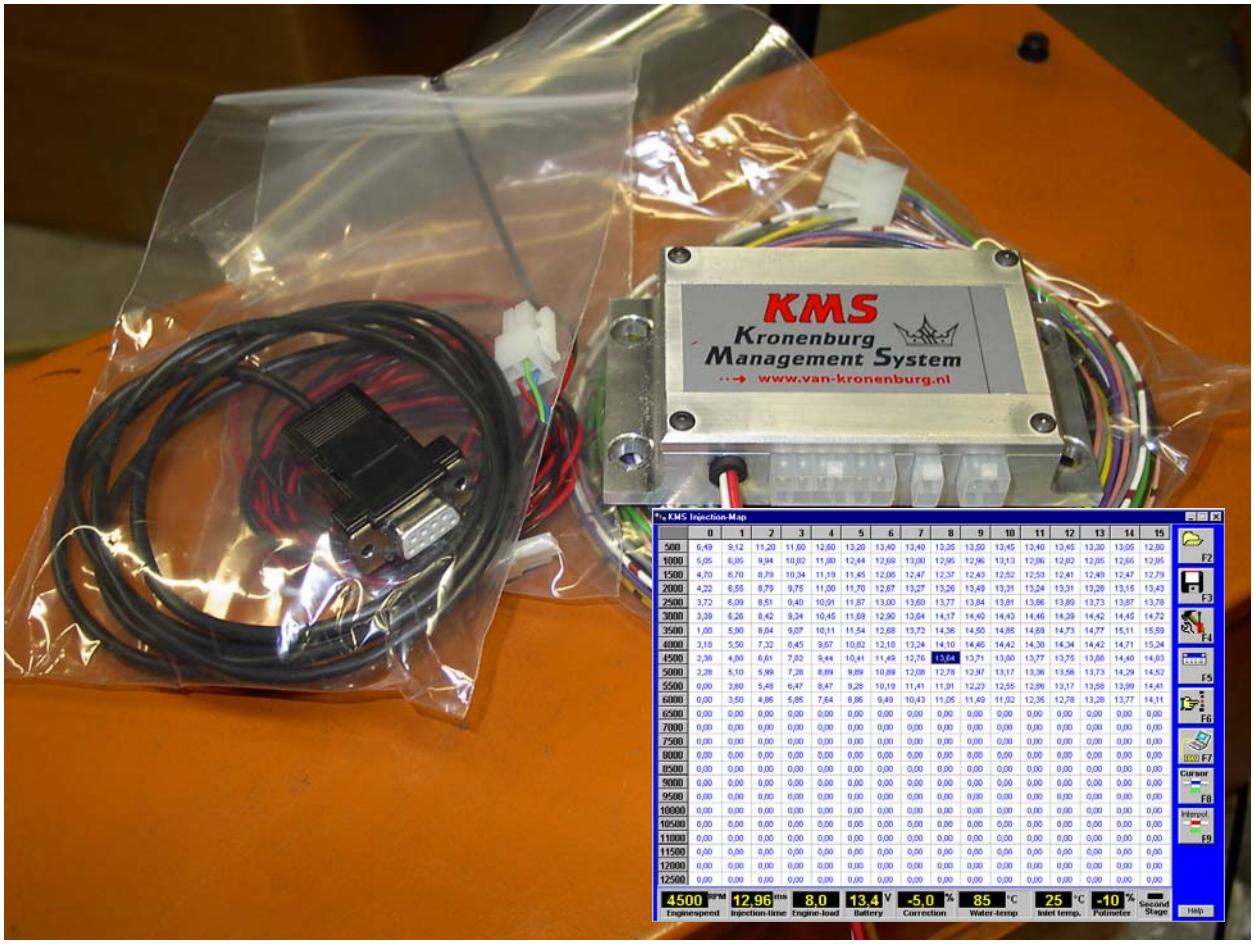
KMS

van **K**ronenburg **M**anagement **S**ystem

Fuel version V2.2



Inhoudsopgave

Blz.

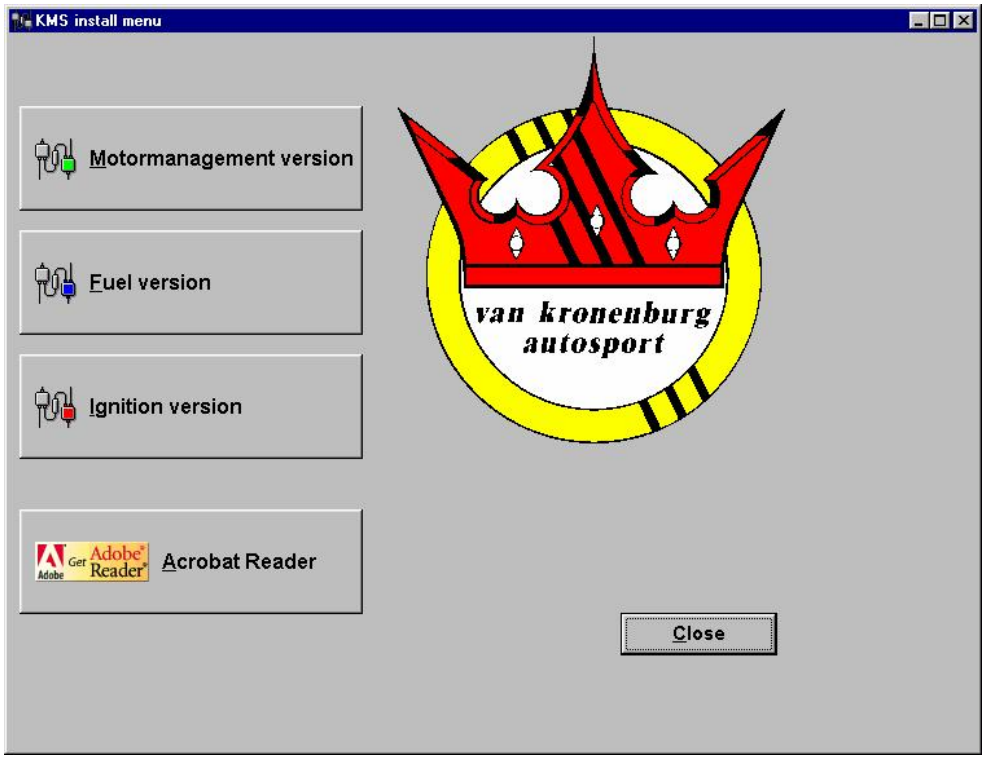
1 KMS (Kronenburg Management System)

This management system can be used as an independent injection/ignition system for virtually all types of Otto engine (engines in which the fuel mix is ignited via a spark plug).
It can also be used in combination with a standard engine management system, to take over the standard injection/ignition at any desired engine speed, boost pressure or throttle valve position. For this purpose it is mainly applied in compressor or turbo sets.
This makes it possible to maintain certain factory settings, such as the cold/hot starting characteristics, lambda control in part-load areas, idling control etc.
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. We recommend you leave the programming to specialists.

