

# FuelTech



## **KNOCKMETER**

Knock Meter

Installation and Operation Guide

## Summary

<b>1</b>	<b>Presentation .....</b>	<b>4</b>
1.1	Characteristics.....	4
<b>2</b>	<b>Warranty terms .....</b>	<b>5</b>
<b>3</b>	<b>Installation.....</b>	<b>6</b>
3.1	Harness connection .....	6
3.2	Wiring harness.....	6
3.3	Knock sensor .....	7
3.4	Knock sensor installation.....	7
3.5	RPM input wiring.....	8
3.6	CAN communication with FuelTech ECUs .....	8
<b>4</b>	<b>Navigation and Menus.....</b>	<b>9</b>
4.1	Navigating through menus .....	9
4.2	Dashboard .....	9
4.3	Knock Meter menu map.....	9
<b>5</b>	<b>Configuration .....</b>	<b>10</b>
5.1	Dashboard configuration .....	10
5.2	Knock Meter configuration.....	10
5.3	Engine settings .....	11
5.4	Software version and Serial number.....	11
<b>6</b>	<b>Datalogger connection .....</b>	<b>12</b>



## 1 Presentation

The equipment is designed to measure the noise of anomalous combustion (called knock) on vehicles with internal combustion engines. Through a knock sensor, it is able to analyze the noise from the engine combustion and detect abnormal combustion, which can degrade performance and even damage the engine. This anomaly occurs when abnormal combustion in the ignition advance or physical characteristics and engine parameters such as engine compression rate and inlet air temperature.

This module is able to retard the ignition timing when a knock event is detected. These timing retard signals are sent through a CAN-CAN cable that connects a FuelTech ECU (FT300, FT350, FT400 and FT500) to Knock Meter. In its dashboard you can check in real time the combustion noise level and, through a beep, the event of any knocking.

Knock Meter can also be used independent of a FuelTech ECU and work simply as a tool to tune the ignition timing - the combustion noise level information, as well as the beep, are precious to tune the timing tables. Working in this independent mode, it will only be a conditioner of the knock sensor signal, and there will be no interaction with other ECU to change the ignition timing.

**The correct operation of this product will only be achieved if:**

- **The sensor used is one of the recommended types**
- **The sensor is properly attached to the block (tightening torque and position)**

### 1.1 Characteristics

#### **Specifications and Inputs**

Two knock sensor inputs  
RPM signal input  
0-5V knock level analog output  
CAN port to communicate with FuelTech ECUs

#### **Dimensions:**

3,5" x 2" x 1,2"

## 2 Warranty terms

The use of this equipment implies the total accordance with the terms described in this manual and exempts the manufacturer from any responsibility regarding to product misuse.

Read all the information in this manual before starting the product installation.

**This product must be installed and tuned by specialized auto shops and/or personnel with experience on engine tuning.**

Before starting any electric installation, disconnect the battery.

The inobservance of any of the warnings or precautions described in this manual might cause engine damage and lead to the invalidation of this product warranty. The improper use of the product might cause engine damage.

This product does not have a certification for the use on aircraft or any flying devices, as it has not been designed for such use purpose.

In some countries where an annual inspection of vehicles is enforced, no modification in the OEM ECU is permitted. Be informed about local laws and regulations prior to the product installation.

Important warnings for proper installation of this product:

- Always cut the unused parts of cables off – NEVER roll up the excess
- The black wire of the harness **MUST** be connected directly to the **battery's negative terminal**, as well as each one of the sensors' ground wires.

### Limited Warranty

All products manufactured by FUELTECH are warranted to be free from defects in material and workmanship for one year following the date of original purchase. Warranty claim must be made by original owner with proof of purchase from authorized reseller. This warranty does not include sensors or other products that FUELTECH carries but did not manufacture. If a product is found defective, such products will, at FUELTECH's option, be replaced or repaired at cost to FUELTECH. All products alleged by Purchaser to be defective must be returned to FUELTECH, postage prepaid, within one year warranty period.

This limited warranty does not cover labor or other costs or expenses incidental to the repair and/or replacement of products or parts. This limited warranty does not apply to any product which has been subject to misuse, mishandling, misapplication, neglect (including but not limited to improper maintenance), accident, improper installation, tampered seal, modification (including but not limited to use of unauthorized parts or attachments), or adjustment or repair performed by anyone other than FUELTECH.

