Car Electronic Systems

kdFi V1.3 R98

User Manual

You will find the latest information, documentation and CD images on

www.k-data.org

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1. Introduction

Congratulation for buying the kdFi V1.3.

The circuit of the kdFi based on Megasquirt MS2 V3.0 was enhanced for the firmware MS2extra and provided with additional circuits in order to enable simple adaptation to a great number of engine types.

A Wideband Lambda Controller (JAW) is also arranged on the PCB. The Bosch LSU 4.2 Lambda Sonde and the JAW Micro-processor have to be bought as accessories to use their functions.

In addition the serial inputs were replaced by a USB connection for ease of use.

2. Included in Delivery

- kdFi V1.3 device ready for use
- Software CD
- PVC housing incl. connector
- User manual

3. Software

It is recommended installing the software from the starting menu of the CD before connecting the kdFi for the first time.

3.1 USB

You will find the USB driver of the FTDI company on the CD in the directory „USB“. It is the FTDI2232 Chip.

3.2 Megatune

The Megatune installation files can be found on the CD, directory “Megatune”. We recommend installing the BETA Software, as this runs very smoothly and has got large advantages compared to the Release.

If you want to use the Release version, you have to perform a firmware update using the corresponding version.

During installation the engine parameters are sampled. The best is to enter the future settings immediately for this simplifies considerably the start-up operation afterwards.

When using JAW we recommend selecting the innovative LC-1 as wideband sensor and adjusting afterwards the characteristic of the LC-1 in the software “JAW Deploy”.

The two systems are freely adjustable, that means you can in principle use any characteristic as long as it is the same in both systems (MS and JAW).

3.3 JAW

You can find the JAW Deploy installation files on the CD, directory „JAW“.

4. Connection

A fuse has to be connected ahead of the kdFi as well as of all other tension supplied parts. The fuse amperage must not exceed the maximum admissible cable amperage.

4.1 Cable Types

Recommended cable types:

Ignition:	min 1.5 mm²
Injection:	min 1.5 mm²
VR sensor:	min 0.5 mm², shield
Sensors:	min 0.5 mm², shield
Others:	min 0.75 mm²

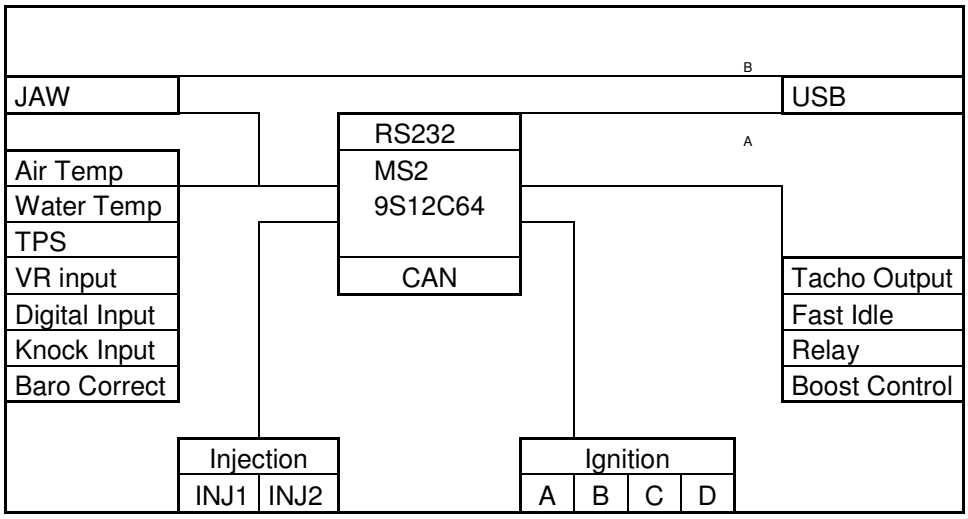
4.2 USB Connection

The USB component is compatible to USB 1.1 as well as to USB 2.0. You can use each standard mini USB cable as connecting cable.

Due to the integrated USB connection, two serial interfaces are available. They are displayed at the device manager of Windows. The MS2 processor is connected to the first COM Port, the JAW to the second one.

