

Spitronics ECU - Ignition Coil Charge Time - Reference Guide

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Ignition coils require time to build magnetic energy before the spark is fired.

This period is called:

- Coil Charge Time.
- Dwell Time.

Correct Coil Charge Time is important for:

- Reliable ignition.
- Strong spark under load.
- Coil life.
- Ignition-driver protection.

Too little charge time produces insufficient spark energy.

Too much charge time does not necessarily produce a stronger spark. Once the coil reaches saturation, additional charge time mainly increases heat in the coil and ignition driver.

The objective is therefore:

Use the minimum Coil Charge Time that provides reliable spark energy, with a suitable safety margin.

Coil Charge Time Settings

Spitronics uses two main Coil Charge Time settings:

- **Coil Charge Time Low**
- **Coil Charge Time High**

The ECU varies the requested dwell between these two settings according to engine operating conditions.

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Coil Charge Time Low (ms)

Coil Charge Time High (ms)

Coil Charge Time Low

Coil Charge Time Low is used during lighter engine load.

At low cylinder pressure, less spark energy is normally required.

Using unnecessarily high dwell at light load:

- Increases coil temperature.
- Increases ignition-driver temperature.
- Provides little or no useful increase in spark energy.

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Coil Charge Time High

Coil Charge Time High is the maximum normal dwell available under higher engine load.

As cylinder pressure increases, a stronger spark may be required.

The ECU therefore progressively increases dwell from the Low value toward the High value.

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Cold Engine Operation

During cold engine operation, the ECU may use the High Charge Time to improve starting and combustion stability.

Below approximately 60°C, the High Charge Time is used as part of the automatic dwell strategy. This helps compensate for more difficult combustion conditions during cold operation.

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Cranking Compensation

Battery Voltage normally drops while the starter motor is cranking the engine.

Lower voltage causes coil current to rise more slowly.

The current Spitronics dwell strategy therefore increases the available dwell during cranking.

150% of the High Charge Time setting

Cranking dwell can increase to approximately 150% of the High Charge Time setting. This assists starting when Battery Voltage is low.

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Typical Starting Values

Different ignition coils have different electrical characteristics.

The following values are useful starting points only:

Coil Primary Resistance Typical High Charge Time

Approximately 0.9 Ω 2.5-3.5 ms

Approximately 0.4-0.5 Ω 1.5-2.0 ms

These values are starting points only and should not replace known coil-manufacturer specifications.

Modern Smart Coils can require substantially different dwell values even when they appear physically similar.

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Unknown Coil

If the correct Coil Charge Time is unknown, start conservatively.

A practical conservative starting point is approximately:

- **Low = 1.5 ms**
- **High = 2.0 ms**

Then establish the actual requirement of the coil before increasing the values.

Do not begin with a high dwell value simply because the engine misfires.

A misfire can also be caused by:

- Incorrect coil trigger polarity.
- Incorrect Ignition Coil Type.
- Poor Coil Ground.
- Wiring faults.
- Incorrect ignition timing.
- Fuel mixture problems.
- Faulty spark plugs.

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Adjusting Coil Charge Time Low

1. Warm the engine above approximately 60°C.
2. Confirm that fuel mixture and ignition timing are reasonably correct.
3. Gradually reduce **Coil Charge Time Low**.
4. Continue until the engine begins to misfire or become unstable at idle or light load.
5. Increase the value again by a suitable safety margin.

The final setting should provide stable ignition without unnecessary coil heating.

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Adjusting Coil Charge Time High

High Charge Time should preferably be tested under controlled engine load.

A dynamometer is ideal.

A useful test point is approximately 3000 RPM under significant controlled load.

1. Confirm fuel mixture and timing first.
2. Apply controlled engine load.
3. Gradually reduce **Coil Charge Time High**.
4. Continue until the engine begins to misfire under load.
5. Increase the value again by a suitable safety margin.

This finds the minimum dwell needed to maintain reliable spark under cylinder pressure.

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Why Too Much Dwell Is Dangerous

Once a coil has reached magnetic saturation, additional charge time does not significantly increase stored spark energy.

Instead:

- Coil current remains high.
- Coil temperature rises.
- Ignition-driver temperature rises.
- Electrical stress increases.

Possible results include:

- Coil overheating.
- Smart-coil igniter failure.
- ECU ignition-driver failure.
- Melted coil housings.
- Intermittent misfire.
- Premature coil failure.

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Coil Trigger Polarity

A displayed dwell value is only meaningful if the coil is being triggered with the correct electrical polarity.

If the trigger polarity is wrong, the software may show a short charge time while the coil is actually energised for much longer.

Possible symptoms include:

- Coil overheating.
- Misfire.
- Incorrect spark timing.
- Coil failure.

Always confirm the correct:

- Ignition Coil Type.
- Driver type.
- Trigger polarity.
- Coil wiring.

before increasing Coil Charge Time.

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Smart Coils

Smart Coils contain their own high-current ignition driver.

The ECU only supplies the trigger signal.

Different Smart Coils can require very different dwell values.

