

Spitronics ECU - Cam and Intake Control - Guide

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Overview

Cam and Intake Control allows the ECU to operate cam-control solenoids and intake-control mechanisms according to engine RPM and throttle position.

The standard Spitronics cam-control strategy is open loop.

Depending on the firmware and application, the system may provide:

- Cam1 control.
- Cam2 control.
- Intake control.
- Simple ON/OFF cam or intake switching through the V-Tech / GP2 function.

Different engines use different cam-control strategies. Generic firmware normally follows the Toyota-style open-loop control method. Engines requiring different control behaviour may require application-specific firmware.

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Cam Control Selection

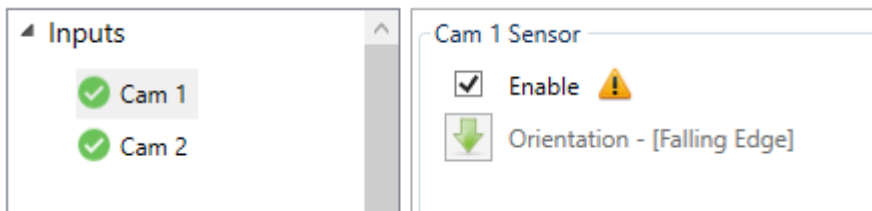
Cam Control must first be enabled in the applicable ECU setup.

One or two cam outputs may be selected.

When a cam output is selected, the software allocates the applicable Driver Output to that function.

These drivers may be shared with General Purpose Outputs. Selecting Cam Control can therefore reserve drivers that would otherwise be available for GP functions.

If Cam Control is not required, deselect the unused cam outputs so that the drivers remain available for other functions.



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Cam Sensor Inputs

Cam sensor inputs are configured under:

Inputs → Cam 1

and where applicable:

Inputs → Cam 2

The available settings depend on the firmware and engine application.

The cam sensor provides engine-position information where required by the application.

Open-loop cam control itself does not necessarily require cam-position feedback for closed-loop correction.

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Cam and Intake Control Settings

Open:

Features → Cam & Intake Control

The software may display:

- Cam1.
- Cam2.
- Intake.

Each available function contains:

- RPM - High.
- RPM - Low.
- TPS.
- Driver Output.

Features

Cam & Intake Control

Cam & Intake Control Settings

VVTI

Cam1

RPM - High 3900

RPM - Low 2100

TPS 30 (%)

Driver Output HV Negative Output 11

Cam2

RPM - High 2500

RPM - Low 1500

TPS 60 (%)

Driver Output HV Negative Output 12

Intake

RPM - High 4100

RPM - Low 2400

TPS 30 (%)

Driver Output HV Negative Output 10

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Cam Operating Window

Cam1 and Cam2 use an RPM and TPS operating window.

The function becomes active when:

RPM is above RPM - Low

AND

RPM is below RPM - High

AND

TPS is above the TPS setting

Conceptually:

RPM > Low

AND RPM < High

AND TPS > Setting

→ Function Active

This allows the cam-control function to operate only in the engine-speed and load area where it is required.

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RPM - Low

For Cam1 and Cam2, RPM - Low sets the minimum engine speed at which the function may become active.

Below this value, the output remains in its inactive condition.

Example:

2100 RPM

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RPM - High

For Cam1 and Cam2, RPM - High sets the maximum engine speed at which the function remains active.

Above this value, the output returns to its inactive condition.

Example:

3900 RPM

The combination of RPM - Low and RPM - High creates the required operating window.

TPS

For Cam1 and Cam2, TPS sets the minimum throttle position required before the function may activate.

Example:

30%

This allows the cam-control function to operate only when sufficient engine load or throttle demand is present.

For Cam1 and Cam2, if TPS falls below the setting, the function becomes inactive even if engine RPM remains inside the configured RPM window.

Driver Output

Driver Output shows the physical ECU driver allocated to the function.

Example:

HV Negative Output 11

The actual Driver Output depends on:

- Product.
- Firmware.
- Cam selections.
- Other functions already using shared outputs.

Always use the Driver Output displayed by the software together with the applicable Product Pin Layout.

Cam1 and Cam2

Cam1 and Cam2 allow two separate cam-control functions where supported.

Typical use is:

- Cam1 - Intake Cam or Cylinder 1 bank.
- Cam2 - Exhaust Cam or opposite bank/cam.

The exact function depends on the engine and firmware.

Do not assume Cam1 and Cam2 always represent intake and exhaust. Confirm the application-specific setup before wiring.

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V Engines

On V engines, Cam1 normally refers to the Cylinder 1 bank or primary cam function.

Cam2 may control the opposite bank or the second intake cam function.

Some open-loop applications may operate two cam solenoids from the same control strategy.

The exact wiring and firmware arrangement must be confirmed for the specific engine.

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Open-Loop Cam Control

Standard Spitronics cam control operates open loop.

The ECU commands the cam-control solenoid according to the configured operating window and firmware strategy.

Cam position is not continuously corrected to a target angle unless the application uses specially developed firmware designed for that control method.

