

# ***KMS*** ***Kronenburg*** ***Management Systems***



**IA23 / IB Manual V2.15**



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# **KMS** **Kronenburg** **Management System**



→ [www.van-kronenburg.nl](http://www.van-kronenburg.nl)

# 1 KMS (Kronenburg Management Systems)

Kronenburg Management Systems (KMS) is a complete line of programmable engine control units (ECU), that offers you an extremely reliable and user-friendly system at a very competitive price. It gives you the possibility to manage all turbo and naturally aspirated Otto engines (engines in which the fuel mix is ignited via a spark plug) up to 12 cylinders.

An engine control unit is a type of electronic control unit that determines the amount of fuel, ignition timing and their parameters which is needed to keep an internal combustion engine running. It does this by reading values from multidimensional maps which contain values calculated by sensor devices monitoring the engine.

The programmable KMS ECU doesn't not have a fixed behaviour, but can be (re)programmed by the user. Programmable ECU's are required when a significant modification has been made to a vehicle's engine. For example adding a turbocharger, changing the camshaft profile or a conversion to an alternative fuel. In these situations, a programmable KMS ECU can be wired in. The KMS ECU's can be programmed/mapped with a laptop connected using a serial or USB cable, while the engine is running.

The programmable ECU controls the amount of fuel to be injected into and ignition moment for each cylinder. This varies depending on the engine's RPM and the position of the gas pedal and/or the Manifold Absolute Pressure (MAP). This can be adjusted by bringing up a spreadsheet page on the laptop where each cell represents an intersection between a specific RPM value and a throttle position. In this cell a value corresponding to the amount of fuel injected can be entered. This spreadsheet is referred to as a fuel table or fuel map. The same way the ignition spreadsheet can be setup.


By modifying these values while monitoring the exhaust gas composition (best way is using a wide band lambda sensor) you can see if the engine runs rich or lean. This way you can find the optimal amount of fuel and optimal ignition moment needed for all possible combinations of RPM and throttle position/manifold absolute pressure. This process can be best carried out at a dynamometer, giving a controlled environment (without influence from outside) to work in. An engine or chassis dynamometer gives a more precise calibration for your (racing) applications. The KMS ECU range offers a complete self learning air fuel ratio control (lambda control) for most common types of oxygen sensors (broadband/narrow band).

In addition to lambda control, this management system also provides the following functions: load-dependent boost pressure control, water injection control, (variable) launch control, power-shifting, (variable) A.L.S., staged/banked injection, maselector, odd fire, idle control, rpm limiters, engine diagnostics, 4mb datalogging, etc.

This IA23 management system can be used as an independent ignition system for virtually all types of Otto engine (engines in which the fuel mix is ignited via a spark plug).

This system provides the opportunity to give the desired spark timing at any running condition, in order to achieve maximum torque and fuel efficiency at any rpm and load. This system also contains options as; shift-light, RPM-limiters, launch control and powershift.

We advice to read the manual complete before starting. The set-up of the system software is kept as clear and simple as possible, so that even people with little computer experience will be able to use this system. Working with the software is simple, but if the settings are incorrectly configured,

there is a serious risk of engine damage. In this manual there are warning signs  and notes that need your extra attention to bring this setup to a good end. We recommend you leave the programming to specialists.





**WARNING:**

Disconnect the battery cables when you're doing electrical work.

Disconnect the KMS ECU from the wiring harness connector when welding on the vehicle.

Make sure there are no fluid leaks and all connections are secured and/or tightened.

Wiring and fuel system components must be mounted away from heat sources or shielded if necessary.

Do not use a batterybooster or a 24V charger. Do not reverse the polarity of the battery or the charging unit. Do not change the battery with the engine running. The peak power supply could severely damage the KMS ECU and other electrical devices.

Avoid open sparks and flames near flammable substances.

Do not use unsuppressed spark plugs and leads. They can cause electromagnetic interference.

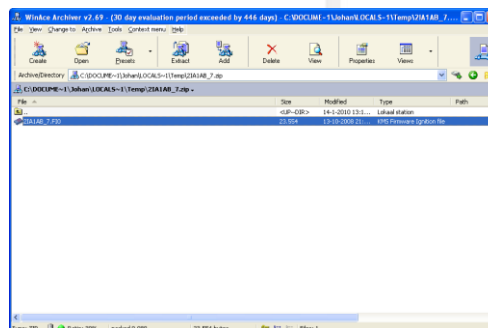


## 2 Software installation

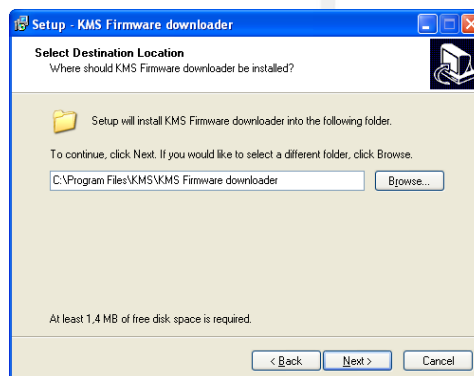
The software is supplied together with the system, on a CD-ROM. Installing the software is very easy. The CD-ROM carries the KMS installation program, which launches automatically when the CD is inserted.



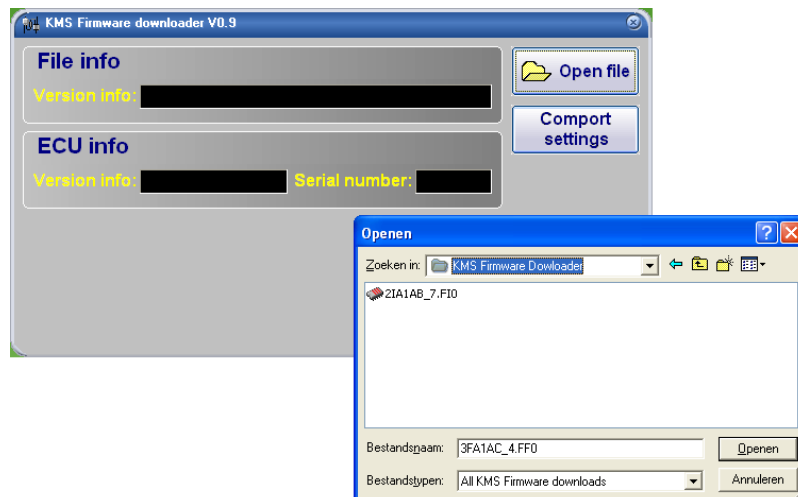
The program **KMS FIRMWARE DOWNLOADER** can be used to update the ECU. When there are new options available, they can be downloaded as a zip file from the [Van Kronenburg website](http://www.van-kronenburg.nl). The zip file consists of 1 file, see figure below.