The parties hereto expressly agree that the purchaser's sole and exclusive remedy against FUELTECH shall be for the repair or replacement of the defective product as provided in this limited warranty. This exclusive remedy shall not be deemed to have failed of its essential purpose so long as FUELTECH is willing and able to repair or replace defective goods.

FUELTECH reserves the right to request additional information such as, but not limited to, tune up and log files in order to evaluate a claim.

**Seal violation voids warranty and renders loss of access to upgrade releases.**

### 3 Installation

For proper installation, the electric cables must be disconnected from the module and the vehicle's battery. It is very important that the cable length is the shortest possible and that exceeding unused parts of wires are cut off.

Choose an appropriate location to affix the module inside the car, and avoid passing the harness wires close to the ignition wires and cables, ignition coils and other sources of electric noise.

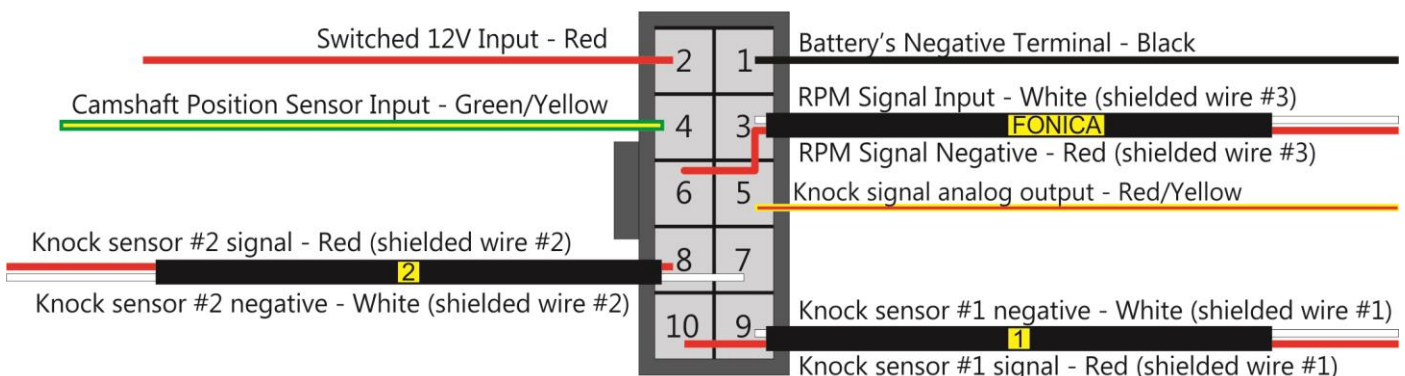
The black wire in the harness is the signal ground wire, and must be connected to the battery's negative terminal.

The electric cables must be protected from contact with sharp parts on the vehicle's body that might damage the wires and cause short circuit. Be particularly attentive to wires passing through holes, and use rubber protectors or any other kind of protective material to prevent any damage to the wires.

#### 3.1 Harness connection

Wire color	Pin	Function	Information
Black	1	Battery negative input	Connect <b>directly</b> to the battery negative. <b>Do not connect this wire to the chassis, engine block or head.</b>
Red	2	12V input from ignition switch	Connect to a relay or ignition switch.
White of crank trigger shielded cable	3	RPM signal input	Connect to the crank trigger sensor (hall or magnetic) or to the distributor – do not connect the shield
Green/Yellow	4	Cam sync signal input	Connect to the cam sync sensor (hall or magnetic)
Yellow/Red	5	Knock level analog output	Connect to any datalogger to log knock events
Red of crank trigger shielded cable	6	Magnetic RPM sensor reference	Connect to the negative wire of the <b>magnetic sensor</b> . When OEM ECU is reading the sensor in parallel, split this wire with OEM sensor negative – Do not connect when using hall effect sensor. (Check chapter 3.5 for more details)
White of shielded cable 2	7	Knock sensor 2 negative	Knock sensor 2 negative Connect directly to the sensor
Red of shielded cable 2	8	Knock sensor 2 signal	Knock sensor 2 positive Connect directly to the sensor
White of shielded cable 1	9	Knock sensor 1 negative	Knock sensor 1 negative Connect directly to the sensor
Red of shielded cable 1	10	Knock sensor 1 signal	Knock sensor 1 positive Connect directly to the sensor

#### 3.2 Wiring harness



Harness Connector Rear View

### 3.3 Knock sensor



This is the main sensor used by Knock Meter to make the knock reading and timing retard control. The knock sensor is capable of measuring the vibration suffered by engine block at the time of occurrence of an anomalous combustion. According to the intensity of this signal, the Knock Meter performs an audible and visual warning, besides retard timing when connected through CAN port to FuelTech ECUs (FT300, FT350, FT400 and FT500), which prevents power loss and engine damage.

