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PROGRAMMING MANUAL
ZeelProg PCDI-24VT

Supported control units: **PCDI-24VT**

ZeelProg is PC application for programming ZEELTRONIC engine *control units*.
For programming special PC-USB programmer is needed.

- ***ZeelProg*** automatically detects PC-USB programmer connection and enables all functions (without PC-USB programmer, ***ZeelProg*** application is locked).
- ***ZeelProg*** automatically detects type of engine *control unit* connected to PC-USB programmer.

TECHNICAL DATA

PCDI-24VT is programmable AC-CDI with exhaust valve controller which runs with single pickup and two ignition coils. It is suitable for wasted spark twins, or “big bang twins”.
PCDI-24VT supports TPS, ignition and exhaust valve map switch, general purpose output (GPO), shift light, quick shift...

Limit values:

- minimum revs	200 RPM
- maximum revs	20000 RPM
- minimum supply voltage	7 Volts
- recommended power supply voltage	12÷15 Volts
- maximum supply voltage	17 Volts
- maximum continuous current for GPO output and shift light	1 Amp
- current draw	25 mAmp

Features:
- fast power-up (also starts only with condenser)
- one isolated input for magnetic pickup
- two independent ignition coil outputs
- two programmable ignition maps with 15 points
- external switch for changing ignition map while riding
- TPS input (Throttle Position Sensor)
- 3D interpolated ignition map, if TPS enabled
- signal delay compensation
- general purpose outputs (GPO)
- shift light output
- soft rev limit (three stage rev limit)
- quick shift
- tachometer output
- reduced spark at high revs with closed throttle (TCT mode)
- easy and fast programming on the field, via hand held programmer

- programming with PC
- programming while machine running
- programmable power valve actuation
- two programmable PV curves
- external switch for changing PV curve while riding
- programmable PV deviation
- programmable max close and max open positions
- self PV test on power-up
- PV error detecting (position sensor failure, servo motor failure)
- timing calculation for every 1 RPM change (1000, 1002, .. , 9805, 9806, ...)
- signal delay compensation ensure accurate ignition advance
- instant monitoring of revs and angle, via LCD(hand held programmer)
- fast processing for high accuracy - delays from 1 us

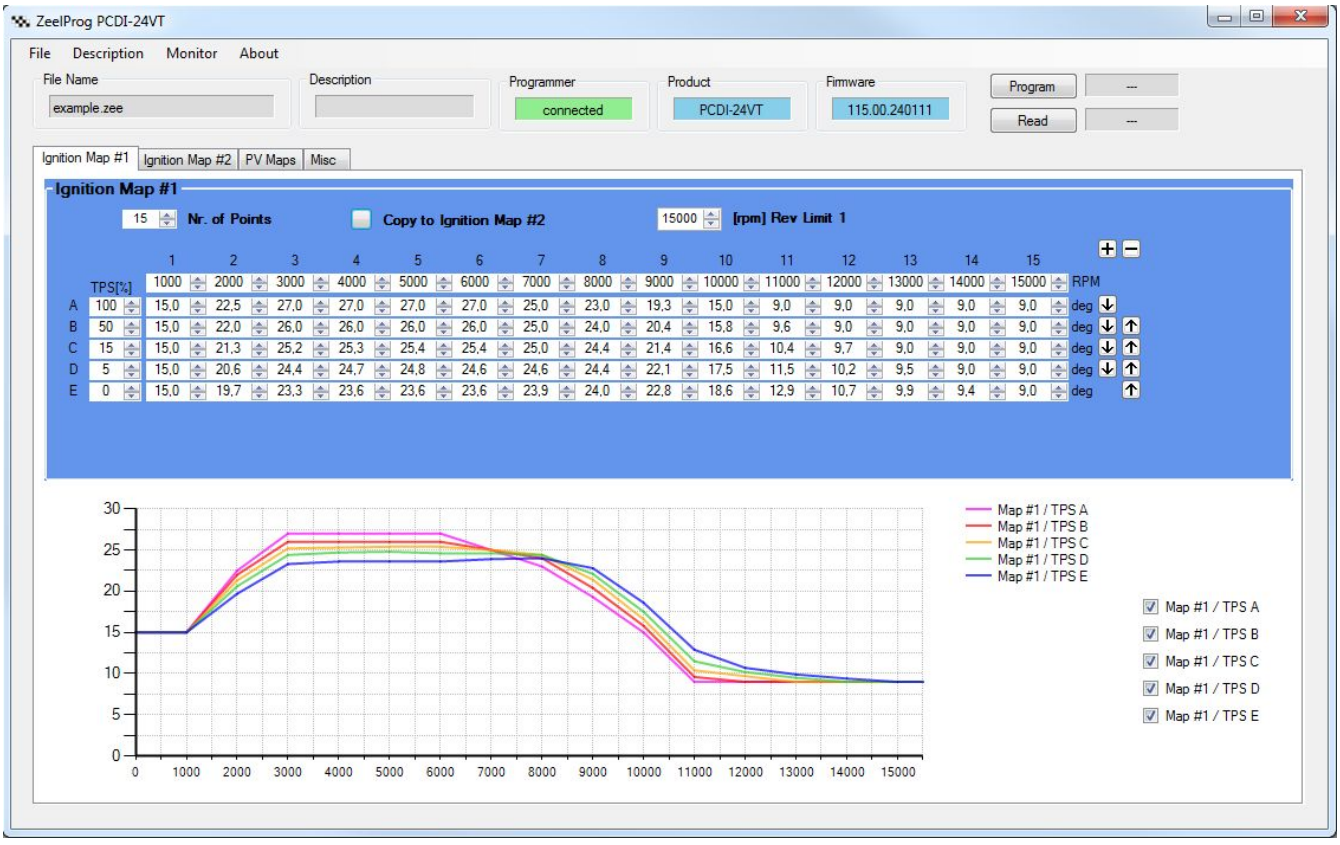
Very important!
Resistor spark plugs must be used, because they produce less electromagnetic disturbances.

