www.zeeltronic.com
info@zeeltronic.com

updated 29.01.2024
firmware: 115.00.240111

PROGRAMMING MANUAL
PCDI-24VT PROGRAMMABLE AC-CDI IGNITION AND PV CONTROLLER

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...

TECHNICAL DATA

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.

1. HOW TO ENTER MENU

Connect **handheld programmer** to **PCDI** and wait few seconds for activation of **handheld programmer** and press ENTER. Move through the menu with pressing +, or - and choose with pressing ENTER.
Exit menu with choosing ***Exit.***

2. MENU ORGANISATION

Set Ign. - set ignition parameters submenu
Set PV - set PV parameters submenu
Exit

2.1. SET IGNITION PARAMETERS SUBMENU

Select Ign. Map - select active ignition map (#1, or #2)
Ign. Map Switch - activating/deactivating external switch for selecting ignition map
Set Ignition Map #1 - ignition map #1 settings
Set Ignition Map #2 - ignition map #2 settings
Advance - advance/retard whole ignition map
Advance 1 - advance/retard ignition coil output 1
Advance 2 - advance/retard ignition coil output 2
Gear Shift Light - shift light
Quick Shift - quick shift settings
Rev Limit 1 - rev limit ignition map #1
Rev Limit 2 - rev limit ignition map #2
GPO - general purpose output settings
Set TPS - TPS (Throttle Position Sensor) settings

TCT mode - reduced spark at high revs when closed TPS
Static Angle - static angle (stator position)
Compensation - signal delay compensation
Trigger Mode - trigger mode
Pulses Per Rev - number pulses per revolution from pickup
Kickback Protection - kickback protection settings
Exit

2.2. SET PV PARAMETERS SUBMENU

Select PV Map - select active PV map (#1, or #2)
PV Map Switch - activating/deactivating external switch for selecting PV map
Set PV Map #1 - PV map #1 settings
Set PV Map #2 - PV map #2 settings
Deviation +- - deviation of PV position
Close Position - max close PV position
Open Position - max open PV position
PV Test - PV position test
Power-up Test - enable, or disable test cycle at power-up
Exit

3. SELECT IGN. MAP

Active map can be selected only, if map switch is disabled. When map switch is enabled, then active map is selected by map switch.
Move to ***Select Ign. Map*** with pressing + , or - and press ENTER .
Select number of ignition map, with pressing + , or - and press ENTER .

4. IGN. MAP SWITCH

Enabling, or disabling ignition map switch. With ignition map switch is possible to change ignition map while riding.

Move to ***Ign. Map Switch*** with pressing + , or - and press ENTER .
Enable, or disable external switch with pressing + , or - and press ENTER .

5. SET IGNITION MAP #1

Ignition advance between programmed points is interpolated.

Move to ***Set Ignition Map #1*** with pressing + , or - and press ENTER .

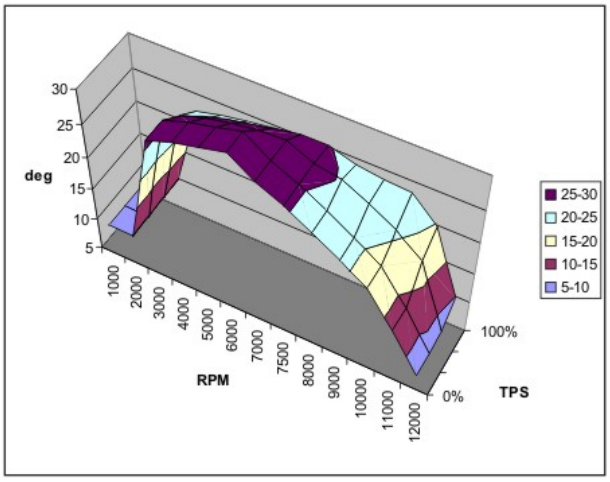
Submenu organisation:
Nr. of Points - number of ignition curve points (from 4 to 15)
Curve TPS 0% - first ignition curve
Curve TPS 5% - second ignition curve
... ...

Curve TPS 100% -
Exit - exit submenu

Number of Curves and TPS values depends on TPS settings ... look at section **Set TPS.**

Important!
To avoid wrong processing, don't make unreasonable curve course.

Ignition Map Example:



Nr. of Points:
Move to ***Nr. of Points*** with pressing + , or - and press ENTER .
Select number of ignition points, with pressing + , or - and press ENTER .

Set Curve TPS xxx%:
Procedure is same for each ignition curve.
xxx% value depends on TPS settings ... look at section **Set TPS.**

Move to ***Curve TPS xxx%*** with pressing + , or - and press ENTER .
Move to point you want to change, with pressing + , or - and press ENTER .
Change rev point with pressing + , or - (in 10 rpm steps) and press ENTER .
Change advance angle with pressing + , or - (in 0.1deg steps) and press ENTER .
Continue with same procedure for each point you want to change.