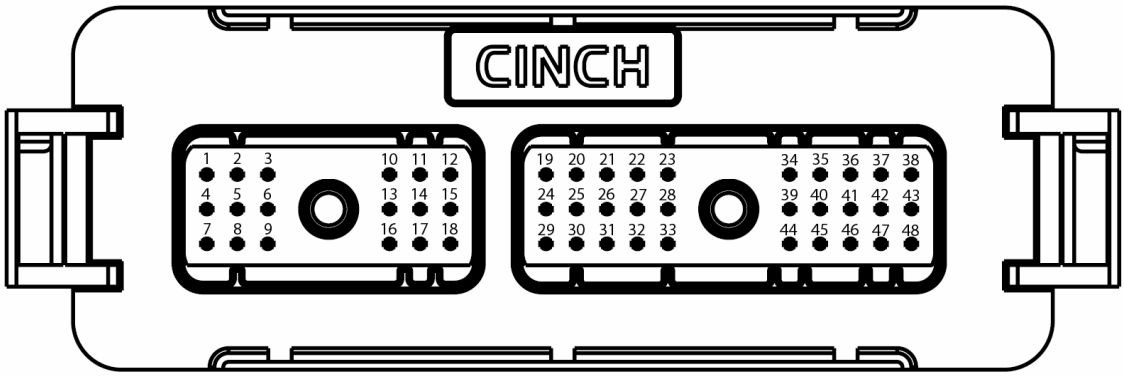
ATTENTION: **The COM Ports should not exceed COM8, because this could produce communication trouble with Megatune. In this case you have to delete unused / invisible ports (incl. the kdFi Ports) from your configuration and to re-install the driver.**

4.3 Schematic



4.4 Assignment

The programmable kdFi inputs / outputs are already connected to the corresponding additional circuits on the PCB.



Circuit points:

Pin	Function	E / A	Function
1	A1	IGN	Ignition output cylinder 1
2	B1	IGN	Ignition output cylinder 2
3	C1	IGN	Ignition output cylinder 3
4	D1	IGN	Ignition output cylinder 4
5	A2	IGN	Ignition output parallel to cylinder 1
6	B2	IGN	Ignition output parallel to cylinder 2
7	C2	IGN	Ignition output parallel to cylinder 3
8	D2	IGN	Ignition output parallel to cylinder 4
9	IGN_GND	IGN	Ground ignition – ground separately
10	INJ1	INJ	Injection valves group 1
11	INJ_GND	INJ	Injection valves ground
12	INJ2	INJ	Injection valves group 2
13	12V	E	Input voltage 12V
14	GND	GND	Ground
15	FP	A	Fuel Pump
16	FDL2	A	Idle speed controller 2-pin / clocked ground connection
17	FDL3Z	A	Idle speed controller 3-pin – CLOSED
18	FDL3A	A	Idle speed controller 3-pin - OPEN
19	HALL	E	HALL sensor
20	JS11	A	Relay output (R0)
21	JS10	A	Tacho output (signal for the tachometer)
22	OXY2	E	Lambda sensor signal 2
23	JS7	E	Digital input
24	GND	GND	Ground
25	GND	GND	Ground
26	GND_RPM	GND	Ground speed measurement
27	GND_OXY	GND	Ground lambda sonde signal
28	JS0	A	Relay output (Pin34)
29	AIR	E	Air temperature sensor
30	CLT	E	Water temperature sensor
31	RPM	E	Speed measurement

32	OXY	E	Lambda sonde signal
33	JS5	E	Knock sensor
34	LSU_RT	JAW	Bosch LSU 4.2 : RED
35	LSU_SW	JAW	Bosch LSU 4.2 : BLACK
36	LSU_GE	JAW	Bosch LSU 4.2 : YELLOW
37	LSU_WS	JAW	Bosch LSU 4.2 : WHITE
38	LSU_GR	JAW	Bosch LSU 4.2 : GREY
39	EGT	E	Exhaust gas temperature sensor
40	USB4	USB	USB Pin 4 (black)
41	USB3	USB	USB Pin 3 (green)
42	USB2	USB	USB Pin 2 (white)
43	USB1	USB	USB Pin 1 (red)
44	GND	TPS	Throttle potentiometer ground
45	TPS	TPS	Throttle potentiometer position signal
46	TPS_5V	TPS	Throttle potentiometer 5V supply
47	TBL	E	Table Switch / map switch
48	JS2	A	Boost-pressure control

