

# SPARKER Racing 3 (v104)

SPARKER Racing 3 is an ignition unit for road motorcycles. The ignition principle is inductive. The unit is programmable through PC. The unit is fully adjustable regarding the ignition timing. It contains two switcheable ignition advance curves / maps dependent on RPM and position of throttle or underpressure in the intake manifold. The ignition also contains output for tachometer, two multifunctional outputs, six multifunctional inputs, outputs and an input for the servomotor exhaust throttle. The unit is also equipped with some racing features - mainly Quickshift and Gear shift light. During programming, the ignition unit is connected to a computer via a serial port. RACING 3.EXE configuration software ("software") is included.

Unit is a four-channel type (maximal four induction coils).

Unit is produced in several further modifications related to the inputs for engine position sensors. The inputs for position sensors are two and each of them can be custom-made in the following versions:

- 1) For inductive sensor (marked **IND** or unmarked)
- 2) For inductive sensor with a pulsed rotor with more than 12 protrusions ( marked **24-2**)
- 3) For inductive sensor with a pulsed rotor with more than 36 protrusions ( marked **48-2** or **60-2**)
- 4) For HALL sensor or optical sensor (marked **HALL**)
- 5) For inductive sensors and pulse rotor with one pulse lobe (marked **ONE LOBE** or **DUCATI KOKUSAN**)

Unit is produced in two further modifications related to the output for ignition coils:

- A) For standard ignition coils (unmarked). This output provide ground when coil is excited.
- B) For ignition coils with integrated driver (marked **SPA**). This output provide +5V when coil is excited.

## HARDWARE

### Supply voltage +12 V input

The nominal power supply voltage should be 14 V. The supply voltage must be between 8-18 V. In this range the unit is able to provide control of all the processes. Above 20 V the unit stops controlling the coils (overvoltage protection). Supply voltage is connected with the positive pole to +12V (pin 8) and with the negative pole to GND (pin 9 and 10).

Pins 9, 10, 19 and 26 are interconnected in the unit. They can all be used either to connect the power (power supply) ground or to connect the ground for sensors. Ground for sensors should be connected from unit and it should not be interconnected with power ground or with engine or chassis mass.

### Input for the engine load sensor

The input for engine load sensor can be realized by the throttle position sensor (TPS) or by intake air pressure sensor (IAPS).

An input is ready for standard TPS or IAPS sensors used on motorbikes. It is designed to bear voltage up to 5V. Setting up the voltage levels of the TPS for 0% and 100% or IAPS for 0-999 kPa is included in software.

TPS or IAPS are powered by reference voltage +5V (pin 20 or 25) and SENSE GND (pins 19 or 26). Ground for sensors should be connected from unit and it should not be interconnected with power ground or with engine or chassis mass. Sensor outlet will be connected to TPS/IAPS (7).

### Crankshaft position sensor CKPS

The ignition unit can be used for almost all known and still unknown motor position pickup systems. Most of the systems can be chosen directly by selecting relevant motorcycle type from the list included in software. Different pickup system can be set following a special procedure in software.

An input is ready for standard pickups (inductive, reluctant type) used on motorbikes. On request, we can also deliver inputs for HALL sensors.

One outlet of the CKPS will be connected to CKPS 1 (pin 27) and the other outlet will be connected to SENSE GND (19 or 26). In double-pickup systems the other sensor's one outlet will be connected to CKPS2 (pin 23) and the other outlet will be connected to SENSE GND (19 or 26). Ground for sensors should be connected from unit and it should not be interconnected with power ground or with engine or chassis mass.

In the case of HALL type sensor the sensor can be powered by +5V (pin 20 or 25) or by +12 V.

### Multifunctional inputs

The unit contains two multifunctional inputs. Inputs should be activated using switch with respect to ground. The inputs can be assigned different functions:

- |                   |  |
|-------------------|--|
| KILL SWITCH       | - the unit will stop ignition when input is grounded                                   |
| BLOCKING          | - the unit will stop ignition when input is ungrounded (security circuit of sidestand) |
| QUICKSHIFT        | - activate Quickshift sequence (gear shift up with full gas)                           |
| RETARD            | - decrease ignition advance with preselected value in full range                       |
| START LIMTER      | - activate Starting limiter (launch control)   |
| 2nd ADVANCE CHART | - switch to 2th ignition advance curve/map   |

GEAR - only multifunctional input 3 (standard resistor gear position sensor is expected).  
SPEED - only multifunctional input 1 (standard hall type vehicle speed sensor is expected).  
N2O - N2O enable, only multifunctional input 2,4, 5, 6.  
One outlet of the multifunctional input 1 will be connected to M IN 1 (pin 8) and the other outlet will be connected to ground.  
One outlet of the multifunctional input 2 will be connected to M IN 2 (pin 19) and the other outlet will be connected to ground.