Do not assume:

- All Smart Coils use the same charge time.
- A dwell value from another ECU is directly transferable.
- More dwell is safer.

Use the coil manufacturer's data where available.

If specifications are unknown, start conservatively and test.

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Basic Coils

Basic Coils require an external high-current ignition driver.

The Coil Charge Time directly affects the current passing through:

- Coil primary winding.
- ECU Coil Negative Driver or external igniter.

Excessive dwell can therefore damage either component.

Lower-resistance coils generally reach high current more quickly and may require shorter charge times.

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Coil Temperature Check

After setting the dwell, allow the engine to operate normally for several minutes.

Check the ignition coils for abnormal heating.

A coil may become warm during operation, but rapid or excessive heating indicates a problem.

Possible causes include:

- Excessive dwell.
- Incorrect trigger polarity.
- Incorrect driver configuration.
- Poor Ground.

- Faulty coil.
- Incorrect supply voltage.

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ECU Temperature Check

Where the ECU contains the high-current ignition drivers, its temperature can also provide a useful warning.

After load testing, check the ECU housing temperature where the ECU contains the high-current ignition drivers.

If the ECU becomes noticeably hot, excessive ignition-driver dissipation may be occurring.

Investigate before continuing high-load operation.

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5 A Coil Fuse

During initial installation and testing, it is good practice to protect each coil supply with an individual:

5 A fuse

where suitable for the coil being tested.

This provides additional protection against excessive current caused by:

- Excessive dwell.
- Incorrect trigger polarity.
- Wiring error.
- Faulty coil.

A 5 A fuse per coil is a practical initial-test protection method where suitable for the coil being tested.

A blown fuse is a warning that the cause must be found.

Do not simply fit a larger fuse.

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Coil Charge Time and Battery Voltage

Coil current depends strongly on supply voltage.

At low Battery Voltage:

- Coil current rises more slowly.
- More dwell may be required.

At high Battery Voltage:

- Coil current rises faster.
- Less dwell may be required.

Spitronics Battery Voltage compensation helps maintain more consistent ignition energy as system voltage changes.

Refer to:

Spitronics ECU - Battery Voltage - Guide

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High RPM Limitation

At high RPM there is less time available between ignition events.

This is particularly important with:

- Single-coil distributor systems.
- Multi-cylinder engines using fewer coils.

The ECU cannot charge a coil for longer than the physical time available between sparks.

A single distributor coil therefore becomes increasingly limited as RPM rises.

Coil-per-cylinder systems have considerably more available charge time.

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Coil Charge Time and Misfire

Do not automatically increase dwell when an engine misfires.

First check:

- [] Fuel mixture.
- [] Spark plugs.
- [] Coil wiring.
- [] Coil Grounds.
- [] Trigger polarity.

[] Ignition timing.

[] Battery Voltage.

[] Coil type.

[] Ignition-driver configuration.

Only adjust dwell after the rest of the ignition system is known to be correct.

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Common Problems

Symptom	Possible Cause	Check
Misfire at light load	Low Charge Time too short	Increase carefully
Misfire under boost/load	High Charge Time too short	Test under controlled load
Coil becomes very hot	Excessive dwell	Reduce charge time
ECU becomes hot	Excessive driver current	Check coil and dwell
Coil fails rapidly	Excessive dwell or wrong polarity	Check setup
5 A fuse blows	Excessive coil current	Find cause before replacing
Starts poorly when Battery Voltage is low	Insufficient cranking spark energy	Check battery and compensation
Misfire persists after dwell increase	Fault elsewhere	Check ignition/fuel system
Software shows short dwell but coil overheats	Trigger polarity may be wrong	Scope trigger signal

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Safe Setup Procedure

For an unknown ignition coil:

1. Identify whether the coil is Basic or Smart.
2. Confirm the coil pinout.
3. Confirm the required trigger polarity.
4. Select the correct Ignition Coil Type in software.
5. Fit suitable coil protection fuses.
6. Start with conservative Low and High Charge Time values.
7. Verify ignition timing.
8. Warm the engine.
9. Adjust Low Charge Time.
10. Test High Charge Time under controlled load.
11. Check coil temperature.
12. Check ECU or external driver temperature.
13. Add a suitable safety margin.
14. Save the final settings.

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Safety

Ignition coils generate dangerous high voltage.

During testing:

- Do not hold a spark plug or HT lead.
- Secure spark plugs correctly during spark tests.
- Keep dwell conservative when coil specifications are unknown.
- Do not increase fuse ratings to compensate for excessive current.
- Stop testing if a coil or ignition driver becomes unusually hot.
- Verify trigger polarity before increasing dwell.

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Setup Check

Before considering Coil Charge Time complete, verify:

[] Coil type is known.

[] Coil wiring is correct.

[] Trigger polarity is correct.

[] Ignition Coil Type setting is correct.

☐ Low Charge Time provides stable light-load operation.

☐ High Charge Time provides reliable spark under load.

☐ Coil does not overheat.

☐ ECU or external driver does not overheat.

☐ Battery Voltage compensation is operating correctly.

☐ Coil protection fuses are suitable.

☐ Dwell is no higher than necessary.

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