Unpack the zip file on your computer in the KMS Firmware downloader folder. This is the location where you installed the Firmware downloader, see example below.



With the firmware downloader this update file can be sent to the ECU (only 1 of the 3 files is visible with the firmware downloader, (see figure below).



For IA23 the update file name starts with the number 2 and has extension \*.FIO. It's only possible to use this firmware downloader if you have an KMS ECU with serial nr. higher then 300000.

Once installed, the program is set to work via communication port COM1. If this port is already being used or not available, another communication port can be used. For the procedure to change the communication port, see [3.2.4.1.7 Communication port](#).

(USB connections have the most various numbers of communication ports, so make sure you've got the communication port right. For settings and finding the right communication port check paragraph [3.2.4.1.7 Communication port](#))

### 3 KMS software

When the program is started, the main screen will appear, which is composed of three parts:

- The ignition characteristic diagram
- The function bar
- The communication bar

The following sections describe the possibilities and functions of the system.

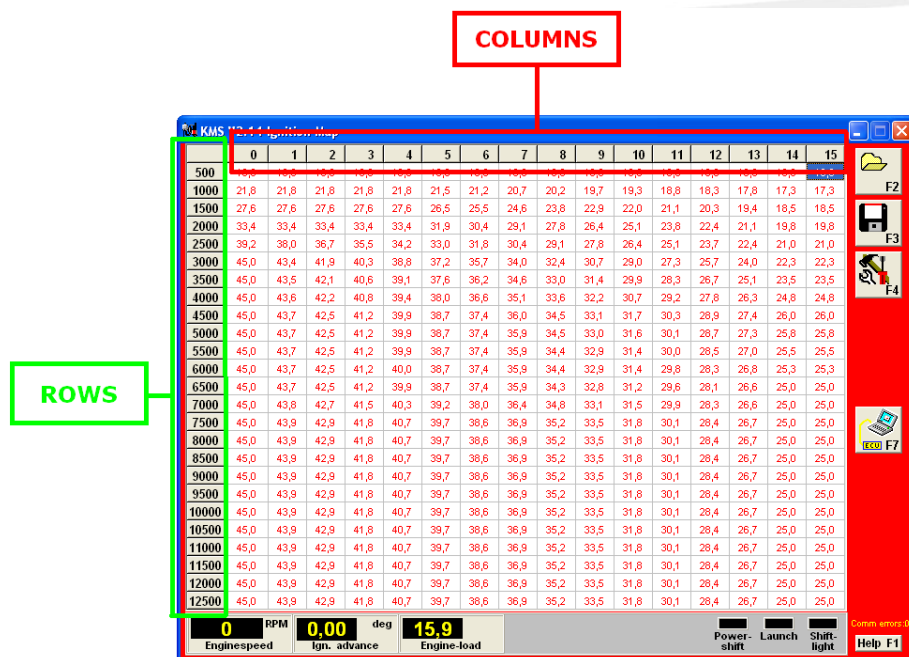
#### 3.1 The main screen

The main screen consists of one spreadsheet, the ignition spreadsheet. The spreadsheet is a two-dimensional diagram showing engine speed against engine load.

The engine speed range can stretch from 500 rpm to 20.000 rpm. Standard the screen stretches from 500 rpm to 12.500 rpm. This however can be changed (see 3.2.4.1.1 RPM pickup). The RPM range is divided over 25 boxes.

The engine load range is sub-divided into 16 boxes dividing the range that has been set for the engine load sensor. When no engine load sensor is connected (for example when one or more carburettor(s) is/are used for fuel delivery) only column 15 of the ignition spreadsheet can be used.

The rows and columns are shown in graphs (in the form of bar charts), when the left mouse button is clicked on an engine speed or a load value. For further information, see section 4. Programming.



## 3.2 The function bar

The vertical bar on the right-hand side of the screen shows several function keys, which can be activated using the mouse arrow or the relevant function keys on the keyboard. An explanation on the different function keys is given in the following sections.


### 3.2.1 Function key F1



This function key gives access to the manual in Acrobat reader. Acrobat reader 3.0 or higher is required. Acrobat reader 4.0 can be found on the installation CD-ROM.

### 3.2.2 Function key F2



This function key enables a previously saved file to be retrieved from the hard disk, CD-ROM, USB memory key, etc. The files can be recognised by a red floppy  icon and by the extension .i02

### 3.2.3 Function key F3



This function key is used to save modified files. The names of these files automatically receive the extension .i02.

### 3.2.4 Function key F4

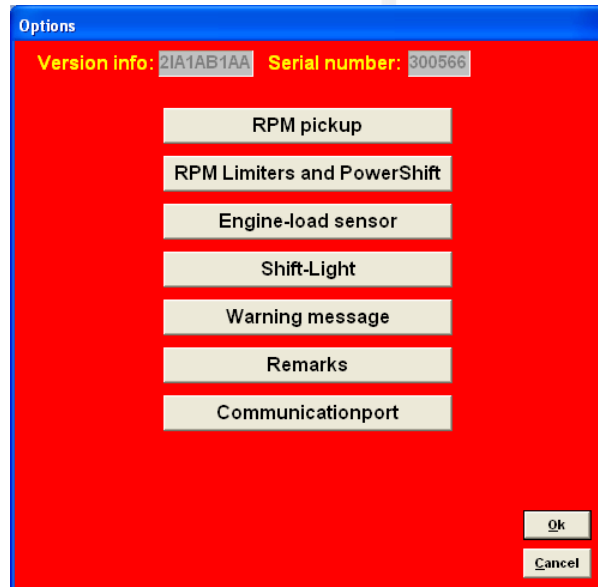


When this function key is activated, a menu will appear on the screen, which gives the option of several settings and tests. The options will be explained in the following sections.



