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# USER MANUAL
# PIIS-23 PROGRAMMABLE INDUCTIVE IGNITION

PIIS-23 is twin channel inductive ignition ECU with 2 switchable ignition maps. It can be programmed with handheld programmer, or PC.

TECHNICAL DATA

Limit values:

| | |
|---|---|
| - minimum revs | 200 RPM |
| - maximum revs | 15000 RPM |
| - minimum supply voltage | 9 Volts |
| - maximum supply voltage | 17 Volts |
| - recommended power supply voltage | 12 ÷ 15 Volts |
| - recommended ignition coil resistance | 2.2 ÷ 4 ohm |
| - recommended ignition coil inductance | 5 ÷ 7 mH |
| - dimensions | 76 x 55 x 28 mm |

Features:
- two inputs for magnetic pickup
- two ignition maps with 20 programmable rpm points adjustable in 10 rpm and 0.1 deg steps
- ignition map switch input
- individual rev limit for each ignition map
- shift light output
- fuel pump relay output
- rev counter output (1 pulse per revolution, 5 Volt square wave)
- quick shift input
- programmable with handheld, or PC-USB programmer
- ignition test
- ignition coil test
- ECU makes quick test of ignition coils at power up. If error is detected then ignition is disabled

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

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

## 1. HOW TO ENTER MENU

ECU does not need to be connected to power supply when battery is installed in to the handheld programmer. Connect handheld programmer to ECU and wait few seconds for activation of programmer and press ENTER. Move through menu with pressing + , or - and choose with pressing ENTER.
Exit menu with choosing ***Exit.***

## 2. MENU ORGANIZATION

| | |
|---|---|
| ***Select Ign. Map*** | - select 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 1*** | - advance/retard whole ignition map #1 |
| ***Advance 2*** | - advance/retard whole ignition map #2 |
| ***Rev Limit Map #1*** | - rev limit for ignition map #1 |
| ***Rev Limit Map #2*** | - rev limit for ignition map #2 |
| ***Static Angle*** | - static angle (stator position) |
| ***Compensation*** | - signal delay compensation |
| ***Trigger mode*** | - depends on trigger system |
| ***Invert Pickup Polarity*** | - depends on trigger system |
| ***Shift Kill Time*** | - shift kill time setting |
| ***Stop SW Mode*** | - stop switch mode |
| ***Shift Light*** | - shift light |
| ***Min Starting Rpm*** | - minimal rpm for starting engine |
| ***Nr Revs Without Ignition*** | - number of revolutions without ignition at starting |
| ***Ignition Test*** | - spark execution test without running engine |
| ***Test Ign. Coils*** | - test of ignition coils |
| ***Power Supply*** | - shows power supply voltage |
| ***Exit*** | |

## 3. SELECT IGN. MAP

Ignition map switch can be selected with the programmer only when map switch is not enabled.

Move to ***Select Ign. Map*** with pressing + , or - and press ENTER to continue.
Select number of ignition map with pressing + , or - and press ENTER to confirm.

## 4. IGN. MAP SWITCH

Enable, or disable 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 to continue.
Enable, or disable ignition map switch with pressing + , or - and press ENTER to confirm.

## 5. SET IGNITION MAP #1

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

Submenu organisation:

| | |
|---|---|
| ***Nr. of Points*** | - number of ignition curve points (from 4 to 20) |
| ***1) 1000 RPM; 15.0 deg*** | - first ignition point |
| ***2) 2000 RPM; 20.0 deg*** | - second ignition point |
| ... ... | |
| ***20) 12000 RPM; 35,0 deg*** | - last ignition point |
| ***Exit*** | - exit submenu |

**Important!**
To avoid wrong processing, don't make unreasonable curve course. First ignition point must have lowest RPM value and every next point must have higher RPM value then previous.

***Nr. of Points:***
It is not necessary to use all 20 ignition points. For simpler ignition map can be used less ignition points.
Move to ***Nr. of Points*** with pressing + , or - and press ENTER to continue.
Select number of ignition points, with pressing + , or - and press ENTER to confirm.

***Ignition points:***
Move to point you want to change, with pressing + , or - and press ENTER to continue.
Change rev point with pressing + , or - (in 10 rpm steps) and press ENTER to continue.
Change advance angle with pressing + , or - (in 0.1 deg steps) and press ENTER to confirm.
Continue with same procedure for each point you want to change.

