

<http://www.ontronic.ch>

ONTRONIC

User's manual

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1. Introduction

Ontronic is an electronic injection and ignition system. Thanks to its high-level electronic and modern control capabilities, Ontronic is especially dedicated to demanding applications.

The injection and ignition device is fully programmable as function of optimization criteria. The numerical data processing is performed by a 32 bit microprocessor, which processes all service parameters to injection and ignition data using multi-dimensional maps (climatic correction, sensors calibration, static and dynamic engine processes).

Table 1-1 shows the main characteristics of Ontronic:

Rpm range	between 60 et 25'000 rpm
Engine types	1, 2, 3, 4, 5, 6, 8, 10 or 12 cylinders 2 or 4 strokes Atmospheric or supercharged
Injection type	Sequential or non-sequential (non-sequential for 8 cylinders or more) Programmable injection advance High or low impedance injectors Between 0 and 32 ms injection duration
Ignition type	One coil per cylinder Double-ignition coils (for 2, 4, 6, 8, 10 and 12 cylinders engines) Distributed (for 1 to 6 cylinders only) Between 0 and 65° ignition advance Between 0 and 720° angular loading time
Sensors	Barometric pressure (intern) Supercharge pressure (for supercharged engines only) Throttle position Aspirated air temperature Coolant temperature Rpm sensor (crankshaft) Phase sensor (camshaft), for phased engines only Lambda (CO) Auxiliary input <i>Ontronic is compatible with all sensor types, calibrable with the operating software</i>
Operating software	Connection to Ontronic through the computer serial port (COM, RS232) Compatible Windows XP, NT, ME, 98, 95 6 three-dimensional maps 15 bi-dimensional maps Integrated data acquisition Lambda control
Reference flywheel	Between 4 and 128 teethes Additional or missing reference teeth for the top dead center (tdc) detection

Table 1-1 : Characteristics

2. Installation

2.1. Reference Flywheels

Ontronic permanently tracks the engine angular position, the revs (rotation per minute, rpm), as well as the phase of the engine (for 4 strokes phased engines exclusively).

To achieve this, two reference wheels have to be installed: one on the crankshaft (flywheel), the second one on the camshaft (for 4 strokes phased engines exclusively).

2.1.1. Reference flywheel (crankshaft)

Ontronic is compatible with an arbitrary number of teethes between 4 and 128 teeth on the crankshaft reference flywheel. As a matter of fact, a wide range of original flywheels can be conserved. Different flywheel types and sizes can be orders from <http://www.ontronic.ch>. Between 16 and 36 teethes seems a good compromise between flywheel production difficulty and engine management accuracy.

In order to identify the top dead center (tdc), an additional (or missing) reference teeth is placed at a special location on the flywheel (Figure 2-1 and next).

Ontronic is also compatible with 2-missing teethes flywheels (Sodemo type). This configuration is however not recommended.

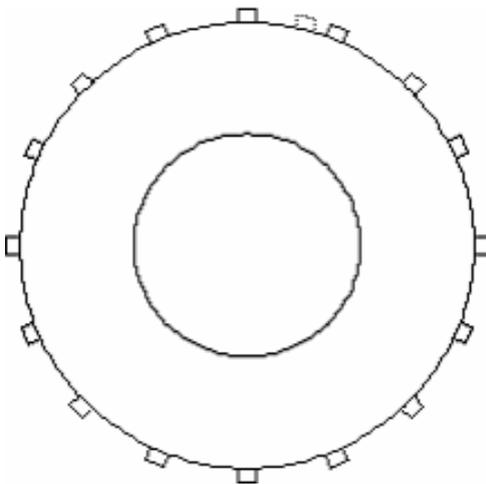


Figure 2-1 : Additional reference teeth

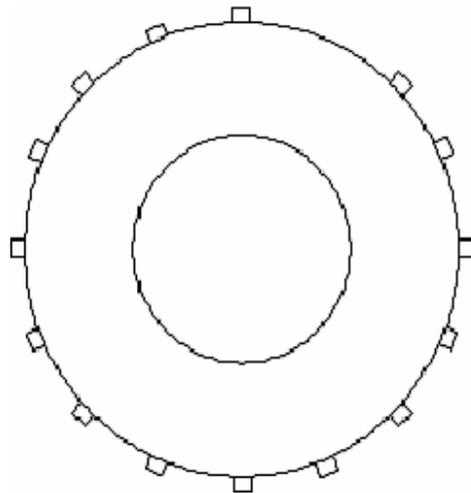


Figure 2-2 : Missing reference teeth

In order to scan the engine rotation in real-time (teethes detection and rev measurement), an inductive sensor has to be installed. The inductive sensors are standard inductive devices with 2 wires, orderable from <http://www.ontronic.ch> or in any automotive workshop. The gap between the sensor and the flywheel teethes

should be $+0.5^{+0.3}_{-0.1}$ mm (Figure 2-3). It is worse reading the technical specification for other types of inductive sensors.

The sensors and flywheel should be robustly fixed to the engine block and to the crankshaft, respectively. Any inaccurate or noisy teeth detection may result in misfiring and power decrease.

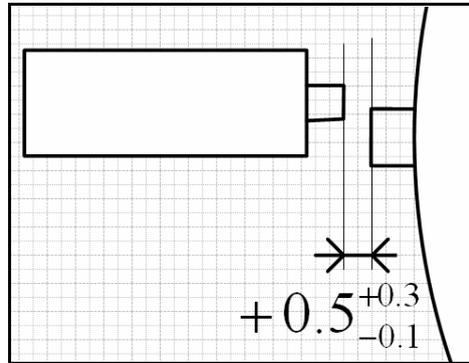


Figure 2-3 : Inductive sensor gap

Figure 2-4 shows the final installation of the reference flywheel and its sensor.

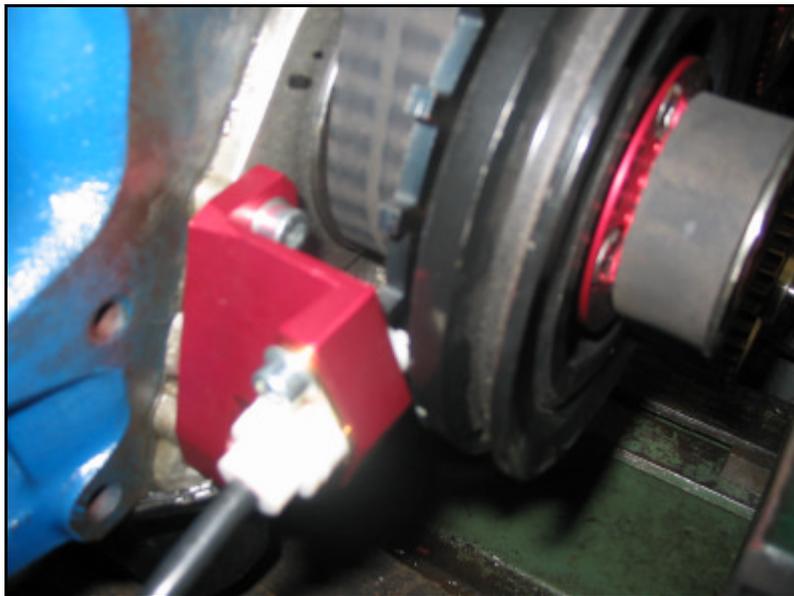


Figure 2-4: Reference flywheel and inductive sensor

The angle between the reference teeth (additional or missing) and the top dead centre of cylinder #1 is called „general offset angle“, as shown in Figure 2-6. This angle can be arbitrary chosen and programmed. It is however good to choose it as far as possible to all cylinder top dead centres. As a matter of a fact, for high compression ratio engines, the engine rotational speed (rpm) may significantly decrease in this region, leading to wrong reference teeth detection, especially at

very low rpm (e.g. during startup). It is therefore wise to shift the reference teeth far to any tdc. For 4 cylinders engines, a general offset angle of 90° is thus recommended (Figure 2-6). This value is then programmed in Ontronic (refer to chapter 3.5.1.)