Very important!
PCDI is protected against static discharge, but too high static charge can damage PCDI.
Be careful when using programmer on the dyno, because static charge can build up on the bike and static discharge can damage PCDI unit, or programmer. Make ground connection to dyno and bike frame to prevent static discharge.

ZeelProg SOFTWARE INSTALLATION GUIDE

Software can be downloaded from web site: http://www.zeeltronic.com/page/zeelprog.php

ZeelProg application can be installed on Windows XP/Vista/7/8/10/11.

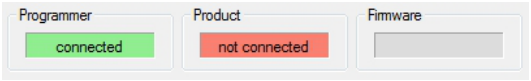


ZeelProg USER INTERFACE

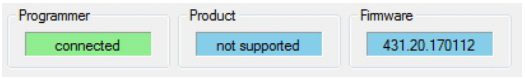
Zeelprog automatically detects USB-Programmer and type of *control unit*.

⇨ Programmer connected, product (*control unit*) connected:

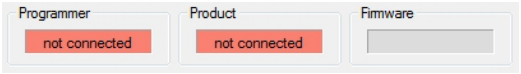
⇨ Programmer connected, product (*control unit*) not connected:



⇨ Programmer connected, product (*control unit*) not supported:

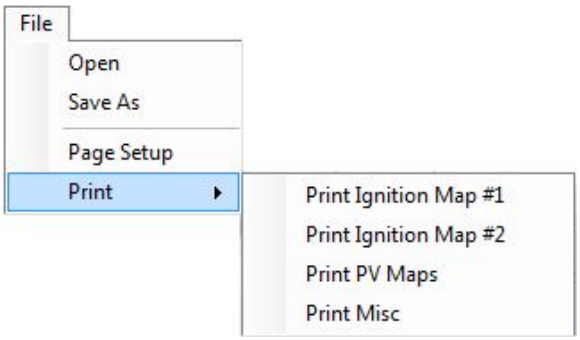


⇨ Programmer not connected, product (*control unit*) not connected:



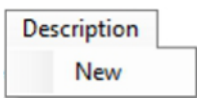
Menu structure

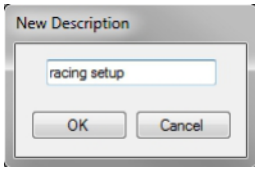
⇨ **File menu** is active when PC-USB programmer is connected