This makes the system suitable for many engines where repeatable cam movement can be achieved using a known solenoid-control strategy.

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Toyota-Style Cam Control

Generic cam-control firmware normally uses a Toyota-style open-loop strategy.

Typical control states are:

- Approximately **25% duty cycle - Retard / Off direction**
- Approximately **50% duty cycle - Hold**
- Approximately **75% duty cycle - Advance / On direction**

These values describe the control principle used by the firmware.

The exact solenoid response depends on the engine and cam-control hardware.

Cam Control Operation

When the operating conditions become true:

RPM enters the configured range

AND

TPS exceeds the configured value

the ECU commands the cam-control strategy required by the firmware.

When the operating conditions are no longer satisfied, the cam returns toward the inactive or retard position.

The exact duty-cycle sequence depends on the firmware.

BMW VANOS and Other Special Systems

Not all variable cam systems operate in the same way.

Some BMW VANOS systems and other manufacturers may require different PWM behaviour from the normal Toyota-style strategy.

These applications may require engine-specific or customised firmware.

The software settings may appear similar, but the internal control method can be different.

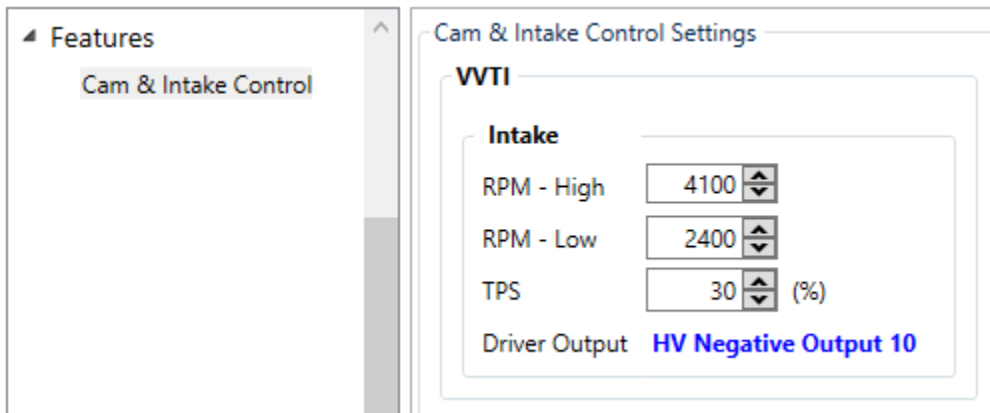
Always use the firmware intended for the engine application.

Intake Control

The **Intake** block is available only where the firmware supports Intake Control.

When enabled by the firmware, the Intake function becomes tunable using:

- RPM - Low.
- RPM - High.
- TPS.
- Driver Output.



The Intake function can be used for mechanisms such as:

- Intake runner control.
- Intake flap control.
- Variable intake switching.
- Other supported intake mechanisms.

The exact hardware function depends on the application.

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Intake Operating Window

The Intake function follows the control strategy defined for the specific firmware and engine application.

The available tuning limits are:

- RPM - Low.
- RPM - High.
- TPS.

These settings define the operating regions used by the firmware.

The Intake output does **not necessarily follow the same activation logic as Cam Control**.

Depending on the application, the output may be active inside or outside the configured RPM range and may also respond differently to the TPS threshold.

The exact switching strategy is determined by the firmware for the specific intake system. Use the applicable engine or firmware documentation when setting the Intake control limits

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Simple ON/OFF Cam or Intake Control

Some engines do not require PWM cam positioning.

Where the mechanism only needs to switch ON or OFF, **General Purpose Output 2** may be used with the V-Tech function.

This provides a simple RPM and TPS controlled output.

This method remains useful for:

- Simple switched cam systems.
- V-Tech type mechanisms.
- Intake flaps.
- Other ON/OFF engine functions requiring an RPM/TPS window.

PWM cam positioning is not used with this method.

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V-Tech / GP2 Control

Select:

Features → Outputs

Then select:

Output Selected → Output 2

Set:

Output Settings → RPM

When Output 2 is configured for RPM control, the additional:

V-Tech TPS

setting becomes available.

The screenshot shows a configuration window titled "General Purpose Outputs". Inside, there is a section for "Output Selected" with a dropdown menu set to "Output 2". Below this, the "Driver Output" is labeled as "LV Positive Output 6" in red text. A sub-section titled "Output Settings" contains a dropdown menu set to "RPM". Under "RPM", there are two input fields: "Min" set to "2000 (RPM)" and "Max" set to "4000 (RPM)". Below these, there is a "V-tech TPS" input field set to "20 (%)".

General Purpose Outputs			
Output Selected	Output 2		
Driver Output	LV Positive Output 6		
Output Settings			
	RPM		
Min	2000 (RPM)	Max	4000 (RPM)
		V-tech TPS	20 (%)

The available settings are:

- Min RPM.
- Max RPM.
- V-Tech TPS.
- Driver Output.