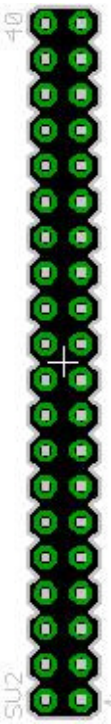
Software outputs:

JS0	PT6/IAC1	Relay Output (Output Pin34)
JS1		---
JS2	PT7/IAC2	Boost Control PWM Output
JS3		---
JS4		Constant Barometric Correction/ 2nd Lambda input
JS5	PA0	Knock Input
JS6		CAN High
JS7		Digital Input (Launch Control)
JS8		CAN Low
JS10		Tacho Output
JS11		Spark Output D / Relay Output (R0)
D14		Spark Output A
D15		Spark Output B
D16		Spark Output C

4.5 Test Pins

Pin assignment:

	40		39	
TBL	38		37	
FP	36		35	USB P1
(Relay Output)	34		33	USB P2
INJ2	32		31	USB P3
INJ2	30		29	JAW GREY
INJ1	28		27	JAW GREY
INJ1	26		25	JAW YELLOW
JS11	24		23	JAW BLACK
FDL2	22		21	JAW RED
JS2	20		19	GND
+12V	18		17	GND
FDL3A	16		15	GND
TPS +5V	14		13	GND
FDL3Z	12		11	P6
RPM IN	10		9	JS7
OXY	8		7	JS5
TPS	6		5	JS10
CLT	4		3	RESET (9S12C64)
AIR	2		1	BKGD (9S12C64)



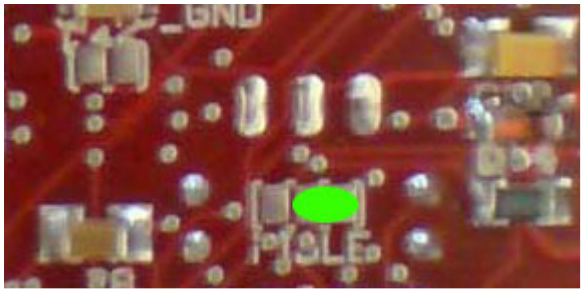
5. Solder Jumpers

The solder jumpers are used for the permanent selection of certain engine parameters, like the speed measurement mode, the number of ignition coils, the type of idle controller, the activation of the JAW controller etc.

5.1 F-IDLE

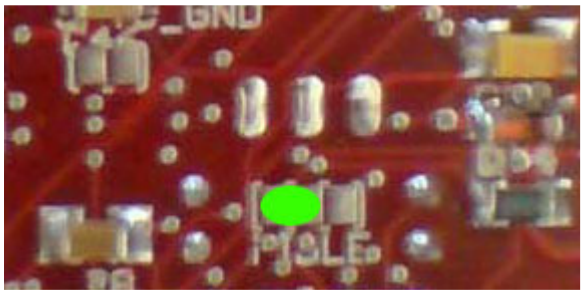
From version V1.3 R71 on, the solder jumper F-IDLE isn't available any more. The LLR can be connected to the required eyelets without adapting the PCB.

2-pin idle controller:



Function: The controller opens a supplementary air supply parallel to the throttle valve/s as long as the output FDL2 is connected to ground. When the kdFi doesn't connect the output to ground any more, the spring integrated in the idle controller stops the air supply again. That is the reason for this output to be very fast pulsed (PWM) in order to hold a certain position with the corresponding pulse width.

3-pin idle controller:



Function: The same as for the 2-pin idle controller, but without spring. The
CLOSE command is also controlled by a magnetic coil. The idle controller opens, when FDL3A (Fast Idle 3-pin OPEN) switches to ground, and closes, when FDL3Z (Fast Idle 3-pin CLOSE) is activated.

5.2 RPM_IN

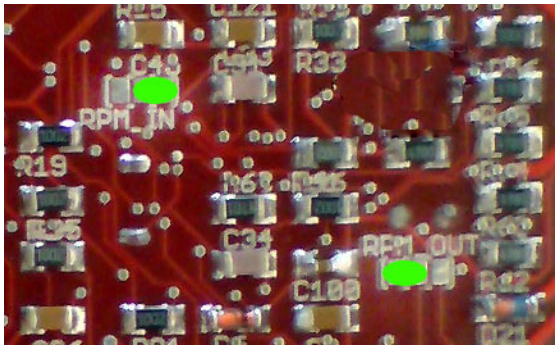
The type of speed measurement is selected by the solder jumper RPM_IN.