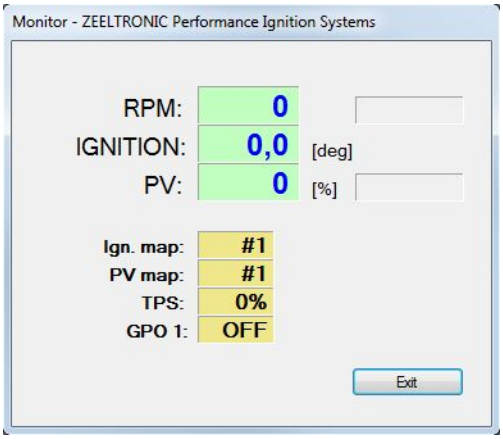
Open → Open an existing *.zee file
Save As → Save all parameters to *.zee file
Page Setup → Page setup for printing
Print Ignition Maps → Print ignition maps page
Print PV Maps → Print PV maps page
Print Misc → Print miscellaneous settings

⇨ **Description** can be added to the settings. Description is added to the saved file and also while programming to the product (ECU).



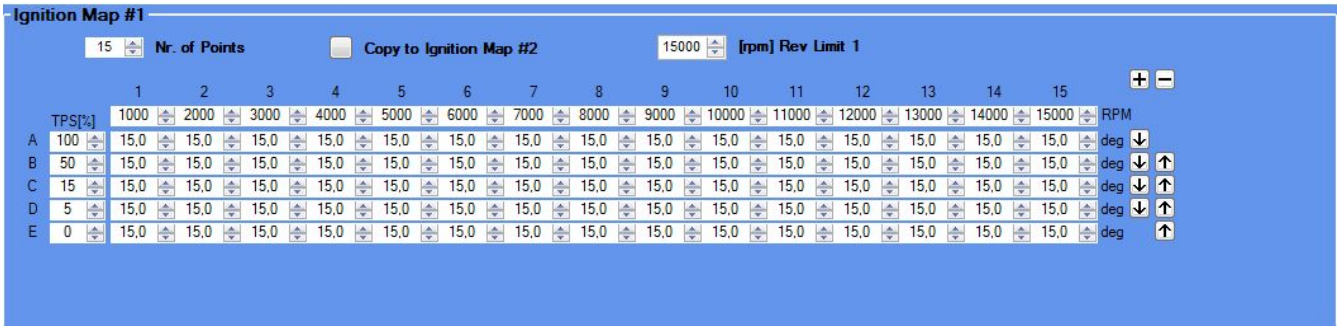


⇨ **Monitor** is active when *control unit* is connected to PC-USB programmer.
Clicking on the **Monitor** opens Monitor window.



⇨ Clicking on **About** opens About window and show some basic information about ***ZeelProg*** application.

Ignition Map #1 Parameters



Ignition advance is 3D interpolated.

⇨ **Nr. of Points** of ignition map can be set from 4 to 15.

⇨ **RPM** of each ignition point can be set from 500 rpm to 20000 rpm in 10 rpm steps. At the left side must be lowest RPM value and each next point must have higher value then previous...

⇨ **deg** ... advance of each ignition point can be set from 0 deg to 85 deg in 0,1 deg steps. Maximum ignition advance is limited by static angle.

⇨ **TPS[%]** ... TPS points can be set from 0% to 100% in 1% steps. At the bottom must be lowest TPS value and each next point must have higher value then previous. TPS points are same for both ignition maps.

⇨ **Rev limit 1** ... rev limit for ignition map #1 ... limits maximum revolutions. It can be adjusted to maximum 20000 rpm in 100 rpm steps.

