

Spitronics ECU - Flat Shift - Guide

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Overview

Flat Shift allows the driver to change gear while keeping the throttle open.

The ECU momentarily reduces engine torque during the gear-change event so that the gearbox can shift more easily and engine RPM can drop quickly enough for the next gear.

Flat Shift is also commonly referred to as:

- No-Lift Shift - NLS.
- Full-Throttle Shift.

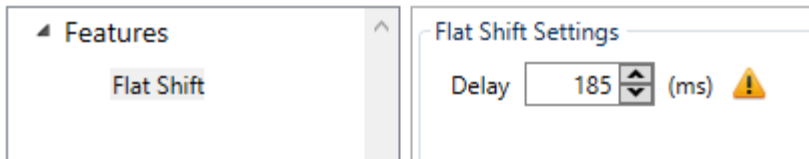
The exact behaviour depends on the firmware and Engine Limiter configuration.

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Flat Shift Settings

Open:

Features → Flat Shift



This software version includes:

- Delay.

Flat Shift also uses the applicable Engine Limiter cut strategy.

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Flat Shift Input

Flat Shift is activated by an **active Ground signal** on the applicable ECU input.

The trigger may come from:

- A mechanical switch linked to the gear lever.
- A clutch or shift switch where suitable.
- An electronic switching circuit.
- An external strain-gauge or load-cell interface.

If a strain gauge or load cell is used, external signal-conditioning electronics are normally required.

The output of that circuitry must provide a clean **active Ground signal** compatible with the ECU input.

Do not connect a raw strain-gauge or load-cell signal directly to the ECU Flat Shift input unless the interface electronics are specifically designed for this purpose.

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Flat Shift Trigger Operation

Flat Shift is triggered on the **trailing edge** of the input signal.

When the input changes to active Ground, the ECU detects one Flat Shift event and applies the configured Delay period.

Holding the input active for longer does not repeatedly trigger additional Flat Shift events.

The input must return to its inactive high state before another Flat Shift event can be triggered.

Conceptually:

Input High → Active Ground → Flat Shift Triggered → Delay Applied

If the input remains at Ground:

No additional Flat Shift event is triggered

When the input returns high, the system is ready for the next gear-change trigger.

This prevents a long switch or strain-gauge pulse from repeatedly restarting the Flat Shift cut.

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Delay

Delay determines how long the Flat Shift torque reduction remains active after the input is triggered.

Example:

185 ms (adjustable from 0-350 ms)

A longer Delay produces a longer engine cut.

A shorter Delay allows engine torque to return sooner.

The correct value depends on:

- Gearbox type.
- Shift mechanism.
- Engine response.
- Driver technique.
- Shift speed.

Use the shortest Delay that allows the gearbox to complete the shift cleanly.

A Delay that is unnecessarily long can cause excessive RPM drop and slow vehicle acceleration.

The available adjustment range depends on firmware.

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Minimum RPM

Flat Shift is disabled below:

2000 RPM

This prevents the function from activating during normal low-speed operation where a Flat Shift torque cut is normally not required.

Above 2000 RPM, the Flat Shift event may operate when the input is triggered.

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Engine Limiter Behaviour

Flat Shift uses the current **Engine Limiter algorithm** during the Flat Shift event.

Supported limiter behaviour is:

- Hard Cut.
- Spark Only.

Soft Limiter is not used for Flat Shift.

The selected Engine Limiter configuration therefore determines how engine torque is interrupted during the Flat Shift Delay.

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Hard Cut

With **Hard Cut** selected, the ECU applies the applicable hard limiter strategy during the Flat Shift event.

This produces a strong and rapid reduction in engine torque.

Hard Cut is useful where a decisive torque reduction is required to unload the gearbox during the shift.

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Spark Only

With **Spark Only** selected, the Flat Shift event uses the Spark Only limiter strategy.

Fuel delivery continues while ignition events are interrupted according to the limiter algorithm.

This can provide a different shift feel and exhaust response compared with Hard Cut.

Use the limiter type that gives the cleanest and safest shift for the application.

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Soft Limiter

Soft Limiter is not used for Flat Shift operation.