2 Software installation

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

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 3.2.3.9.



3 KMS software

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

- The injection characteristic diagram
- The function bar
- The communication bar

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

3.1 The injection characteristic diagram

The spreadsheets are two-dimensional diagrams showing engine speed against engine load.
The engine speed range is fixed and stretches from 500 rpm to 12,500 rpm.
The engine load range is sub-divided into 16 boxes dividing the range that has been set for the engine load sensor.
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 4.3.
Three types of load-sensors can be used.

1) Throttle position sensor
2) MAP-sensor (Manifold absolute pressure)
3) Air mass/flow meter

In the injection characteristic diagram, figures can be entered that indicate the injector opening time per injection in milliseconds. This means that at any engine speed and any engine load, the desired quantity of fuel can be injected.

KMS Injection-Map

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
500	6,49	9,12	11,20	11,60	12,60	13,20	13,40	13,40	13,35	13,50	13,45	13,40	13,45	13,30	13,05	12,80
1000	5,05	6,85	9,94	10,82	11,80	12,44	12,69	13,00	12,95	12,96	13,13	12,86	12,82	12,85	12,65	12,85
1500	4,70	6,70	8,79	10,34	11,19	11,45	12,08	12,47	12,37	12,43	12,52	12,53	12,41	12,49	12,47	12,79
2000	4,22	6,55	8,79	9,75	11,00	11,70	12,67	13,27	13,26	13,49	13,31	13,24	13,31	13,28	13,15	13,43
2500	3,72	6,09	8,51	9,40	10,91	11,87	13,00	13,60	13,77	13,84	13,81	13,86	13,89	13,73	13,87	13,78
3000	3,39	6,26	8,42	9,34	10,45	11,69	12,90	13,64	14,17	14,40	14,43	14,46	14,39	14,42	14,45	14,72
3500	1,00	5,90	8,04	9,07	10,11	11,54	12,68	13,72	14,36	14,50	14,85	14,69	14,73	14,77	15,11	15,59
4000	3,18	5,50	7,32	8,45	9,67	10,82	12,18	13,24	14,10	14,46	14,42	14,38	14,34	14,42	14,71	15,24
4500	2,38	4,80	6,61	7,82	9,44	10,41	11,49	12,76	13,64	13,71	13,80	13,77	13,75	13,88	14,40	14,83
5000	2,28	5,10	5,99	7,28	8,89	9,89	10,89	12,08	12,78	12,97	13,17	13,36	13,56	13,73	14,29	14,52
5500	0,00	3,60	5,48	6,47	8,47	9,28	10,19	11,41	11,91	12,23	12,55	12,86	13,17	13,58	13,99	14,41
6000	0,00	3,50	4,86	5,85	7,64	8,86	9,49	10,43	11,05	11,49	11,92	12,35	12,78	13,28	13,77	14,11
6500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
9000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
9500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
11000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
11500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12000	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12500	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

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 F2

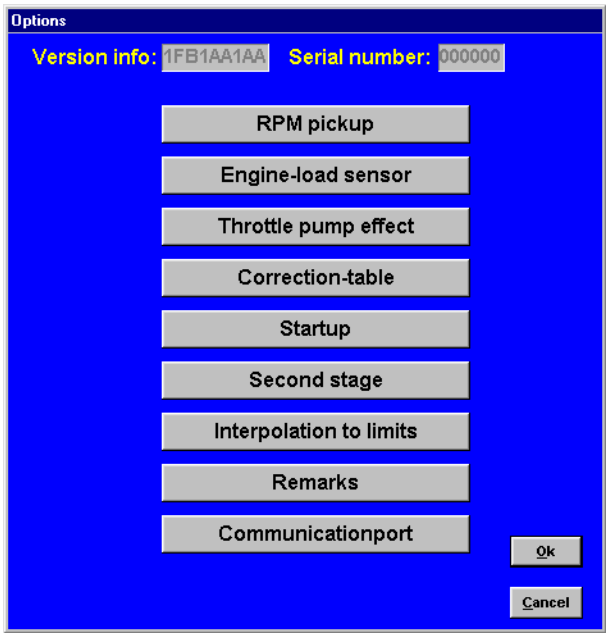
This function key enables a previously saved file to be retrieved from the hard disk, floppy, CD-ROM etc. The files can be recognised by a blue  floppy icon and by the extension .f00

3.2.2 Function key F3

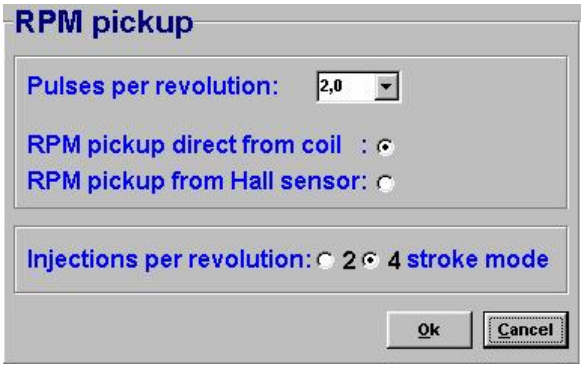
This function key is used to save modified files.
The names of these files automatically receive the extension .f00.

3.2.3 Function key F4

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



3.2.3.1 RPM pickup

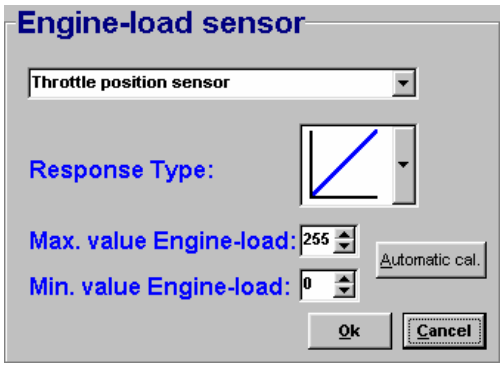


The engine speed signal can be obtained both from a high-voltage signal (e.g. coil ground) and from a low-voltage signal (e.g. signal wire of distributor with Hall sensor / coil with built-in output stage).
The software is as standard set for a high-voltage signal. If the engine speed is going to be registered through a low-voltage signal, set check box “RMP pickup from Hall sensor”, !! Ensure that it is set to the correct position before starting!! This can have harmful consequences for the computer.
The number of pulses registered per revolution is of course dependent on the place of engine speed registration. Some examples:

Engine type (4-stroke Otto engines)	*Place of engine speed registration*	*Pulses per revolution*
1 cyl.	single coil/Hall sensor	0.5
2 cyl.	single coil/Hall sensor	1.0
3 cyl.	single coil/Hall sensor	1.5
4 cyl.	single coil/Hall sensor	2.0
5 cyl.	single coil/Hall sensor	2.5
6 cyl.	single coil/Hall sensor	3.0
8 cyl.	single coil/Hall sensor	4.0
10 cyl.	single coil/Hall sensor	5.0
n/a	direct coil single spark	0.5
n/a	dis coil	1.0

There is also a choice between 2-stroke and 4-stroke mode. In the 2-stroke mode the injection frequency is once per revolution. In the 4-stroke mode the injection frequency is once per two revolutions. In general, selecting the 4-stroke mode is recommended.

