SECTION BOOKLET

D Cranking Button

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Each guide keeps its own page numbers and version stamp. The newest versions are always online.

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IMPACT ECU · CRANKING BUTTON GUIDE

Cranking Button Overview

The **Cranking** button in TunerStudio holds the settings for starting the engine: the squirt of fuel when you turn the key on, the fuel and spark timing while the starter turns the engine, and the extra fuel for the first moments after it starts. This guide is the map to its menu: what each item is for, and which guide explains it.

Your tune came with these set for your bike. Most of them never need changing.

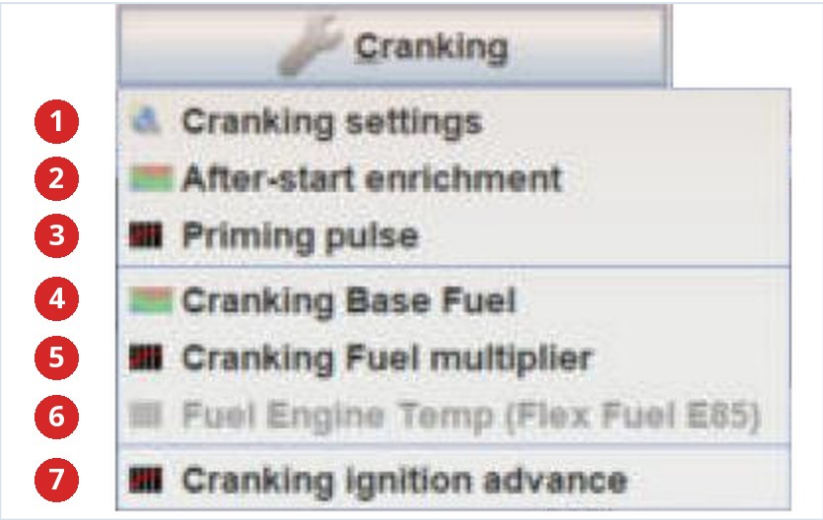
What happens when you start the bike

STEP 1 **KEY ON**	**Priming pulse:** a moment after the key goes on, the injectors open once to wet the intake with a little fuel.
STEP 2 **CRANKING**	While the starter turns the engine, the ECU uses the **cranking fuel**, spark timing and coil charge time (dwell) instead of the normal ones. Keep the twist grip closed: opening it gives less fuel, and wide open cuts the fuel completely (flood clear).
STEP 3 **RUNNING**	Once the engine reaches the **Cranking RPM limit** (the speed at which the ECU counts the engine as started), it switches to the normal Fuel and Ignition settings.
STEP 4 **JUST STARTED**	**After-start enrichment** adds extra fuel for about the first 15 seconds, more when the engine is cold.

Before you change anything

- **Save a copy of your tune first**, so you can always go back.
- **Burn means save.** Changes go to the ECU as you make them, but are only kept after you click **Burn**.
- **Greyed-out items** are switched off by another setting. Each guide says which one.
- **Missing items?** Some only show when **Setup ▸ Vehicle Information ▸ Tuning View** is set to **Full**.
- **Hard starting is often not the tune.** Check the battery first: a weak battery turns the engine slowly and makes a weak spark.
- **Change one thing at a time.** Not sure? Call us first.

The Cranking menu, item by item



*Items 2, 3, 6 and 7 only show when **Tuning View** is **Full** (Setup ▸ Vehicle Information). If your menu shows only three items, set it to Full.*

1. **Cranking settings** The Cranking RPM limit, how the injectors fire while cranking, cranking timing and dwell, and flood clear.
2. **After-start enrichment** Extra fuel for the first moments after the engine starts.
3. **Priming pulse** The squirt of fuel when the key goes on.
4. **Cranking Base Fuel** The starting amount of fuel for each injection while cranking, by engine temperature. The multipliers then add to it.
5. **Cranking Fuel multiplier** More cranking fuel when the engine is cold.
6. **Fuel Engine Temp (Flex Fuel E85)** The same, for E85 (fuel with 85% ethanol). Only with a flex fuel sensor; greyed out otherwise.
7. **Cranking ignition advance** The spark timing while cranking.

The idle valve opening while cranking is set in the **Idle** button (**Cranking Idle Valve Curve** and **Idle Valve Crank-to-Run Taper**). The Idle guides explain them.