### Outputs for induction coils IC 1, 2, 3, 4

One outlet of the induction coil IC 1 will be connected to IC 1 (pin 34) and the other one to the switched +12V.  
One outlet of the induction coil IC 2 will be connected to IC 2 (pin 33) and the other one to the switched +12 V.  
One outlet of the induction coil IC 3 will be connected to IC 3 (pin 31) and the other one to the switched +12 V.  
One outlet of the induction coil IC 4 will be connected to IC 4 (pin 32) and the other one to the switched +12 V.  
Dwell mode of the ignition coils can be set to short/long/manual/auto using software. When setting up the dwell it is necessary to check whether the used induction coil is suitable for the chosen configuration. Short dwell is generally used for ignition coils with primary coil resistance less than 2 Ohm. Long dwell time with these ignition coils can result in their destruction. On the contrary, if short dwell time is used for coils that need long dwell time, the energy of spark could be reduced especially in high RPM. You can also set the dwell time manually or automatically for specific induction coil. For more details see the Software section.

### Tachometer output TACHO

The tachometer output is compatible with most on-board devices used on motorbikes. Number of pulses per one revolution and possible corrections are set using software.

TACHO is supplied by 12 V voltage and GND. TACHO output will be connected to TACHO (pin 15).

The revolution indicator output is not compatible with on-board devices used on old Honda motorcycles from the 1990s (ignition units with OKI 16pin connector). Unit can be equipped with revolution indicator output compatible with these on-board devices (marked **HONDA TACHO**).

### Multifunctional outputs

The unit contains three multifunctional outputs (Power Outs). Outputs are type NPN opek collector (it provide ground when is switched on). Outputs can switch resistive or inductive load up to 2 A. Outputs can work with various modes preselected with software:

Fuel pump - it is switched on for 4 seconds after unit switch on and always when engine is running.  
Gear shift light - two stage gear shift light.  
PowerJet Honda - behavior like PowerJet at Honda RS125.  
Special - switch on and and switch off according curve/map with pulse-width modulation possibility (powerjet).  
Special PWM - continuous control with pulse-width modulation according curve/map (powerjet for example).  
Special pulse - continuous control using the pulse length according curve/map (oilmaster for example).  
N2O - output for N2O control (only Multifunctional output 3 at pin 14).

Multifunctional output 1: Load should connected with one outlet to POWER OUT 1 (pin 16) and second outlet to +12 V.

Multifunctional output 2: Load should connected with one outlet to POWER OUT 2 (pin 17) and second outlet to +12 V.

Multifunctional output 3: Load should connected with one outlet to POWER OUT 2 (pin 14) and second outlet to +12 V.

### Outputs and input for SERVO

Servo outputs and input are compatible with most of servomotors used on motorbikes for exhaust throttle (e.g. Yamaha EXUP). The unit is equipped with servo control only in the full (4-channel, 4CH) version. Required dependency of servo position on RPM and engine load can be configured in program.

Servomotor outputs are M (pins 21 and 22). Power supply for servo position sensor is connected to +5V (pin 20 or 25) and SENSE GND (pins 19 or 26). The output of position sensor is connected to STPS (pin 18).

### Connector adapter, basic harness

For many motorcycles we manufacture so-called **connector adapter**. This is a short bundle, on one side equipped with a connector fitting into unit and on the other side equipped with a connector fitting the original ignition unit. This connector adapter provides **plug and play** connection possibility with the original cable harness.