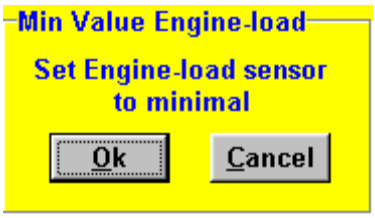
3.2.3.2 Engine-load sensor



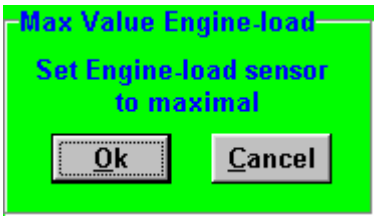
The engine load sensor connected to the system will have to be calibrated.
The range within which the sensor operates can be set here. A load sensor issues a voltage of 0 to 5V. The range is divided into 8 bits (256 steps). In practice a load sensor does not run through its full range. For this reason, the upper and lower limits must be set, so that the 16 columns in the spreadsheets can be best utilised.
There are two ways of calibrating the load sensor:

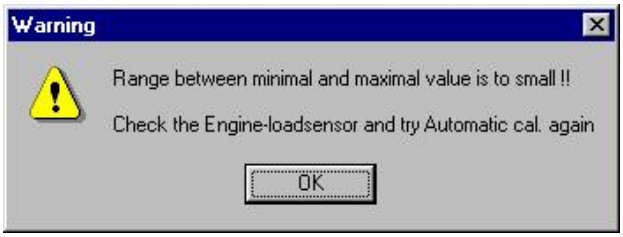
1) Automatic calibration
2) Manual calibration

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.

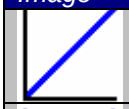




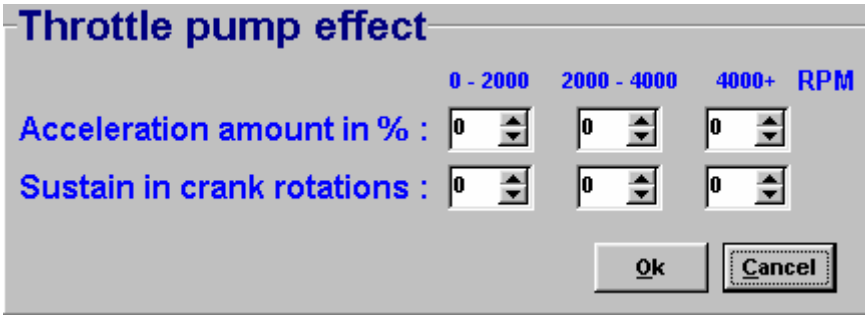
The minimum and maximum values of the throttle positions will now be shown.
A warning will appear if automatic calibration cannot be finished correctly. For possible causes, see 'Fault tracing'.

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: make the minimum value 15 and the maximum value 250.

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.

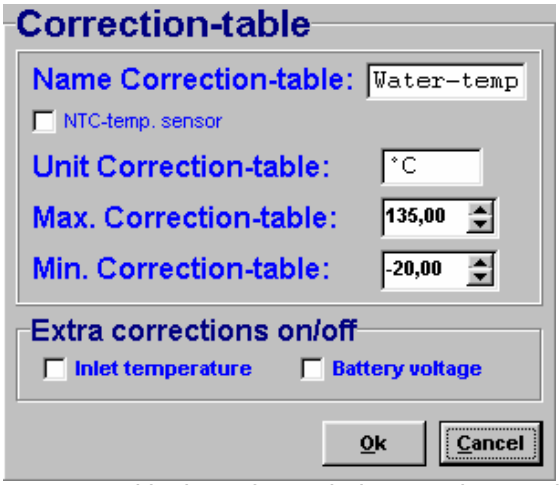
Image	*Definition*	*Function*	*Application*
	Lineair	The load steps are divided in proportion to the signal.	
	Logarithmic	At lower loads the load signal is divided over a smaller number of steps and at higher loads it is divided over a larger number of steps.	Air mass sensor
	e-log (umgekehrter Logarithmus)	The action is opposite to that of the logarithmic parabola.	Throttle valve casings

3.2.3.3 Throttle-pump effect



When the throttle valve is opened, the engine will draw in more air and therefore need more fuel to keep the mix ratio at a constant level. As air is a gaseous substance, it will reach the inlet valve earlier than the liquid fuel, which because of its higher inertia needs more time to accelerate. As a result, there will briefly be a weak mix, causing the engine to 'hesitate'. The faster the throttle valve is opened, the greater this effect will be. To neutralise the effect of fuel having a higher inertia than air, acceleration enrichment can be applied. This means that, depending on the throttle valve opening speed, extra fuel is injected. This prevents the formation of a poor mix. The quantity of extra fuel to be injected can be set for the three engine speed ranges indicated. The duration of enrichment can be set by entering the number of crankshaft rotations. The acceleration enrichment will automatically decrease at lower throttle valve opening speeds.

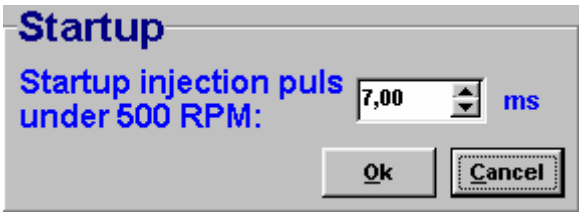
3.2.3.4 Correction-table



This menu offers the possibility to calibrate a sensor to which corrections can be made. Normally, a water temperature sensor is used for this purpose, to enable cold start enrichment to be set. Cold start enrichment is required at low engine temperatures, because the fuel then condenses against the cold cylinder walls and is forced out of the exhaust without having been burned. As a result, the mix becomes too poor, so that the engine will hesitate. To compensate for the loss of fuel at low engine temperatures, more fuel will have to be injected.

