

# IGNITION TUNING GUIDE

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The first step in any form of tuning is to calibrate and to confirm feedback loop. In the case of ignition, it is ignition angle and knock level.

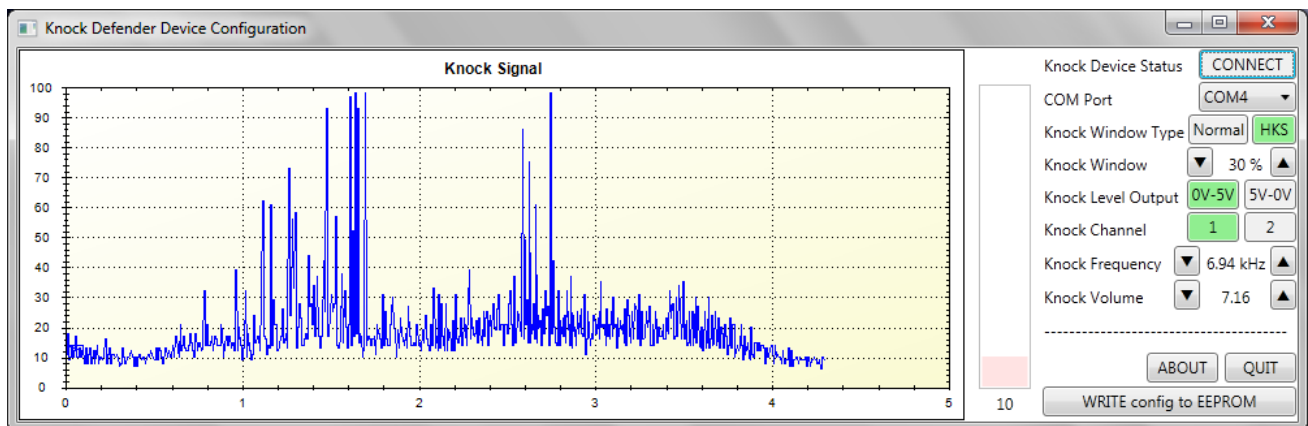
Knock level noise and signal over engine load and RPM needs to be determined. This is done through the knock device (in his case, Knock Defender Configuration Interface).

An example configuration is:

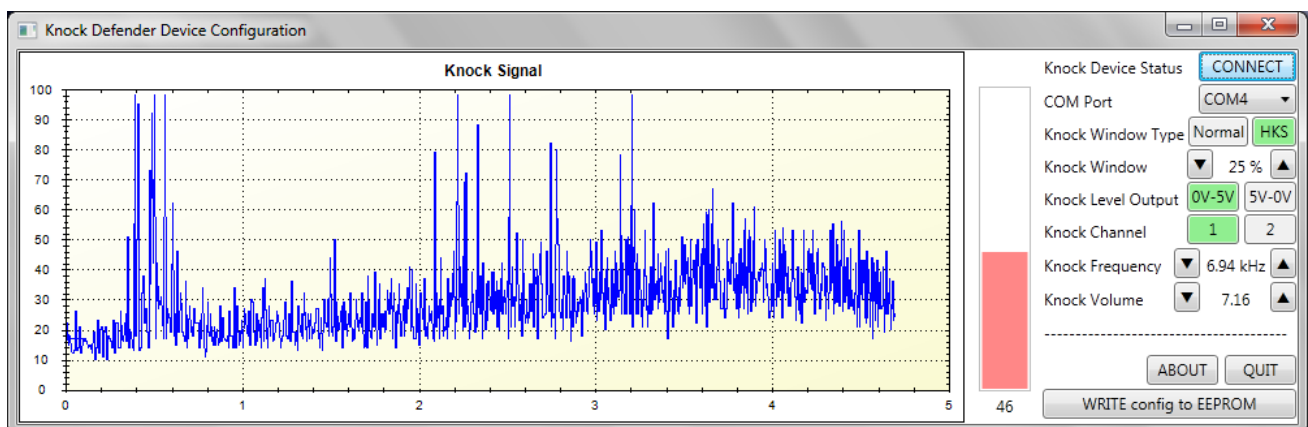
- Knock Window: 35%
- Knock Frequency: 6.94 kHz (eg: 1JZ, 2JZ, RB25)
- Knock Volume: 3.5

If knock level is consistently below 30, even under high load and high RPM, it is calibrated properly. If there are spikes above 30, then that is sign of knock. No further calibration is needed. As long as noise is below 30, or even 20, then it is fine. If it is more, Knock Volume needs to be reduced.