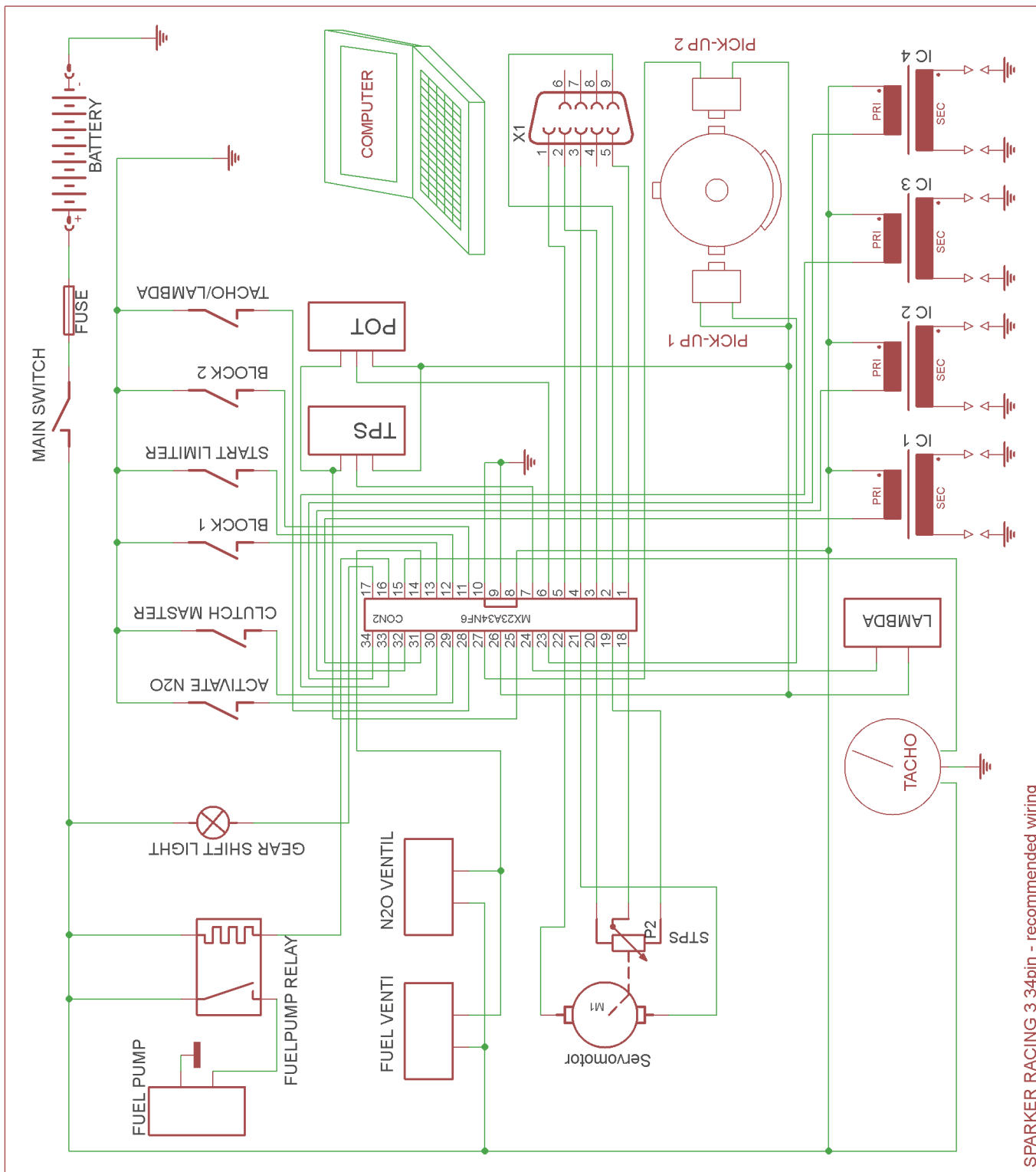
Next connection possibility is **Basic harness**. This is counterpart connector with all wires with pins crimped. Length is 1.3 m. We offer also **Reduced basic harness**. This contains only wires necessary for basic work of ignition.

In the connector adapters we use the colours of the wires listed in the following table.

### Wire colors Racing 3.

color in connector adapter	pin number	Name	Description
blue	1	GND	pin 5 COM connector
orange	2	COM	pin 9 COM connector
black	3	COM	pin 2 COM connector
yellow	4	COM	pin 3 COM connector
violet	5	COM	pin 1 COM connector
white/black	6	POT	input for correction potentiometer
grey	7	TPS	Engine load sensor
red	8	+12 V	Power supply +12 V
blue	9	GND	power ground
blue	10	GND	power ground
black	11	M IN 4	multifunctional input 4
grey/black	12	M IN 5	multifunctional input 5
grey/red	13	M IN 6	multifunctional input 6
pink	14	N2O OUT	N2O power output
green/yellow	15	TACHO	Tachometer output
violet	16	POWEROUT 1	PoweOut 1
blue/white	17	POWEROUT 2	PowerOut 2
white/blue	18	STPS	Servomotor position sensor
blue	19	SENE GND	ground for sensors
white/red	20	+5 V	Power supply for sensors
green	21	M	Servomotor output
green	22	M	Servomotor output
yellow	23	CKPS 1	Crankshaft position sensor 1
thin white	24	LAMBDA	Lambda sensor input
white/red	25	+5 V	Power supply for sensors
blue	26	SENSE GND	ground for sensors
brown	27	CKPS 2	Crankshaft position sensor 2
blue/black	28	M IN 1	multifunctional input 1
blue/red	29	M IN 2	multifunctional input 2
green/black	30	M IN 3	multifunctional input 3
yellow/black	31	IC 3	ignition coil 3
red/black	32	IC 4	ignition coil 4
white	33	IC 2	ignition coil 2
orange	34	IC 1	ignition coil 1

### Recommended connection diagram



SPARKER RACING 3 34pin - recommended wiring

# TCIP4 software

## Pull down menus

**File** - includes items:

- New** - default data setting.
- New for current tab** - default data settings only for the current tab.
- Open** - opens data file.
- Open from exe dir** - opens data file from the same directory as the control software.
- Open for current tab** - opens data file for the current tab only. If you will open setting data file - you can see full path to file location at upper toolbar.
- Save** - saves data file.
- Save to exe dir** - saves data file to the same directory as the control software.
- Nine last opened data files**
- Print** - prints current settings of the current tab.
- Exit** - exits the program.