2.1.2. Phase sensor (camshaft)

A phase sensor has to be installed for all phased engine on the camshaft (sequential injection)

Important :

- Engines with 8 cylinders or more require double-coils (for example: 4 double-coils for an 8 cylinders engine). Therefore, they cannot be phased
- Two strokes engines are obviously not phased

The installation of the camshaft sensor is similar to the flywheel. Figure 2-5 shows the overall installation of the reference flywheel and the phase sensor.



Figure 2-5: Installation of the phase sensor (tdc, explosion cylinder #1). Counter-clockwise rotation

Flywheel with additional reference teeth

→ Top Dead Center on cylinder #1 (explosion)

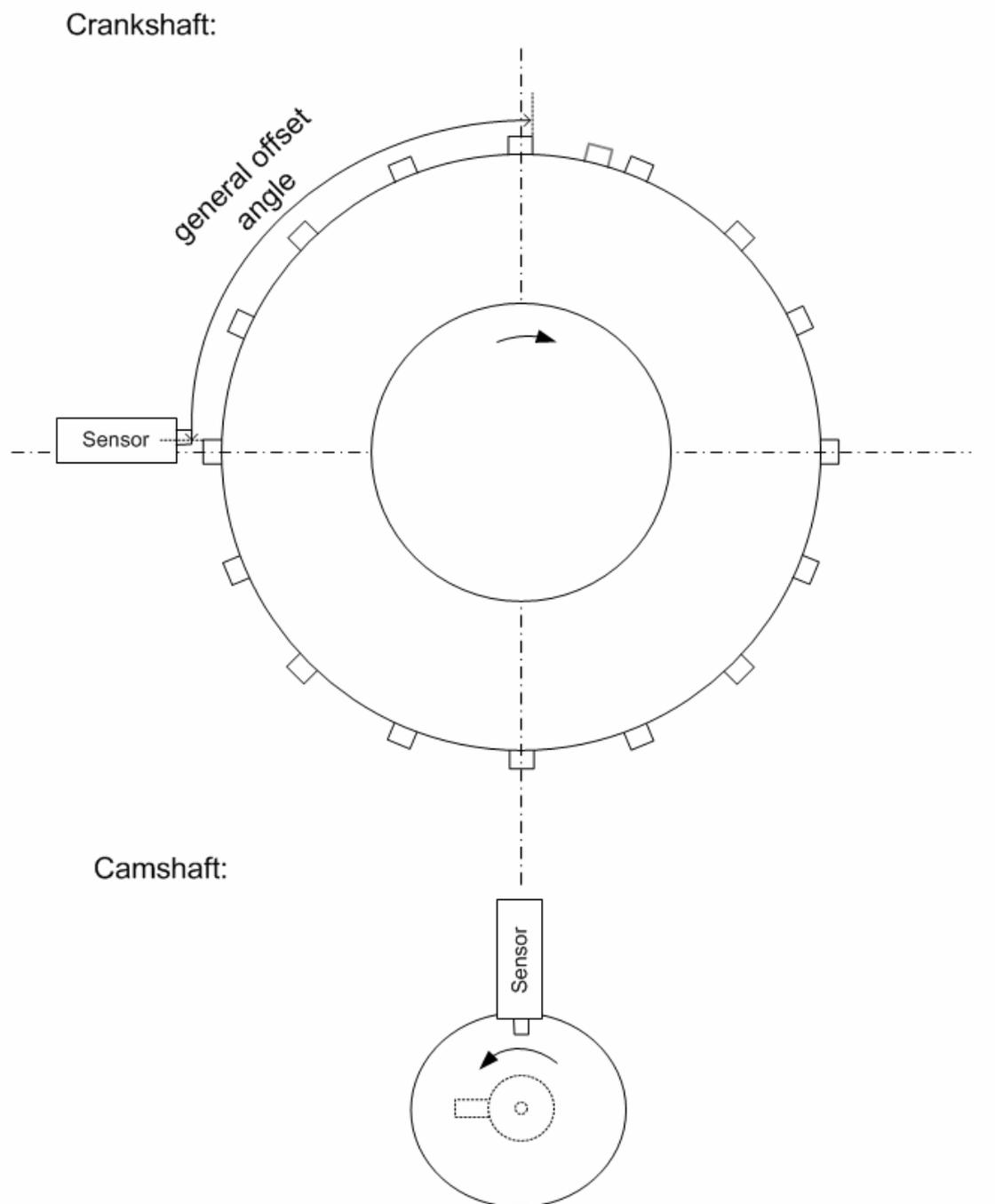


Figure 2-6 : Flywheel with additional reference teeth

Flywheel with missing reference teeth

→ Top Dead Center on cylinder #1 (explosion)