When using a VR sensor the factory settings can be retained unchanged.

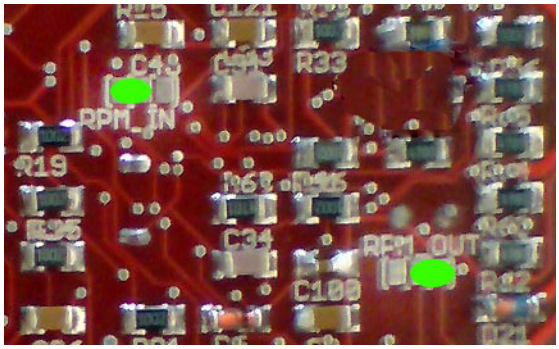
When using a hall sensor the connection has to be changed – as shown on the pictures below.

If the option LM_IN / LM_OUT available from version V1.3 R98 is used, the two RPM solder jumpers must not be set!

VR Sensor: (Standard)



Hall Sensor:



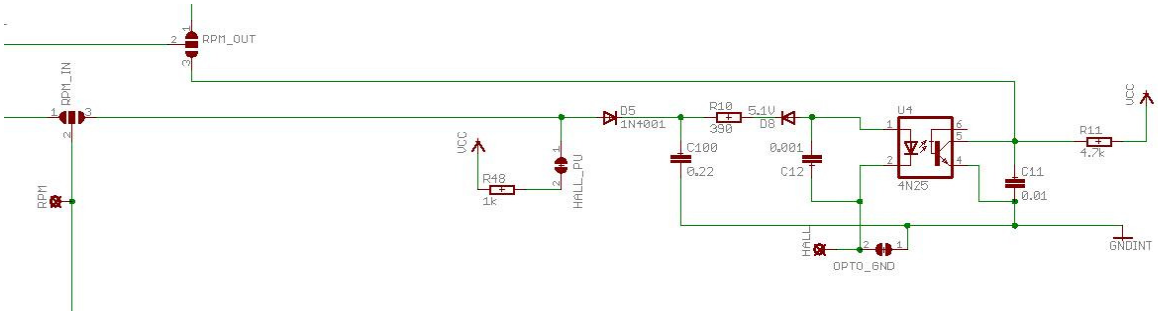
5.3 RPM_OUT

This one has to be selected according to RPM_IN. See pictures 5.2.

5.4 OPTO_GND

Connection to ground of the hall sensor if needed is the same as for MS V3.

Connection:



5.5 HALL_PU

When using HALL sensors you sometimes need a 1k Ohm Pull-Up resistor at the input of the control unit. From version V1.3 R81 on, it is already included and is activated by closing the solder jumper.

5.6 LM_IN

As an alternative option to the standard circuit for the VR sensor you have the possibility to use the integrated circuit of the LM1815. This chip has been developed especially for the evaluation of VR sensors and therefore is ideal because of its adaptation possibilities. Potentiometers don't have to be adjusted in this case.

The solder jumpers RPM_IN and RPM_OUT must not be set in this case!

5.7 LM_OUT

Has to be selected according to LM_IN. See pictures in 5.2.

5.8 JAW

The option JAW has to be activated if the JAW wideband controller is intended to be used. This establishes a connection between the JAW output V2 and the input OXY and transmits the analog wideband signal directly.

For this you will need the accessories JAW µC and Bosch LSU 4.2.

If you select this option, any external lambda signal must not be connected to the OXY input.

5.9 R0

R0 activates the output JS11 as "Relay Output". For this you have to connect the coil of a relay to +12V (ignition), the second contact of the coil to JS11.

The function of this output is now adjustable via Megatune "Extended" – "Output Port Settings".

5.10 BARO_OXY

With this solder jumper you can select the input JS4 to be used for automatic altitude correction or as a second lambda sensor input (e.g. V8 engine).

Connection of the solder jumper if marking is legible:

Centre-left: OXY2 / 2. Lambda sonde input active

Centre-right: BARO / Permanent altitude correction active – A second pressure sensor has to be installed.