Clicking **New** results in automatic default settings of all parameters. These correspond to four-stroke engine without TPS.

**Port** - includes items to select the communication line.

- COM offline** - communication off.
- COM XX** - list of useable serial ports.
- COM auto** - automatic connection

For PCs without serial port (USB only) it is necessary to use USB/RS232 adapter.






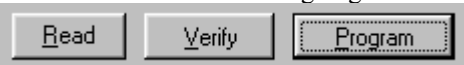
- Ignition** - includes items
  - Read** - reads data from the unit.
  - Verify** - compares data in PC with data in the unit.
  - Program** - sends data to the unit and performs verification.
  - Reset** - resets the unit.

**Tools** – includes tools to set the advance, UNDO and REDO.

**Language** - language settings: **English, Czech, German**

- Help** - includes items
  - Help** - opens Assembly guide (this file).
  - About the program** - information on the software (version, date).

## Icons menus

-  - sets default values. Warning!!! Clicking this icon results in automatic default settings of all parameters.
-  - opens data file.
-  - saves data file.
-  - prints the current settings.
-  - tools for going back or forward step by step when changing the settings.
-  - see pull down menu Ignition.

## Tab sheet Miscellaneous

- Limiter** - engine speed limiter value settings (limits with all ignitions off).
- Start limiter** - Start limiter value settings (limits with all ignitions off)

- Start limiter delay** - Start limiter activation delay value settings. This is useful when Start limiter switch is located at clutch lever. Start limiter is activated with delay, so that are not problems if clutch is used for next driving.
- Quickshift time** - sets ignition switch off period during gear shift.
- Quickshift pause** - sets time of clutch master insensitivity after gear shift.
- Retard** - sets the value for ignition advance retard if the function is active.
- Dwell** - sets dwell mode of induction coils.
- Short** - for coils with resistance lower than 2 Ohm. Dwell time 1 ms with the dynamic addition 12%.
- Long** - for coils with resistance higher than 2 Ohm. Dwell time 3 ms with the dynamic addition 12%.
- Manual** - possibility to manually configure the excitation time.
- Auto** - automatic dwell time determination. The unit itself determines optimal dwell time by measure dynamic current in channel 1. With this choice the ignition coil has to be connected to channel 1.
- Dwell time** - dwell time required with manual settings [ $\mu$ s].
- Dwell correction** - automatically determined dwell time can be corrected by percentage [%].
- Dynamic dwell addition** - dwell addition to compensate uneven engine running at low RPM [%].
- Max. dwell time** - dwell time limitation, including dynamic addition [ $\mu$ s].
- Min. spark time** - minimum unchangeable spark duration [ $\mu$ s].
- Max rpm for dwell by lobe** - determination of the revolutions into which the ignition uses the starting sequence of dwelling the coils(excitation by a fixed angle given by a virtual lobe. This virtual lobe is defined in the settings of the pickup system (see tab Bike).
- Inputs for neutral and side stand** - logic of neutral and side stand inputs is set so that BLOCK function is activated when both inputs are used (if at least one multifunction input is grounded, the bike is not blocked).
- Multifunctional Input 1, 2, 3, 4, 5**
- Off** - no function.
- Kill switch** - when input is grounded - the unit will stop ignitions.
- Blocking** - when input is not grounded - the unit will stop ignitions.
- Quickshift** - function to interrupt or retard the ignition when gear up shifting. Settings is at tab sheet Race.
- Retard** - function to decreases the ignition advance by preset value.
- Start limiter** - function to activate Start limiter.
- 2nd advance chart** - function to change ignition advance from curve/map 1 to curve/map 2.
- Gear (input 3)** - function for measure voltage from gear position sensor. Voltage is converted to gear position according setting at tab sheet Gear. This selection will be switch on automatically when choice Sensor will be selected in Determining gear at tab sheet Gear. Voltage for each gear is possible to set at tab sheet Gear.
- Speed (input 1)** - function for count pulses from speed sensor. Pulses are converted to speed value according setting at tab sheet Gear. This selection will be switch on automatically when choice Ratio Rpm/Speed or Automatic ratio Rpm/Speed will be selected in Determining gear at tab sheet Gear. Setting of ratio for each gear is possible to set at tab sheet Gear.
- Inverse polarity** - standard polarity is that input is activated by grounding. With inverse polarity will input activated by ungrounding.
- Input =** - visualisation of input activation.