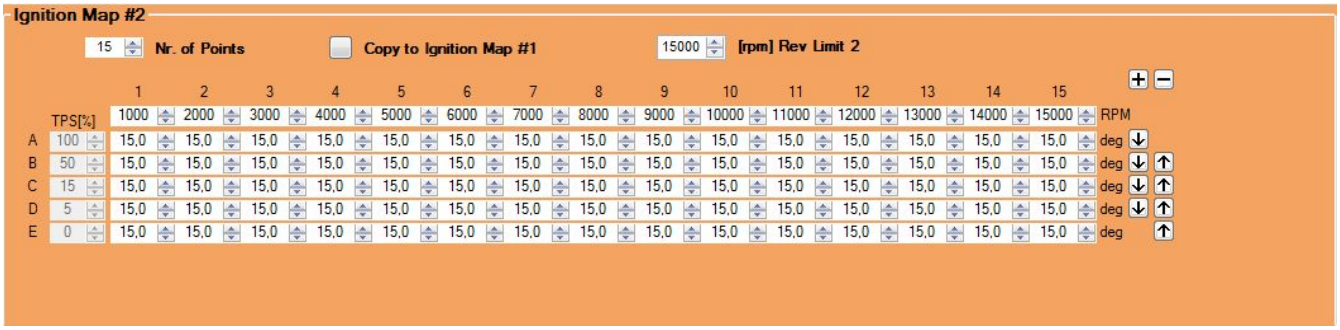
⇨ ➕... increment all ignition points

⇨ ➖... decrement all ignition points

⇨ ↓... copy down entire row

⇨ ↑... copy up entire row

Ignition Map #2 Parameters



Ignition advance is 3D interpolated.

⇨ **Nr. of Points** of ignition map can be set from 4 to 15.

⇨ **RPM** of each ignition point can be set from 500 rpm to 20000 rpm in 10 rpm steps. At the left side must be lowest RPM value and each next point must have higher value then previous...

⇨ **deg** ... advance of each ignition point can be set from 0 deg to 85 deg in 0,1 deg steps. Maximum ignition advance is limited by static angle.

⇨ **TPS[%]** ... TPS points can be set only at ignition map #1 and are same for both ignition maps.

⇨ **Rev limit 2** ... rev limit for ignition map #2 ... limits maximum revolutions. It can be adjusted to maximum 20000 rpm in 100 rpm steps.