## 6. SET IGNITION MAP #2

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

## 7. ADVANCE 1

With this setting is possible to advance, or retard whole ignition map #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 ***0.0 deg***.

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

## 8. ADVANCE 2

With this setting is possible to advance, or retard whole ignition map #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 ***0.0 deg***.

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

## 9. REV LIMIT MAP #1

Rev limit of ignition map #1 is active when ignition map #1 is selected.

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

## 10. REV LIMIT MAP #2

Rev limit of ignition map #2 is active when ignition map #2 is selected.

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

## 11. STATIC ANGLE

Static angle represents pickup position and it is reference point for ECU to calculate correct ignition advance. Find more information's about static angle in section **MEASURING STATIC ANGLE** and **Explanation of trigger signal from pickup**.

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

## 13. COMPENSATION

Delay compensation is compensation of signal delay from pickup to spark plugs.
Compensation ensures that ignition advance is same as programmed (accurate). Before checking compensation it is necessary to pogram correct static angle.
Default copensation is 30 ms and it is good in most cases.
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

Enter menu and move to ***Compensation*** with pressing + , or - and press ENTER to continue.
Change compensation delay with pressing + , or - and press ENTER to confirm.

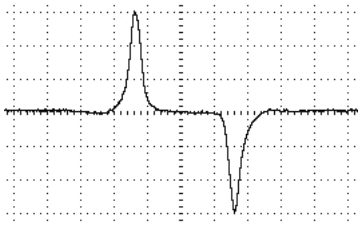
## 14. TRIGGER MODE

For the correct ECU operation correct trigger mode have to be selected.
- trigger mode 1 when using two pickups and single lobe at the flywheel
- trigger mode 2 is suitable for Suzuki GSX-R750 1988-1992 trigger system

Move to ***Trigger Mode*** with pressing + , or - and press ENTER to continue.
Set trigger mode with pressing + , or - and press ENTER to confirm.

## 15. INVERT PICKUP POLARITY

Trigger signal from pickup consist of positive and negative pulse. Positive pulse must be first and is generated by leading edge of trigger lobe ... negative pulse must be second and is generated by trailing edge of trigger lobe.



If trigger signal is opposite (first negative and second positive), then wires from the pickup need to be swapped, or ***Invert Pickup Polarity*** can be enabled.

Move to ***Invert Pickup Polarity*** with pressing + , or - and press ENTER to continue.
Enable, or disable invert pickup polarity with pressing + , or - and press ENTER to confirm.

## 16. SHIFT KILL TIME

Shift kill time have to be set when using quick shift sensor for shifting gear without clutch.
Default value is 60 ms and should be good in most cases.

Move to ***Shift Kill Time*** with pressing + , or - and press ENTER to continue.
Set kill time [ms] with pressing + , or - and press ENTER to confirm.

## 17. STOP SWITCH MODE

It defines stop switch position for engine stop.
"**low stop**" ... engine stops when low level signal (when stop switch connected to the ground).
"**high stop**" ... engine stops when high level signal (when stop switch is opened).

Enter menu and move to ***Stop SW Mode*** with pressing + , or - and press ENTER to continue.
Change ***Stop SW Mode*** with + , or - and press ENTER to confirm.

## 18. SHIFT LIGHT

Shift light output is activated when engine rpm is above programmed rpm for the shift light.

Enter menu and move to ***Shift Light*** with pressing + , or - and press ENTER .
Change rev point with pressing + , or - (in 10 rpm steps) and press ENTER .

## 19. MIN STARTING RPM

Minimum rpm for starting engine. It prevents possible kickback at starting.

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

## 20. NR REVS WITHOUT IGNITION

Number of engine revolutions without ignition at starting. It prevents possible kickback at starting.

Move to ***Nr Revs Without Ignition*** with pressing + , or - and press ENTER to continue.
Set number of engine revolutions with pressing + , or - and press ENTER to confirm.

## 21. IGNITION TEST

Spark execution test without running engine. Spark can be optically checked, with removed spark plug from cylinder and connected to the plug cup and to the frame, or engine.

Enter ***Set Ign.*** menu and move to ***Ignition Test*** with pressing + , or - . With pressing ENTER multiple sparks will occur for about 1 second.

## 22. TEST IGNITION COILS

Test of ignition coils is recommended after installing new ignition coils, or checking ignition coils for possible defect while troubleshooting.