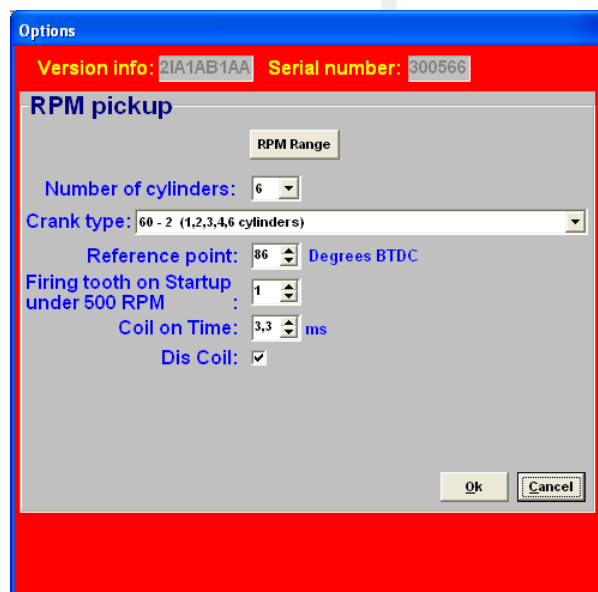
### 3.2.4.1 Options

If 'Options' is selected, a menu appears which lists several possible settings. These settings are described below.



#### 3.2.4.1.1 RPM pickup

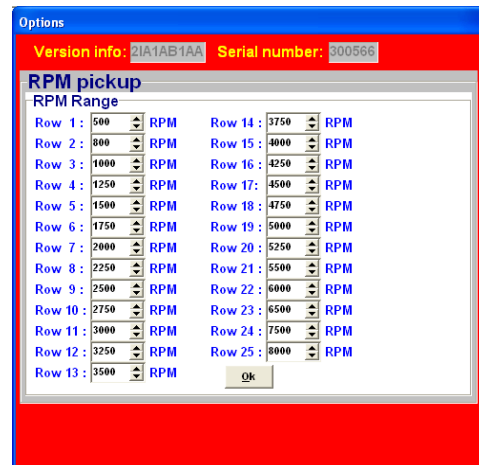
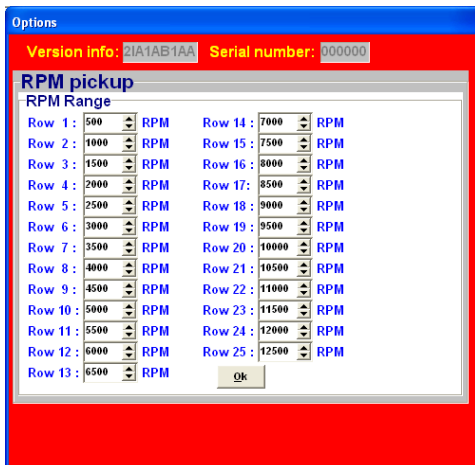
In this menu, the settings for the rpm pickup signal, the type of ignition.



*RPM Range:*

By clicking on the function you can set the rpm range for the main parameter maps (minimum rpm is 500 and maximum is 20.000).

Standard the 25 rows are divided over a rpm range 12.500 rpm (example see left figure below). If your engine doesn't make more than 8.000 rpm, you can divide the 25 rows over this 8.000 rpm (example see right figure below). So the mapping will be more fine tuned for this engine rpm range.



### Number of cylinders:

Here you can choose the number of cylinders your engine has. If the engine is a six cylinder, the 60-2, 36-2 or 36-1 trigger patterns are the only ones that can be used with a crank pickup.

### Crank-type:

The rpm signal has to be delivered by an hall/inductive sensor using a rotating trigger pattern. The individual pattern types are listed under the pulldown menu. Not all trigger patterns are compatible with all engine types.

When using a 60-2 trigger pattern the maximum engine speed is limited to 12.500 rpm.

### Ref. point:

The reference point (the position of the piston at the moment the first tooth after the missing tooth/teeth passes the sensor) of the crank pickup sensor can be set between 0 and 180 degrees before TDC (for most engines recommended between 70 - 120degree). The position of the reference point in the software must be checked. Mark the TDC on the crankshaft pulley or flywheel. Check with a timing light the degrees when igniting on cylinder 1 in TDC with a static engine speed. If the ignition advance set in the software deviates from the measurement with the timing light, than you have to correct the reference point in the software.

TIP: set for the complete rpm-range the ignition advance map to 10 degrees. The ignition advance read out on the software screen will be stable and doesn't change when your engine speed varies a bit.

For example your reference point set in the software is 90 degrees. The ignition advance 10 degrees at 1000 rpm. Checking with the timing light on cylinder 1 gives you 5 degrees ignition advance. That's a deviation of 5 degrees which must be corrected on the reference point. The correct reference point is  $90 - 5 = 85$  degrees.



### Warning:

When using wasted spark the read out on the timing light must be divided by 2. A timing light displaying 20 degrees advance with wasted spark is in reality 10 degrees ignition advance.

Coil on time:

A coil should be charged before every discharge (plug spark). The coil charging time is indicated in ms. It should normally be 1.4 to 3.5 ms depending on the type of coil. Longer coil charging leads to unnecessarily high power consumption and heat development, shortening the service life of the coil.



**Warning:**

Do not use unsuppressed spark plugs and leads. They can cause electromagnetic interference.

Firing tooth under 500 rpm:

This is for setting the number of teeth before TDC at which an ignition impulse is given (under 500 rpm). Keep this number as low as possible to prevent backfiring when the engine is started. For engines with a high compression ratio it is recommended not to set this to a number higher than 1.

Dis-coil:

The choice is between dis-coil (wasted spark) and single coil control (rotor and distributor cap). If you have a dis-coil (and also when using coil per plug wasted spark) the box has to be ticked.