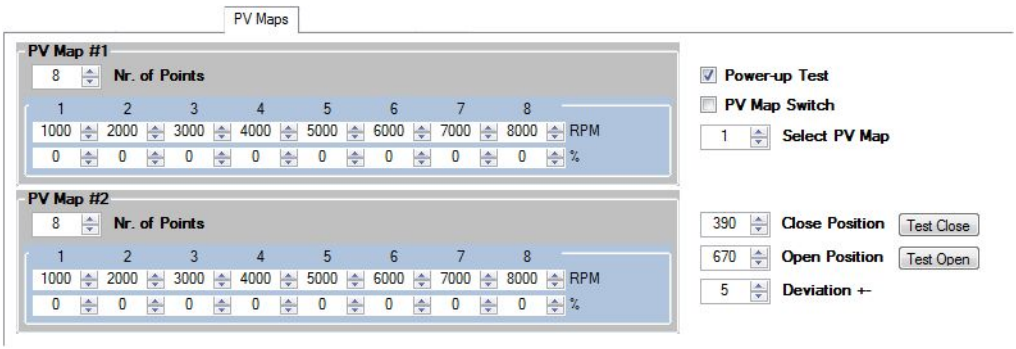
⇨ ➕... increment all ignition points

⇨ ➖... decrement all ignition points

⇨ ⬇... copy down entire row

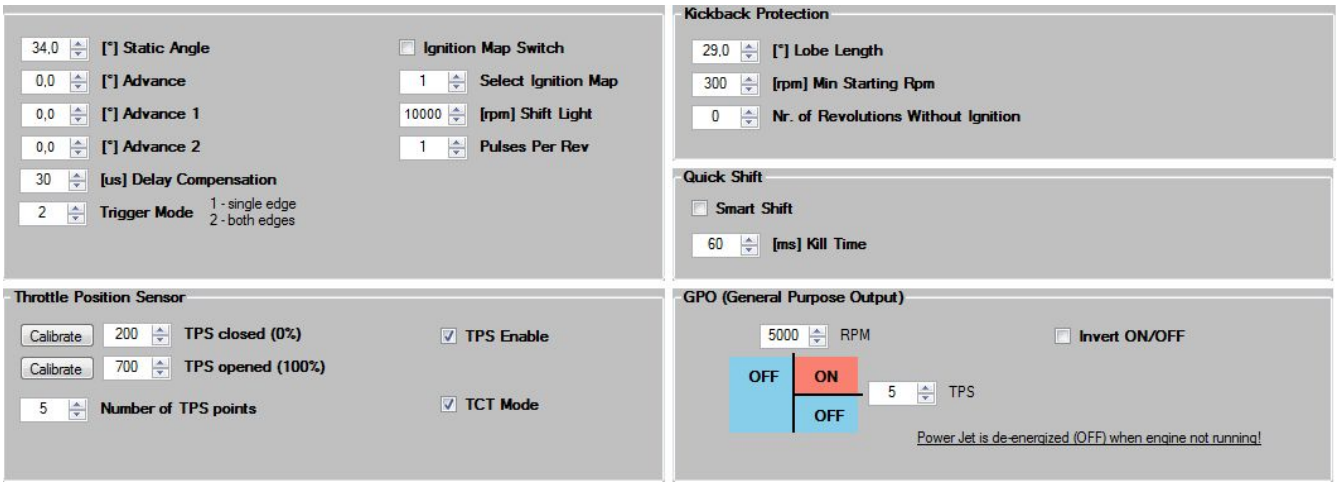
⇨ ⬆... copy up entire row

PV Maps Parameters

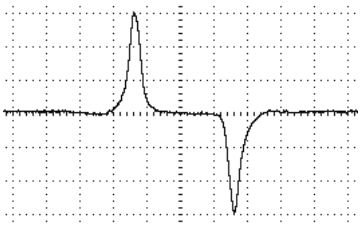


- ⇨ **Nr. of Points** for each PV map can be set from 2 to 8.
- ⇨ **RPM** of each PV point can be set from 100 rpm to 20000 rpm in 100 rpm steps. At the left side must be lowest RPM value and each next point must have higher value then previous...
- ⇨ **%** ... PV position of each PV point can be set from 0% to 100% in 1% steps.
- ⇨ **Power-up Test** ... enables, or disables PV test at switching on power supply.
- ⇨ **Select PV Map** ... selecting active PV map (only when PV map switch disabled)
- ⇨ **Deviation** ... prevents 'hunting' of PV servo.
- ⇨ **Close Position** of PV servo. Close position is 0% on PV map.
- ⇨ **Open Position** of PV servo. Open position is 100% on PV map.
- ⇨ **Test Close** .. .clicking on **Test Close** button, opens Test Close window. Function is active when PC-USB programmer and *control unit* are connected.
- ⇨ **Test Open** ... clicking on **Test Open** button, opens Test Open window. Function is active when PC-USB programmer and *control unit* are connected.
- ⇨ **PV Map Switch** ... enables, or disables PV map switch. PV map can be selected with switch, when function is enabled.