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V-Tech / GP2 Operating Logic

The output becomes active when:

RPM is above Min

AND

RPM is below Max

AND

TPS is above V-Tech TPS

Example:

Min = 2000 RPM

Max = 4000 RPM

V-Tech TPS = 20%

The output is therefore active only inside this RPM window and above the configured throttle position.

This is a simple ON/OFF output.

No PWM cam-position control is used.

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Choosing Between Cam Control and V-Tech / GP2

Use **Cam & Intake Control** when the application requires the dedicated cam-control strategy and PWM behaviour provided by the firmware.

Use **V-Tech / GP2** when the engine or intake mechanism requires only a simple ON/OFF output based on RPM and TPS.

Both methods are valid where they match the hardware and engine requirements.

Basic Cam Setup

1. Confirm the correct firmware is loaded.
2. Confirm whether one or two cam outputs are required.
3. Enable the required cam outputs.
4. Confirm the assigned Driver Outputs.
5. Wire the cam solenoid according to the applicable Pin Layout.
6. Set RPM - Low.
7. Set RPM - High.
8. Set TPS.
9. Confirm correct operation at low engine load.
10. Increase engine load gradually.
11. Adjust the operating window where required.
12. Confirm the cam returns correctly when the function becomes inactive.

Basic Intake Setup

1. Confirm that the firmware supports Intake Control.
2. Confirm that the Intake block is visible.
3. Confirm the assigned Driver Output.
4. Wire the intake mechanism according to the applicable Pin Layout.
5. Set RPM - Low.
6. Set RPM - High.
7. Set TPS.
8. Confirm correct switching in Realtime Data.
9. Test operation under controlled load.
10. Adjust the operating window as required.

Basic V-Tech / GP2 Setup

1. Open **Features** → **Outputs**.
2. Select **Output 2**.
3. Select **RPM** as the Output Setting.
4. Confirm that **V-Tech TPS** becomes visible.
5. Set Min RPM.
6. Set Max RPM.
7. Set V-Tech TPS.
8. Confirm the assigned Driver Output.
9. Wire the mechanism according to the applicable Product documentation.
10. Confirm ON/OFF operation using Realtime Data.
11. Test the function under controlled engine load.

Testing Cam Control

Before full-load testing, confirm:

- ☐ Correct firmware is loaded.
- ☐ Correct cam outputs are selected.
- ☐ Driver Outputs are correct.
- ☐ Cam solenoid wiring is correct.
- ☐ RPM - Low is correct.
- ☐ RPM - High is correct.
- ☐ TPS threshold is correct.
- ☐ Function activates only inside the required operating window.
- ☐ Function becomes inactive outside the operating window.
- ☐ Engine behaviour remains stable.

Testing V-Tech / GP2

Confirm:

- ☐ Output 2 is selected.
- ☐ RPM control is selected.
- ☐ V-Tech TPS is visible.
- ☐ Min RPM is correct.
- ☐ Max RPM is correct.
- ☐ TPS threshold is correct.
- ☐ Output switches ON inside the required window.
- ☐ Output switches OFF outside the required window.

[] Output is wired to a suitable load or relay.

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Fault Finding

Symptom	Possible Cause	Adjustment / Check
Cam block not visible	Cam Control not selected	Enable required cam output
No Driver Output visible	Function not allocated or firmware mismatch	Check cam selection and firmware
Cam never activates	RPM or TPS condition not satisfied	Check Realtime Data and settings
Cam always active	Operating window incorrect	Check RPM and TPS thresholds
Cam movement incorrect	Wrong firmware strategy	Confirm application-specific firmware
Cam reacts opposite to expected	Solenoid strategy or wiring incorrect	Confirm firmware and wiring
Intake block not visible	Firmware does not enable Intake Control	Confirm firmware application
Intake never activates	RPM/TPS conditions not satisfied	Check settings and Realtime Data
V-Tech TPS not visible	Output 2 not set to RPM	Select GP Output 2 and RPM
V-Tech output does not switch	RPM/TPS conditions incorrect	Check Min, Max and TPS
Output driver unavailable	Driver already allocated	Check shared GP/Cam functions
Engine runs poorly when cam activates	Operating window unsuitable	Adjust RPM/TPS window and verify cam behaviour

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Setup Check

Before completing setup:

[] Correct firmware is loaded.

[] Cam Control method is suitable for the engine.

[] One or two cam outputs are selected correctly.

[] Intake Control is available where required.

[] V-Tech / GP2 method is used where simple ON/OFF control is preferred.

[] Driver Outputs are confirmed.

[] Wiring matches the applicable Product Pin Layout.

- [] RPM - Low settings are correct.
- [] RPM - High settings are correct.
- [] TPS thresholds are correct.
- [] Cam or intake operation is confirmed in Realtime Data.
- [] Function activates only in the intended operating area.
- [] Function becomes inactive correctly outside the operating area.
- [] Full-load testing is performed only after basic operation is confirmed.

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Related Documents

Refer to the applicable manuals for:

- Outputs.
- Crank and Cam Sensors.
- Engine Data.
- Spark and Timing.
- Product Pin Layouts.
- Power and Grounding.
- Installation Safety and Wiring Precautions.

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