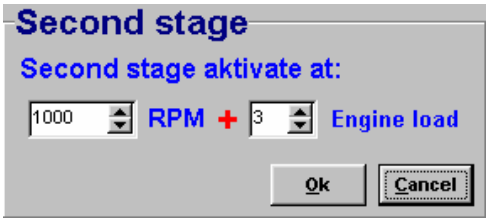
When a 2-pole Bosch water temperature sensor is used, the only thing to do is click the box next to the text 'NTC-temp. sensor'. As this sensor is pre-programmed in the software it does not have to be calibrated. When another sensor is used, the range can be set manually.
This menu also offers the possibility to make a correction to the air temperature and/or the battery voltage. The air temperature correction is a fixed table and cannot be changed with the PC software. This air temperature correction can only be made if an NTC temperature sensor is used. For the correct type of sensor, see 6.5 (sensor connections).
The battery voltage correction is used to make corrections for the opening loss time of an injector. This opening loss time is dependent on the battery voltage and may vary from 1.8 milliseconds at 8 volts to 0.4 milliseconds at 16 volts. For instance, 0.68 milliseconds will be added to the duration of injection when the battery voltage is 12.6 volts. The table can be used for injectors with a resistance of 12 to 15 ohms.
If the air temperature and battery voltage correction functions are not activated, this will be shown in the communication bar. The two relevant readings will then turn grey.

3.2.3.5 Startup



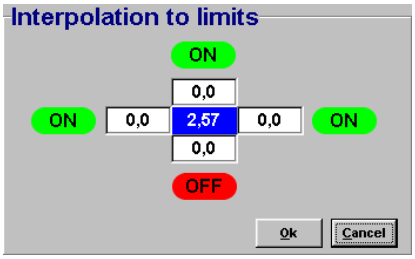
When the engine is started, a certain quantity of extra fuel (in most cases dependent on the coolant temperature) will have to be injected to ensure proper firing of the engine. There is a possibility of giving a start-up injection impulse. The start-up injection impulse is given each time a crankshaft signal is registered under 500rpm.

3.2.3.6 Second stage



This menu enables a second stage to be activated at a certain engine speed or engine load. So an extra output can be activated, providing an earth-switching output directly (up to 15 watts) or via a relay. This can be used for a shift light or water injection, for example.

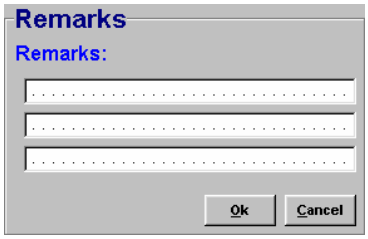
3.2.3.7 Interpolations to limits



This function enables the interpolation within the outer limits of the graphs to be switched on or off. This enables a safe engine speed limiter to be set or to stop injection entirely when the accelerator is released. In the case of the speed limiter, the engine can be prevented from running on an increasingly poor fuel air mix, which might cause engine damage.

3.2.3.8 Remarks

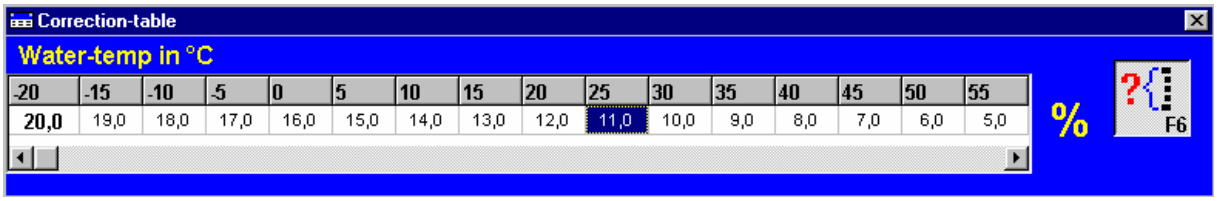
This is room for making notes, for instance engine specifications.



3.2.3.9 Communicationport

Select the required communication port and save using the 'Save' button.

3.2.4 Function key F5

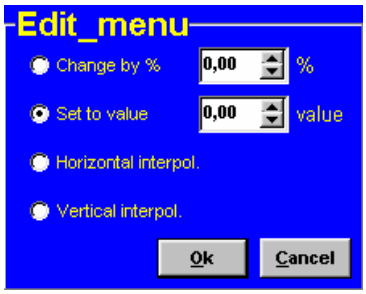


When this function key is clicked, a correction table will appear. This table is used to enter figures that indicate the relative richness or weakness (over the entire injection diagram, %) at readings that are within the range of the correction sensor.

3.2.5 Function key F6

2992	0	1	2	3
500	6,49	9,12	11,20	11,60
1000	5,05	6,85	9,94	10,82
1500	4,70	6,70	8,79	10,34
2000	4,22	6,55	8,79	9,75
2500	3,72	6,09	8,51	9,40
3000	3,39	6,26	8,42	9,34
3500	1,00	5,90	8,04	9,07

4208	0	1	2	3
500	6,49	9,12	11,20	11,60
1000	5,05	6,85	9,94	10,82
1500	4,70	6,70	8,79	10,34
2000	4,22	6,55	8,79	9,75
2500	3,72	6,09	8,51	9,40
3000	3,39	6,26	8,42	9,34
3500	1,00	5,90	8,04	9,07



After this function key has been clicked and one or more boxes in the diagram have been selected, an edit menu will appear. In this edit menu the values of the selected boxes can be changed. The choice is between a change in terms of percentage, a change to a fixed value, and horizontal or vertical interpolation. Horizontal or vertical interpolation is only possible if three or more boxes have been selected in the diagram. With these functions, the values (horizontal or vertical) between the outermost selected boxes will be interpolated.

3.2.6 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 yet been saved. Save the changes by pressing the F7 function key.

KMS Injection-Map — DATA is NOT LOCKED !!!

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
500	6,49	9,12	11,20	11,60	12,60	13,20	13,40	13,40	13,35	13,50	13,45	13,40	13,45	13,30	13,05	12,80
1000	5,05	6,85	9,94	10,82	11,80	12,44	12,69	13,00	12,95	12,96	13,13	12,86	12,82	12,85	12,65	12,85
1500	4,70	6,70	8,79	10,34	11,19	11,45	12,08	12,47	12,37	12,43	12,52	12,53	12,41	12,49	12,47	12,79
2000	4,22	6,55	8,79	9,75	11,00	11,70	12,67	13,27	13,26	13,49	13,31	13,24	13,31	13,28	13,15	13,43
2500	3,72	6,09	8,51	9,40	10,91	11,87	13,00	13,60	13,77	13,84	13,81	13,86	13,89	13,73	13,87	13,78
3000	3,39	6,26	8,42	9,34	10,45	11,69	12,90	13,64	14,17	14,40	14,43	14,46	14,39	14,42	14,45	14,72
3500	1,00	5,90	8,04	9,07	10,11	11,54	12,68	13,72	14,36	14,50	14,85	14,69	14,73	14,77	15,11	15,59

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.