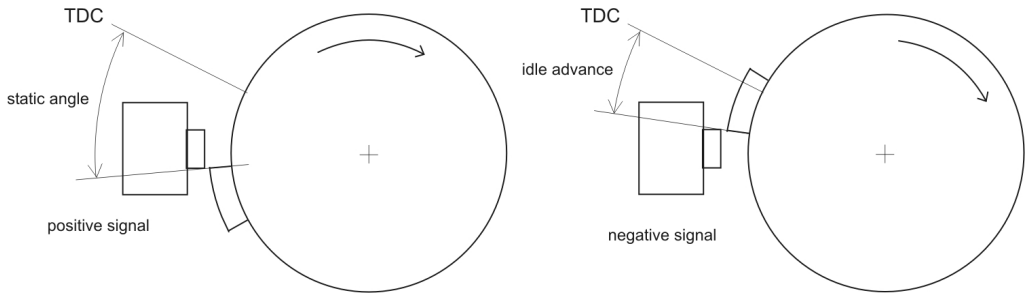
Misc Parameters



⇨ **Static Angle** is pickup advance position from TDC (Top Dead Centre)
⇨ **Advance** ... advances, or retards whole ignition map from -10 deg to 10 deg in 0,1 deg steps. Positive value advances and negative value retards.
⇨ **Advance 1** ... advances, or retards ignition advance of the entire ignition map #1, from -10 deg to 10 deg in 0,1 deg steps. Positive value advances and negative value retards.
⇨ **Advance 2** ... advances, or retards ignition advance of the entire ignition map #2, from -10 deg to 10 deg in 0,1 deg steps. Positive value advances and negative value retards.
⇨ **Delay Compensation** ... ensures correct ignition angle through whole revs. Default value is 30 us.
Delay compensation is compensation of signal delay from pickup to spark plugs. Compensation ensures that ignition advance is same as programmed (accurate).
How to check, if compensation is correct:
- program flat ignition curve
- measure ignition advance with strobe light at low and at high revs
- if advance at low and high revs is not same, then compensation delay must be adjusted
⇨ **Trigger Mode:**



Trigger signal from pickup consist of positive and negative pulse. Positive pulse must be first and is generated by leading edge of trigger bar ... negative pulse must be second and is generated by trailing edge of trigger bar.
If trigger signal is opposite (first negative and second positive), then wires from the pickup have to be swapped ... that changes polarity of signal from pickup.
Positive pulse defines static angle position and negative pulse defines idle running timing position.

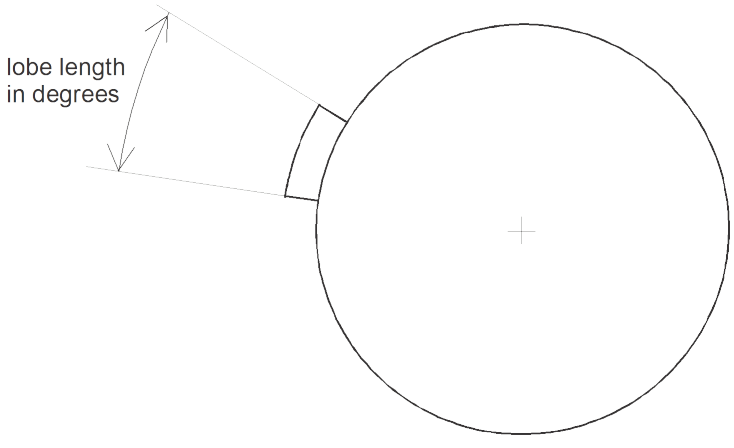


⇨ When **Trigger Mode 1** is selected, then only positive signal is detected and ignition timing is calculated for all revs as programmed with ignition map.
⇨ When **Trigger Mode 2** is selected, then both signals are detected. Revs of first ignition point define switching point between, programmed ignition map and idle running timing position. Trigger Mode 2 ensures stable ignition advance at starting and is recommended for larger displacement cylinders (prevents kickback).
- Ignition timing is defined with trailing edge of trigger bar, at revs lower then first ignition point (idle advance ... see drawing above).
- Ignition timing is defined with programmed map, at revs higher then first ignition point.
Example: if first ignition point is programmed at 1500 rpm, then below 1500 pm ignition timing is defined with trailing edge of trigger bar (idle advance ... see drawing above) and above 1500 rpm ignition timing is defined by programmed ignition map.

⇨ Set **Trigger Mode 1** when using custom, or modified trigger rotor, or upgrade from static ignition timing CDI.
⇨ Set **Trigger Mode 2** when using original trigger rotors, or flywheels. First ignition point should be programmed somewhere between 1000 - 2000 rpm.

⇨ **Ignition Map Switch** ... enables, or disables ignition map switch. Ignition map can be selected with simple on/off switch, when function is enabled.
⇨ **Select Ignition Map** ... selection is active only when **Ignition Map Switch** is not enabled.
⇨ **Shift light** ... activates shift light output above programmed revs. It can be adjusted to maximum 20000 rpm in 100 rpm steps.
⇨ **Pulses per Rev**...set 1 for twins “big bang” operation and set 2 for twins wasted spark.

Kickback protection:
⇨ **Lobe Length [°]** ... trigger lobe length in degrees. Lobe length is used to calculate RPM at starting. Wrong value results in wrong calculation(available only in Trigger Mode 2).
⇨ **Min Starting RPM** ... minimal RPM for starting.
⇨ **Nr. of Revolutions Without Ignition** ... number of revolutions without ignition at starting.