### 3.2.4.1.2 RPM limiters and Power Shift

#### 3.2.4.1.2.1 Standard Limiters

This menu can be used to set various speed limiters and Power Shift.

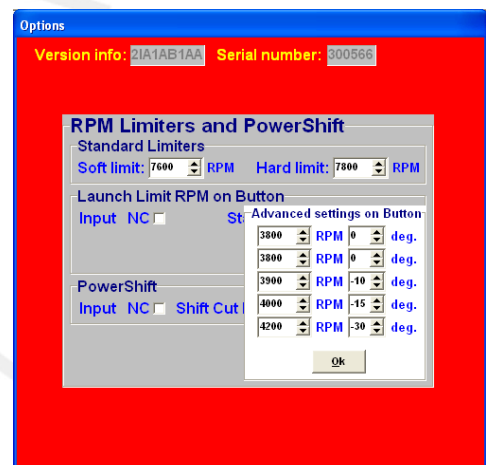
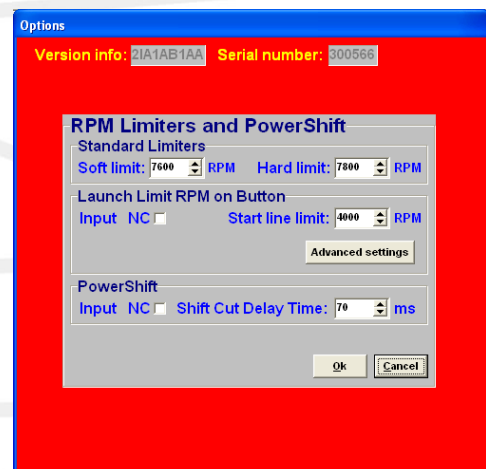
The standard limiters include a soft and a hard limiter. The soft limiter stops ignition partially so that power is lost. The hard limiter switches off ignition completely.

For the KMS IA23 management system the maximum rpm limiter is 20.000 rpm \*

\*: with a 60-2 crank trigger pattern the maximum engine speed is limited to 12.500 rpm.

Launch Limit RPM on button

At launch limit an extra limiter (start line) can be set which is activated, for instance, by a button that connects pin 19 to the ground. Depending on the type of button, NC (normally closed) or NO (normally open), 'Input NC' will have to be ticked or not. If the NO type is used (recommended) do not tick the box. There is also the possibility to set an extra launch limiter. This second limiter can be activated by connecting the pin 22 to the ground.



### Advanced settings:

This can be used to built up boost pressure before start. 'Advanced settings' gives the possibility of setting a fixed ignition moment (between 54 degrees before and 54 degrees after TDC. After TDC is indicated by a negative number). This enables a high boost pressure to be built up in turbocharged engines without further increasing the engine speed. Should the engine speed increase in spite of 'ignition retard', the startline limiter will intervene by stopping ignition.



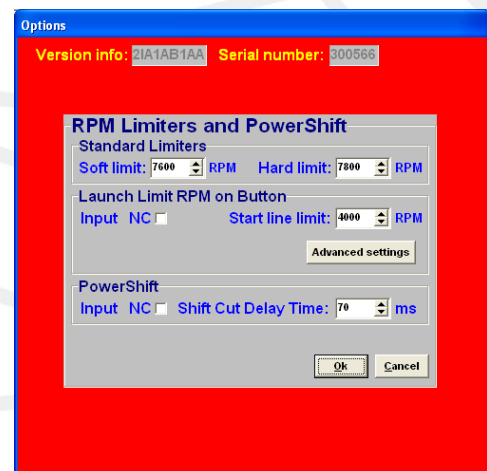
### Warning:

When ignition retard is applied, the temperature of the exhaust gasses may rise so high that the exhaust valves, exhaust manifold and turbocharger will be damaged. We recommend you to activate this function for no longer than a few seconds!

#### 3.2.4.1.2.2 Powershift

Powershift is a function that can be used for changing gear in sequential gearboxes.

A switch on the gearbox shifter enables the engine output to be briefly interrupted, so that a gear change can be made with the throttle valve fully open. This minimizes the duration of gear-change. The duration of the interruption can be set to a maximum of 200 ms. Depending on the type of switch, NO (recommended) or NC, the 'NC' box should be ticked. If the 'use advance settings' control box is selected, the 'advanced settings' menu must be set.



#### 3.2.4.1.3 Engine load sensor

Engine load sensor calibration:

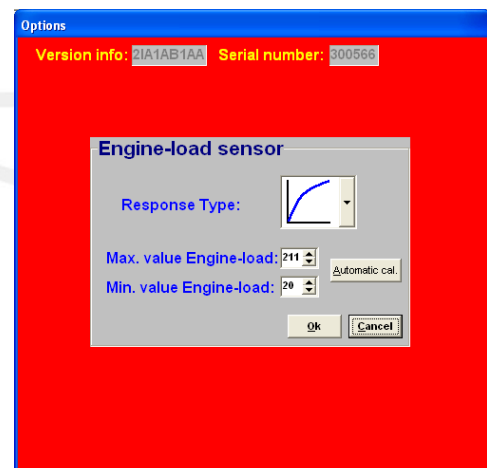
The engine load sensor connected to the system will have to be calibrated.

The range within which the sensor operates can be set here. A load sensor issues a voltage of 0 to 5V. The range is divided into 8 bits (256 steps). In practice a load sensor does not run through its full range. For this reason, the upper and lower limits must be set, so that the 16 columns in the spreadsheets can be best utilized.

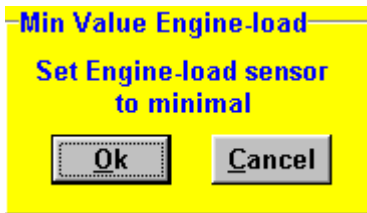
When no engine load sensor is connected (for example when one or more carburettor(s) is(are) used for fuel delivery) only column 15 of the ignition spreadsheet can be used.