Which guide to read

GUIDE	MENU ITEMS	WHAT IT COVERS
Cranking Settings	1	Cranking RPM limit, injection mode, cranking timing mode and dwell, flood clear
After-Start Enrichment	2	Extra fuel just after the engine starts
Cranking Fuel	3–6	Priming pulse, cranking base fuel and multipliers
Cranking Ignition Advance	7	Spark timing while cranking

Which setting fixes what?

IF THE BIKE…	LOOK AT
Turns over but never fires	Make sure the twist grip is closed and the battery is strong. Then call us
Cranks a long time before it fires	**Cranking Fuel** (base fuel and multiplier) and the priming pulse. Call us before changing them
Smells of fuel or floods when you try to start it	If you can see or smell leaking fuel, don't try to start it: call us. Otherwise the engine may be flooded (too much fuel): use flood clear (see Cranking Settings), then call us
Starts, then dies within a few seconds	**After-Start Enrichment**, and the Idle button's cranking idle valve settings
Kicks back or pops while cranking	Check the battery first, and make sure **Ignition ▸ Ignition settings ▸ Timing Mode** is **dynamic**. Then call us. Don't change Cranking Ignition Advance yourself

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IMPACT ECU · CRANKING BUTTON GUIDE

Cranking Settings

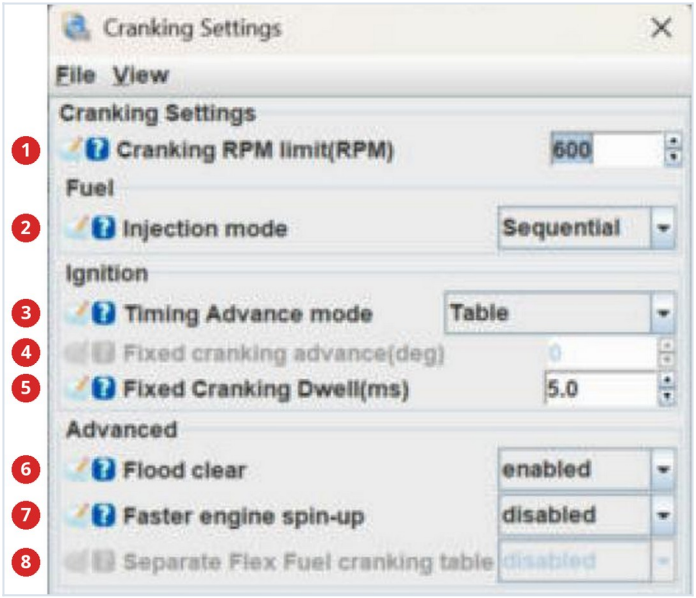
This window sets when the ECU counts the engine as **cranking** (being turned by the starter), how the injectors fire while cranking, the spark timing and coil charge time (dwell) while cranking, and flood clear.

Your tune came with these set for your bike. **You should never need to change them.**

WHERE TO FIND IT
Cranking ▸ Cranking settings

The numbers in these pictures come from one example bike. Your tune's numbers will be different, so don't copy them. Units are Metric (°C, kPa, km/h). Red numbers in each picture match the table below it.

The settings



#	SETTING	WHAT IT DOES
1	**Cranking RPM limit (RPM)** LEAVE AS SET	The engine counts as started when it first reaches this speed: **600** here. Until then, from a stop, the ECU is **cranking** and uses the cranking fuel, timing and dwell. Once started, it uses the normal Fuel and Ignition settings until the engine stops, even if the RPM dips below 600.

#	SETTING	WHAT IT DOES
2	**Injection mode** LEAVE AS SET	**Sequential:** each injector fires once per engine cycle (two crankshaft turns), timed for its own cylinder. **Batch:** both fire together twice per cycle, each with half the fuel.
3	**Timing Advance mode** LEAVE AS SET	**Table:** the timing while cranking comes from **Cranking ▸ Cranking ignition advance**. **Fixed (auto taper):** it starts at the number in 4 and blends toward the normal timing as RPM rises.
4	**Fixed cranking advance (deg)** LEAVE AS SET	The starting timing for Fixed (auto taper). Greyed out while 3 is **Table**.
5	**Fixed Cranking Dwell (ms)** LEAVE AS SET	Coil charge time while cranking: **5.0** ms here, with no battery voltage correction. It replaces the Ignition button's Dwell curves until the engine starts.
6	**Flood clear** LEAVE AS SET	**enabled:** while the engine isn't running, holding the twist grip wide open (more than 90%) stops all fuel, to clear a flooded engine. **enabled** here.
7	**Faster engine spin-up** LEAVE AS SET	**enabled** lets the ECU fire sooner, before it has timed a full engine cycle. **disabled** here: while it finds the engine's position, the first fire can take up to four crankshaft turns.
8	**Separate Flex Fuel cranking table** NOT USED HERE	Also uses the **Fuel Engine Temp (Flex Fuel E85)** curve, blended by ethanol content. Only with a flex fuel (ethanol) sensor; greyed out without one.