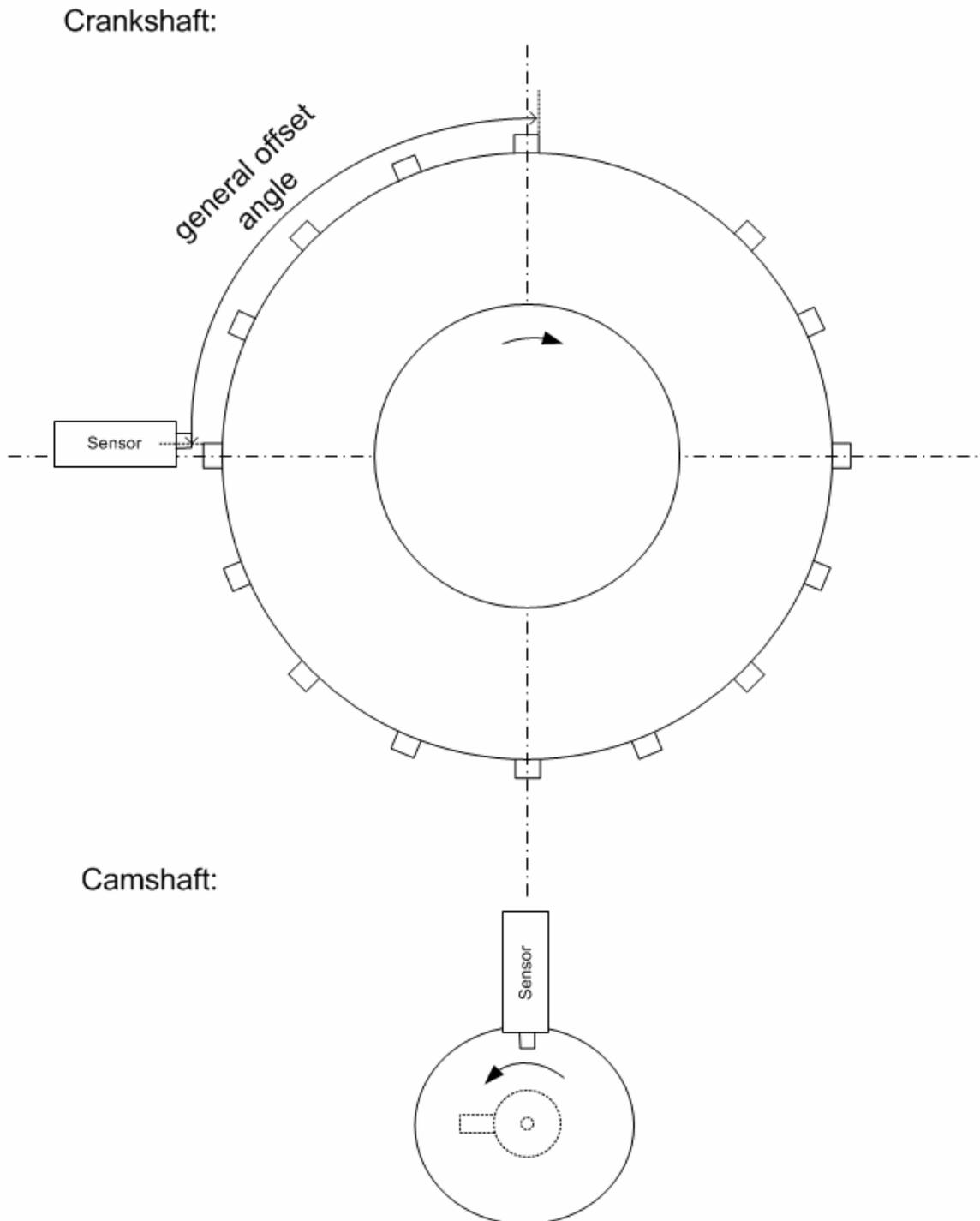


Figure 2-7 : Flywheel with missing reference teeth

2.2. Wiring

Ontronic is delivered with or without wiring cable.

The wiring and electrical connections jobs should be achieved by an experienced person. The realisation of the wiring is an important and delicate process which requires automotive electricity knowledge and experience. The wiring process is estimated to 5 hours of work. Ontronic is delivered with the electrical contacts (pins) (Figure 2-8).

The sensor plugs (Figure 2-9) are exclusively provided with sensors ordered from <http://www.ontronic.ch>.

It is recommended to weld all connections.

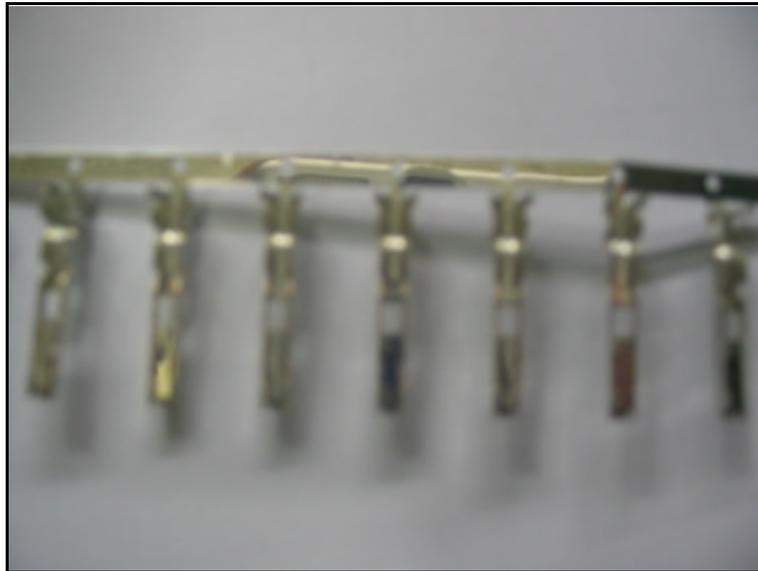


Figure 2-8: Electrical contacts (pins)



Figure 2-9: Sensor connection plug

The main electrical connector of Ontronic is divided in 3 parts: high, medium and weak currents (Figure 2-10, Figure 2-11, Figure 2-12, Figure 2-13, Figure 2-14, Figure 2-15). The connection diagram is shows in Table 2-1.

TOP

52	51	50	49	48
IGN 2 -	IGN 4 -	IGN 6 -	BIGGND	GND
1	2	3	4	5
IGN 1 -	IGN 3 -	IGN 5 -	Shield	12 V

BOTTOM

Figure 2-10: High current connector

Important:

Cylinder numbering: ignition order

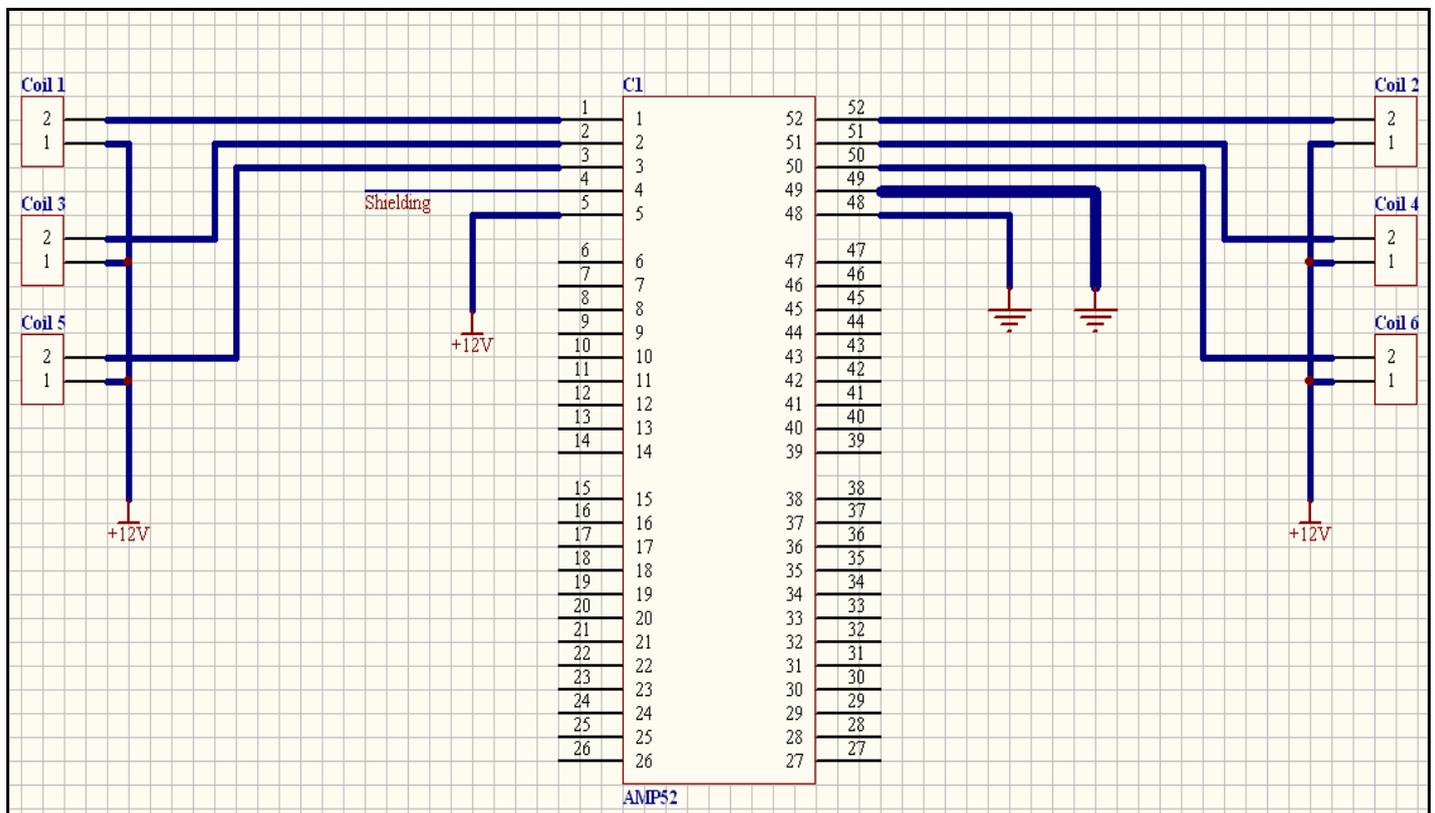


Figure 2-11: Wiring diagram of the high current connector

TOP

47	46	45	44	43	42	41	40	39
NC	INJ 2 -	INJ 2 +	INJ 4 -	INJ 4 +	INJ 6 -	INJ 6 +	INJ 8 -	INJ 8 +
6	7	8	9	10	11	12	13	14
12 V INJ	INJ 1 -	INJ 1 +	INJ 3 -	INJ 3 +	INJ 5 -	INJ 5 +	INJ 7 -	INJ 7 +

BOTTOM

Figure 2-12: Medium current connector

Important:

Cylinder numbering: ignition order

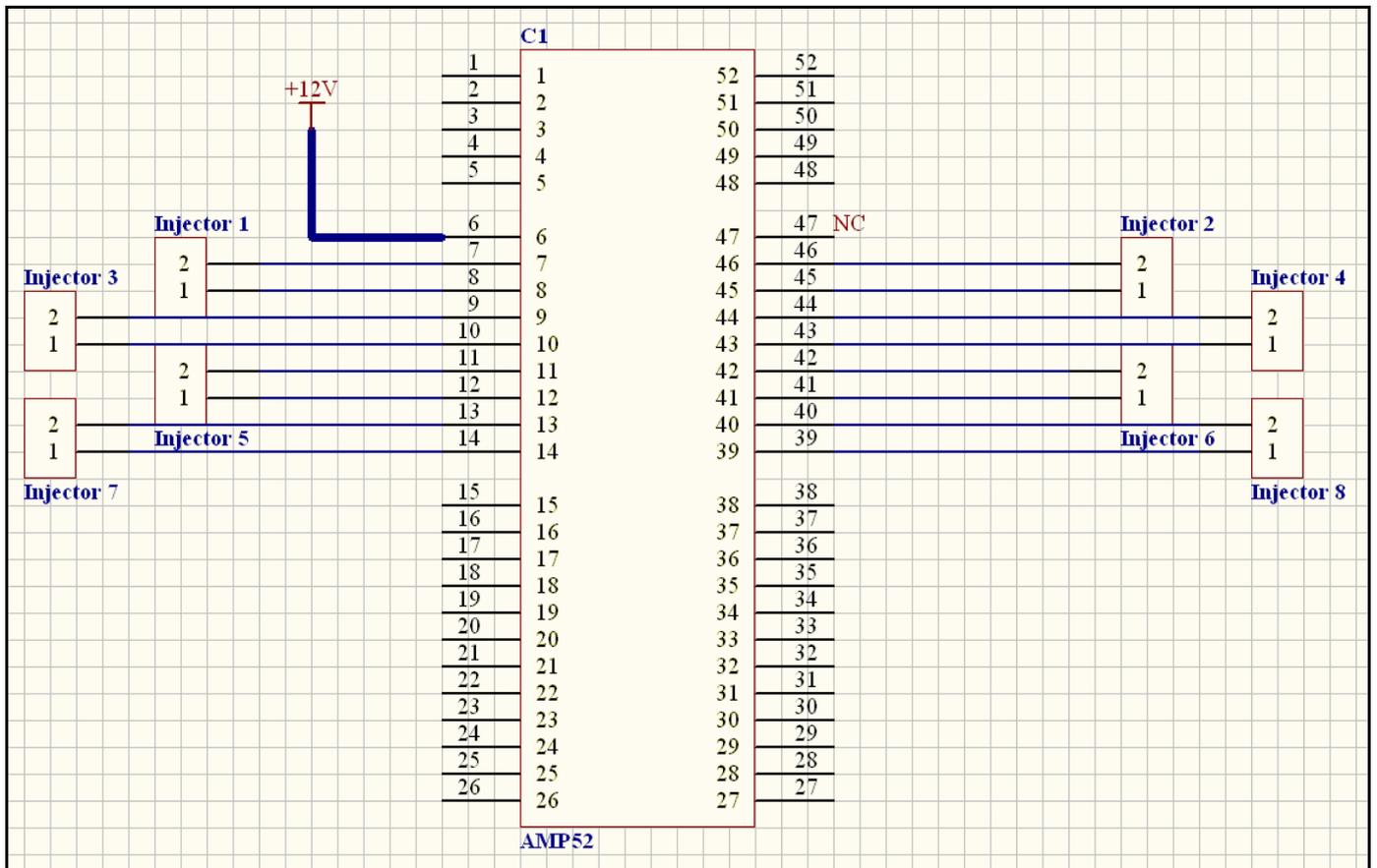


Figure 2-13: Wiring diagram of the medium current connector

TOP

38	37	36	35	34	33	32	31	30	29	28	27
Output 3	Flash light	RPM	Lambda +	Lambda -	Water +	Water -	MAP +	MAP	MAP -	CAM -	CAM
15	16	17	18	19	20	21	22	23	24	25	26
Output 1	Output 2	COM 2	COM 3	COM 5	Air +	Air -	Throttle +	Throttle	Throttle -	RPM -	RPM +

BOTTOM

Figure 2-14: Weak current connector (signals, sensors)