The installation of the sensor is simple: attach it to the middle of the block by applying 18 lbf.ft torque on your screw.

The sensor should be wideband without internal filter. Below are some compatible Bosch part numbers:

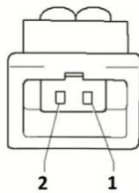
Bosch 0 261 231 006  
Bosch 0 261 231 007  
Bosch 0 261 231 018  
Bosch 0 261 231 040  
Bosch 0 261 231 047  
Bosch 0 261 231 118  
Bosch 0 261 231 120  
Bosch 0 261 231 148  
Bosch 0 261 231 153

The only difference between the sensors above is the connector.

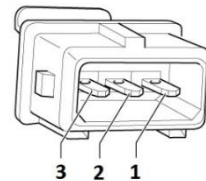
### 3.4 Knock sensor installation

Most sensors have two pins and the pinout usually does not affect the reading. It is recommended not to share the sensor with other equipment, if this happens there will be need to connect as the original pin out (positive signal in the red wire and the negative in white). In sensors with three pins, the third pin is connected to the shielded cable (in this case we recommend the sensors listed in this manual).

Pin 1: Signal  
Pin 2: Negative



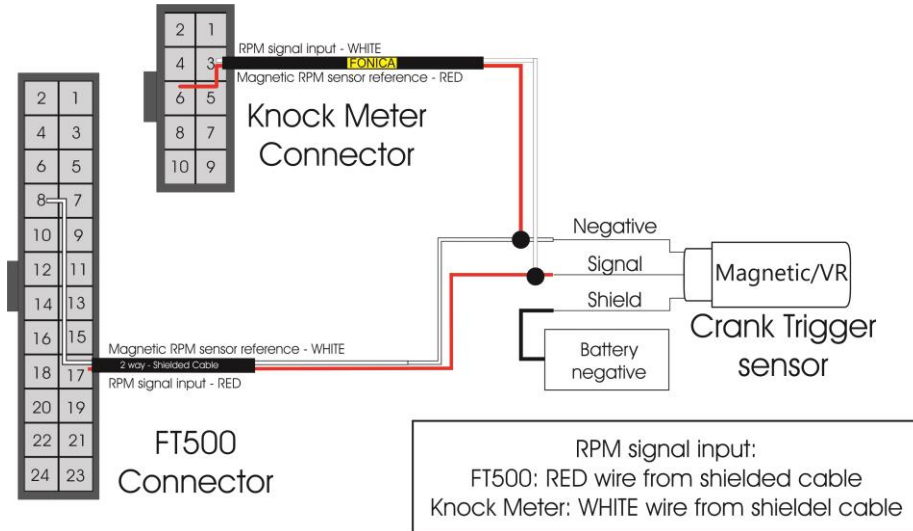
Pin 1: Signal  
Pin 2: Negative  
Pin 3: Shield