If the normal Engine Limiter is configured for a Soft Limiter strategy, Flat Shift will not use that Soft Limiter behaviour.

Flat Shift requires a supported **Hard Cut** or **Spark Only** limiter strategy.

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Tune Selection / Dual Tune Input Sharing

On supported firmware, Flat Shift may share the same physical input as Tune Selection / Dual Tune.

When this arrangement is used, the input performs different functions during startup and normal running.

During startup:

Input released → Tune 1 selected

Input active → Tune 2 selected

After startup, the same input becomes the Flat Shift trigger.

This means live Tune Selection is not available on the shared input while Flat Shift is being used.

The required Tune must therefore be selected during startup.

The exact input allocation depends on firmware and should always be confirmed in the applicable software and Pin Layout.

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Typical Operation

A normal Flat Shift sequence is:

1. The engine is operating above 2000 RPM.
2. The driver keeps the throttle open.
3. The driver moves the gear lever.
4. The gear-lever switch, strain-gauge interface or other trigger pulls the Flat Shift input to Ground.
5. The trailing edge triggers one Flat Shift event.
6. The ECU applies the configured Engine Limiter strategy.
7. Engine torque drops for the configured Delay period.
8. The gearbox completes the shift.
9. Normal engine operation resumes.
10. The input must return high before another Flat Shift event can be triggered.

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Setting the Delay

Begin with a conservative Delay value.

Test the shift under controlled conditions.

If the gearbox does not unload sufficiently or the gear is difficult to engage:

Increase the Delay slightly.

If RPM falls too far or the vehicle hesitates noticeably after the shift:

Reduce the Delay.

Make small changes and test each adjustment.

The objective is:

Enough torque reduction to complete the shift cleanly, but no longer than necessary.

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Mechanical Switch Setup

A mechanical switch may be mounted so that gear-lever movement produces the active Ground signal.

The switch should:

- Operate early enough to unload the gearbox.

- Release reliably after the shift.
- Produce a clean electrical signal.
- Avoid repeated contact bounce where possible.

Confirm the switch operation using Realtime Data before testing Flat Shift at high load.

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Strain Gauge or Load Cell Setup

A strain gauge or load cell can detect force applied to the gear lever before the gear actually moves.

This can provide very fast Flat Shift triggering.

The sensor normally requires external electronics to:

- Amplify the sensor signal.
- Detect the required force threshold.
- Filter noise.
- Produce the required ECU-compatible output.

The final output to the ECU must provide an **active Ground signal**.

Because Flat Shift triggers only once on the signal transition, a prolonged force signal does not repeatedly restart the Flat Shift Delay.

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Input Signal Check

Before driving, confirm that the Flat Shift input behaves correctly.

Using Realtime Data:

- [] Input is inactive when no shift force is applied.
- [] Input switches to active Ground when the shift is initiated.
- [] Input returns high after the shift.
- [] The signal does not flicker or trigger randomly.
- [] Each gear-change movement produces only one intended trigger.

Do not begin full-load testing until the input operation is reliable.

Basic Setup Procedure

1. Complete the normal engine Tune.
2. Configure the Engine Limiter.
3. Select Hard Cut or Spark Only as required.
4. Configure the Flat Shift input.
5. Confirm Dual Tune sharing where applicable.
6. Set a conservative Flat Shift Delay.
7. Verify the input using Realtime Data.
8. Test above 2000 RPM at moderate load.
9. Increase load gradually.
10. Adjust Delay until the shift is clean.
11. Confirm the input returns high after every shift.
12. Test all required gears.

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Testing

Initial testing should be performed at moderate engine load.

Confirm:

- Flat Shift does not activate below 2000 RPM.
- Flat Shift activates once per gear-change trigger.
- Holding the input active does not retrigger the function.
- The input resets after returning high.
- Engine torque reduces sufficiently.
- RPM does not fall excessively.
- Normal engine operation resumes immediately after the Delay.
- The gearbox shifts cleanly.

Only move to full-load testing once basic operation is confirmed.