Enter menu and move to ***Test Ignition Coils*** with pressing + , or - and press ENTER to start test of ignition coils. ECU measures dwell time and current of each ignition coil and show results on the LCD. Press ENTER to exit.

Recommended ignition coil dwell time is between 2.5 and 5 ms.
Recommended ignition coil current is between 2.5 and 5.5 Amp at 12.5 Volt power supply.

## 23. MONITORING

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

Programmer show revs, calculated ignition advance angle and selected ignition map ... depends on setting in the menu.

**ECU** can be connected, or disconnected from **programmer** any time without any harm. It is not important, if motor running, or not. Just be careful about possible static chage.

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

## 24. 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 than programmed, or vice versa.
The most accurate procedure of measuring static angle is with dial gauge and strobe light.

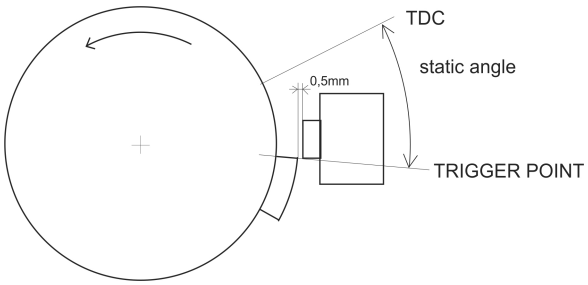
Procedure applies to single and multiple cylinder engines. If you have a multi cylinder engine with multple pickups it is recommended (but not required) that you perform this procedure on each cylinder/pickup pair for most accurate timing.

Necessary tools:
- strobe light
- dial gauge

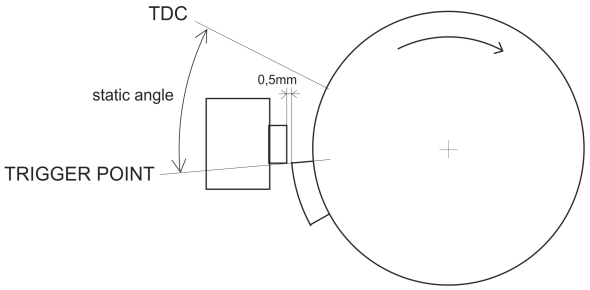
Follow the procedure:
Measure approximate static angle with a degree wheel, just to have starting point.

- move rotor to the top dead centre (TDC)
- move rotor bachwards (opposite from engine rotation) until trigger lobe leaving metal part of the pickup...look at drawing below
- angle between TDC and rotor position at drawing is approximate static angle

Counterclockwise rotation:



Clockwise rotation:




- program CDI with measured approximate static angle
- program CDI with flat ignition curve...16 deg 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:
$\alpha$ = 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 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 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!

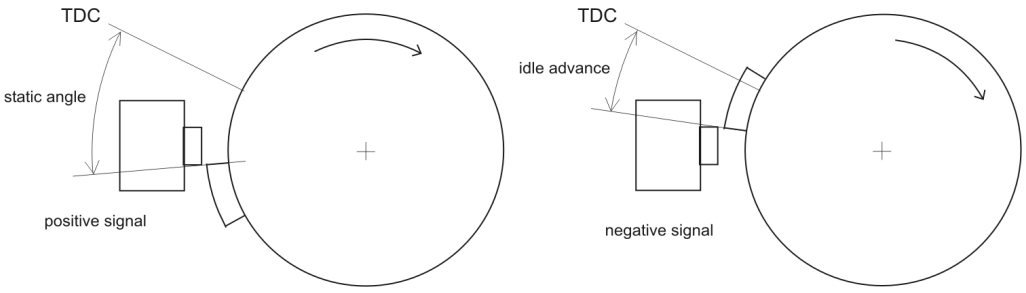
- Static angle is reference point for CDI to calculate delay for programmed ignition advance.
- Static angle has to be greater then maximum ignition advance!
- Example - If maximum advance in ignition map is 30 deg, then static angle has to be at least 31deg.
- Very large static angles are not a good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

electronic ignition advance stability (do not use static angle greater then 50deg 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.

## 25. Explanation of trigger signal from pickup

Trigger signal from pickup consist of positive and negative pulse. Positive pulse must be first and is generated by leading edge of trigger lobe ... negative pulse must be second and is generated by trailing edge of trigger lobe.
If trigger signal is opposite (first negative and second positive), then wires from the pickup need to be swapped ... that changes polarity of signal from pickup.
Leading edge of trigger lobe defines static angle position and trailing edge defines idle running timing position.
Ignition running from trailing edge from starting and to rpm of first ignition point in the ignition map.