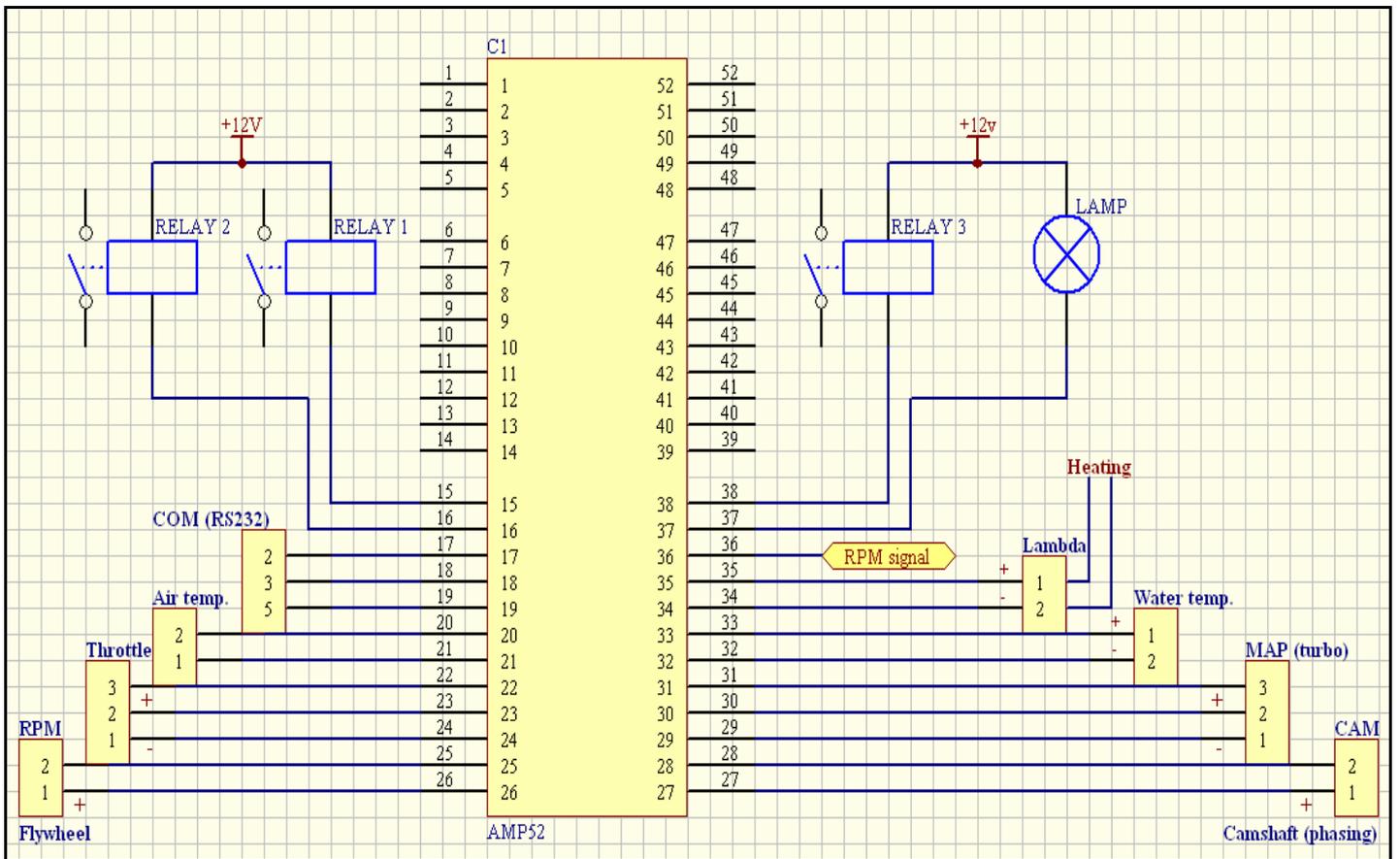


Figure 2-15: Wiring diagram of the weak current connector

Pin	Description	Type	Estimated current [A]	Wire cross-section [mm ²]
1	Coil 1	Output	10	2.50
2	Coil 3	Output	10	2.50
3	Coil 5	Output	10	2.50
4	Ground output (shielding)	Output	0	1.50
5	Ontronic power supply +12V	Input	2	1.50
6	Injectors power supply +12V	Input	20	4.00
7	Injector 1 -	Output	3	1.50
8	Injector 1 +	Output	3	1.50
9	Injector 3 -	Output	3	1.50
10	Injector 3 +	Output	3	1.50
11	Injector 5 -	Output	3	1.50
12	Injector 5 +	Output	3	1.50
13	Injector 7 -	Output	3	1.50
14	Injector 7 +	Output	3	1.50
15	External system 1 -	Output	1	1.50
16	External system 2 -	Output	1	1.50
17	Serial connection (2)	Input / Output	0	1.50
18	Serial connection (3)	Input / Output	0	1.50
19	Serial connection (5)	Input / Output	0	1.50
20	Aspirated air temperature sensor +	Input	0	1.50
21	Aspirated air temperature sensor +	Input	0	1.50
22	Throttle position sensor (+ 5V)	Output	0	1.50
23	Throttle position sensor (signal)	Output	0	1.50
24	Throttle position sensor (ground 0V)	Input	0	1.50
25	Crankshaft inductive sensor -	Input	0	1.50
26	Crankshaft inductive sensor +	Input	0	1.50
27	Camshaft inductive sensor (phase) +	Input	0	1.50
28	Camshaft inductive sensor (phase) -	Input	0	1.50
29	Turbo pressure sensor (ground)	Output	0	1.50
30	Turbo pressure sensor (signal)	Input	0	1.50
31	Turbo pressure sensor (+5V)	Output	0	1.50
32	Coolant temperature sensor -	Input	0	1.50
33	Coolant temperature sensor +	Input	0	1.50
34	Lambda sensor signal -	Input	0	1.50
35	Lambda sensor signal +	Input	0	1.50
36	Rpm signal (1 signal / cycle)	Output	1	1.50
37	Gear lamp	Output	1	1.50
38	External system 3 -	Output	1	1.50
39	Injector 8 +	Output	3	1.50
40	Injector 8 -	Output	3	1.50
41	Injector 6 +	Output	3	1.50
42	Injector 6 -	Output	3	1.50
43	Injector 4 +	Output	3	1.50
44	Injector 4 -	Output	3	1.50
45	Injector 2 +	Output	3	1.50

46	Injector 2 -	Output	3	1.50
47	Not connected			
48	Ontronic ground (+0V)	Input	2	1.50
49	Injectors and coils ground (+0V)	Input	30	6.00
50	Coil 6	Output	10	2.50
51	Coil 4	Output	10	2.50
52	Coil 2	Output	10	2.50

Table 2-1: Connector wiring and electrical characteristics

3. Operating software

3.1. Installation and Configuration

Ontronic is delivered with an installation CD containing the exclusive operating software. The software is compatible with the following Microsoft® operating systems:

- Windows XP
- Windows NT (SP1+)
- Windows 98
- Windows 95.