Throttle Position Sensor:
⇨ **TPS closed [0%]** ... TPS close position must be calibrated, for correct TPS operation !

⇨ **TPS opened [100%]** ... TPS open position must be calibrated, for correct TPS operation!
⇨ **Number of TPS points** ... set number of TPS points in ignition map from 1 to 5 points.
⇨ **TPS Enable** ... enable, or disable TPS.
⇨ **TCT mode** ... Throttle Close spark Termination mode, reduces number of sparks above 8000 rpm (spark is active every third revolution), when throttle is closed. TCT mode ensures better engine cooling. This setting is primarily for race use, for normal road use the recommended setting is 'DISABLED'. If you have errors on the rev counter 'DISABLE' this setting.

Quick Shift:

⇨ **Smart Shift**... enable, or disable Smart Shift. Smart shift function automatically adjusts kill time for different revs. Shift kill time must be always set, as basic kill time.
⇨ **Kill Time**... for shifting without using clutch - shift sensor is required. Function is disabled with setting to 0 ms.

GPO(General Purpose Output):

GPO changes state when revs and TPS are higher/lower then programmed value.
⇨ **Invert ON/OFF**... inverting GPO operation.
⇨ **RPM** of each point can be set from 500 rpm to 20000 rpm in 10 rpm steps.
⇨ **TPS[%]** ... TPS points can be set from 0% to 100% in 1% steps.

Example of GPO operation:
Apply to above screen shoot settings...
ON means energized GPO and OFF means de-energized GPO.
GPO is ON when revs are above 5000 rpm and TPS is above 5%.

PROGRAMMING AND SETTING NEW PARAMETERS

➲ While programming, or reading *control unit* does not need to be connected to power supply, because it is supplied through PC-USB programmer.

Changing control unit parameters

① Read parameters from connected *control unit*, by pressing **Read** button.

Progress bar indicate read and verify process.

Successful reading is indicated as: 

Error while reading is indicated as: 

If error occurs, then repeat reading.
② Change parameters
③ Program parameters to connected *control unit*, by pressing **Program** button.

Progress bar indicate program and verify process.

Successful programming is indicated as: 

Error while programming is indicated as: 

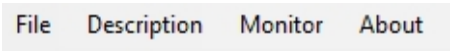
If error occurs, then repeat programming.

Make new *.zee file without connecting control unit

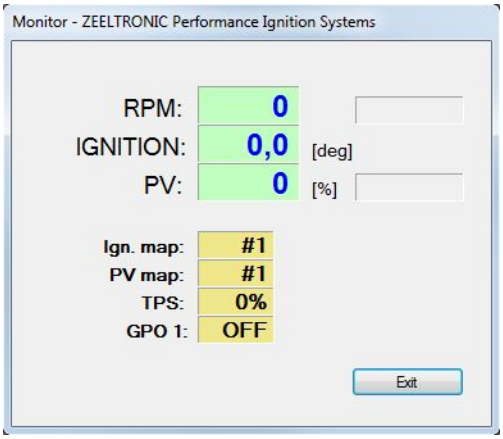
① Connect PC-USB programmer to PC.
② Set parameters
③ Save parameters by clicking **Save As** from **File menu**.

MONITOR FUNCTION

⇨ **Monitor** function is active when *control unit* is connected to PC-USB programmer.



Clicking on **Monitor** opens Monitor window.



⇨ Monitor shows engine revolution, ignition advance angle, PV position, TPS position, selected ignition and PV map, rev limit operation, GPO operation.

MEASURING STATIC ANGLE

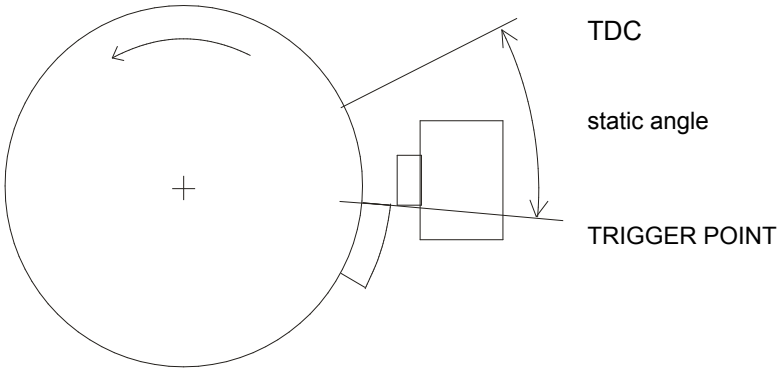
Measuring correct static angle is very important. Wrong static angle will cause inaccurate ignition advance. If static angle is programmed larger than mechanical static angle ignition advance will be smaller than programmed, or vice versa.
The most accurate procedure of measuring static angle is with dial gauge and strobe light.

