

Spitronics - Electronic Throttle Control Calibration - Guide

Throttle calibration should be performed using a suitable Startup Tune. This ensures that the basic settings and operating ranges are already within safe limits before fine adjustment begins. A suitable Startup Tune can be downloaded from the Portal in Cosmos.

Perform the initial calibration with the engine switched off.

Warning: Keep fingers, tools and loose objects away from the throttle plate while the Device is powered. The throttle can move suddenly during testing and calibration.

Prepare the Device for Calibration

Make sure that all installation and wiring requirements have been completed correctly before calibration begins.

Before connecting power to the ETC, disconnect all outputs from the system. Connect only P1 and the Comms connector. This prevents incorrect Tune data or unsuitable motor-power settings from driving the throttle before a safe Startup Tune has been loaded. Electronic throttles do not all require the same motor power, and excessive power can damage the internal gears.

Before calibrating the throttle, temporarily disable all functions that can modify the Throttle Target.

Go to MAP Sensor and disable the MAP input.

Go to Pedal TPS and disable:
Enable Pedal Response Graph

Go to Coolant Temp and disable:
Coolant Throttle Minimum Graph
Coolant Throttle Maximum Graph

Go to RPM and disable the RPM input completely.
If Idle Control is still visible or active under Features, the RPM input has not been disabled correctly.

These functions must remain disabled during basic throttle calibration. An active graph or Idle Control can modify the Throttle Target and make the throttle appear to respond incorrectly.

Check the TPS Sensor Ranges

Before operating the throttle motor, verify the raw pedal and throttle sensor ranges. Rest Position Test removes motor drive so that the throttle can be moved freely by hand.

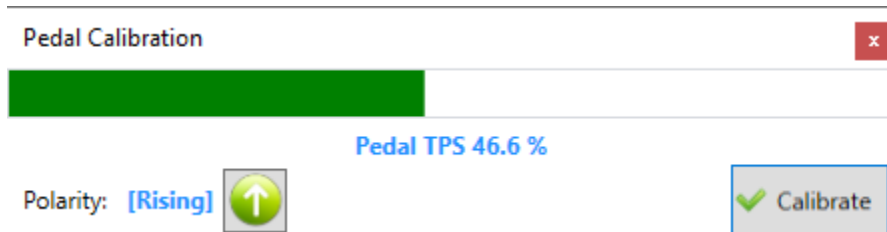
Go to Features > Throttle Settings and select:
Throttle Test Mode - Rest Position Test

Set Maximum Motor Power to 0% as a safe starting value.

Set Opening Hold Power to 0%.

Set Closing Hold Power to 0%.

Press the pedal slowly and observe Pedal TPS 1. The value must increase as the pedal is pressed. If the value decreases, go to Inputs > Pedal TPS > Calibrate and change the sensor Polarity direction. Do not perform the calibration yet; close the calibration window with the red X after changing the direction. If Falling polarity is required for correct operation, the 5 V and Ground wires are likely swapped. Correct the wiring where possible so that the installation remains compatible with the standard Startup Tunes.



Release the pedal. Pedal TPS 1 should remain above the lower electrical rail; it should not fall all the way to 0%. As a practical guide, keep at least about 5% of the bar available below the normal released-pedal signal. If the signal reaches the rail, check the second TPS signal in the pedal and confirm that the correct sensor track is connected.



Press the pedal fully. Pedal TPS 1 should also remain below the upper electrical rail. As a practical guide, keep at least about 5% available above the normal full-pedal signal, meaning the raw signal should normally remain at approximately 95% or less. If it reaches the rail, check the second TPS signal and confirm that the correct track is connected.



If the pedal test is correct, click the save button. Switch the power off and connect P3 to the ETC. With the Maximum Motor Power and Hold Power settings at zero, there is no power on the throttle.

Go to Features > Throttle Settings and select:

Throttle Test Mode - Rest Position Test

Move the throttle open by hand and observe Throttle TPS 1. The value must increase as the throttle opens. If it decreases, switch the power off and correct the throttle TPS 5 V and Ground wiring before continuing. Observe the maximum raw Throttle TPS value. It should normally remain below approximately 95%. If it reaches the upper rail, check the second TPS signal and confirm that the correct sensor track is connected. Record this value as Raw Open.

Move the throttle fully closed by hand and observe Throttle TPS 1. The value should remain above the lower electrical rail and should not fall all the way to 0%. As a practical guide, keep at least about 5% available below the normal closed-throttle signal. If it reaches the rail, check the second TPS signal and confirm that the correct track is connected. Record this value as Raw Close.