3.2.7 Function key F8

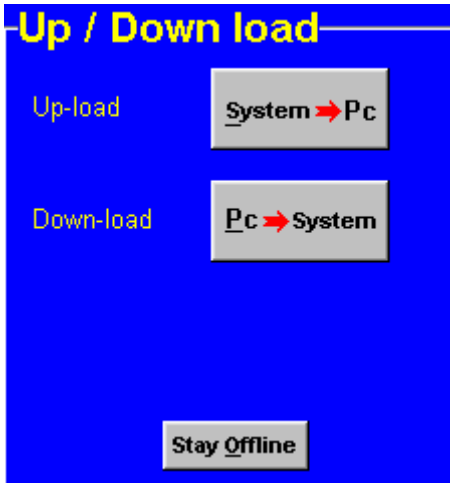
With function key F8, the cursor (the blue box) can be switched on and off. When the cursor is on, it will always follow the operating situation of the engine. At that point, it is only possible to change a selected box if it matches the operating situation of the engine at that moment. When the cursor is off, any box can be selected and changed, irrespective of the operating situation of the engine.

3.2.8 Function key F9

With this key the interpolation between the boxes can be switched on or off. When the interpolation function is on, interpolation to the surrounding boxes will take place during engine operation, taking account of engine speed and engine load. When the interpolation function is off, there will be no interpolation to adjacent boxes, but the value shown in the box matching the situation in which the system is functioning at that moment will be adhered to.

3.2.9 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.



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 De communicatiebalk

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. The following readings will be shown:
-engine speed
-injection-time
-engine-load
-battery voltage
-correctionpercentage
-watertemperature
-airtemperature *
-Correction percentage for fuel (programming unit)
-Second stage (on/off)

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

* There is a non-progammable correction table for air temperature written in the software. You only need to connect a Bosch 2-pin air-temperature sensor.

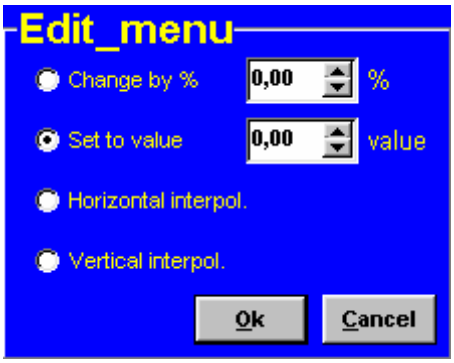
4 Programming

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:

1) Filling in the data manually, using the F6 edit menu
2) Making changes using potentiometer and button
3) Changing bar charts using arrow keys

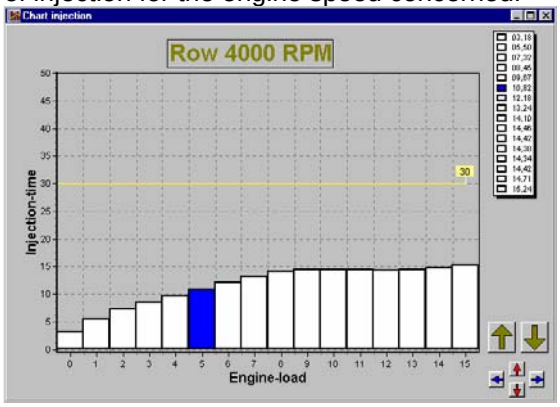
4.1 Manual changing

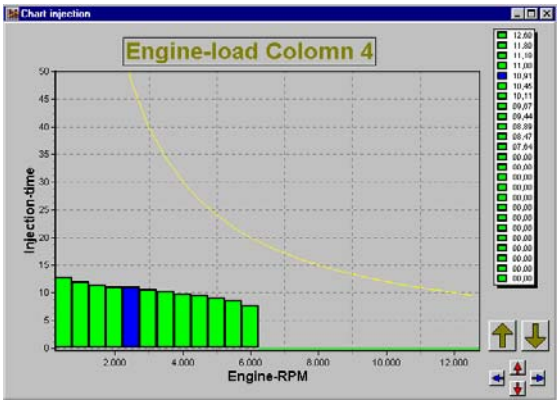
The value of a selected box can be changed manually. If the F6 button is on, an edit menu will appear which offers several ways to change the selected values (see 3.2.5.).



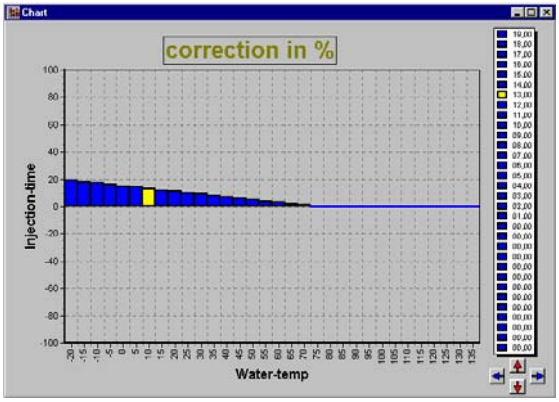
4.2 Bar charts

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. The thin yellow line in the graphs of the injection diagram indicates the maximum duration of injection for the engine speed concerned.





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.
The correction table can also be shown in the form of a bar chart if a correction figure is clicked. And here, too, the arrow keys can be used to change the values.



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 should be fitted in a dry and not too hot place. When fitting it, make sure that the cover is readily accessible for easy removal. Removal is necessary for the connection of a communication cable.

5.2 Connecting the wire loom

The wiring harness supplied with the system is already provided with plugs for connecting the air temperature sensor, water temperature sensor, injector group and engine load sensor. For connecting the supply to the ECU there are two wires, the plus wire (black wire) of which is provided with a fuse holder with a 7.5A fuse. Never fit a fuse of more than 7.5A. It is important that the brown ground wire should be connected directly to the chassis. Switching in the ground wire will cause irreparable damage to the ECU.

5.2.1 Adjust the RPM pickup to the signal level

The ECU is as standard suitable for reading the engine speed signal of a standard coil without output stage. The ECU can be adapted when a coil with built-in output stage is used or when a distributor with a Hall sensor is fitted. This can be set by software the engine speed input must **no longer** be connected directly to a standard coil. This would cause irreparable damage to the ECU. The adjusting of the signal level is shown in the picture below. See chapter 3.2.3.1 RPM Pickup.

WARNING: the ECU is not suitable for Thyristor or MSD ignition systems!!!