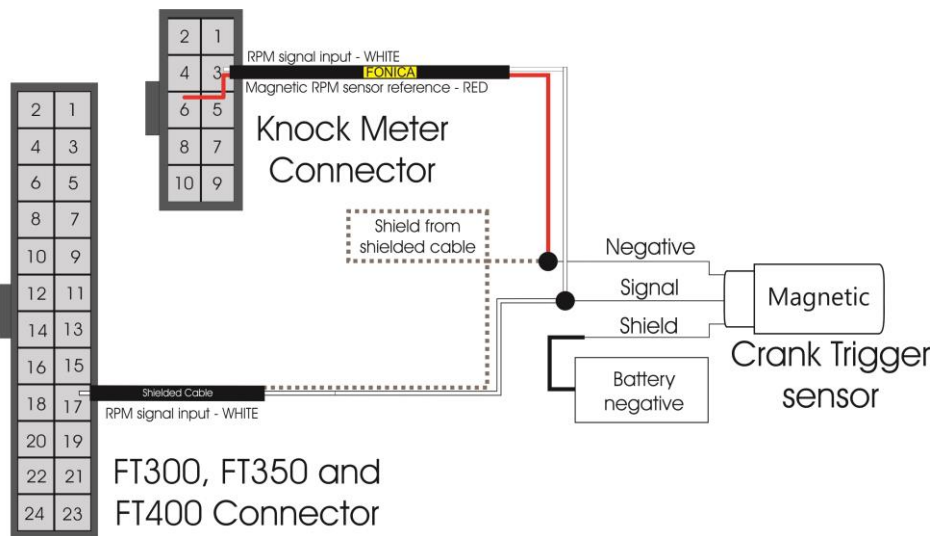
### 3.5 RPM input wiring

The crank trigger shielded cable is responsible by the Knock Meter RPM reading. The white wire from crank trigger shielded cable will be hooked to the crank trigger sensor signal (red wire of shielded cable in FT500 and white wire of shielded cable in the rest of FuelTech line). The red wire goes to sensor's negative or differential input pin.

#### Installation with FT500 - differential input



#### Installation with older FT ECUs - non-differential input (FT300, FT350 and FT400)



### 3.6 CAN communication with FuelTech ECUs

Knock Meter can be easily connected to a FuelTech ECU through a CAN CAN cable. This cable is connected to the Knock Meter CAN port and the ECU CAN port (FT300, FT350, FT400 and FT500).

When a knock event is detected and the CAN CAN cable is connected, Knock Meter automatically sends a timing retard signal to the ECU.

**Important:** the retarded timing is not shown on FuelTech display. Its display continues to show normal timing, as if there is no retard, although the FT is retarding the timing as Knock Meter sends. The retard can be seen on the ECU internal datalogger.

## 4 Navigation and Menus

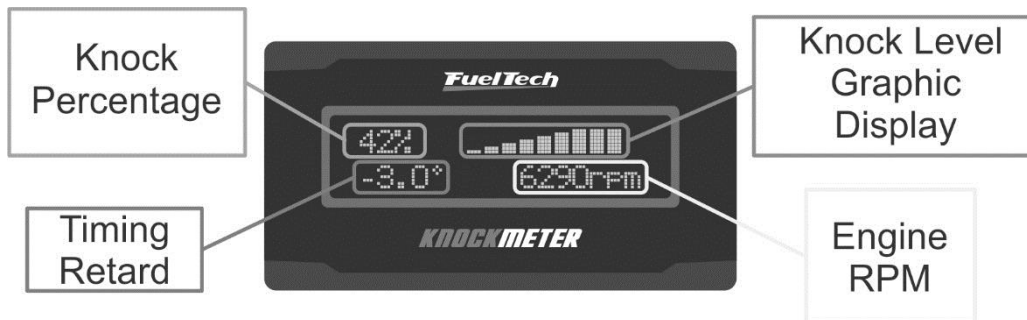
### 4.1 Navigating through menus

To navigate the menus and setup Knock Meter only one button is necessary.