Rev points are same for all TPS curves in same ignition map. If first rev point is changed in one of the TPS curves, then all first rev points in all TPS curves in same map will change. Same apply when changing any other rev point.

6. SET IGNITION MAP #2

Procedure is same as for ignition map #1... look at section **SET IGNITION MAP #1.**

7. ADVANCE

With this setting is possible to advance, or retard whole ignition map for both ignition outputs. When setting is positive, then ignition map is advanced and when setting is negative, than ignition map is retarded. Ignition map advance is unchanged, with setting ***0.0deg***.

Move to ***Advance***, with pressing + , or - and then press ENTER .
Set advance with pressing + , or - (in 0.1deg steps) and press ENTER .

8. ADVANCE 1

With this setting is possible to advance, or retard whole ignition map for ignition output 1. When setting is positive, then ignition map is advanced and when setting is negative, than ignition map is retarded. Ignition map advance is unchanged, with setting ***0.0deg***.

Move to ***Advance 1***, with pressing + , or - and then press ENTER .
Set advance with pressing + , or - (in 0.1deg steps) and press ENTER .

9. ADVANCE 2

With this setting is possible to advance, or retard whole ignition map for ignition output 2. When setting is positive, then ignition map is advanced and when setting is negative, than ignition map is retarded. Ignition map advance is unchanged, with setting ***0.0deg***.

Move to ***Advance 2***, with pressing + , or - and then press ENTER .
Set advance with pressing + , or - (in 0.1deg steps) and press ENTER .

10. GEAR SHIFT LIGHT

Gear Shift Light output is activated when engine revolutions are higher then programmed.

Move to ***Gear Shift Light***, with pressing + , or - and then press ENTER .
Set engine revolutions for activating shift light with pressing + , or - and press ENTER .

11. QUICK SHIFT

Move to ***Quick Shift***, with pressing + , or - and then press ENTER to enter submenu.

Submenu organisation:
Shift Kill Time - basic kill time
Smart Shift - activating/deactivating automatic kill time for different revs
Exit

Move to ***Quick Shift***, with pressing + , or - and then press ENTER .
Set kill time with pressing + , or - and press ENTER .

Move to ***Smart Shift*** with pressing + , or - and press ENTER .
Enable, or disable smart shift with pressing + , or - and press ENTER .

12. REV LIMIT 1

Rev limit for ignition map #1.

Move to ***Rev Limit 1*** with pressing + , or - and press ENTER .
Change rev limit with pressing + , or - and press ENTER .

13. REV LIMIT 2

Rev limit for ignition map #2.

Move to ***Rev Limit 2*** with pressing + , or - and press ENTER .
Change rev limit with pressing + , or - and press ENTER .

14. GPO (General Purpose Output)

GPO is general purpose output.

GPO changes state when revs and TPS are higher/lower then programmed value.
GPO is de-energized (OFF) when engine not running!
Display explanation:

```
GPO 1      10%
   OFF   5000    ON
```

- 10% means TPS value
- 5000 means RPM value
- OFF means de-energized GPO
- ON means energized GPO

Explanation of operation of above settings:
GPO is ON when revs are above 5000 rpm and TPS is above 10%, otherwise GPO is OFF.

Move to ***GPO*** with pressing + , or - and then press ENTER .
Change ON/OFF state with pressing + , or - and press ENTER .
Change TPS value with pressing + , or - and press ENTER .
Change RPM value with pressing + , or - and press ENTER .

When TPS disabled, then GPO TPS value can't be adjusted and TPS position does not affect on GPO operation.

15. Set TPS

Settings for Throttle Position Sensor.

Move to ***Set TPS*** with pressing + , or - and press ENTER .
Submenu organization:

TPS enable/disable	- enable, or disable TPS
TPS close [0%]	- calibrate TPS close position
TPS open [100%]	- calibrate TPS open position
Nr. of TPS Ign. Points	- number of TPS ignition points
Set TPS Points	- set TPS points for ignition map
Exit	- exit submenu

TPS enable/disable:
Move to ***TPS*** with pressing + , or - and press ENTER .
Enable, or disable TPS with pressing + , or - and press ENTER .

When ***TPS*** disabled, then other TPS parameters can't be adjusted.

TPS close [0%]:
For correct operation, TPS close position must be calibrated!
Move to ***TPS close [0%]*** with pressing + , or - and press ENTER .
Hold throttle at close position and confirm calibration with pressing ENTER , or exit calibration with pressing - . Displayed number should be between 0 and 500.

