and let the unit repaint the pattern. When drawing the threshold, please be reminded that you must do so slowly. The slower the more accurately the unit can capture the movements.

4.4 PROCEED WITH TUNING

With the baseline run complete (and optional threshold set) the user may proceed to tune normally, slowly increasing his timing, boost and/or AFR ratios.

If the system detects knock, it will flash a [KNOCK!] text alert as well as flash the screen (if enabled). On Map vs Knock vs RPM view, or Knock vs RPM; the tool will show red dots or pink dots that will represent knocking on the left sensor or right sensor respectively.

5 IDENTIFYING KNOCKS

Knocks will appear on the graph as orange and pink stars above the threshold. The device will pretty much use the threshold set to determine what is knock from regular combustion. This applies to both manually drawn threshold as well as auto thresholds. The device will display a "KNOCK!" on screen, regardless of which view is active.

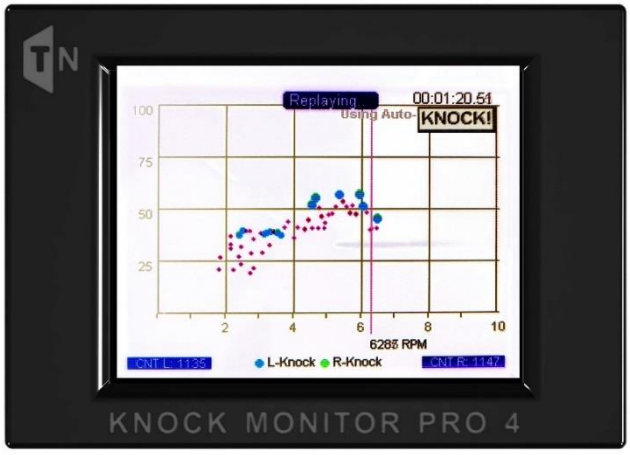
Outside of what the chart shows, you can still identify knock using the waveform view. Look for repetitive spikes in the waveform as is displayed in this photo on the right.

The sound output can also catch detonation not caught by the device.

5.1 FLASHING SCREEN

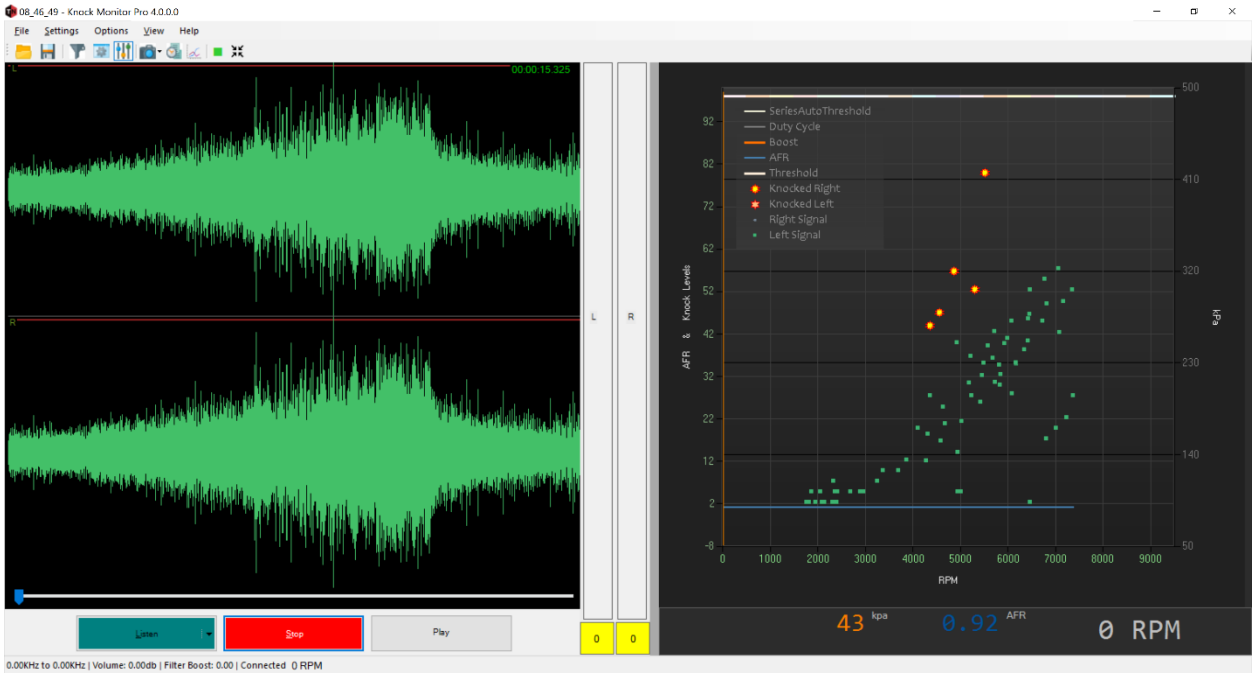
The device offers the capability to flash the LCD screen when it detects detonation.