Procedure applies to single and multiple cylinder engines. If you have a multi cylinder engine with multple pickups it is recommended (but not required) that you perform this procedure on each cylinder/pickup pair for most accurate timing.

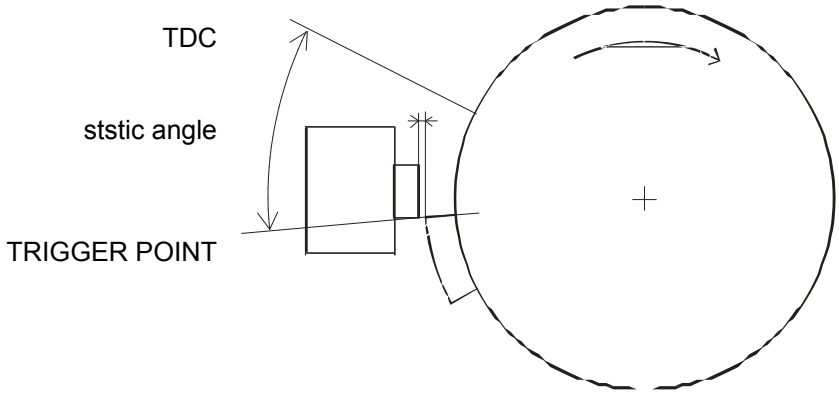
Necessary tools:
- strobe light
- dial gauge

Follow the procedure:
Measure approximate static angle with a degree wheel, just to have starting point...look at the drawing below.

Counterclockwise rotation:



Clockwise rotation:



- program CDI with measured approximate static angle
- program CDI with flat ignition curve...16deg advance is suitable for most engines.
- find information about engine stroke and conrod length
- convert programmed flat ignition advance angle to millimetres

Example:
α =16deg (ignition advance)
L=110mm (conrod length)
R=54/2=27mm (engine stroke divided by 2)
T=1,3mm (calculated ignition advance in mm)

Equation for calculating from degrees to millimetres:

α = ignition advance in degrees
T = ignition advance in mm
R = engine stroke divided by 2 in mm
L = conrod length in mm

$$T = L + R \cdot (1 - \cos\alpha) - \sqrt{L^2 - (R \cdot \sin\alpha)^2}$$

Downloadable spreadsheet is available on request.

- remove sparkplug from cylinder head and mount dial gauge in cylinder.
- find TDC (Top Dead Centre)
- rotate engine backwards (opposite from running engine rotation) to calculated advance in millimetres (in example above it is 1,3mm) and make marks on rotor and stator
- remove dial gauge and install sparkplug back in cylinder head
- start engine and run at constant speed of 3000rpm to 4000rpm
- use a strobe light to check alignment of marks on rotor and stator
- adjust static angle with programmer to align marks on the rotor and stator

Result of above procedure is very accurate static angle.

Important!

- Static angle is reference point for CDI to calculate delay for programmed ignition advance.
- Static angle has to be greater then maximum ignition advance!
- Example - If maximum advance in ignition map is 30deg, then static angle has to be at least 31deg.
- Very large static angles are not a good solution, because it decreases electronic ignition advance stability (do not use static angle greater then 45deg if not necessary).

If you find when testing with your strobe light that your timing marks are off by 10 or more degrees it may be neccessary to reverse the wiring from the reluctor pickup to the ignition and test again. Reluctor pickups have polarity but it is rarely marked on the pickups so must be determined by the trial and error method. Incorrect wiring polarity will cause the reluctor pickup to send the trigger signal on the trailing edge of the rotor instead of the required leading edge of the rotor.