The grey help box at the bottom of the window has general notes for all engines. Where they differ from this guide (350–450 RPM, "Simultaneous", "Constant mode", 95%), go by this guide.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

> **CLEARING A FLOODED ENGINE** In **neutral**, hold the twist grip **wide open** and crank for a few seconds: no fuel is injected. If it starts to fire, let go of the grip at once. Then start normally, grip closed. Still floods? Call us.

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IMPACT ECU · CRANKING BUTTON GUIDE

Cranking Fuel

Starting fuel comes in two parts: the **priming pulse**, a squirt of fuel when the key goes on, and **cranking fuel** for each injection while the starter turns the engine.

Your tune came with these set for your bike. A cold engine needs much more fuel to start than a warm one.

WHERE TO FIND IT

- (A) **Cranking ▸ Priming pulse** shows when Tuning View is Full
- (B) **Cranking ▸ Cranking Base Fuel**
- (C) **Cranking ▸ Cranking Fuel multiplier**
- (D) **Cranking ▸ Fuel Engine Temp (Flex Fuel E85)** flex fuel bikes only

The numbers in these pictures come from one example bike. Your tune's numbers will be different, so don't copy them. Units are Metric (°C, kPa, km/h). Red numbers in each picture match the table below it.

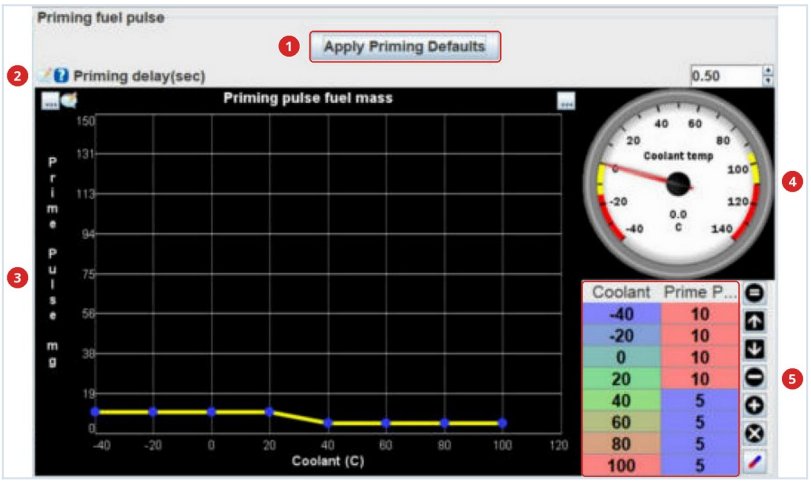
How cranking fuel is worked out

CRANKING FUEL = Base fuel (B) × Cranking Fuel multiplier (C) × throttle multiplier

- Fuel amounts are in **milligrams (mg)** per injection. The ECU turns that into injector open time.
- The **throttle multiplier** goes by the twist grip. In this tune it's **1.50** with the grip closed and drops to **1.00** wide open, so opening the grip while you start gives less fuel, not more. Past 90% open, **Flood clear** stops the fuel completely (see the Cranking Settings guide). It's set in your tune but isn't on any TunerStudio menu.
- **Example:** engine at 20 °C (68 °F), the 0 column, twist grip closed: 58.5 mg × 1.84 × 1.50 = about 161 mg.
- In a datalog (a recording of what the engine is doing), **Fuel: Cranking cycle mass** shows the cranking fuel while cranking, and **Fuel: Cranking cycle base mass**, **Fuel: cranking CLT mult** and **Fuel: cranking TPS mult** its three parts (the last one says TPS, but goes by the grip).
- Cranking fuel stops when the engine reaches the Cranking RPM limit. Then the normal fuel tables and After-start enrichment take over.