It's important to note that this feature is exclusive to live detection and won't function during playback. While the knock indicators remain visible on the screen during playback, the LCD flashing is intentionally disabled. This design allows users to conduct a more focused observation of the replay without the distraction of screen flashing.



6 PC SOFTWARE INTERFACE

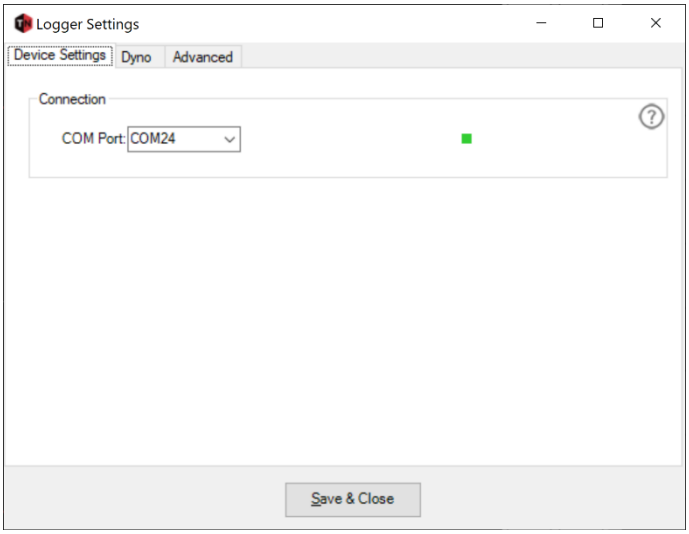
The Knock Monitor Pro PC software can receive sound and data from the knock Monitor Pro 4 unit.



Software can be downloaded from our website. No license key is needed for V4 devices. It is recommended you leave the installer at the default settings. Software can be downloaded at Tunernerd.com/downloads

A connection via USB is required. This software will display both waveform and chart view of knock vs RPM. Connecting via USB:

1. Connect your Knock Monitor to the PC via the USB cable provided.
2. In Knock Monitor Pro, click the **Settings > Logger** menu item.



Select the COM port from the drop down that represents the device.

When the correct port is selected the indicator should turn green. Click Save & Close to now use the software.

6.1 SAVE RECORDINGS (PC)

When the PC software is monitoring live data from the device, the user may choose to record these logs on the PC itself.

By default, all recordings are saved to My Documents folder\Knock Monitor Pro

You have the option to log information without saving the sound files. Uncheck the corresponding menu option to configure this preference.

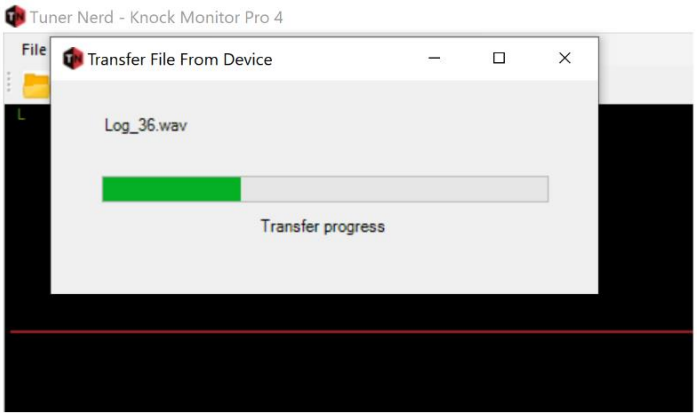
6.2 TRANSFERRING FILES

Menu » Logs

You may transfer files to the Knock Monitor PC by first connecting the PC software to the device, and then accessing the log from the log menu.