5.11 IGN_A – IGN_D

The jumper IGN_A is used for triggering the ignition output A. IGN_B to IGN_D are responsible for the ignition signals B to D accordingly. Software settings: Megatune "Basic Setup" – "Tacho input / Ignition Settings"

Examples:

Engine with mechanical distributor: Only IGN_A

1-cylinder engine: Only IGN_A

2-cylinder in-line engine with wasted spark: IGN_A with 2 power drivers

4-cylinder in-line engine with wasted spark: IGN_A, IGN_B with 2 power drivers each

6-cylinder in-line engine with wasted spark: IGN_A, IGN_B, IGN_C with 2 power drivers each

8-cylinder V engine with wasted spark: IGN_A, IGN_B, IGN_C, IGN_D with 2 power drivers each (max. equipment)

5.12 SJ201 – SJ204

Halving the series resistance of the ignition groups

If only one power driver is used per ignition output, the series resistance for the power driver can be halved. In operation, however, it turned out to be useful to always set a jumper in order to reduce the susceptibility to failure.

6. Start-up

Attention:

- The kdFi V1.3 is protected by a self-resetting thermal fuse (Polifuse). It is reset by switching off the power supply AND by cooling down at the same time.
- Take care that the TO220 housings of the power elements don't all have the same potential and so need to be isolated from the heatsink by e.g. mica washer and plastic stopper.
- **Operation of the kdFi without heatsink will cause total damage of the power elements!**

6.1 Light Emitting Diodes

Description	Colour	Function
RS232 A TxD	yellow	Data packet from USB to MS2
RS232 A RxD	green	Data packet from MS2 to USB
RS232 B TxD	yellow	Data packet from USB to JAW
RS232 B RxD	green	Data packet from JAW to USB
D15	blue	Depending on software (Standard: Firing pulse)
D16	blue	Depending on software (Standard: Cold advance)
D17	blue	Depending on software (Standard: Acceleration)
Knock	red	Knock identified

6.2 Speed Measurement

1. VR sensor

The measurement via VR sensor is the most widespread way in Europe for car engines. An AC voltage is induced in the coil of the VR sensor by a metal wheel with 60-2 or 36-1 cogs. The voltage threshold has to be set by the potentiometer **R55** and the hysteresis by the potentiometer **R54.**

These potentiometers don't have any mechanical end stop. The end can be recognized by a light, repetitive click at every rotation. In case of doubt you may make 30 counter clockwise rotations, and then the potentiometer is sure to be in zero position.

2. HALL sensor

In order to use a HALL sensor for rotation speed measurement, you have to set the jumpers RPM_IN and RPM_OUT (point 5.2) correctly. We recommend in addition closing the jumper HALL_PU (point 5.5).

3. Ignition coil signal

For "Fuel only" versions, where the existing ignition control should be retained, the speed signal is directly gripped at the primary side (12V) of the ignition coil.

Attention:

Never connect a measuring line to the high voltage side of the ignition coil. This will cause the complete destruction of the kdFi and can produce life-threatening situations!

6.3 Sensors

The factory settings of kdFi are adapted to Bosch sensors. It is possible to calibrate the sensors separately by software via Megatune.

If desired this can also be changed by exchanging the two wired resistors **R4** and **R7** on the PCB.

Sensor	Manufacturer	Series resistance
AC Delco/GM	Daewoo, Buick, Cadillac, Chevrolet, Oldsmobile, Pontiac, GMC	**2.49k**
Ford	Ford, Lincoln, Mercury	**27k**
Bosch and Nippon Denso	Acura, Audi, BMW, Honda, Infiniti, Jaguar, Kia, Lexus, Mazda, Mitsubishi, Nissan, Suzuki, Toyota, Volkswagen, Volvo (96-up)	**2.2k (Standard)**
Mopar	Chrysler, Dodge, Plymouth	**9.31k**

6.4 Throttle Potentiometer

The throttle potentiometer is connected up by a 3-wire cable. +5V and GND are connected to the outer static pins of the potentiometer. The voltage relating to the throttle position is tapped via the sliding contact and connected to the input TPS (Throttle Position Sensor).

The covered distance of the potentiometer can be longer than the rotation of the throttle axle. The corresponding calibration is done via Megatune “Tools” – “Calibrate TPS”.

6.5 Knock Input

You can employ usual knock sensors (preferentially original engine sensors). The knock frequency can be regulated via the potentiometer R88. For controlling or multiplying the setting, the control voltage relating to the adjusted knock frequency is measured at the connector JP1. The red LED D30 is used as calibration assistance. It signalises that an identified knock is transmitted to the processor input.