Low-RPM, low-engine-load:



low-mid-RPM, high-engine-load: *Knock Volume set too high, Knock Window set too low.*



*Knock Defender serial cable does not need to be connected if only utilising PowerWriter software, as Knock level output will always be updated, if connected and configured.*

# Tuning Software Configuration

In order to log knock level against engine load and RPM, software (and hardware) needs to know which input to use:

## Settings: Parameter Settings (1):

- Control → *Voltage Input 1* → **Knock Level**
- Ignition 2 → *Knocking 100 Level Voltage* → **4900**
- Ignition 2 → *Knocking 0 Level Voltage* → **0**
- Ignition 2 → *Knocking Detect Timing (BTDC)* → **-10** degrees

*Note: Knocking Detect Port settings does not matter.*

## Knock Feedback Table: Ignition Map 2 → Knock:

	400	1000	1500	2000	2500	3000	3500	4500	5500	6500	7500
0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	1	1	1	1	1	1	1	1	1
20	0	0	2	2	2	2	2	2	2	2	2
30	0	0	1	1	1	1	1	1	1	1	1
40	0	0	0	0	0	0	0	0	0	0	0
50	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
55	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
60	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
65	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
70	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
75	0	0	-2	-2	-2	-2	-2	-2	-2	-2	-2
80	0	0	-3	-3	-3	-3	-3	-3	-3	-3	-3
85	0	0	-3	-3	-3	-3	-3	-3	-3	-3	-3
90	0	0	-3	-3	-3	-3	-3	-3	-3	-3	-3
95	0	0	-3	-3	-3	-3	-3	-3	-3	-3	-3
100	0	0	-5	-5	-5	-5	-5	-5	-5	-5	-5

## Knock Logging:

- "Data Log" (*Pencil icon on far right*)
- "Log View Setting" (*4th icon from left*)

Disable all settings (*unmark View checkbox*) except for:

- **RPM**
- **Pressure**
- Throttle
- AFR1
- SPEED
- **Knock**
- INJ Main
- **IGN Main**
- F Total
- **I Total**
- **I Knock** (*last item on list*)

Configure **I Knock**:

- change to color Green or something else than Red.
- set min: -5
- set max: 5

→ "**Start(L)**" Button.

## Knock Logging: Procedure

The most important to ignition tuning is to go through the ignition table in a consistent pattern. For initial set of tune, it is best not to do too high RPM until it is confirmed you are not triggering HARD knock.

For example:

- cruise at 2000 RPM, 4th gear, full throttle until 3500 RPM
- cruise at 2000 RPM, 3rd gear, full throttle until 4000 RPM
- cruise at 2000 RPM, 2nd gear, full throttle until 4000 RPM.
- stop logging.
- analyse log.

The most critical part of tuning is low-RPM low-boost high-load (2000 RPM, 0psi), to mid-RPM full-boost high-load. (3500 RPM, 15-20 psi).

Once this part is tuned, tuning beyond 3500 RPM can be performed (*once ignition table has been altered by hand*)

Next steps would be to cruise at 2500 RPM or even 3000 RPM, in each gear, until 4000-6000 RPM.

Once majority of knock is removed, interpolation can be performed *\_outside\_* of typical ignition table (*eg: 4000-6000 RPM low boost conditions, and 1500-3000 RPM high boost conditions*)