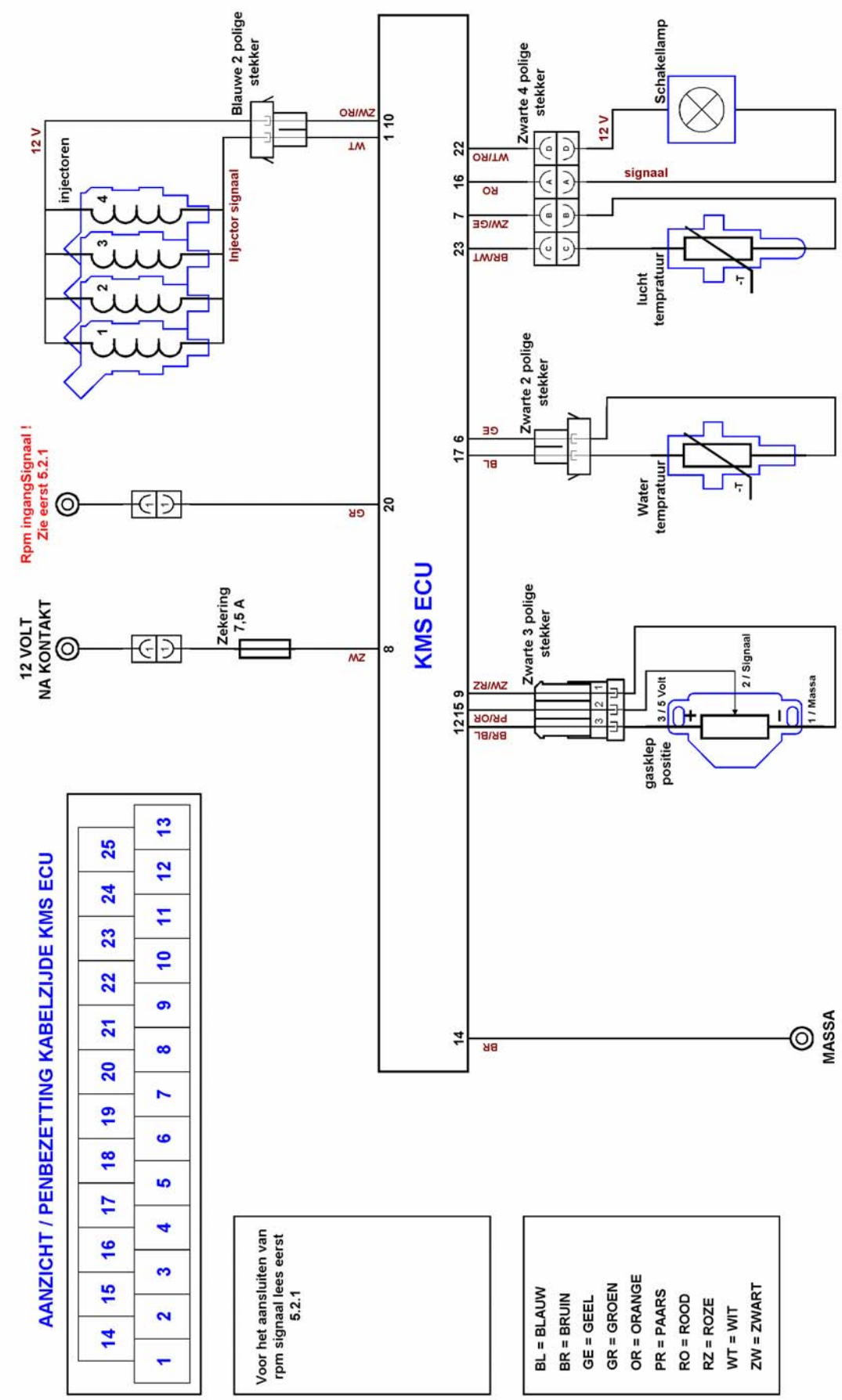
5.3 Connecting the communication cable

There is a cover at the back of the ECU. Removing this cover gives access to the communication connector. A standard RS232 cable (serial 9-pole male female 1:1) can be connected to this connector. This cable is not included in the standard package supplied, and can be ordered separately.

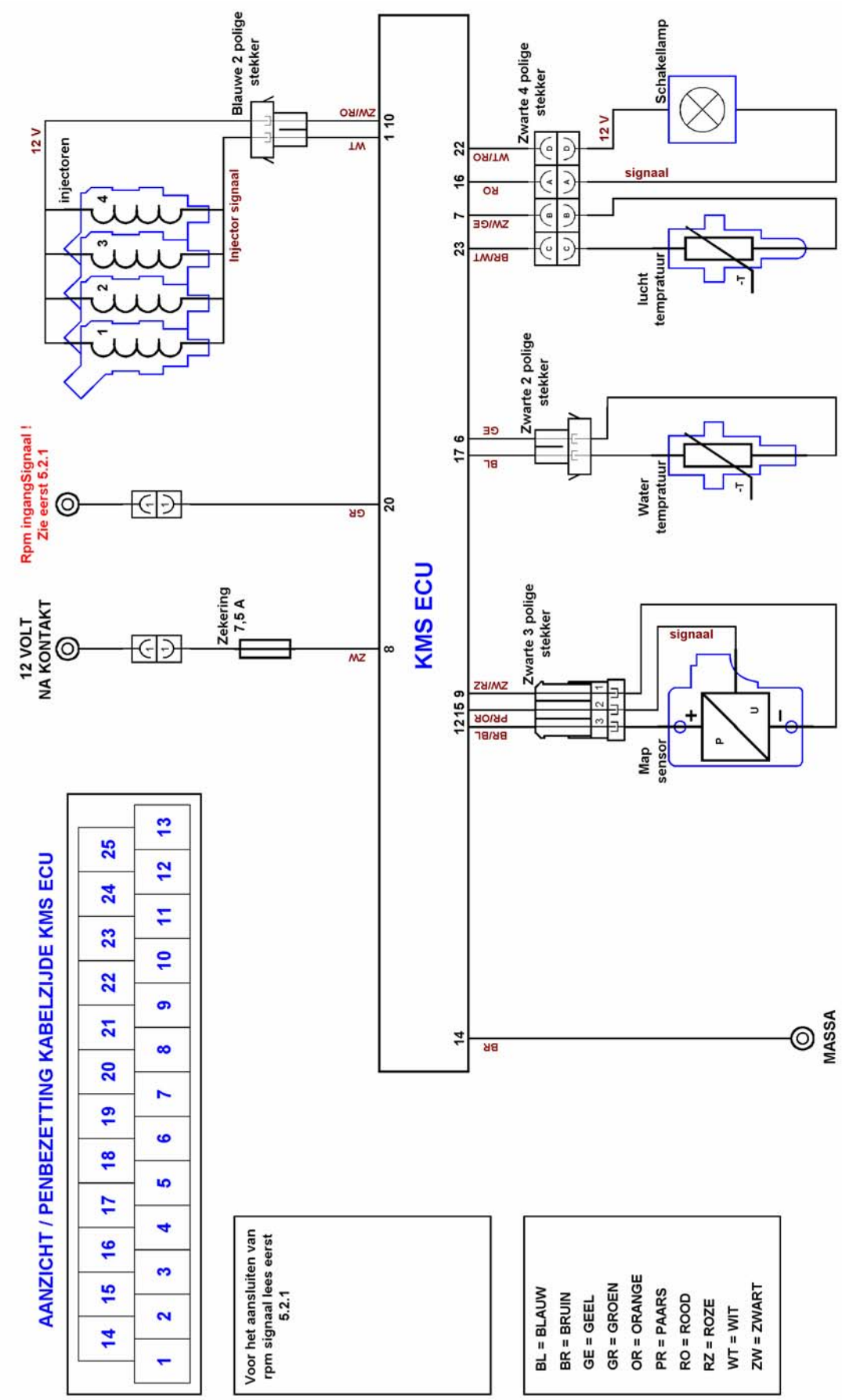
6 Application examples

In this chapter a few standard applications of the system are defined. There are also a few example files added. These are to be found in the map: **..\KMS Fuel\Examples**