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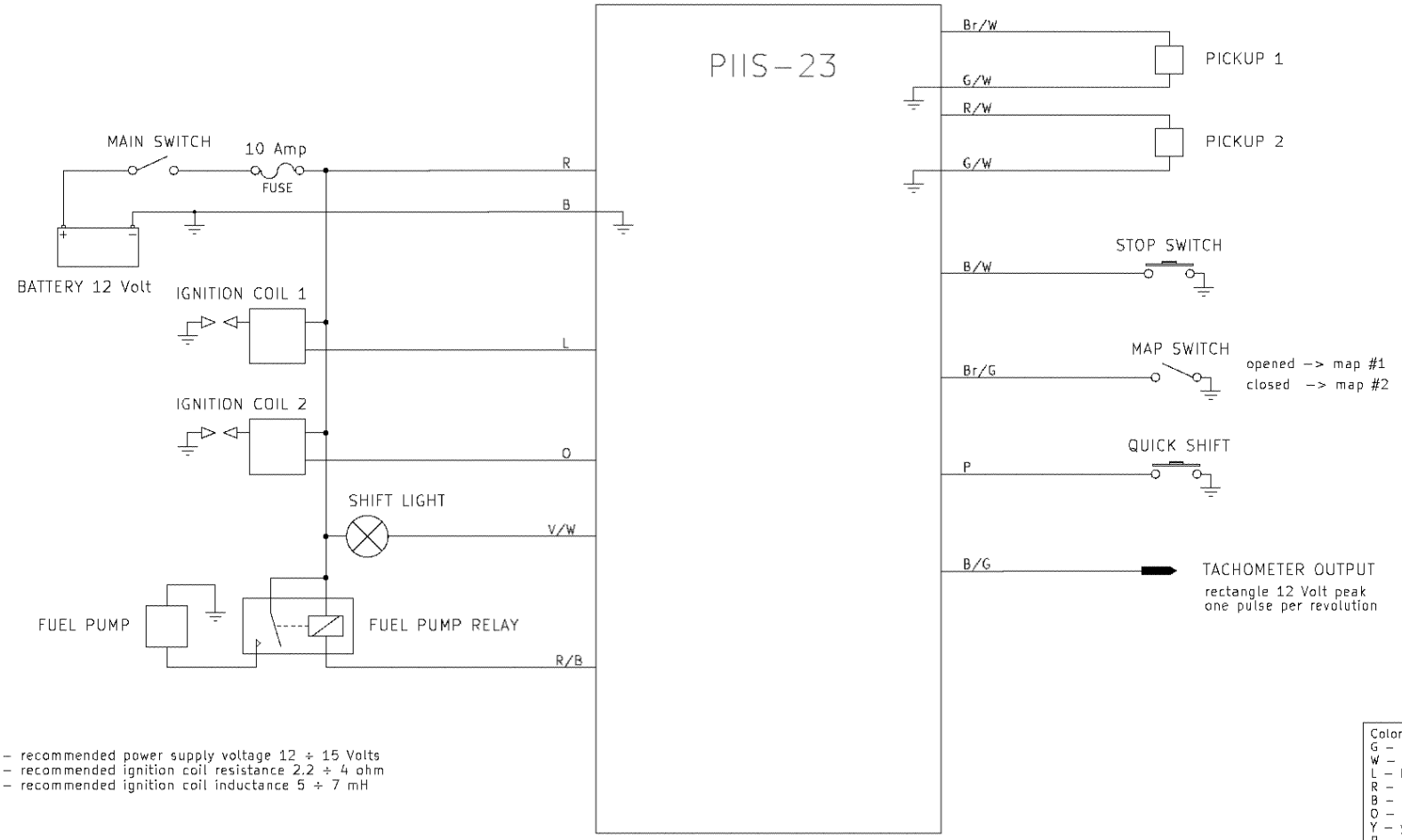
# WIRING DIAGRAM




– recommended power supply voltage 12 ÷ 15 Volts
– recommended ignition coil resistance 2.2 ÷ 4 ohm
– recommended ignition coil inductance 5 ÷ 7 mH

Color legend:
G – green
W – white
L – blue
R – red
B – black
O – orange
Y – yellow
P – pink
V – violet
Br – brown
Gr – gray