## **Tab sheet Bike**

- Motorcycle type** - crankshaft position sensing system selection for specific motorbike.
- Tachometer output**
- Number of pulses per revolution** - basic tachometer output settings.
- Corrections** - percentage corrections of tachometer values [%].
- Compensation** - frequency compensation of the phase error of engine position inputs. The phase error is due to the frequency dependency of trigger level of input and the delay that occurs when processing the input signal. The phase error is mainly dependent on the number of lobes of the pickup system of the motor position.
- RPM without ignition** - sets the number of starting revolutions without ignition. For a **kick start system** this value represents the number of revolutions when all channels ignite together.
- Sensor polarity** - Sensor polarity selection (Plus/Minus/Auto).
- Plus** - designed for pickup connection, where - as the pulse lobe is getting near to the sensor, it generates positive voltage, and when the lobe is moving away it generates a negative voltage.
- Minus** - designed for pickup connection, where - as the pulse lobe is getting near to the sensor, it generates negative voltage, and when the lobe is moving away it generates a positive voltage.
- Auto** - unit itself determines correct polarity automatically (the algorithm is based on the assumption that the sum of pulse lobe angles is lower than the sum of gaps in between).
- Pickup interchange** - interchanges the engine position sensor inputs (pins 9 and 20).

**No polarity check** - the unit controls polarity of the sensor using shape of the signal. If the actual polarity of the sensor is different from the selected one, the unit will block ignition. This option cancels the blocking of ignition.

**Interlock input** - this option works only for pickup system **1 lobe, 2 pickups**. With elevated levels of electromagnetic interference (e.g. at the time of ignition) on some motorcycles (e.g. Ducati) unwanted activation of the pickup input may occur, especially that input which at the moment is not active. This option prevents unwanted activation blocking input 2 during activation of input 1, and vice versa: blocking input 1 during the activation of Input 2. This option, however, may cause problems, when combined with automatic determination of sensor polarity.

**Spark possible before lobe** - during standard operation of the unit ignition can take place only in the section after the start of the virtual lobe. This option allows to burn even before the virtual lobe. Unfortunately this is at the cost of the virtual lobe being 360°, which significantly affects the accuracy of ignition especially at low revolutions.

**Lower advance at start (next edge)** - this option decreases (moves) advance to the next start pulse edge compared to the standard starting position in advance. Valid only for starting speed (speed less than 500 RPM). This option can be used especially for large volume single-cylinder engines to prevent kick-back when starting el. starter. You can use this option only for some pickup systems.

**Lower advance at start (%)** - this option delayed starting advance upon angle. This angle is determined as % part of virtual lobe. Valid only for starting speed (speed less than 500 RPM). This option can be used especially for large volume single-cylinder engines to prevent kick-back when starting el. starter. You can use this option for most pickup systems.

**Special dwell by start** - this option can be used to reduce the current load on the ignition coils when starting for pickup systems where the virtual lobe is too wide. As a standard the unit in starting revolutions excites the ignition coil from the start of the virtual lobe to the ignition at the end of the virtual lobe. With this option the dwell starts at the end of the virtual lobe, gives 2 ms and then ignition takes place. Valid only for starting speed (speed less than 500 RPM). This option partially reduced advance for the starting speed (due to delay of 2 ms).

**Description of synchronization** - here the current pickup system can be modified, or new one created (only when selecting **Special settings** in the **Motorbike type menu**). BEWARE: only for very experienced users. Please consult with us any atypical configurations of pickup systems.

System work so: Unit read signal from pickup and find trigger condition. This condition can be long lobe or narrow lobe or long gap (missing lobe) or narrow gap (inserted lobe) etc. If condition is founded - unit will numbering lobes. First lobe after founded condition is number 1, next is number 2 etc.

Each item allows you to define the so-called **Virtual pulse lobes**. The virtual pulse lobe can be either a single pulse lobe or a sequence of several pulse lobes and spaces between them. First edge of Virtual lobe is determined by Maximal advance and second edge is determined by Starting advance. Each edge of Virtual lobe is determined by lobe number, edge (begin or end) and pickup (CKPS 1 or CKPS 2)

**Number of lobe at rotor** - setting of number of lobes at pulse rotor.

**Number of outputs (coils)** - setting of number of used ignition outputs (coils).

**Maximum advance** - determination of begin edge of Virtual lobe.

**Start advance** - determination of end edge of Virtual lobe.

**Number of ignitions per revolution** - setting of number of ignitions per revolution. Determine how many ignitions per one revolution are executed by ignition outputs. This can be different if pickup system is located at crankshaft or at camshaft etc.