TPS open [100%]:
For correct operation, TPS open position must be calibrated!
Move to ***TPS open [100%]*** with pressing + , or - and press ENTER .
Hold throttle at open position and confirm calibration with pressing ENTER , or exit calibration with pressing - . Displayed number must be greater then for TPS close position.

Nr. of TPS Ign. Points
Move to ***Nr. of TPS Ign. Points*** with pressing + , or - and press ENTER to continue.
Select number of ignition points, with pressing + , or - and press ENTER to continue.

Set TPS points:
Move to ***Set TPS Points*** with pressing + , or - and press ENTER .
Adjust TPS value with pressing + , or - and press ENTER .
Continue with same procedure for all TPS points.
First TPS point from the left must be lowest value, each next point must have higher value then previous.

16. TCT mode

Throttle Close spark Termination mode, reduces number of sparks (spark is active every third revolution) above 8000 rpm, when throttle is closed. TCT mode ensures better engine cooling and lubrication when TPS closed.
TPS must be enabled.

Move to ***TCT mode*** with pressing + , or - and press ENTER .
Enable, or disable ***TCT mode*** with pressing + , or - and press ENTER .

17. STATIC ANGLE

Move to ***Static Angle*** with pressing + , or - and press ENTER .
Set static angle with pressing + , or - and press ENTER .

Find more information's about static angle in section **MEASURING STATIC ANGLE** and **Explanation of trigger signal from pickup**.

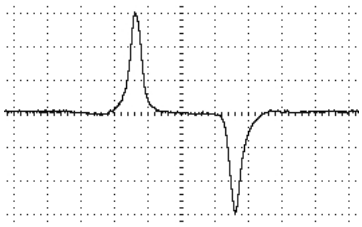
18. COMPENSATION

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

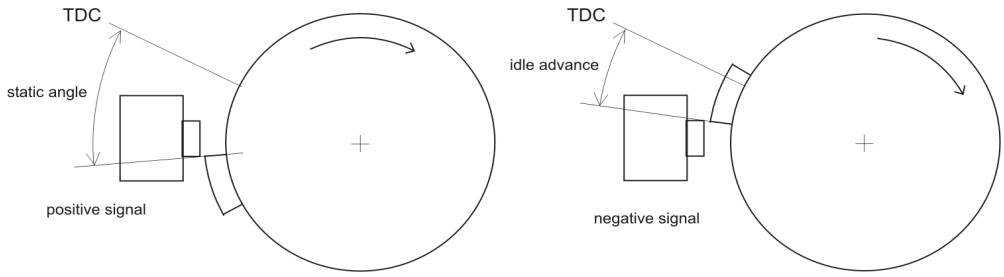
Change Compensation:
Move to ***Compensation*** with pressing + , or - and press ENTER .
Change compensation delay with pressing + , or - and press ENTER .

19. Set TRIGGER MODE

Move to ***Trigger Mode*** with pressing + , or - and then press ENTER .
Change ***Trigger Mode*** with pressing + , or - and then press ENTER .



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 advance 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 advance 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 rpm ignition timing is defined with trailing edge of trigger bar (idle advance ... see drawing above) and above 1500rpm 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.

20. PULSES PER REV

It is number of pulses per rev from pickup coil and is important for correct rev reading.
Set 1 for twins “big bang” operation and set 2 for twins wasted spark.

Move to ***Pulses Per Rev*** with pressing + , or - and press ENTER .
Change nr. of pulses per rev with pressing + , or - and press ENTER .

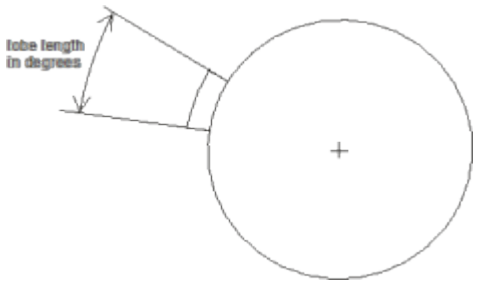
21. KICKBACK PROTECTION

Move to ***Kickback Protection*** with pressing + , or - and press ENTER .

Submenu organization:

Lobe Length	- trigger rotor lobe length in degrees (only with ***Trigger Mode 2***)
Min Starting Rpm	- minimal rpm for starting engine
Nr Revs Without Ignition	- number revolutions without ignition
Exit	- exit submenu

Lobe Length:
Lobe length is used to calculate RPM at starting. Wrong value results in wrong calculation.



Minimal rpm for starting engine

Move to ***Min Starting Rpm*** with pressing + , or - and press ENTER .
Set rpm with pressing + , or - and press ENTER .

Nr Revs Without Ignition
Number revolutions without ignition at starting.

Move to ***Nr Revs Without Ignition*** with pressing + , or - and press ENTER .
Set number with pressing + , or - and press ENTER .