A Priming pulse

The window is titled **Priming fuel pulse**. The injectors open once, together, a moment after the key goes on with the engine stopped. After several key-ons without starting, the ECU may skip it, so the engine doesn't flood. With a failed engine temperature sensor (**CLT error**), there's no priming pulse, and cranking fuel is set for a cold engine even when it's hot.

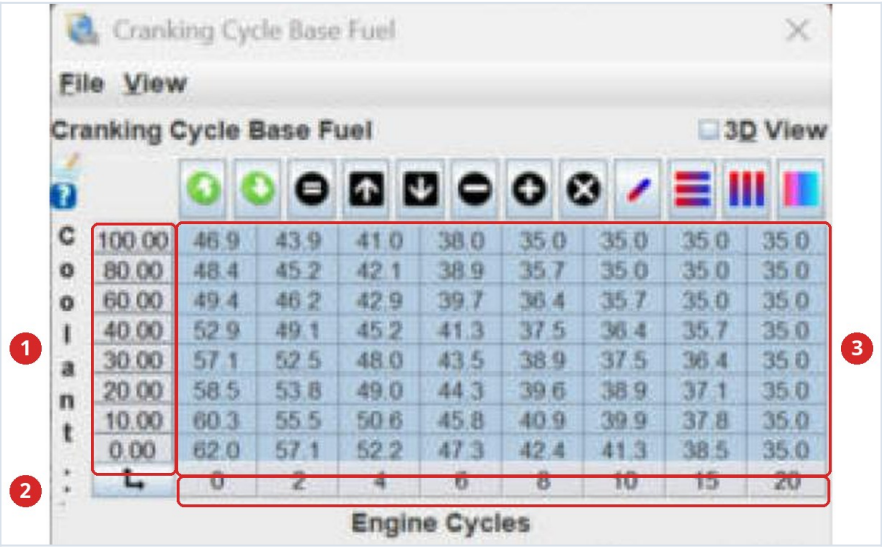


#	SETTING	WHAT IT DOES
1	**Apply Priming Defaults**	Replaces your tune's priming settings with the ECU's default ones. **Don't click it** unless we ask you to. Clicked it by mistake? Don't click Burn, and call us.
2	**Priming delay (sec)** LEAVE AS SET	How long the ECU waits after the key goes on before priming, so the fuel pump can build pressure: **0.50** seconds here. The ECU adds another 0.1 second.
3	**Priming pulse fuel mass** LEAVE AS SET	A graph of the priming fuel against engine temperature. Its numbers are in 5.
4	**Coolant temp gauge** DISPLAY ONLY	Live engine temperature. It reads 0.0 when TunerStudio isn't connected.
5	**Coolant and Prime Pulse columns** LEAVE AS SET	The priming fuel (mg) at each engine temperature: **10** mg at 20 °C (68 °F) and colder, **5** mg at 40 °C (104 °F) and warmer in this example.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

B Cranking Base Fuel

The window is titled **Cranking Cycle Base Fuel**. In this picture all the cells happen to be selected, so they show light blue instead of colors.



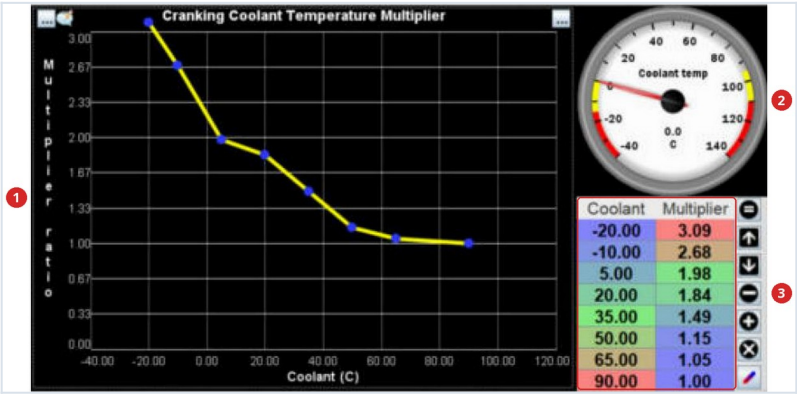
#	SETTING	WHAT IT DOES
1	**Coolant rows (°C)**	Engine temperature, from 0 °C (32 °F) to 100 °C (212 °F).
2	**Engine Cycles columns**	Engine cycles since the engine started turning: here 0 to 20. One engine cycle is two turns of the crankshaft, with each cylinder firing once.
3	**Base fuel cells (mg)** MAIN SETTING	The base fuel for each injection. In this example: **62** mg in the 0 column at 0 °C, down to **35** mg by 20 cycles; **46.9** mg at 100 °C, down to **35** by 8 cycles.