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Incorrect Delay

Delay Too Short

Possible symptoms:

- Gear difficult to engage.
- Gear lever feels loaded.
- Shift is harsh.
- Gearbox does not complete the shift cleanly.

Increase Delay slightly.

Delay Too Long

Possible symptoms:

- Excessive RPM drop.
- Vehicle hesitates after the shift.
- Engine falls below the useful power range.
- Shift feels unnecessarily slow.

Reduce Delay.

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Flat Shift Does Not Activate

Check:

- Engine RPM is above 2000 RPM.
- Flat Shift input is configured correctly.
- Input reaches active Ground.
- Input transition is visible in Realtime Data.
- Correct Engine Limiter strategy is selected.
- Delay is not set to a disabled or minimum condition.
- Applicable firmware supports Flat Shift.

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Flat Shift Activates Only Once

This may be normal if the input remains at Ground.

Flat Shift does not retrigger continuously while the input is held active.

The input must return high before the next Flat Shift event can occur.

Check:

- Switch release.
- Strain-gauge interface output.
- Load-cell interface reset behaviour.
- Wiring.

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Flat Shift Activates Randomly

Check for:

- Switch bounce.
- Loose wiring.
- Poor Ground.
- Electrical interference.
- Strain-gauge sensitivity set too high.
- Incorrect external signal-conditioning setup.

The Flat Shift input should remain stable until a genuine shift event occurs.

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Wrong Tune Selected at Startup

Where Flat Shift shares the Tune Selection / Dual Tune input, the input state during startup determines which Tune is loaded.

Check whether the Flat Shift switch or external interface is active while the ignition is switched on.

Make sure the input is in the required state before startup.

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Gearbox Protection

Flat Shift reduces engine torque during the shift, but it does not remove all mechanical stress from the gearbox.

Incorrect setup can still cause:

- Gear damage.
- Dog-ring damage.
- Synchro damage.
- Shift-fork damage.
- Excessive driveline shock.

Use the shortest Delay that produces a reliable shift.

Flat Shift should not be used to compensate for a damaged or incorrectly adjusted gearbox.

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Engine and Exhaust Considerations

Spark Only Flat Shift may allow unburned mixture to enter the exhaust system.

This may increase:

- Exhaust noise.

- Exhaust temperature.
- Turbocharger energy on turbocharged engines.

Repeated or excessively long Flat Shift events can increase thermal stress.

Avoid unnecessarily long Delay settings.

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Fault Finding

Symptom	Possible Cause	Adjustment / Check
Flat Shift does not activate	RPM too low or input not detected	Check RPM > 2000 and input signal
Activates once but not again	Input remains at Ground	Confirm input returns high
Gear remains difficult to engage	Delay too short	Increase Delay slightly
RPM drops too far	Delay too long	Reduce Delay
Random Flat Shift events	Noisy or unstable input	Check switch, wiring or signal conditioning
Wrong Tune loads at startup	Shared Dual Tune input active	Check input state during startup
No torque reduction	Incorrect limiter configuration	Check Hard Cut or Spark Only selection
Shift feels excessively harsh	Cut strategy or Delay unsuitable	Adjust limiter type and Delay

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Setup Check

Before using Flat Shift:

- ☐ Normal engine Tune is correct.
- ☐ Engine Limiter is configured.
- ☐ Hard Cut or Spark Only is selected.
- ☐ Flat Shift input is wired correctly.
- ☐ Input provides active Ground.
- ☐ Strain-gauge or load-cell interface is correctly conditioned where used.
- ☐ Input transition is visible in Realtime Data.
- ☐ Input returns high after activation.
- ☐ Tune Selection / Dual Tune startup behaviour is understood where the input is shared.
- ☐ Delay is set conservatively.
- ☐ Flat Shift is confirmed disabled below 2000 RPM.
- ☐ Initial testing is performed at moderate load.
- ☐ Full-load testing is performed only after correct operation is confirmed.

Related Documents

Refer to the applicable manuals for:

- Engine Limits.
- Tune Selection.
- General Purpose Inputs.
- Software Realtime Data.
- Spark and Timing.
- Fuel and Timing.
- Product Pin Layouts.