## Knock Logging: Procedure: Graphical form: Ignition: Boost-vs-RPM

	0	400	700	1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	5500	6000	6500	7000
0.10	4	4	21	23	26	28	31	32	33	33	33	33	34	34	35	35	35	35	35	35
0.20	4	10	10	23	26	28	31	32	33	33	33	33	34	34	35	34	33	33	34	34
0.30	4	10	10	23	26	28	31	32	33	33	33	33	34	34	34	34	32	32	32	33
0.40	4	10	10	22	26	28	30	31	32	32	33	34	34	33	32	30	30	30	31	31
0.50	4	10	10	25	26	27	28	29	30	31	32	34	34	32	30	28	29	29	30	30
0.60	4	4	21	24	25	26	27	29	30	31	32	34	34	32	29	27	27	28	29	29
0.70	4	4	20	23	24	25	26	28	29	30	31	32	32	30	27	25	26	26	28	28
0.80	4	4	19	22	23	24	26	26	28	29	30	30	30	28	25	23	24	25	26	26
0.90	4	4	17	20	21	23	25	26	27	28	28	28	27	25	23	22	23	23	25	25
1.00	4	4	16	20	21	23	24	25	26	28	27	28	25	24	22	20	21	22	24	24
1.10	4	4	15	17	19	21	23	24	24	26	25	24	24	22	20	19	20	21	23	23
1.20	4	4	14	16	18	20	21	22	23	24	24	23	22	21	19	18	19	20	22	22
1.30	4	4	12	14	17	19	20	21	22	22	22	20	19	18	17	18	19	21	21	21
1.40	4	4	12	14	16	19	19	20	19	19	20	19	18	17	16	17	18	20	20	20
1.50	4	4	10	12	15	18	17	18	18	19	18	18	17	17	16	16	17	18	18	18
1.60	4	4	9	11	14	17	16	17	16	17	17	16	16	16	15	15	16	17	17	17
1.70	4	4	7	9	12	14	14	14	14	15	16	16	16	16	15	15	16	17	17	17
1.80	4	4	6	8	10	12	12	12	13	14	15	15	15	15	14	14	14	15	16	16
1.90	4	4	5	7	9	11	11	11	13	14	15	15	15	15	14	14	14	15	16	16
2.00	4	4	4	6	8	10	10	10	12	13	14	14	14	13	13	13	13	14	15	15
2.10	4	4	4	5	6	8	9	9	10	11	13	13	13	13	13	13	13	13	14	15
2.20	4	4	4	4	5	6	8	8	9	10	12	12	13	12	12	12	12	12	13	14
2.30	4	4	4	4	5	6	8	8	9	10	12	12	13	12	11	11	11	12	13	14
2.40	4	4	4	4	5	6	7	7	8	9	11	12	12	11	10	10	10	11	12	13

If maximum boost can be controlled, then it is advised to set in 0.1 or 0.2 intervals from minimum to maximum setting. Example:

- +0.8 bar
- +1.0 bar
- +1.2 bar
- +1.4 bar

## Analyse Logs:

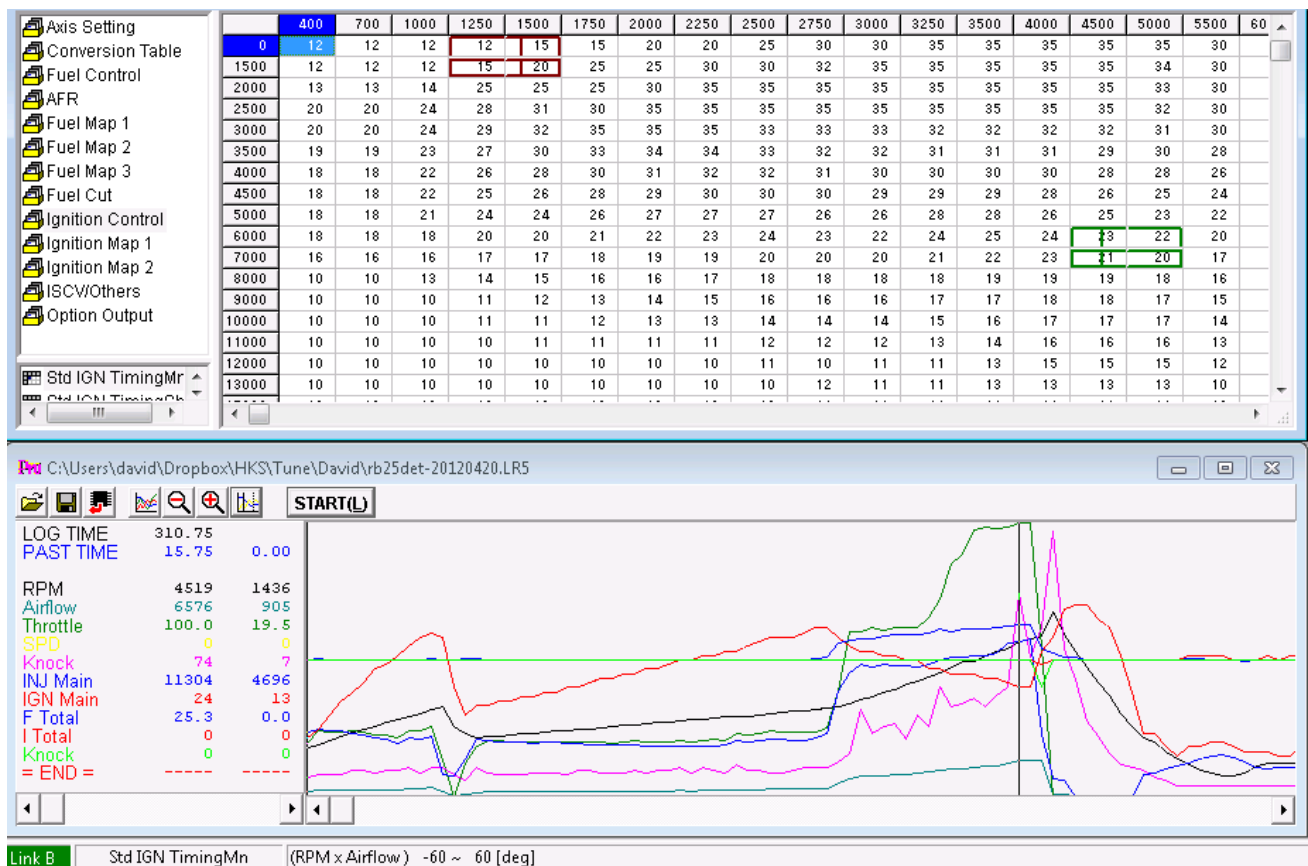
- PowerWriter software is a bit primitive when it comes to logging... it can only log every 250 ms interval (*unless hardware based logging is utilised, but that is outside of the scope of this document for the time being*).