Release the throttle and allow the return spring to move it to its mechanical Rest Position, also known as the limp position. This value will normally be higher than Raw Close. Record it as Raw Rest.



The initial TPS range check is now complete. If the throttle plate cannot be reached by hand, the Raw Open and Raw Close limits can also be identified during the Open Test and Close Test procedures that follow.

The unused margin at both ends of the TPS signal provides diagnostic headroom. It allows the ETC to detect a signal that moves outside its expected operating range, including faults caused by a disconnected 5 V supply, Ground or sensor signal. When a critical TPS fault is detected, the ETC removes motor power and allows the throttle to return to limp mode. DTC 37 indicates a Pedal Sensor Failure and DTC 38 indicates a Throttle Sensor Failure.

Determine Maximum Motor Power

Maximum Motor Power must be high enough for good throttle response, but no higher than necessary. Begin with a low value and increase it only until the throttle has sufficient opening speed.

Maximum Motor Power	0		(%)
Opening Hold Power	0		(%)
Closing Hold Power	0		(%)

Go to Features > Throttle Settings and select:
Throttle Test Mode - Open Test

The ETC now drives the motor in the opening direction. Opening Hold Power determines the applied motor power during this test. Increase Opening Hold Power in small steps while observing Throttle TPS 1. The throttle will move from Raw Rest toward Raw Open. When Raw Open is just reached, record the Opening Hold Power value as Open High. Do not continue increasing the value once the mechanical limit has been reached.

Next, determine whether the available motor power gives suitable opening speed.

Select Throttle Test Mode - Rest Position Test. The motor drive is removed and the return spring will move the throttle back to its mechanical Rest Position.

Select Throttle Test Mode - Open Test again and observe the opening speed. If the throttle opens too slowly, increase Opening Hold Power by approximately 5 counts and repeat the Rest Position Test/Open Test sequence. Use the lowest value that gives a suitably quick response. Avoid excessive power. The throttle should not slam hard against its mechanical stop, as this can damage the internal gears or throttle mechanism.

Enter the resulting value as Maximum Motor Power. Do not fine-tune this setting again until the final adjustment stage.

Example:

Maximum Motor Power	51	 	(%)
Opening Hold Power	51	 	(%)

If the throttle cannot be reached by hand, the Open Test can also be used to identify Raw Open. Record the Throttle TPS 1 value when further increases in motor power no longer produce additional opening movement.

Determine Opening Hold Power

Select Throttle Test Mode - Open Test.

Opening Hold Power establishes the neutral motor-power level used while controlling the throttle in the opening direction. Opening Response is not active during this test, so the required Hold Power can be determined independently of the closed-loop Response setting.

Start Opening Hold Power at 0%.

Opening Hold Power	0	 	(%)
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Increase Opening Hold Power slowly until Raw Open is just reached. Record the setting as Open High. Do not continue increasing the value once the throttle has reached its mechanical limit. If you overshoot, reduce the value until movement is seen again, then approach the point slowly. The throttle may initially appear not to move and can begin moving quickly once sufficient motor power is reached, so make small adjustments near this point.

Now decrease Opening Hold Power until the throttle has just returned to Raw Rest. Record this setting as Open Low. Repeat the test if necessary to obtain a repeatable value.

Calculate:

$$\text{Opening Hold Power} = (\text{Open High} + \text{Open Low}) / 2$$

Enter the calculated average as the final Opening Hold Power.

This places the Hold Power approximately in the centre of the motor-power range required to control the throttle between its Rest Position and the opening direction.

Determine Closing Hold Power

Closing Hold Power is determined using the same principle in the opposite direction. In Close Test, motor power is reversed and the throttle is driven below its mechanical Rest Position toward Raw Close.

Select:

Throttle Test Mode - Close Test

Closing Hold Power establishes the neutral motor-power level used while controlling the throttle in the closing direction. Closing Response is not active during this test, so the required Hold Power can be determined independently of the closed-loop Response setting.

Start Closing Hold Power at 0%.

Closing Hold Power (%)

Increase Closing Hold Power slowly until Raw Close is just reached. Record the setting as Close High. Do not continue increasing the value once the throttle has reached its mechanical limit. If you overshoot, reduce the value until movement is seen again, then approach the point slowly. Make small adjustments as Raw Close is approached.

Now decrease Closing Hold Power until the throttle has just returned to Raw Rest. Record this setting as Close Low. Repeat the test if necessary to obtain a repeatable value.