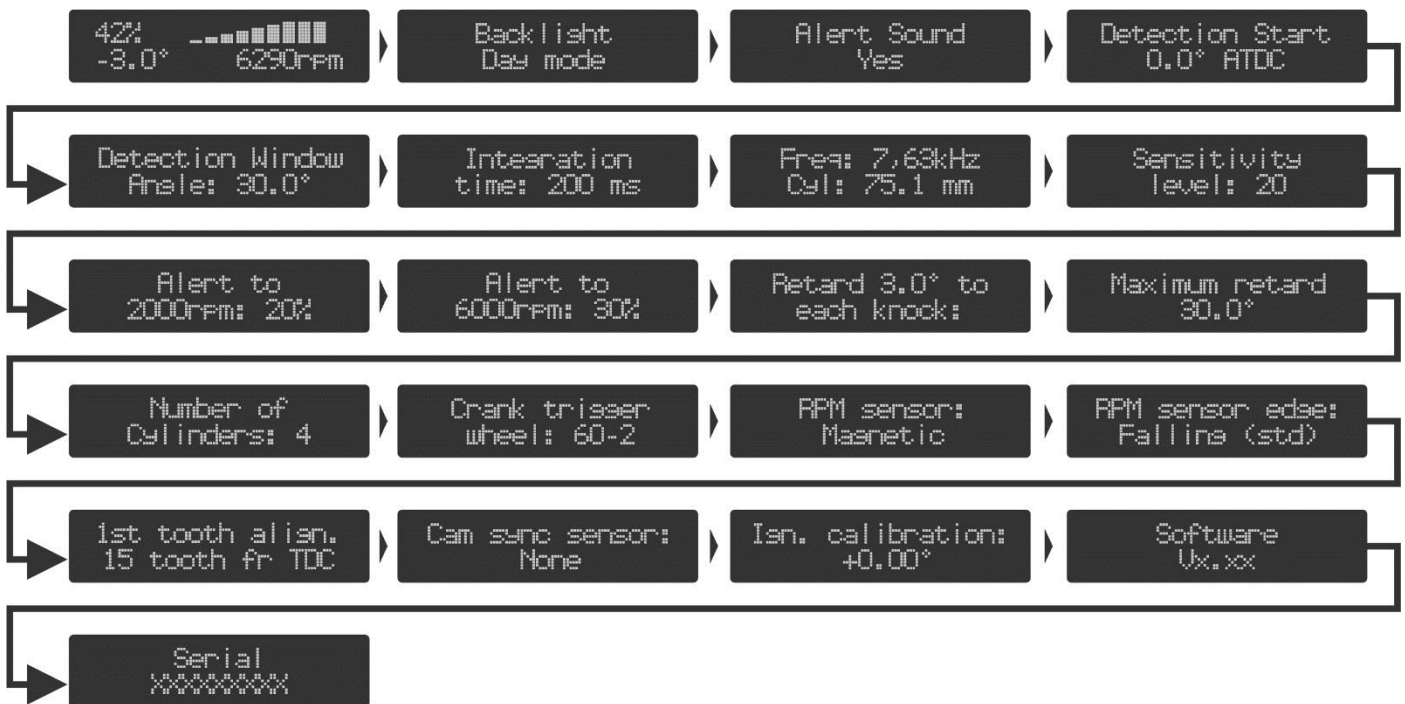
- **Short press:** Change the displayed menu or its value
- **Long press (1 sec):** Enter the settings menu, select the item to configure or to confirm the edition.
- **Keep pressed for 2 seconds:** Back to dashboard

### 4.2 Dashboard

During its operation, Knock Meter shows information in the dashboard. Below is a brief description of each.



### 4.3 Knock Meter menu map.





## 5 Configuration

### 5.1 Dashboard configuration

**Backlight:** Night mode – attenuates the display light;

Day mode – normal light.

**Alert sound:** Set the alert sound to turn on above a set % value.

Backlight  
Day mode

Alert Sound  
Yes

### 5.2 Knock Meter configuration

**Detection Start:** Shows the crankshaft angular position, after the top dead center (ATDC) where the knock sensor's detection window will be opened.

Suggested value: 0° ATDC

Detection Start  
0.0° ATDC

**Detection Window Angle:** Duration, in degrees, of the detection window after knocking is read.

Suggested value: 15 to 20° ATDC

Detection Window  
Angle: 30.0°

**Integration time:** Signal acquisition time inside the detection window. This parameter has the purpose of smooth the signal.

Suggested value: 200ms

Integration  
time: 200 ms

**Freq/Cyl:** Specifies the knocking frequency, which is related to the engine bore size.

Suggested value: choose according to the engine bore size.

Freq: 7,63kHz  
Cyl: 75.1 mm

**Sensitivity level:** Defines the reading sensitivity level. This parameter requires great care in programming, because too high values will amplify the knock sensor signal and hide the knock noise.

Suggested value: 20

Sensitivity  
level: 20

**Alert to 2000rpm:** Noise percentage that is considered abnormal above 2000rpm;

Suggested value: 30%

Alert to  
2000rpm: 20%

**Alert to 6000rpm:** Noise percentage that is considered abnormal above 6000rpm;

Suggested value: 60%

Alert to  
6000rpm: 30%

**Retard x.x° to each knock:** Set the timing retard send to ECU to each knock event. Each new knock, the retard will be summed until the knock stops.