The latest update of the software can be freely downloaded from the internet site <http://www.ontronic.ch>. Software updates are released regularly. The following hardware configuration is recommended (Table 3-1):

Operating system	Windows XP
Processor	Pentium III 1000 MHz or above
Memory	128 Mb or above
Ports	1x Serial (COM), or USB
Screen	15"

Table 3-1 : Recommended hardware configuration

The Ontronic operating software is to be installed by double-clicking on „setup.exe” from the installation CD. Then simply follow the standard installation instructions.

3.2. Functions

The Ontronic operating software is used for the following functions:

- Engine configuration (cylinders, cutoffs etc.)
- Sensors calibration



- Correction factors
- Injection and ignition tuning

All those process parameters are grouped in an entity (object) called „**eprom**“, as an analogy to the first generation of electronic injection systems where all parameters were stored in an eprom .

Physically, Ontronic does not feature an internal eprom, but a „flash memory“ (electrically erasable memory), as well as a fast memory SRAM for emulation purposes (see chapter 3.4.5. *Emulation mode*).

In emulation mode, all engine parameters can be updated and modified online, as the engine is operating (dynamometer, road).

Once satisfied with the settings, the flash memory can be written. The tuning functions are described in chapter 3.5. .

3.3. Serial connection to Ontronic

The connection (dialog) between Ontronic and the computer is ensured by a standard serial data cable to be connected in a computer serial port (COM, RS232), on which the operating software has been previously installed.

Use preferably the COM port number 1 (COM #1). Different ports can be activated using the Ontronic operating software. In case the computer does not feature any serial port, Ontronic can also be connected to an USB port using a dedicated COM-USB interface. Such interfaces can be ordered online from <http://www.ontronic.ch>.

The connection cable should respect the wiring diagram.

3.4. Overview of the operating software (management program)

3.4.1. Program Startup

Once Ontronic is connected as described in chapter 2, the computer can be connected to Ontronic using a standard serial cable. Then start the Ontronic operating software from the Windows menu „start“ (Figure 3-1).



Figure 3-1 : Windows start menu

Once the software has started, the main Ontronic window opens. The main basic functions and tools are shown in Figure 3-2.

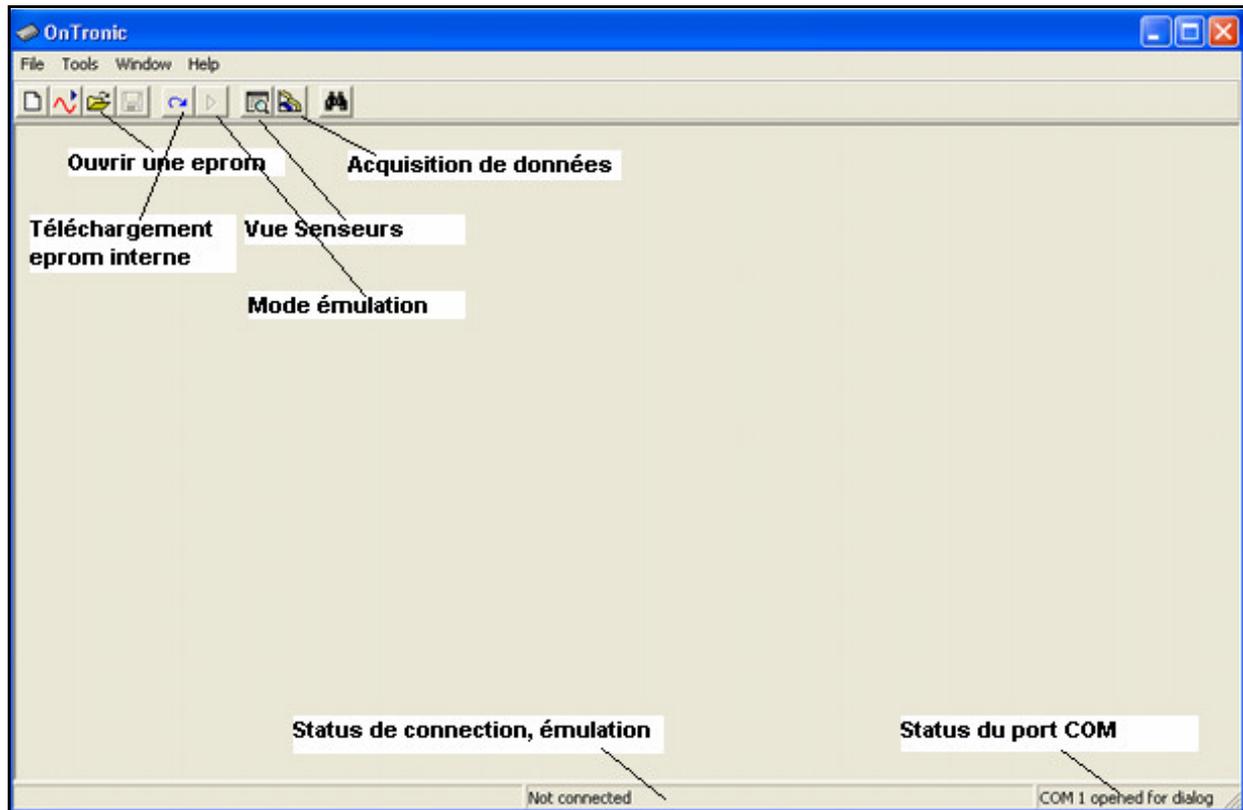


Figure 3-2 : Ontronic main window

When Ontronic is not connected (e.g. no data flow to the computer), the message „not connected“ appears in the task bar, at the bottom of the main window (connection status, emulation). When Ontronic is connected, the message „connected“ appears. This means that the computer receives the data flow from Ontronic. If the „connected“ message does not appear after having powered on, disconnected Ontronic immediately and check for the following issues:

1. Was the wiring of Ontronic performed correctly?
2. Is the power supply in accordance to the diagrams of chapter 2.2. , with ground and +12V ?
3. Was the serial connection cable (COM) performed and connected correctly?
4. Is the computer serial port (COM) available and opened?

All Ontronic devices are systematically tested before shipment. Check meticulously the 4 points mentioned above before contacting our technical support.

3.4.2. Sensors Window

The different real-time process parameters, the sensor values, and other parameters can be displayed at any time by opening the „sensors” window, as shown in Figure 3-3.

The window opens with all engine parameters. The descriptions of all parameters are presented in Table 3-2.