There are two ways of calibrating the load sensor:

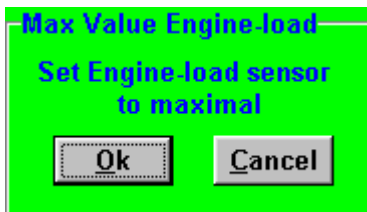
- Automatic calibration
- Manual calibration



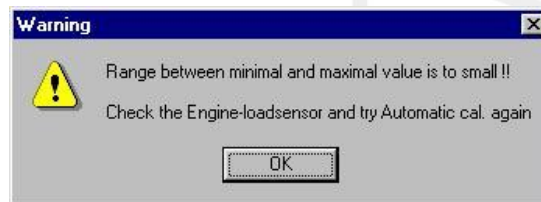
Automatic calibration. When a throttle valve potentiometer is used, it is easy to opt for automatic calibration. Select 'Automatic cal.' and then keep the throttle valve in rest position, pressing 'OK'.



Then turn the throttle valve to full load and press 'OK' again.



The minimum and maximum values of the throttle positions will now be shown. A warning will appear if automatic calibration cannot be finished correctly. For possible causes, see 'Fault tracing'.

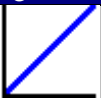
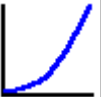
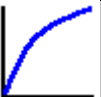


Manual calibration. When a map sensor or an air mass sensor is used, automatic calibration is not easy, because the minimum and maximum output signals of the sensor are not known before the engine has run. We recommend filling in the figures by hand, making sure that the output signal of the sensor under any engine operating condition is between the two figures set.

Tip: first set the minimum value 15 and the maximum value 250. If you use a KMS 400 kPa Map sensor there are recommended settings for the calibration on the datasheet of the sensor.

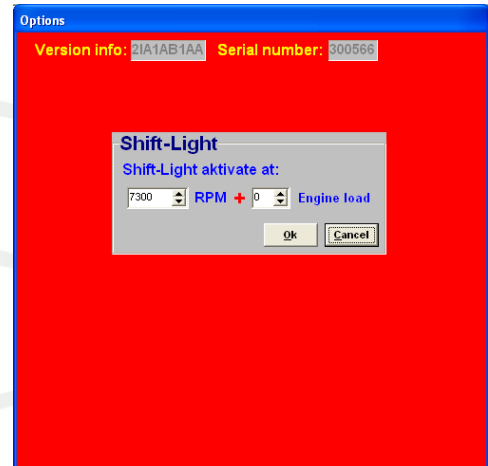
Not all load sensors emit signals that are linear with the engine load. For this reason the system offers the possibility to choose between three load characteristics. This enables the upper/lower areas to be made more sensitive or less sensitive.

The three load characteristics are linear, logarithmic and e-log and are explained in a overview on below.

Image	Definition	Function	Application
	Linear	The load steps are divided in proportion to the signal.	MAP-sensor
	Logarithmic	At lower loads the load signal is divided over a smaller number of steps and at higher loads it is divided over a larger number of steps.	Air mass sensor
	e-log	The action is opposite to that of the logarithmic parabola.	Single Throttle body setup

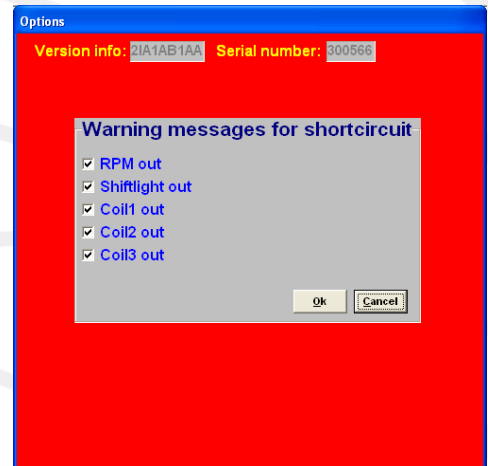
### 3.2.4.1.4 Shift-light

This menu enables a shift light to be activated at a certain engine speed or engine load. So an extra output can be activated, providing an ground-switching output directly (maximum is 1A) or via a relay.



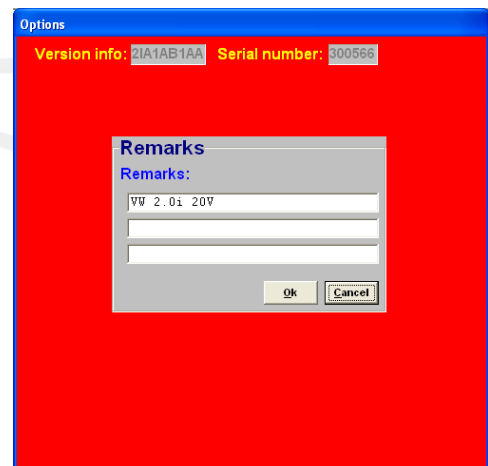
### 3.2.4.1.5 Warning message

In this option menu you can select the warning messages that the ECU software displays when the connections are short-circuit.



### 3.2.4.1.6 Remarks

This is room for making notes, for instance; engine specifications.



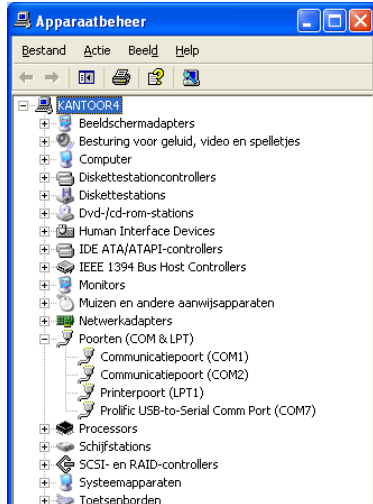
### 3.2.4.1.7 Communication port

Select the required communication port to which the ECU is connected, and save using the 'Save' button.

The system only has an serial port connection. If you want to use this ECU on newer PC's with only USB then you will need an USB to serial converter.