22. SELECT PV MAP

Active power valve map can be selected only, if map switch is disabled. When map switch is enabled, then active map is selected by map switch.
Move to ***Select PV Map*** with pressing + , or - and press ENTER .
Select number of ignition map, with pressing + , or - and press ENTER .

23. PV MAP SWITCH

Enabling, or disabling power valve map switch. With PV map switch is possible to change PV map while riding.

Move to ***PV Map Switch*** with pressing + , or - and press ENTER .
Enable, or disable PV map switch with pressing + , or - and press ENTER .

24. Set PV Map #1

Move to ***Set PV Map #1*** with pressing + , or - and press ENTER .

Submenu organisation:

Nr. of Points	- number of PV curve points (from 2 to 8)
1)	- first valve position point
2)	- second valve position point
Exit	- exit submenu

Important!
To avoid wrong processing, don't make unreasonable curve course.

24.1. Change Number of Curve Points

Move to ***Nr. of Points*** with pressing + , or - and press ENTER .
Select number of curve points, with pressing + , or - and press ENTER .

24.2. Change Parameters of PV Map Points

Move to point you want to change, with pressing + , or - and press ENTER .
Change rev point with pressing + , or - (in 100 rpm steps) and press ENTER .
Change PV position from 0% to 100%, with pressing + , or - (in 1% steps) and press ENTER .

25. Set PV Map #2

Procedure is same as for PV map #1... look at section **Set PV Map #1.**

26. Set Deviation

Move to ***Deviation*** with pressing + , or - and press ENTER .
Change deviation from 2% to 20% with pressing + , or - and press ENTER .
Deviation means how accurate valve is moved to calculated position. If deviation is too low then servo motor won't be stable – it will always search for calculated position in small movements. Default setting is +-5% and should meet in most cases.

27. CLOSE POSITION

Max close position must be calibrated after installation. Max close position is when curve is set to 0%. Close position can be moved to any desired position. Close position must have lower value then open position.

Move to ***Close Position*** with pressing + , or - and press ENTER .
Set close position with pressing + , or - and press ENTER .

28. OPEN POSITION

Max open position must be calibrated after installation. Max open position is when curve is set to 100%. Open position can be moved to any desired position. Open position must have higher value then close position.

Move to ***Open Position*** with pressing + , or - and press ENTER .
Set open position with pressing + , or - and press ENTER .

29. PV Test

PV test can be used for testing, or measuring valve position. Valve can be moved to any position from 0% to 100%, without engine running.

Move to ***PV Test*** with pressing + , or - and press ENTER .
Set valve position with pressing + , or - and press ENTER to exit.

30. POWER-UP Test

Enabling, or disabling test cycle of PV servo at power-up. Power-up test does not work when programmer is connected to the CDI.

Move to ***Power-up Test*** with pressing + , or - and press ENTER .
Enable, or disable power-up test with pressing + , or - and press ENTER .

31. MONITORING

Connect programmer to **PCDI** and wait few seconds for activation of programmer. Fist information displayed on the programmer is firmware version.

Programmer shows revs, calculated ignition advance angle, TPS position ... depends on setting in the menu.

Information!
You can connect, or disconnect **PCDI** unit from **programmer** any time you want, without any harm. It is not important, if motor running, or not.

Important!
Do not use too much force when connecting, or disconnecting **programmer** unit!

32. MEASURING STATIC ANGLE

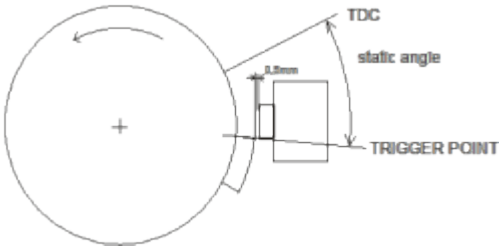
Measuring correct static angle is very important. Wrong static angle will cause inaccurate ignition advance. If static angle is programmed larger than mechanical static angle, then ignition advance will be smaller then programmed, or vice versa.
The most accurate procedure of measuring static angle is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

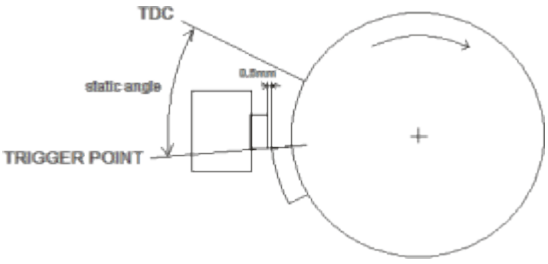
Necessary tools:
- strobe light
- dial gauge

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 ... 16d eg 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 1,3 mm) 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 3000 rpm to 4000 rpm
- 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 30 deg, then static angle has to be at least 31 deg.
- 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.