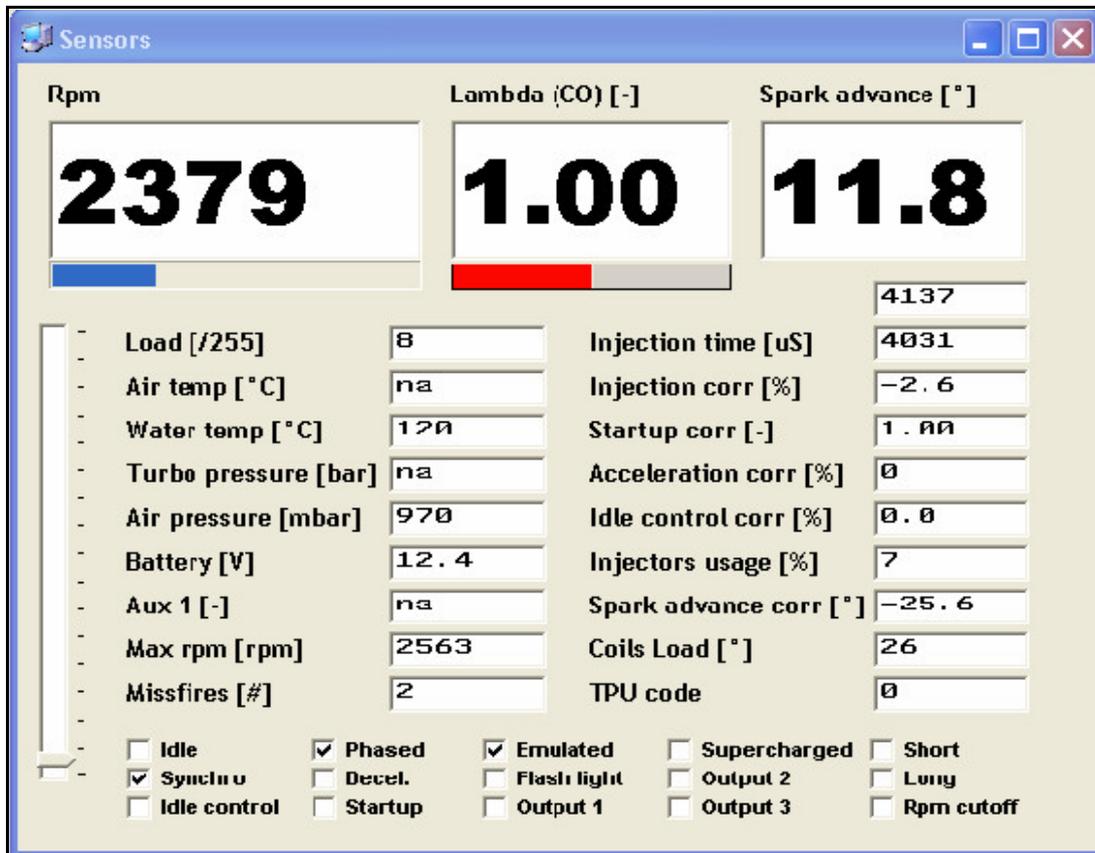


Figure 3-3: Sensor's window

Parameter	Description
rpm	Engine rotational speed, rotations per minutes [rpm]
Lambda	Air/fuel ratio (lambda, CO)
Ignition advance	Ignition advance [°]
Load	Engine load (throttle position or turbo pressure) [/255]
Air temp	Aspirated air temperature [°C]
Water temp	Coolant temperature [°C]
Turbo pressure	Turbo pressure [mbara]
Air pressure	Barometric pressure [mbara]
Battery	Battery tension [V]
Aux 1	Auxiliary sensor [-]
Max rpm	Maximum rpm [rpm]
Missfire	Number of missfires
Injection time	Injection duration per cycle [uS]
Injection corr	Injection correction [%]

Startup corr	Startup injection correction [%]
Acceleration corr	Acceleration correction (dynamic operation) [%]
Idle control corr	Injection correction for Idle control [%]
Injector usage	Injector usage [%]
Ign. advance corr	Ignition advance correction [%]
Coils load	Coils load [°]
TPU code	Reserved
Idle	Engine stopped
Synchro	Engine synchronized (flywheel)
Idle control	Idle control activated
Phased	Engine phased
Deceleration	Engine decelerating (injectors are closed)
Startup	Startup
Emulated	Emulation mode activated
Flash light	Gear lamp (flash light)
Output 1	Output 1 activated
Supercharged	Supercharged engine
Output 2	Output 2 activated
Output 3	Output 3 activated
Short	Reserved
Long	Reserved
Rpm cutoff	Rpm cutoff [rpm]

Table 3-2: Description of the parameters in the sensors window

3.4.3. Data acquisition

All data received from Ontronic are permanently stored in the operating software memory (Figure 3-4). The memory capacity reaches about 6 hours. All this data can subsequently be visualized and analysed by opening the „data acquisition” window, as shown in Figure 3-2.