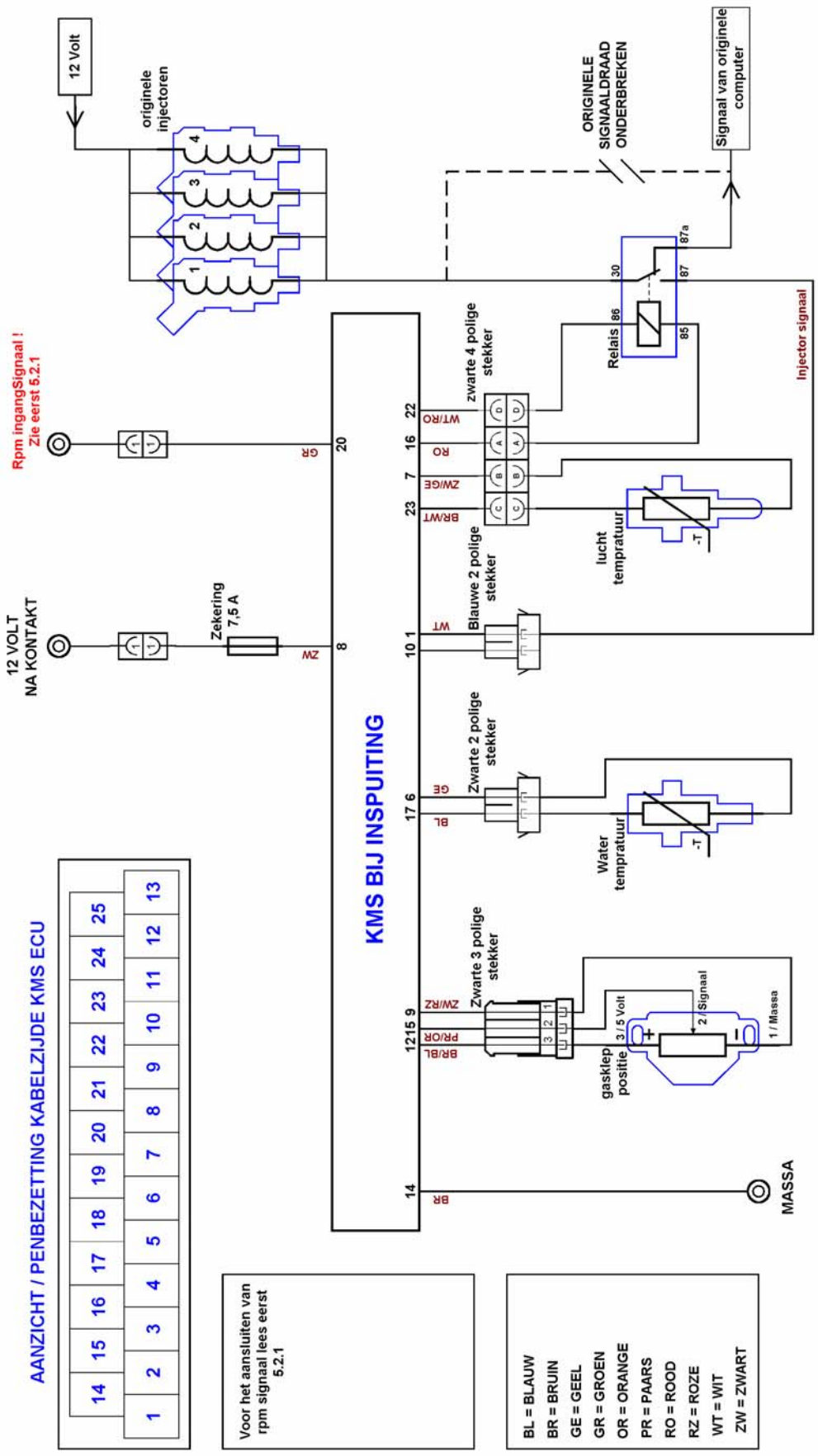
6.1.1 Normal injectionsystem for non-turbo engine (Black Box)



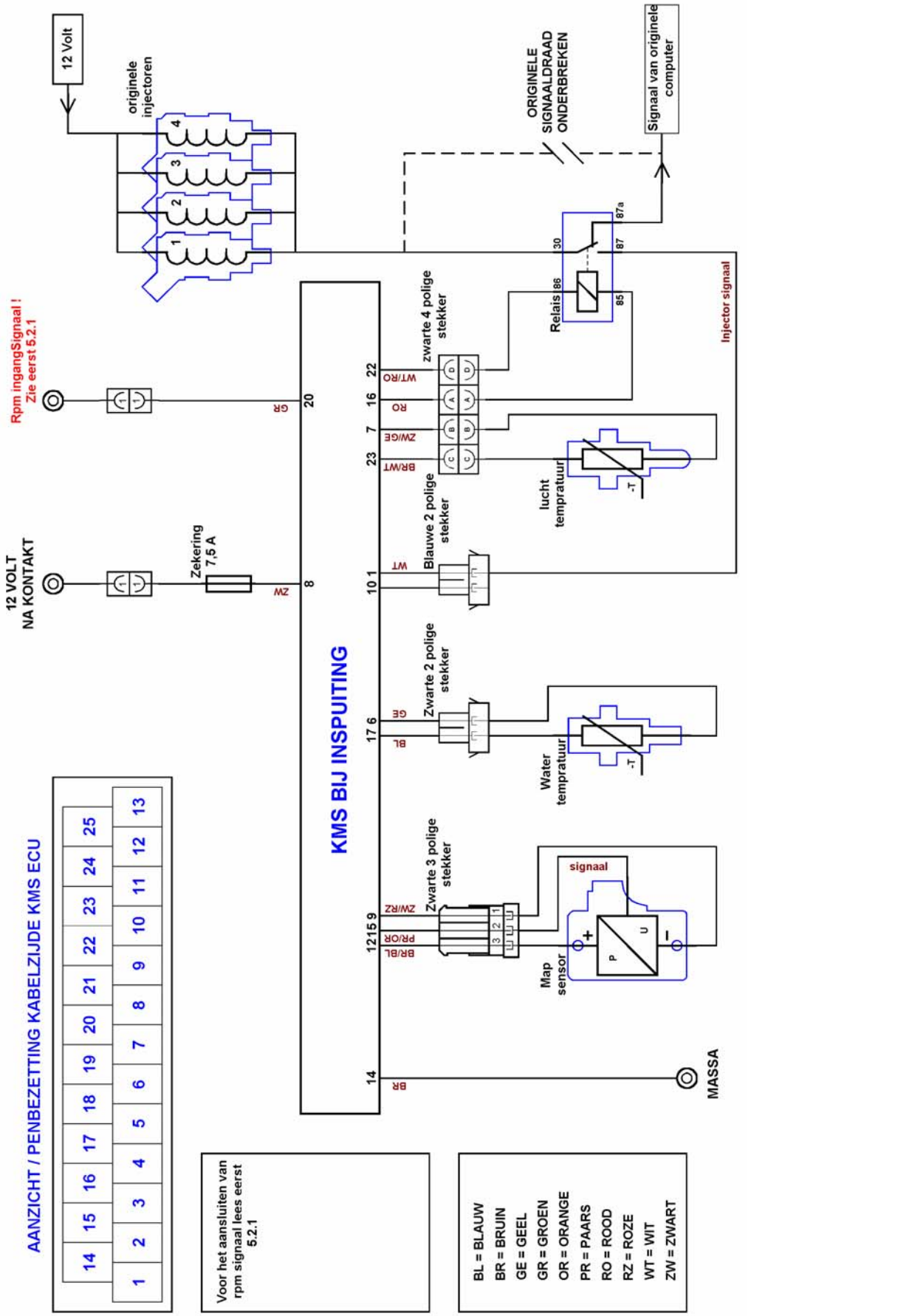
6.1.2 Normal injectionsystem for turbo engine with external pressure-sensor (Black Box)