The first few cycles get the most fuel: the intake ports are dry and soak some of it up. Past the last column, the ECU keeps using the last column; outside the temperature rows, it uses the nearest row. The window's help (?) mentions IAT and a starting point of 60 mg per liter. Those are general notes: air temperature isn't used for cranking fuel, and your tune's numbers are set for your engine.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

C Cranking Fuel multiplier

Window title: **Cranking Coolant Temperature Multiplier**. It multiplies the base fuel by engine temperature: **1.00 = no change, 2.00 = double**.



#	SETTING	WHAT IT DOES
1	**Multiplier graph**	A graph of the multiplier against engine temperature. Its numbers are in 3.
2	**Coolant temp gauge** DISPLAY ONLY	Live engine temperature. It reads 0.0 when TunerStudio isn't connected.
3	**Coolant and Multiplier columns** MAIN SETTING	In this example: **3.09** at −20 °C (−4 °F), **1.84** at 20 °C (68 °F), **1.15** at 50 °C (122 °F) and **1.00** at 90 °C (194 °F).

Cranks a long time before it fires? It may need more cranking fuel. Floods? Use **Flood clear** first (Cranking Settings); if it keeps flooding, it may need less. Call us before changing these tables.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

D Fuel Engine Temp (Flex Fuel E85)

The same kind of curve, for E85 (85% ethanol). Used only with a flex fuel sensor and **Separate Flex Fuel cranking table** on: the ECU blends C and this curve by ethanol content. Otherwise greyed out; it only shows when Tuning View is Full.

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IMPACT ECU · CRANKING BUTTON GUIDE

After-Start Enrichment

Right after it starts, an engine needs a little extra fuel to run smoothly, most of all when cold. **After-start enrichment** adds that fuel for the first moments after a start, then fades away.

1.00 = no change. 1.30 = 30% more fuel. Your tune came with this set for your bike.

WHERE TO FIND IT
Cranking ▸ After-start enrichment shows when Tuning View is Full

The numbers in these pictures come from one example bike. Your tune's numbers will be different, so don't copy them. Units are Metric (°C, kPa, km/h). Red numbers in each picture match the table below it.

How it works

- It starts when the engine reaches the **Cranking RPM limit** (Cranking settings) and switches to its normal fuel.
- It multiplies the normal fuel, on top of **Warmup enrichment** (Fuel button). It can only add fuel: the smallest number it takes is 1.00 (no extra fuel).
- The columns count **engine cycles** since the engine started turning. One engine cycle is two turns of the crankshaft. The count starts with cranking, so a few cycles have passed by the time the engine runs. It starts again from 0 every time the engine stops, so a restart after a stall gets the full enrichment again.
- After the last column (150 cycles: about 15 seconds at a cold idle), it stops adding fuel.
- The ECU blends between neighboring cells. With a failed engine temperature sensor, it uses the 0 °C row.

Stalls or runs rich after starting?

- Starts, then stalls within a few seconds when cold? It may need more after-start enrichment, or it may be the idle air (**Idle ▸ Idle Valve Crank-to-Run Taper**). Runs rich (smells of fuel) just after a cold start? It may need less. Call us before changing it.
- In a datalog (a recording of what the engine is doing), **Fuel: Post cranking mult** shows the multiplier. It shows a number while cranking too, but it's only used once the engine is running.

The table

The window is titled **After start enrichment**.



#	SETTING	WHAT IT DOES
1	**Coolant Temp rows (°C)**	Engine temperature, from −20 °C (−4 °F) to 80 °C (176 °F).
2	**Engine Cycles columns**	Engine cycles since the engine started turning: 0 to 150.
3	**Multiplier cells** MAIN SETTING	The extra fuel at each temperature and time after the start. **1.00 = none**.