Next, click Xfer to transfer the file to the PC software.

The PC software will pop up the File Transfer window showing the file transfer progress.



At the end of the transfer, you will be asked to name the log, and save it to the computer.

7 PC SOUND TROUBLESHOOTING

Problem: I'm seeing the green dots but not getting any audio or waveform.

a. Close software
   Remove then reconnect USB
   restart software

Problem: I'm hearing a ticking noise that sounds like the injector.

b. While the wires for knock sensor is shielded, some noise can still be received by the unit.
c. Some amount of ticking is normal, as the engine is revved higher it will dissipate.
d. Contact us via the facebook page if problem persists.

Problem: Not hearing engine, not seeing any sound indication on screen

- Check to ensure the right sound device is selected.
- Check connection between device and knock sensor

Problem: I'm seeing sound indication on screen, but not hearing anything

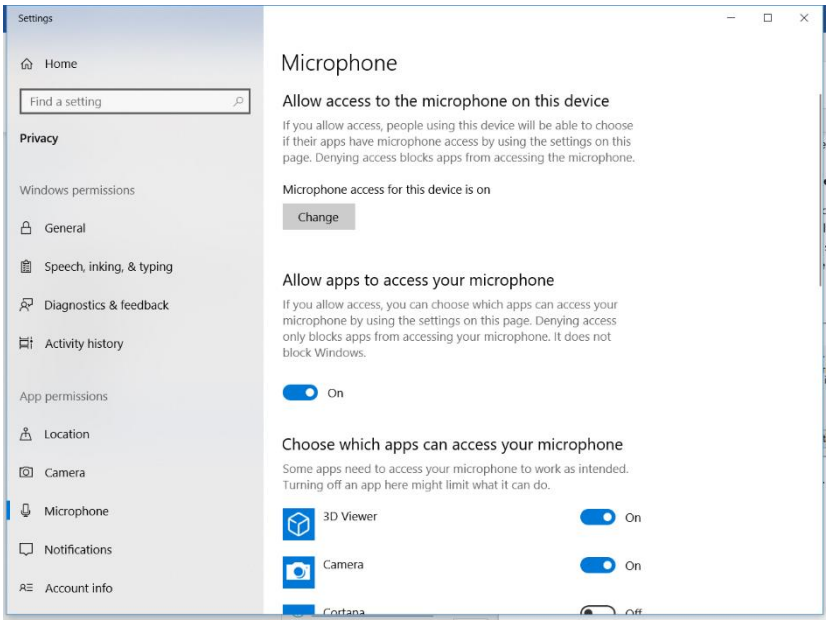
a. Check to ensure your headphone is plugged into the default windows playback device
    a. If you headphone is plugged into the same device as your knock sensor / TKM, then use Windows to set this device as your default playback device.
    b. Check the sound mixer volume in Windows

Problem: I get this error message:

Unspecified Error Calling WaveInOpen

a. This can be attributed to a microphone privacy setting. Go to start menu and type *Microphone privacy*. Allow all apps.

   The setting should look like this.



8 OTHER GENERAL INSTRUCTIONS

- This device is not waterproof. Use accordingly.
- Do not connect any of the RPM probes to a voltage source higher than 14 volts. The map sensor maximum is 5V.
- Avoid using abrasive objects as styluses on the display.
- The audio log will record for a maximum of 2 minutes and 30 seconds. A new file will be started automatically after each 2:30 interval.
- Avoid running cables close to alternator and high-tension ignition sources.
- The unit nor its cables are fire resistant, avoid areas of high temperature.

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