In this example on the left (start→control panel→system→device

manager) you can see that the USB-to-serial connection has

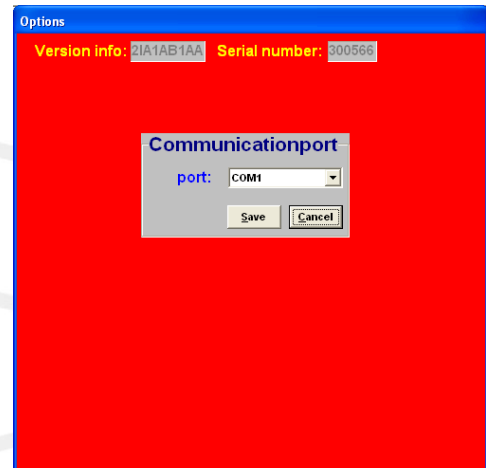


set to COM 7.

(make sure that USB serial converter will be dedicated to a COM connection

between 1 and 8. If this

number exceeds 8, sometimes the converter will not function properly. At the advanced settings of the COM port you can change the port number of your converter to a number between 1 and 8).



#### 3.2.4.1.7.1 Communication with a Windows Vista based desktop/laptop

Windows Vista uses a different kind of communication then for example Windows XP.

The KMS software must be modified to the compatibility of Windows XP.

To modify the KMS software to a Vista computer, look for the 'KMS motormanagement.exe' file. (if you installed the KMS software the standard way, you can find this file at c:/program files/KMS/KMS Motormanagement ). Press with the right mouse button on this file and select 'properties'. You will now see a screen with some tabs. Select the tab 'compatibility' and set the compatibility mode in this screen to Windows XP SP2. Don't forget to click the box above it to select the compatibility modes.



The KMS software will now 'see' the different communication ports and you will be able to connect the ECU to the desktop/laptop.

### 3.2.5 Function key F7

When data is changed or downloaded to the system, the screen will show the text 'DATA IS NOT LOCKED !!!'. At the same time, the silver-colour bar of the diagram will change to a yellow colour. This is to indicate that the changes have not been saved yet. Save the changes by pressing the F7 function key.

KMS V2.14 Ignition-Map		DATA IS NOT LOCKED !!!														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
500	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0
750	21,8	21,8	21,8	21,8	21,8	21,5	21,2	20,7	20,2	19,7	19,3	18,8	18,3	17,8	17,3	17,3
1000	27,6	27,6	27,6	27,6	27,6	26,5	25,5	24,6	23,8	22,9	22,0	21,1	20,3	19,4	18,5	18,5
1200	33,4	33,4	33,4	33,4	33,4	31,9	30,4	29,1	27,8	26,4	25,1	23,8	22,4	21,1	19,8	19,8

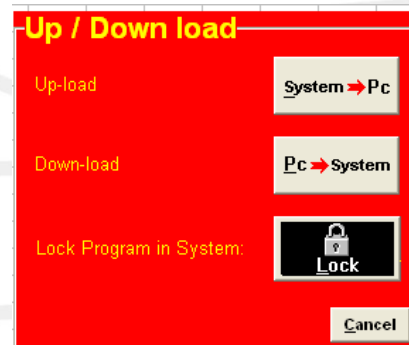


When the  box is clicked, the changes will be saved. If saving is successful, the box will automatically change to . Once again, if UNLOCKED is not clicked after the program has been changed, the changes in the system will be lost when the power supply to the system is broken.

### 3.2.6 Function key F10



Function key F10 offers the choice of working off-line or on-line. It switches communication with the system on or off. Communication will also be stopped when the power supply to the system is broken. If there is no communication, a red bar will appear at the bottom of the screen. To resume the communication with the system, function key F10 should be pressed. A menu will appear offering a choice between loading the file on the PC to the system and loading the file in the system to the PC. There will still be the possibility of breaking the communication again.



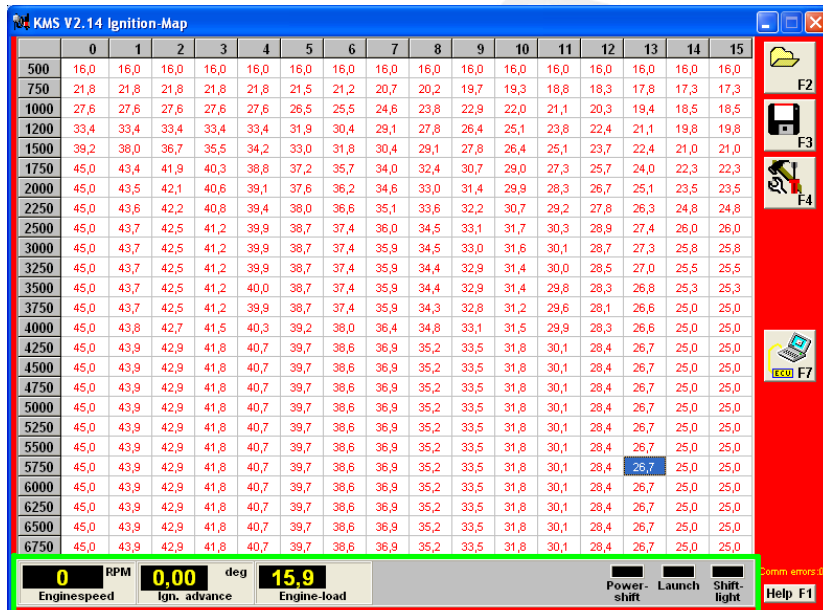
**Warning:** Make sure that the battery of the vehicle supplies more than 10V. If the battery doesn't exceed 10V the changes you made to the ECU will not be saved.

Tip: On vehicles with an ignition lock switched in such a way that the power supply to the system is cut off when the engine is started, always download the data from the PC to the system (as in the PC the modified data will not get lost when the power supply to the system is broken). This is of course only necessary if the data has not been saved to the system.



### 3.3 The communication bar

The horizontal bar at the bottom of the screen is the communication bar. If the system is connected to the COM port of the PC and the power supply to the system is on, function key F10 can be used to activate the communication.