On the bottom left of this tab there are some statistical data collected from the unit. These data are read out even in the case when the version of the unit control firmware and software are not compatible. It is sufficient when the connection is established and active. The following data are read: The name of Racing 3 unit, firmware version date, number of programming sessions.

## **Tab sheet Sensors**

**Lambda sensor** - here the characteristics of the lambda sensor can be defined using 6-point curve (AFR voltage).  
- default UEGO (linear wideband lambda sensor – Ignitech WB1 and Bosch LSU4.9).  
- default Standard (standard lambda sensor)

**Lambda on RPM** - setup of sensitivity of display for air-fuel ratio using the tachometer.

**Sensor** - here you can find the selection of engine load sensor.

**None** - no load sensor is in use.

**TP** - throttle position sensor is used.

**IAP** - inlet air pressure sensor in the intake manifold is used.

**TPS sensor** - here you can set values of the TPS voltage [mV] for 0% and 100% opening of throttle.

**IAP sensor** - here you can set characteristic of IAPS using two points voltage/pressure.

Set TPS 0

- by pushing it measures and sets voltage for 0% TPS (unit connected with PC, no gas).

Set TPS 100

-by pushing it measures and sets voltage for 100% TPS (unit connected with PC, full gas).

**After determining the limit values, it is necessary to store these values in the ignition by pushing the "program" button, otherwise they will not be executed.**

## Tab sheet Advance map

It contains two sub tab sheets of switchable ignition advance curves/maps Advance 1 and Advance 2.

### **Advance map 1 and 2**

The advance map contains up to 15x10 adjustable points depending on revolutions and the engine loads (TPS or IAP) value. If no load map is used, the advance map becomes just a 15-point curve of advance depending on the revolutions. Number of the columns is possible to set with tool at right side of curve/map.

Setting of the advance map (curve) can be done in several ways.

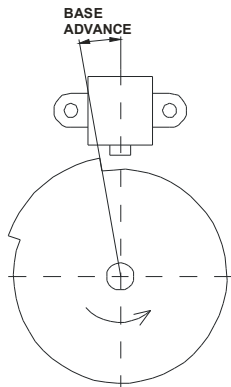
- by writing individual values directly into the edit boxes of the PC keyboard.
- by using graphic tools up / down arrow (always to the right from the value of the edit field).
- using +/- buttons. This option allows you to change only the current edit box in the engine running mode (the active field is green) or when **ALL** option is activated the entire map (curve) can be moved in both running and off modes.
- by pressing F4 and F5, F4 has the same function as the button "-" and F5 has the same function as the button "+".
- using the scroll wheel of the mouse – by tapping the edit box the option to change by scrolling is activated.
- in display mode of the advance map **TAB** and **2D** it is also possible (using the mouse) to pull individual points of the curve.

**Base advance** - is the angular difference between the position when the crankshaft position sensor is directed to the end of the virtual pulse lobe pulse and the top dead centre position (see angle "base advance" in the picture below). **This value is always determined by the mechanical constitution of pickup system and shall never be changed by software settings!!!**

The field "**Base advance**" thus is not there to change the base advance: into this field the value must be entered that corresponds to the physical condition of the engine. Use stroboscope lamp for check of base advance value.

To the first point of the revolution of advance curve the unit ignites on the value of base advance (at the end of the virtual pulse lobe). The exception is the "**Start of lobe system**" that can ignite at the beginning of the of the virtual pulse lobe. **Therefore for revolutions lower than the first point of advance curve early ignition point cannot be set, as it is derived from the mechanical design of the pickup system!!! The first revolution point of the curve in most cases should be chosen above idle speed!!!**

Please contact us in case of any uncertainties regarding the design of the pickup systems and their functioning with unit.



**Correction** - Correction of the advance of individual cylinders [°].

## Tab sheet Power Out

Contains settings for three multifunctional outputs **Power out 1, 2 and 3**

**Off** - the output is not active.

**Fuel pump** - to control the fuel pump relay, after the ignition is activated for 4 s, when engine running always activated.

**Gear shift light** - to control the two-state gear shift indicator. One state blinking, second state lighting.

**Power jet Honda** - to control PowerJet. The output is switched to ground according to truth table (marked cell) after the comparison limits derived from values on table axes are exceeded. Settings is predefined as original control at motorcycle Honda RS125.

**Special** - to control specific devices (pair valve, Powerjet). The output is switched to ground according to truth table (marked cell) after the comparison limits derived from values on table axes are exceeded.

**Hysteresis [RPM]** - engine speed hysteresis. Difference of RPM for switch on and switch off. (for Special and Power jet Honda).