In this example: at 0 °C (32 °F) and −20 °C (−4 °F) it starts at **1.30** (30% more fuel), and fades to 1.05 at 0 °C and 1.10 at −20 °C. At 20 °C (68 °F): 1.10 fading to 1.00. At 40 °C (104 °F): 1.05 fading to 1.00. From 60 °C (140 °F) up: **1.00**, no extra fuel.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

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Cranking Ignition Advance

This curve sets the spark timing while the starter turns the engine, by engine speed (RPM). Starting timing is kept low, near **top dead center** (TDC: the piston at the very top, 0°), so the engine doesn't kick back against the starter.

Your tune came with this set for your bike. **You should never need to change it.**

> **WHERE TO FIND IT**
> **Cranking ▸ Cranking ignition advance** shows when Tuning View is Full

The numbers in these pictures come from one example bike. Your tune's numbers will be different, so don't copy them. Units are Metric (°C, kPa, km/h). Red numbers in each picture match the table below it.

When it's used

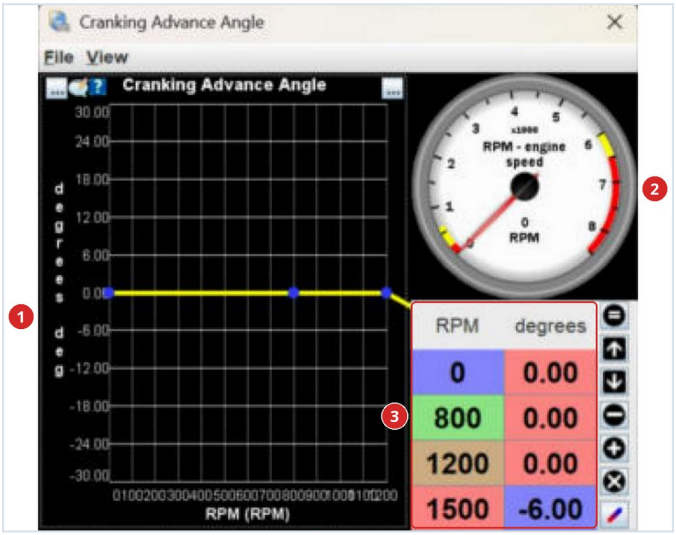
- Only while cranking: from a stop until the engine first reaches the **Cranking RPM limit** (600 here). After that, the normal timing tables in the Ignition button take over.
- Only when **Cranking ▸ Cranking settings ▸ Timing Advance mode** is **Table**, as in our tunes. With **Fixed (auto taper)**, the timing starts at the **Fixed cranking advance** instead and blends toward the normal timing as RPM rises, and this menu item is greyed out.
- No timing corrections are used while cranking: not the engine temperature or air temperature corrections, and not **Idle ▸ Closed-loop idle timing**.
- If **Ignition ▸ Ignition settings ▸ Timing Mode** is **fixed**, the Fixed Timing number is used instead, even while cranking.

Good to know

- Kicks back against the starter, or pops while cranking? Too much cranking advance can do that. Call us before changing this curve.
- The coil charge time while cranking is the **Fixed Cranking Dwell** in Cranking settings.
- In a datalog (a recording of what the engine is doing), **Ign: Timing Cyl 1** (rear) and **Ign: Timing Cyl 2** (front) show the timing in use, while cranking too.

The settings

The window is titled **Cranking Advance Angle**.



#	SETTING	WHAT IT DOES
1	**Cranking Advance Angle** LEAVE AS SET	A graph of the timing against RPM. Its numbers are in 3. The graph only goes up to 1200 RPM, so the 1500 RPM point is off its right edge.
2	**RPM gauge** DISPLAY ONLY	Live engine speed. It reads 0 when TunerStudio isn't connected.
3	**RPM and degrees columns** LEAVE AS SET	The timing at each RPM, in degrees before top dead center (a negative number fires after it). In this example: **0°** at 0, 800 and 1200 RPM, and **−6°** at 1500 RPM.

Cranking ends at the Cranking RPM limit (600 RPM here), so the ECU only uses the line between the 0 and 800 RPM points. Both are **0°** here, so this bike cranks at 0° every time. The 1200 and 1500 RPM points are never used. The grey help box at the bottom of the window (below the part in the picture) mentions "useSeparateAdvanceForCranking": that's **Timing Advance mode** in Cranking settings.

Burn means save. Changes go to the ECU as you make them, but they are only kept after you click **Burn**.

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