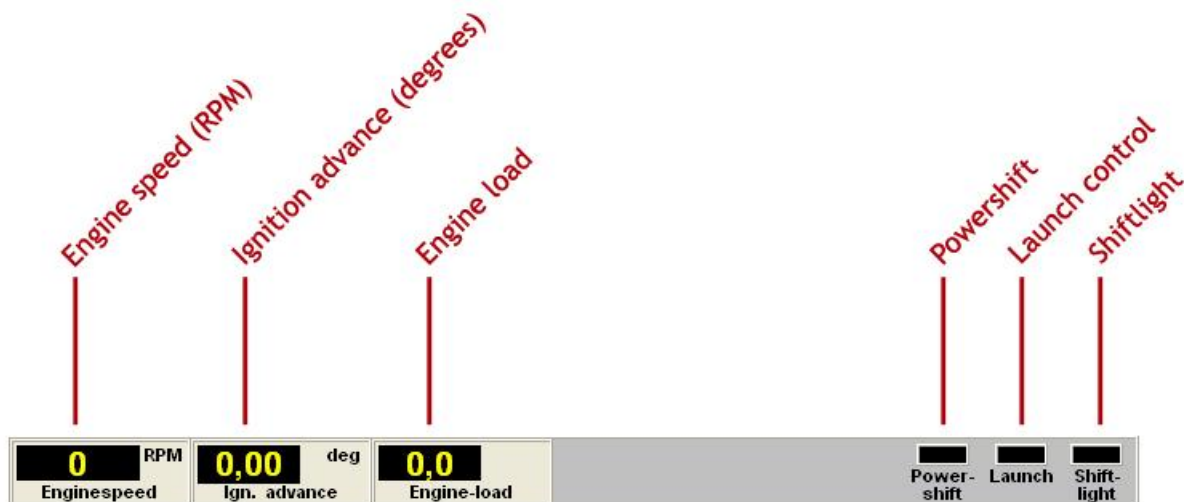


There are three check lights in the communication bar, which indicate the status of the relevant outputs.

The following readings will be shown:

- Engine speed
- Advanced ignition angle
- Engine load

These readings can be used to check whether the right sensors are being used and all settings are correct.



## 4 Programming

Before programming is started, all connections and sensors must be checked. Look at the communication bar to check the sensors for correct functioning and setting.

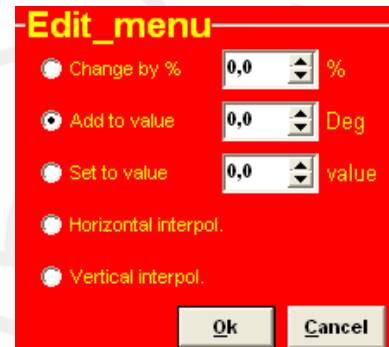
If everything is in good working order, the programming of the diagrams can be started.

There are three ways of changing the values shown in the diagrams:

- Filling in the data manually.
- Making changes using potentiometer and button (mapping box).
- Changing bar charts using arrow keys.

### 4.1 Manual changing

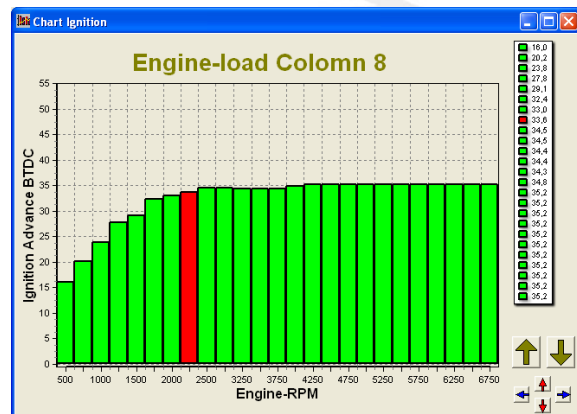
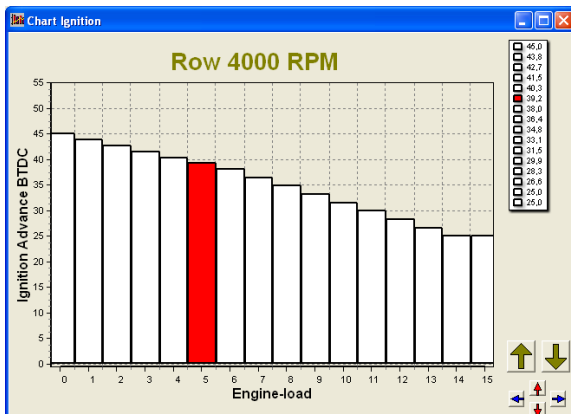
By checking a control box, the relevant parameter can be set manually. If a control box has been selected, an edit menu will appear that allows you to change the selected values in various ways.



### 4.2 Bar charts

The columns or rows of the diagrams can also be shown in the form of bar charts. The bar charts will appear when an engine speed or engine load value is clicked. If an engine speed is clicked, a bar chart will appear showing all the values related to that engine speed.

If an engine load value is clicked, a bar chart will appear showing all the values related to that engine load value. Access to the bar charts can also be obtained by pressing the ALT + C keys or the ALT + R keys simultaneously.



It is also possible to modify the diagram values in the bar charts by using the arrow keys, or the arrow keys in combination with the Ctrl or Alt key. The left/right arrow keys can be used to move through a column or row. When the upward or downward arrow key is used, the value will go up or down 0.10 with each touch of the key. If the Alt key is pressed simultaneously, the value will change 0.01 per touch and if instead of the Alt key the Ctrl key is pressed, the value will change 1.00 per touch.

When the engine is running, the space bar can be touched to go automatically to the relevant value in the bar chart (matching the current situation of the engine), even when this value is at another engine speed or engine load.  
To go to another engine speed or engine load, use the Page Up / Page Down keys.



## 5 Hardware installation

To guarantee that the system functions properly, it is of utmost importance to adhere to the instructions given below.

### 5.1 Fitting the ECU

It is important that the ECU is fitted in a dry and not too hot place.

### 5.2 Connecting the communication cable

Attached to the included wiring loom of your KMS IB/IA23 system is a serial port. You can use this communication for your desktop/laptop and make a connection with the KMS Ignition software.