The best way to analyse knock vs engine load and RPM is to use "Log Link" mode. Steps:

1) Menu → OPTION → **LOG LINK(L)**.

1b) If there is "Link" in green on bottom left of window, then it is enabled.

2) Minimise log window to 50% or 33% to the bottom, and show Ignition table on top 50-66%



Where there are high values of knock (*in pink, knock feedback was not configured so green is always 0*), you can see on the ignition table (in Green box) the RPM and engine load (*in this special case, AirFlow. Other people will see boost level*)

If there are high level of knock, it is best to reduce the ignition by 1 or 2, not by the full amount as done by the knock feedback. For example, "I Knock" may show -5, for the cells "23, 21". Reduce those two cells by 2 so they will now be "21,19" vertically. It is best to only change the numbers vertically in twos, rather than by 2x2.

Selecting the part of the log is done by mouse cursor (Green). The dark red is the vertical-dash line. It is advised to ignore the red box for the time being. Keep going through the log until there are no further parts to remove (or add) ignition.

"IGN Main" shows the original ignition values... so if you change it a few times in the table, it will not influence this "logged" value unless re-logging is performed.

Tuning ignition is an iterative process. Keep logging and adjusting values until no knock.

## Knock Feedback: Permanent Installation

Once tuning is complete, knock device can be permanently installed to continuously monitor knock level and adjust ignition based on the knock level, creating closed loop feedback cycle. The knock-ignition feedback table can be left as previously used for tuning, or slightly altered. It is really up to personal taste, sensitivity settings based on engine build (eg: forged pistons), and how much to reduce (retard) - or even increase - ignition depending on RPM.

Here's a real example to use in permanent installation:

	400	1000	1500	2000	2500	3000	3500	4500	5500	6500	7500
0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0
40	0	0	-1	-1	-1	-1	0	0	0	0	0
50	0	0	-1	-1	-1	-1	-1	0	0	0	0
55	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
60	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
65	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
70	0	0	-1	-1	-1	-2	-2	-2	-2	-2	-2
75	0	0	-1	-1	-1	-2	-2	-2	-2	-2	-2
80	0	0	-1	-1	-1	-2	-2	-3	-3	-3	-3
85	0	0	-1	-1	-1	-2	-2	-3	-3	-3	-3
90	0	0	-1	-1	-1	-2	-3	-3	-3	-3	-3
95	0	0	-2	-2	-2	-2	-3	-3	-3	-3	-3
100	0	0	-2	-2	-2	-3	-3	-4	-5	-5	-5