**PWM [%]** - percent value of duty for pulse-width modulation (for Special). Frequency of modulation is 10 Hz.

**Special PWM** - to control specific devices (pair valve, Powerjet) using PWM (pulse-width modulation). Values of PWM you can set in curve/map. Frequency of PWM can be set 2-20 Hz.



- Special pulse** - to control specific devices (oil master) using repeated pulses. Period of pulses you can set in curve/map. Length of pulses can be set 5-500 ms.
- N2O** - Setting N2O is at separate tabsheet N2O..
- POUT1, 2, 3** - Power out work visualisation.

## Tab sheet Servo

**Servo on** - Software activation of servo controller.

**Map of positional requirements** - of servo controller has up to 15x10 adjustable points depending on revolutions and engine load (TPS angle or the pressure in the intake manifold IAP). If no load map is used, the map becomes only (up to) 15-point curve. Number of the columns is possible to set with tool at right side of curve/map.

The requirement for the position of the servo controller has two modes.

**Voltage** (option "percent" is not checked) - the servo controller searches for the calculated voltage resulting from the map (or curve). After the ignition is switched on the unit checks the servo controller so that it must find the highest and lowest required voltage value, which is located on the map (or the curve) of voltage requirements. When these voltage values are not found (whether due to mechanical obstructions or due to wrong settings), the servo is shut down.

2) **Percent** (option "percent" is checked) - the servo controller searches for the calculated percentage values resulting from the map (or the curve). After the ignition is switched on the unit finds (through mechanical stops - must be available!!!) lower position, which is marked as 0% and the upper position, which is marked as 100%. The servo controller then moves between these points according to calculated current requirements.

**1/P[mV]** - this is the voltage deviation from which there is linear decrease of the performance of the servo controller towards the required value. Size must be set so that the engine does not tremble and at the same time it must have the smallest regulation deviation. In practice 100 - 600 mV. BEWARE - in case you set too low value there is a risk of servo oscillation.

**Off [mV]** - voltage deviation from which the servo is completely switched off towards the required value of servo position. In practice 5-50 mV.

**Servo =** - actual demanded/measured value of servomotor position [mv].

## Tab sheet Gear

**Determining of gear** - defines the method of determining an engaged speed gear.

**Number of gears** - here it is necessary to enter the number of the motorcycle's speed gears (except the neutral gear).

**Sensor** - determination according to voltage measured on Multifunctional input 3. A rheostat (resistance) monitor is used as the sensor (mostly it is a part of the gearbox) and its highest resistance should not exceed 20 kOhm. The activation of this selection automatically sets the selection for Multifunctional input 3 as Gear on the tab sheet Miscellaneous. Gear ratios are entered manually by inserting values in the Voltage of gears fields or by shifting to the given gear and clicking the respective button "Gear 0-6". The values must be saved in the unit using the Program button.

**Gear voltage =** - currently measured voltage at gear position sensor.

**Ratio Rpm/Speed** - determination using a calculation of the engine speed/vehicle speed ratio with manual input. The activation of this selection automatically sets the selection for Multifunctional Input 1 as Speed on the tab sheet Miscellaneous. It is necessary to use a HALL type sensor with an open collector or a reed contact. Gear ratios are entered manually by inserting values in the Rpm/Speed fields or during engine run by shifting to the given gear and clicking the respective button Gear 0-6. The values must be saved in the unit using the Program button.

**Rpm/Speed=** - currently measured/computed rpm/speed ratio.

**Automatic ratio Rpm/Speed** - determination using a calculation of the engine speed/vehicle speed ratio with automatic search. The activation of this selection automatically sets the selection for Multifunctional Input 1 as Speed on the tab sheet Miscellaneous. It is necessary to use a HALL type sensor with an open collector or a reed contact. In order to guarantee the correct operation of this function, it is necessary to fill in the "Automatically from ratio Rpm/Speed column.

**Min time [s]** - this is the minimum time for the stabilization of the Rpm/Speed ratio which is necessary for the overwriting of the ratio for the given speed gear.

**Min RPM [RPM]** - this is the RPM value which the engine must reach for the overwriting of the ratio for the given speed gear.

**Min TPS [%]** - This is the minimum angle for the opening of the throttle which is necessary for the overwriting of the ratio for the given speed gear.

**Zone [0.1 %]** - this is the percentage value of the deviation in tenths of the gear ratio, under which the respective gear ratio is determined.

### **Setting of speedometer**

**Pulses over 1 s for 100 km/h** - number of pulses per 1 second for 100 km/h (suitable for a higher number of pulses – for example for the sensor in the gearbox).

**Distance for pulse** - distance between individual pulses in millimetres of distance covered (suitable for a small number of pulses – for example one per a wheel revolution).