Suggested value: 2° to 3°

Retard 3.0° to  
each knock:

**Maximum retard:** Set the maximum timing retard that will be send to the ECU in case of several knock events.

Suggested value: 10°

Maximum retard  
30.0°

### 5.3 Engine settings

All these settings are automatically filled when the Knock Meter is connected to FuelTech ECUs through CAN CAN cable, but, when using it without the CAN CAN cable, all of these parameters must be set manually.

**Number of Cylinders:** tells the Knock Meter how many cylinders has the engine;

Number of  
Cylinders: 4

**Crank trigger wheel:** crank trigger wheel pattern;

Crank trigger  
wheel: 60-2

**RPM sensor:** choose between magnetic (variable reluctance) or Hall Effect;

RPM sensor:  
Magnetic

**RPM sensor edge:** tells the Knock Meter how it should read the RPM signal. Choose between Falling (standard) or Rising (inverted);

RPM sensor edge:  
Falling (std)

**1<sup>st</sup> tooth alignment:** tooth distance between the tooth that indicates the TDC and the sensor;

1st tooth align.  
15 tooth fr TDC

**Cam sync sensor:** when using this sensor, set if it is magnetic or Hall Effect;

Cam sync sensor:  
None

**Ign. calibration:** it is important to make sure the timing the ECU reads is really correct with the engine. This function locks the timing at 20° BTDC that must be checked with the timing light

Ign. calibration:  
+0.00°

### 5.4 Software version and Serial number

**Software:** Specifies the software version used in the device.

Software  
Ux.xx

**Serial:** Serial number - identifies its manufacturing characteristics.

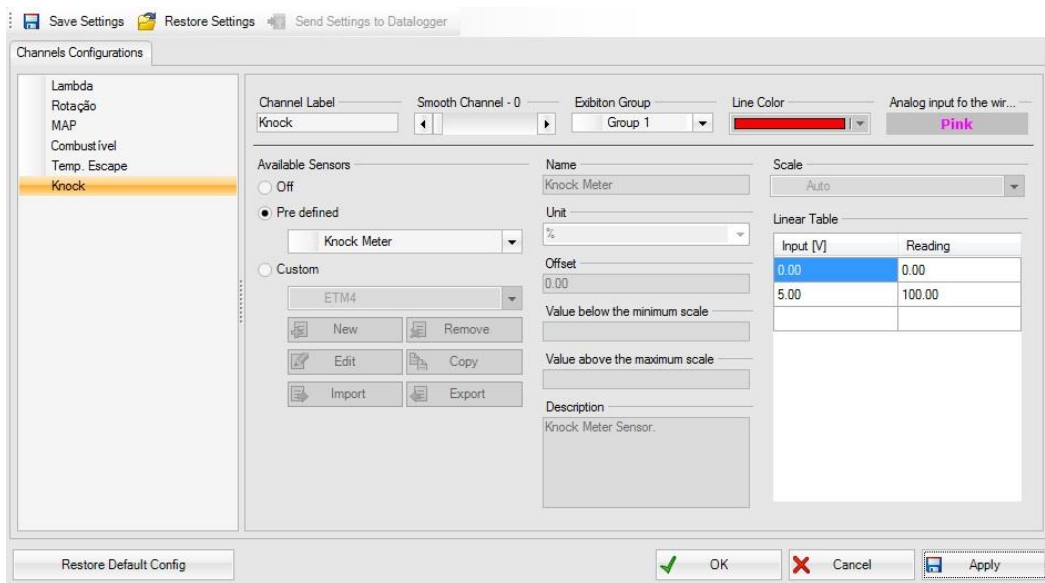
Serial  
XXXXXXXX

## 6 Datalogger connection

The Knock Meter analog output can be connected to any kind of Datalogger or ECU that has an analog input (i.e. FT500) to log knock events. Below are instructions on how to wire and setup the input:

Pin/Knock Meter wire color	Function	Description
Pin 5 Yellow/Red	Knock signal analog output	Knock Meter Analog signal to the datalogger. This channel must be connected to white inputs of PRO24 Datalogger or the analog inputs of WB-O2 Datalogger (white, blue, pink or orange wires).

These inputs are configured as pre-defined "Knock Meter" in FuelTech datalogger software.



### Internal Datalogger example graphic