6.6 Digital Input

There is a digital input that can be used for example as “Launch Control”. The corresponding function has to be defined in Megatune. Specify JS7 as input.

6.7 Table Switch

Via the input “TBL” you can activate another parameter set in the control unit. You can toggle between two deposited ignition and injection maps by means of a switch that grounds the input. This is very useful for different tunings like: Road/ race mode, petrol/gas, petrol/E85 etc.

Do not connect tensions higher than 5 V for this would destroy the kdFi processor. Digital inputs must only be connected to ground.

6.8 Barometric Correction

For using the constant barometric correction there must be a second absolute pressure transmitter (MPX4250) at the back side that is not installed ex works.

The option “Barometric Correction” has to be activated in Megatune “Basic Settings” – “General Lags” and adjusted in “Extended” – “Barometric Correction”.

Choose JS4 as input.

The sensor is mounted directly on the solder pads of PCB next to the MAP sensor.

6.9 Tacho Output

The output “Tacho Output” is provided for standard tachometers. It can be activated in Megatune “Extended” – “Tacho Output”. Choose “IGN (JS10)” as “Output on”.

6.10 Idle Speed Controller

The kdFi V1.3 supports the 2-pin as well as the 3-pin idle speed controller.

Pins of the idle speed control:

2-pin: +12V and FDL2

3-pin: +12V and FDL3A (open) and FDL3Z (closed)

6.11 Ignition

The ignition coil can be activated directly by the power drivers integrated in the kdFi V1.3. We recommend using a shielded multi-conductor cable for connection. The kdFi can be extended to up to 8 power drivers enabling direct activation of 8 ignition coils according to the wasted spark principle.

Alternatively ignition modules such as EDIS or Bosch can be used as well. Therefore the triggering signal can be tapped from the solder jumper IGN_A to IGN_D.

6.12 Injection

There are two outputs (INJ1, INJ2) for injection groups available. The additional ground connection (INJ_GND) between the outputs should be connected to ground with low resistance (with large conductor cross-section) in order to avoid potential shifts on the PCB. The injection valves are supplied with +12V via the ignition, the ground wires of the valves are activated via the control unit.

Attention: The setting whether the injection valves are of high or of low resistance has to be entered in Megatune “Basic Settings” – “Injector Characteristics” in any case prior to the first test run. False settings can cause destruction of the injection valves or of the kdFi.

Initial values (no guarantee):

High resistance: PWM Current Limit (%): 100
PWM Time Threshold (ms): 25.5

Low resistance: PWM Current Limit (%): 30
PWM Time Threshold (ms): 1.5

6.13 Relay Output

See 5.9 R0

6.14 Boost Control

The boost pressure is controlled by means of a fast acting valve at the Waste Gate. In MSextra this part of the software is described as “EXPERIMENTAL – use with care”. For further information please refer to actual details on the internet.

6.15 JAW

(Just Another Wideband from Alan To - www.14point7.com)

The JAW circuit was integrated in the kdFi V1.3 for obtaining a space-saving, advantageous solution. By retrofitting the socketed Jaw processor, a wideband lambda controller is available at once. Its analog output “V2” can be connected to the “OXY” input of the kdFi by the solder jumper “JAW” on the back side of the PCB.

JAW can be activated and configured by the JAW Deploy software and the second serial port installed after the connection of the kdFi.

6.16 CAN Bus

Like for the Megasquirt 2 the CAN Bus is prepared concerning the hardware, but has to be programmed by the user if desired. For further information on this item please read the respective Megasquirt /MSextra websides on the internet.

6.17 EGT / Exhaust Gas Temperature

The exhaust gas temperature is measured by a K-type sensor. For displaying the EGT in Megatune you have to adjust the MEGATUNE.INI.

7. Firmware Updates

As usual for MSextra, the firmware updates are performed **without** setting a boot jumper. You have to start the program “Download-Firmware” from the Megasquirt folder of your Windows starting menu and to select the same COM port as in Megatune.

Megatune has to be closed during the firmware updates to avoid access troubles.

Disconnect the ignition coils in any case during the firmware update until the correct configuration has been reloaded (MSQ file); otherwise this could cause destruction of the power driver as well as of the ignition coils!

8. Notes