**Warning:**

Be sure what kind of ignition coil you have. Is this a coil without amplifier, use the thicker wires of the ECU. If you have a coil with amplifier it's important to use the thinner connector wires.

## 6 Fault tracing

<b>Fault</b>	<b>Possible cause</b>	<b>Solution</b>
No communication between ECU and PC	<ul style="list-style-type: none"> <li>- No power supply to the system</li> <li>- Cable connected to wrong COM port (standard is COM1)</li> </ul>	<ul style="list-style-type: none"> <li>- Switch the contact on or check the fuse</li> <li>- Connect cable to COM1 or select another COM port</li> </ul>
Engine does not start	<ul style="list-style-type: none"> <li>- No engine speed signal</li> <li>- Crank Type set is not correct</li> </ul>	<ul style="list-style-type: none"> <li>- Check the sensor and wiring</li> <li>- See section <a href="#">3.2.4.1.1 RPM pickup</a></li> </ul>
Auto calibration gives message 'warning range too small'	<ul style="list-style-type: none"> <li>- Sensor range too small or potentiometer connected incorrectly</li> </ul>	<ul style="list-style-type: none"> <li>- Check the wiring</li> <li>- Fill in the values of the engine load sensor manually</li> </ul>
Auto calibration gives message 'warning signal reversed'	<ul style="list-style-type: none"> <li>- Throttle valve potentiometer turns in the wrong direction</li> </ul>	<ul style="list-style-type: none"> <li>- Interchange the earth and 5V wiring of the potentiometer</li> </ul>
Auto calibration gives message 'engine load sensor not connected'	<ul style="list-style-type: none"> <li>- The engine load sensor signal does not change</li> <li>- Interruption in potentiometer signal wiring or potentiometer does not turn when the throttle valve is opened</li> </ul>	
Only coils 1-4 give ignition	<ul style="list-style-type: none"> <li>- Dis coil box not ticked</li> </ul>	<ul style="list-style-type: none"> <li>- See paragraph <a href="#">3.2.4.1.1 RPM pickup</a></li> </ul>



## 7 Specifications

### Minimum system requirements:

Windows 95, 98, 2000, NT, ME, XP or Vista  
Internal memory 32Mb  
Screen resolution 800 x 600  
Standard RS232C port  
CD-ROM station (software is also available on diskette)  
Acrobat reader 3.0 or higher (Acrobat reader 5.0 is included on the CD-ROM supplied)

### ECU specifications:

Supply voltage 8.5 - 16V  
Power consumption 250mA at 12V  
5V supply to sensors can have maximum 100mA

### Inputs:

Inputs are protected up to 50V  
Input for engine load is suitable for potentiometers, air mass meters and map sensors with an output between 0 and 5V.

### Outputs:

Shift-lamp output max. 1A at 12V per output

### Dimensions:

*KMS IA23*

LxWxH: 85 x 85 x 40 mm

Weight: 280 gram

*KMS IB*

LxWxH: 111 x 67 x 22 mm

Weight: 200 gram

## 8 Wiring diagram

### 8.1 Wiring diagram IA23

#### standard colours KMS IA23 wiring-loom

PIN nr.	colour	0,5mm <sup>2</sup>	0,75mm <sup>2</sup>	function	details
1	purple		*	Coil 3 (amplified)	For use directly on -coil
2	purple	*		Coil 3	Only used to trigger an coil driver
3	red/black	*		Tacho output	Low voltage RPM signal
4	blue	*		Shiftlight	Activates when connected to ground
5	white/red	*		Analog aux input	Not yet available
6	black		*	ECU ground	Make permanent connection!
7	red		*	ECU +12V supply	Use 5-10 Amp. Fuse on ignition key
8	green	*		communication	
9	green		*	Coil 2 (amplified)	For use directly on -coil
10	green	*		Coil 2	Only used to trigger an coil driver
11	orange/black	*		Crank sensor signal	(hall sensor)
12	red	*		Crank sensor signal	Twisted with blue (inductive sensor)
13	grey	*		Load signal	For example TPS/MAP/MAF
14	black	*		Load signal ground (TPS/MAP)	For example TPS/MAP/MAF
15	red	*		communication	
16	orange		*	Coil 1 (amplified)	For use directly on -coil
17	brown		*	Ground ignition drivers	Connect permanent when using amplified outputs
18	orange	*		Coil 1	Only used to trigger an coil driver
19	blue	*		Crank sensor ground	Twisted with red
20	yellow	*		Load-sensor +5V supply	For example TPS/MAP/MAF
21	green/red	*		Powershift	Activates when connected to ground
22	yellow/black	*		Launch control	Activates when connected to ground
23	black	*		communication	

## 8.2 Wiring diagram IB

standard colors KMS IB breakout-loom				
color	0,5mm <sup>2</sup>	0,75mm <sup>2</sup>	function	details
white/red	*		Analog aux input	Not yet available
red/black	*		Tacho output	Low voltage RPM signal
purple	*		Coil 3	Only used to trigger an coil driver
green	*		Coil 2	Only used to trigger an coil driver
orange	*		Coil 1	Only used to trigger an coil driver
purple		*	Coil 3 (amplified)	For use directly on -coil
green		*	Coil 2 (amplified)	For use directly on -coil
orange		*	Coil 1 (amplified)	For use directly on -coil
brown		*	Ground amplified internal outputs	Connect permanent when using amplified outputs
red		*	ECU +12V supply	Use 5-10 Amp. Fuse on ignition key
yellow	*		Load-sensor +5V supply	For example TPS/MAP/MAF
grey	*		Load signal	For example TPS/MAP/MAF
black	*		Load signal ground (TPS/MAP)	For example TPS/MAP/MAF
black	*		Extra ground	For connecting powershift/launch control
blue	*		Crank sensor ground	Twisted with red
red	*		Crank sensor signal	Twisted with blue (inductive sensor)
orange/black	*		Crank sensor signal	(hall sensor)
yellow/black	*		Launch control	Activates when connected to ground
green/red	*		Powershift	Activates when connected to ground
blue	*		Shiftlight	Activates when connected to ground
black		*	ECU ground	Make permanent connection!