Calculate:

$$\text{Closing Hold Power} = (\text{Close High} + \text{Close Low}) / 2$$

Enter the calculated average as the final Closing Hold Power.

This places the Hold Power approximately in the centre of the motor-power range required to control the throttle between its Rest Position and the closing direction.

Calibrate the Pedal and Throttle

Once the basic motor-power settings have been established, proceed to Pedal TPS Calibration. This is a good time to save your Tune.

When Calibration is activated, all functions that can influence Throttle Target are disabled automatically. They remain disabled for the duration of the calibration process. Once calibration is complete, normal setup can continue and the required functions can be enabled again.

Throttle Test Mode - Off
MAP Sensor - Disabled

RPM - Disabled completely
Idle Control - Disabled
Pedal Response Graph - Disabled
Coolant Throttle Minimum Graph - Disabled
Coolant Throttle Maximum Graph - Disabled

Open Pedal TPS Calibration, perform the pedal calibration and select Save.

Saving the pedal calibration also starts the automatic electronic-throttle calibration procedure.

During this process the Device will:

1. Open the throttle fully for approximately one second.
2. Allow the throttle to return to its mechanical Rest Position for approximately 0.5 seconds.
3. Close the throttle fully for approximately one second.
4. Allow the throttle to return to its mechanical Rest Position.
5. Capture the required throttle calibration values.

After calibration, both Pedal TPS and Throttle TPS should operate over their calibrated 0.0-100.0% ranges.

Slowly operate the pedal and verify that Throttle TPS moves smoothly through its complete calibrated range.

With all modifying features disabled, Pedal TPS, Throttle Target and Throttle TPS should follow each other directly through the normal operating range. Minimum Throttle Opening can prevent the target from following the pedal below the configured minimum value.

Set the Rest Position

After calibration, Rest Position is expressed in the calibrated 0.0-100.0% throttle range rather than the earlier Raw Rest value. To verify the setting, disconnect the throttle motor fuse so that the return spring places the throttle at its mechanical Rest Position. Throttle TPS should then agree with the Rest Position setting. If there is a small difference, adjust Rest Position slightly to match the measured Throttle TPS value.

Adjust Throttle Response

After Opening Hold Power and Closing Hold Power have been established, start with Opening Response and Closing Response values of 15.

Position Control	
Opening Hold Power	24 (%)
Opening Response	15
Closing Hold Power	28 (%)
Closing Response	15

Press the pedal quickly to approximately 70% and observe Throttle TPS. Increase the relevant Response value until the throttle begins to show excessive shudder or oscillation, then reduce the

value until the throttle moves smoothly and stabilises quickly. Repeat the test in the closing direction by releasing the pedal to just above idle, including operation through the lower side of the Rest Position. A very fast pedal movement may cause a small transient movement, but it should settle quickly and remain stable.

The Response settings act as control-gain sensitivity. If Throttle TPS consistently lags too far behind Throttle Target, increase the relevant Response value. If the throttle becomes nervous, shudders or oscillates, reduce the value.

Fine-Tune Maximum Motor Power

Observe how quickly Throttle TPS follows Throttle Target during normal pedal movement.

If the throttle reaches Target correctly but appears lethargic or responds too slowly, increase Maximum Motor Power slightly.

If the throttle responds unnecessarily aggressively or strikes its mechanical limits hard, reduce Maximum Motor Power.

The objective is for Throttle TPS to follow Throttle Target quickly and smoothly without excessive mechanical impact.

Maximum Motor Power is therefore not a value to make as high as possible. It should provide enough power for good Target tracking without making throttle operation unnecessarily aggressive.

Final Check

Before enabling the additional ETC functions, verify:

- Pedal TPS operates smoothly from 0.0-100.0%.
- Throttle TPS operates smoothly from 0.0-100.0%.
- Rest Position is correct.
- Opening Hold Power has been calibrated.
- Closing Hold Power has been calibrated.
- Maximum Motor Power provides good throttle response.
- Pedal TPS and Throttle Target correspond correctly.
- Throttle TPS follows Throttle Target quickly and smoothly.
- The throttle does not strike its mechanical limits excessively.
- No Pedal TPS or Throttle TPS DTC is active.

Once the basic throttle operates correctly, the Pedal Response Graph, MAP input, RPM input, Idle Control and Coolant Throttle graphs can be enabled and tuned individually.

Important: Always calibrate the basic throttle first. Do not use Idle Control, Pedal Response or protection graphs to compensate for incorrect basic throttle calibration.