## Tab sheet Race

- Quickshift mode** - setting of the quickshift mode. The quickshifter can be set in such a way that either ignitions are blocked for the period during which the quickshift is in operation, or retardation of advance (set to Quickshift advance).
- Quickshift - various** - setting of various quickshift parameters.
- Quickshift pause 1** - this is the delay time between the quickshift switch signal and the beginning of the quickshift procedure. It is used in cases when a sensor of the position of the gear-shift lever is used.
- Quickshift pause 2** - this is the protective period during which no other requirements are accepted from the quickshift sensor. This prevents the undesirable switching-on of the quickshifter, e.g. when the gear-shift lever returns.
- Min Rpm for quickshift** - this is the value of engine speed, under which the quickshift function is not executed.
- Quickshift advance** - this is the value of advance which will be implemented when the Retard mode is selected.
- Setting according gear**
- Quickshift time** - here are the values of quickshift times for individual gears.
- Correction according to speed gear**
- Advance** - here are the +/- corrections of ignition advance for individual speed gears.
- Limiter:** - here are the +/- corrections of the revolutions of limiters for individual speed gears.
- Servo:** - here is the value of revolutions which is added or subtracted from actual revolutions, and the result is used to make a selection from the map (or curve) of the servodrives.
- Pout1, 2:** - here are the +/- values of revolutions for individual speed gears which are added or subtracted from actual revolutions, and the result is then used as a value for the switching of power outputs 1 and 2.

## Tab sheet N2O

Unit control N2O valve using PWM (Pulse Width Modulation). Duty of PWM is set in %.

- N2O enabled** - software enabling of N2O.
- N2O** - setting of N2O.
- N2O 1** - beginning PWM [%].
- N2O 2** - final PWM [%].
- Delay** - delay after Start limiter use [ms].
- Build up time** - build up time from beginning PWM to final PWM [ms].
- N2O** - current value of PWM [ms].
- Retard** - setting of ignition advance during N2O.
- Retard 1** - beginning advance retardation [°].
- Retard 2** - final advance retardation [°].
- Delay** - delay after Start limiter use [ms].
- Build up time** - build up time from beginning advance retardation to final advance retardation [ms].

## Tab sheet Tests

Here you can manually perform some actions that are used to test the outputs of the unit.

- Ignition** - test of individual ignition outputs.
- Servo** - test of servo (both directions). The parameter **Time** specifies the time period during which the servo test is carried out.
- Rpm** - test of tachometer output. Rpm parameter specifies the engine speed with which the output will be tested.
- Powerouts** - test of multi-function outputs 1, 2 and N2O.
- Hour meter** - running hours counter
- Overtoltage in the on-board network** - number of overvoltage incidents during unit life.
- monitor PickUps** - run window for pickups signals monitoring.
- Setting of Lambda bar graph** - Setting of bar graph of Lambda in Monitor. Values are in 0.1 AFR.

## Monitor

The monitor is located in lower section. Sensor values and engine's operational characteristics can be observed here. If **No connection with PC** is in the upper right corner, the unit is not connected, switched on, or correct COM port is not used. When unit start communication - software reads data from unit and compare it with current data in software. If data in unit and in software are different - software will notice you.

<b>Programming after a change</b>	- automatic programming settings (after every change).
<b>Not Reading</b>	- reading is not allowed (after programming with this option data cannot be retrieved from the unit).
<b>COM</b>	- signal of currently used communication port.
<b>RPM</b>	- current engine speed.
<b>TP/IAP</b>	- current throttle position.
<b>LAMBDA</b>	- current lambda values [AFR and mV].
<b>Potentiometer</b>	- current setting of correction potentiometer [mV].
<b>Pickup 1 and 2</b>	- pickup work or error of pickup system visualisation.
<b>U</b>	- current supply voltage.
<b>ADVANCE 1 to 4</b>	- current ignition advance of individual cylinders.
<b>Gear</b>	- current engaged gear.
<b>Speed</b>	- current vehicle speed [km/h].
<b>Kill switch</b>	- visualisation of Kill switch function activation.
<b>Blocking</b>	- visualisation of Blocking function activation.
<b>Quickshift</b>	- visualisation of Quickshift function activation.
<b>Retard</b>	- visualisation of Retard function activation.
<b>Tacho/Lambda</b>	- visualisation of Tacho/Lambda function activation.
<b>Limiter</b>	- visualisation of rev Limiter activation.
<b>Start limiter</b>	- visualisation of Start rev limiter activation.
<b>2nd advance chart</b>	- visualisation of switch to 2nd advance chart.
<b>Dwell</b>	- real dwell time of induction coil. Real dwell is presented including the dynamic addition or during startup sequence).