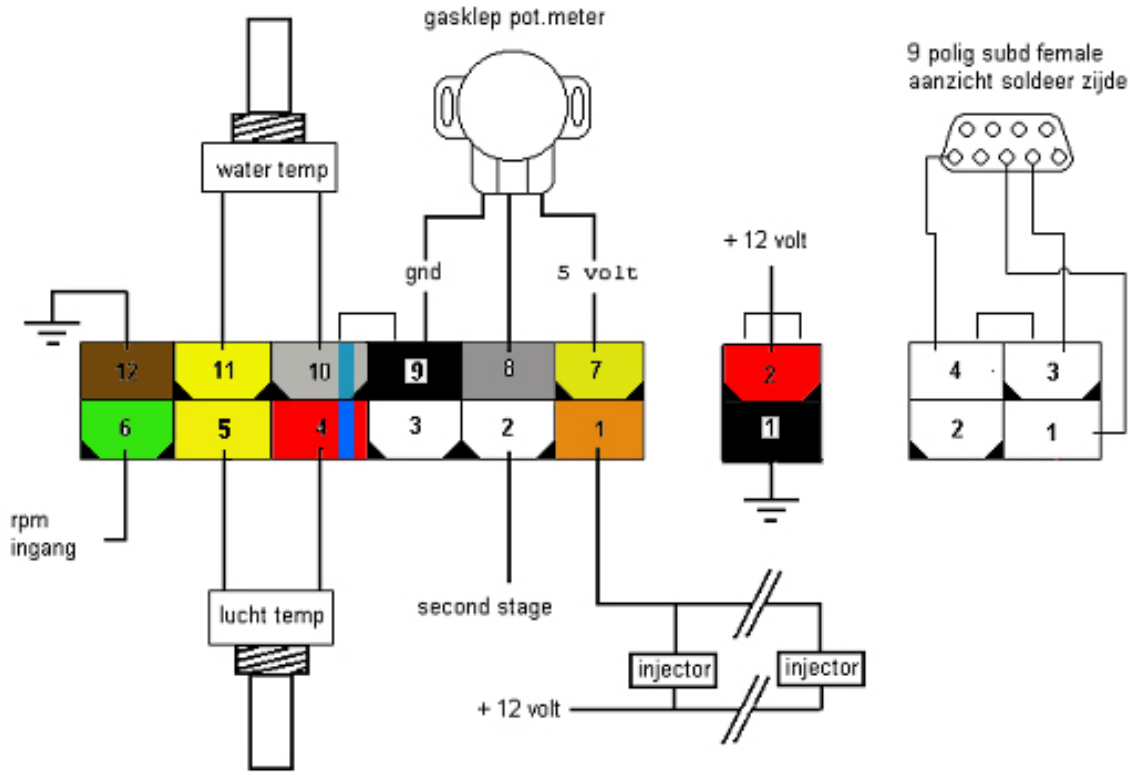
6.1.3 Extra enrichment injectionsystem for non-turbo engine (Black Box)



6.1.4 Extra enrichment injectionsystem for turbo engine with an external pressure-sensor (BB)



6.1.5 Normal injectionsystem for turbo engines and non-turbo engines (Alu Box)



7 Fault tracing

Fault	*Possible causes*	*Remedies*
No communication between PC and system	- No power supply to the system - Defective or incorrect communication cable - Cable connected to wrong COM port (standard is COM1)	- Switch the contact on or check the fuse - Use a serial 9-pole male female 1:1 cable - Connect cable to COM1 or select another COM port; see section 3.2.3.9
Engine does not start	- No engine speed signal or signal-level too low - Start-up menu settings are not correct	-Check wiring/adjust signal-level see 5.2.1. - Set duration of injection to the correct value
Poor engine starting when the engine is cold	- Engine temperature correction table not correctly set	- Set correction table correctly
Poor accelerator to engine response	- Incorrect setting of acceleration enrichment - Defective engine load sensor - Engine load sensor not calibrated	- Adjust values in throttle pump effect menu - Check whether the engine load indicated on the dashboard changes evenly when the accelerator is slowly depressed - See paragraph 3.2.3.2
Wrong engine-speed reading	- wrong value in Pulses per revolution	-see paragraph 3.2.3.1

8 Specifications

Minimum system requirements:

Windows 95,98,2000,NT,ME or XP
Internal memory 32Mb
Screen resolution 800x600
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 - 16 volts
Power consumption 50mA at 12 volts
5 volt supply to sensors can have maximally 100mA

Inputs:

Inputs are protected up to 50 volts.
toerental ingang is beveiligd tot 800 Volt en is niet geschikt voor Thyristor of MSD ontstekingssystemen

Input for coolant and air temperature is suitable for an NTC-sensor as standard.

Input for engine load is suitable for potentiometers, air mass meters and map sensors with an output between 0 and 5 volts.

Internal map sensor (optional) available in 250KPa version

Outputs:

Injector output can deliver at most 7 amps at 12 volts (for instance 6 injectors with a resistance of 16 ohms)
Second stage output: max. 1 amp at 12 volts

Dimensions and weight:

LxWxH: 110 x 60 x 23 mm
Weight including mounting bracket: approx. 0.172 kg