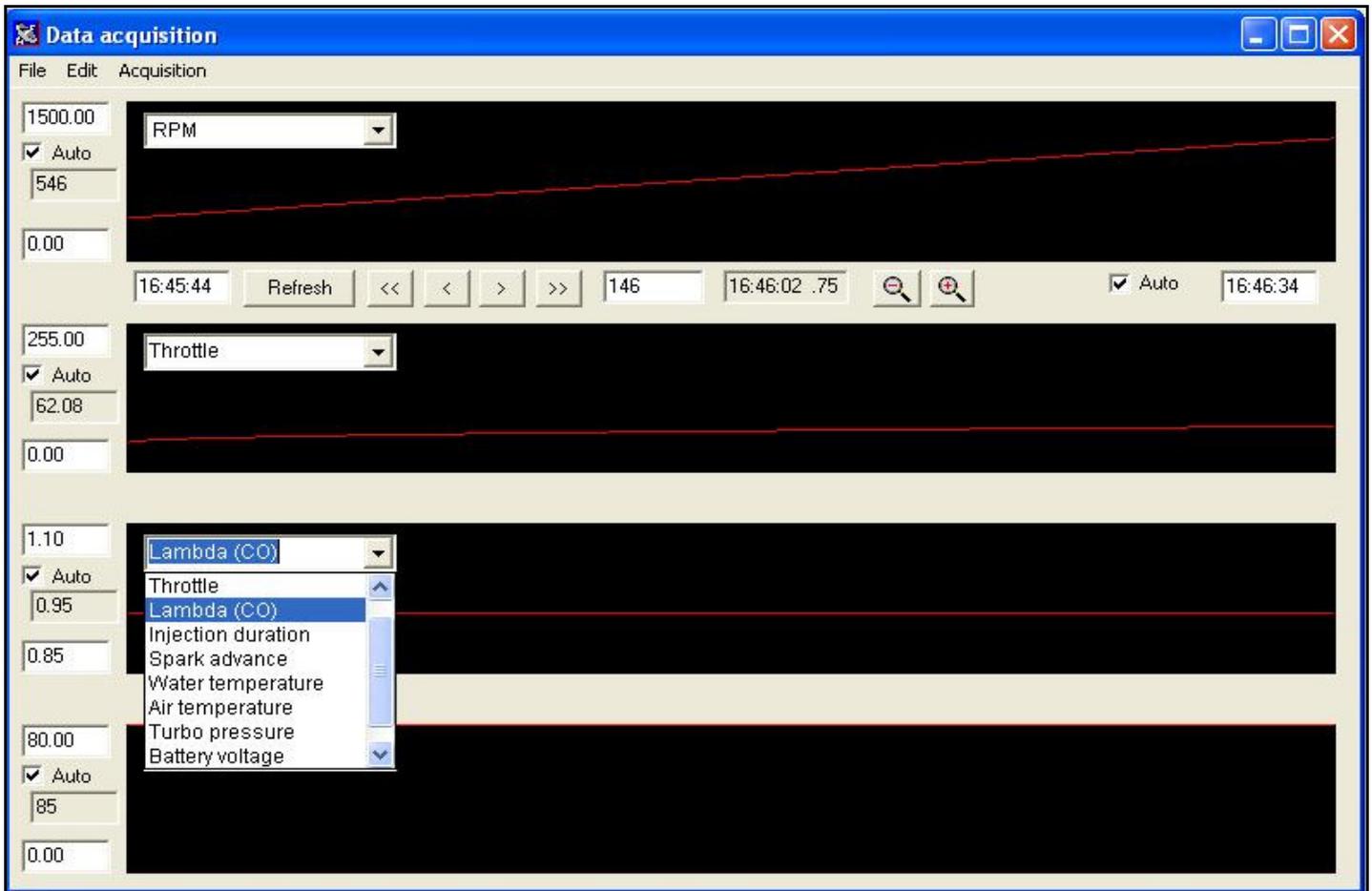


Figure 3-4: Data acquisition

3.4.4. Opening / Downloading an eprom code

An eprom object file can be opened, even if Ontronic is not connected to the computer. An eprom file includes all the engine parameters (cutoffs, three-dimensional and two-dimensional maps, correction and calibration graphs) (Figure 3-5).

The Ontronic software being highly flexible, it is possible to open an infinite number of eprom codes at the same time. It is recommended to begin any tuning with an already existing eprom file (having more or less the same characteristics: power, rpm, cylinders etc). A large number of eprom files are available on the installation CD (\eprom directory). In addition, several eprom codes are distributed freely by the user's community on <http://www.ontronic.ch>. The default eprom code which is pre-programmed in the Ontronic flash memory, reflects a 4 cylinders, 2000 cm³, with a power of about 250 CV.

The internal eprom code can be downloaded by clicking on the „download” button, as shown in Figure 3-2. The download time is about 4 seconds.

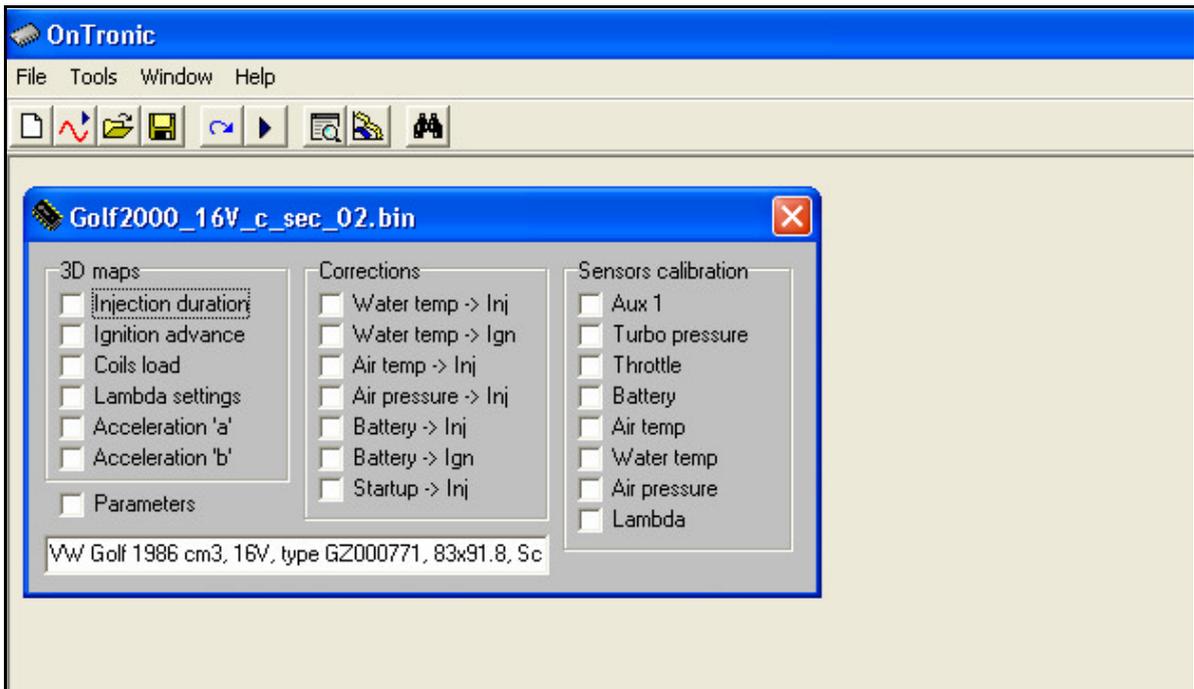


Figure 3-5: Eprom object

Name	Parameter	Type
Injection duration	Injection duration	3D
Ignition advance	Ignition advance	3D
Coils load	Coild load (angle)	3D
Lambda settings	Lambda	3D
Acceleration 'a'	Acceleration 'a' (3.5.5. Dynamic compensation (acceleration pump))	3D
Acceleration 'b'	Acceleration 'b' (3.5.5. Dynamic compensation (acceleration pump))	3D
Parameters	Engine parameters	Numeric
Water temp->inj	Injection correction as function of the coolant temperature	2D
Water temp->ign	Ignition correction as function of the coolant temperature	2D
Air temp->inj	Injection correction as function of the aspirated air temperature	2D
Air pressure->inj	Injection correction as function of the barometric pressure	2D
Battery->Inj	Injection correction as function of the battery tension	2D
Battery->Ign	Ignition correction as function of the battery tension (load angle)	2D
Startup->Inj	Injection startup correction	2D
Aux 1	Auxiliary sensor calibration	2D
Turbo pressure	Turbo pressure sensor calibration	2D
Throttle	Throttle sensor calibration	2D
Battery	Battery tension calibration	2D
Air temp	Aspirated air temperature sensor calibration	2D
Water temp	Coolant temperature sensor calibration	2D
Air pressure	Barometric pressure sensor calibration (internal sensor)	2D
Lambda	Lambda sensor calibration (CO)	2D

Table 3-3 : Eprom file content

3.4.5. Emulation mode

In emulation mode, the eeprom code is sent to the fast memory (SRAM) of Ontronic. In this mode, each modification performed on the maps and in the engine parameters are updated instantaneously in Ontronic. The new settings are therefore immediately available on the engine, even during operation. This mode is used to tune an engine in real time (on dynamometer or on the road), as well as to calibrate the sensors. Emulation mode is activated (or deactivated) by clicking on the „Tools/Emulation” menu, or by clicking on the button „emulation” (Figure 3-2).

If the power supply is interrupted during emulation, Ontronic will restart in normal mode, using the latest settings of the internal Flash memory. It is then required to re-enter emulation.

In emulation mode, the current positions read by Ontronic on the maps are displayed by a white cross. This allows the engine developer to easily figure out which points need to be modified (Figure 3-6).

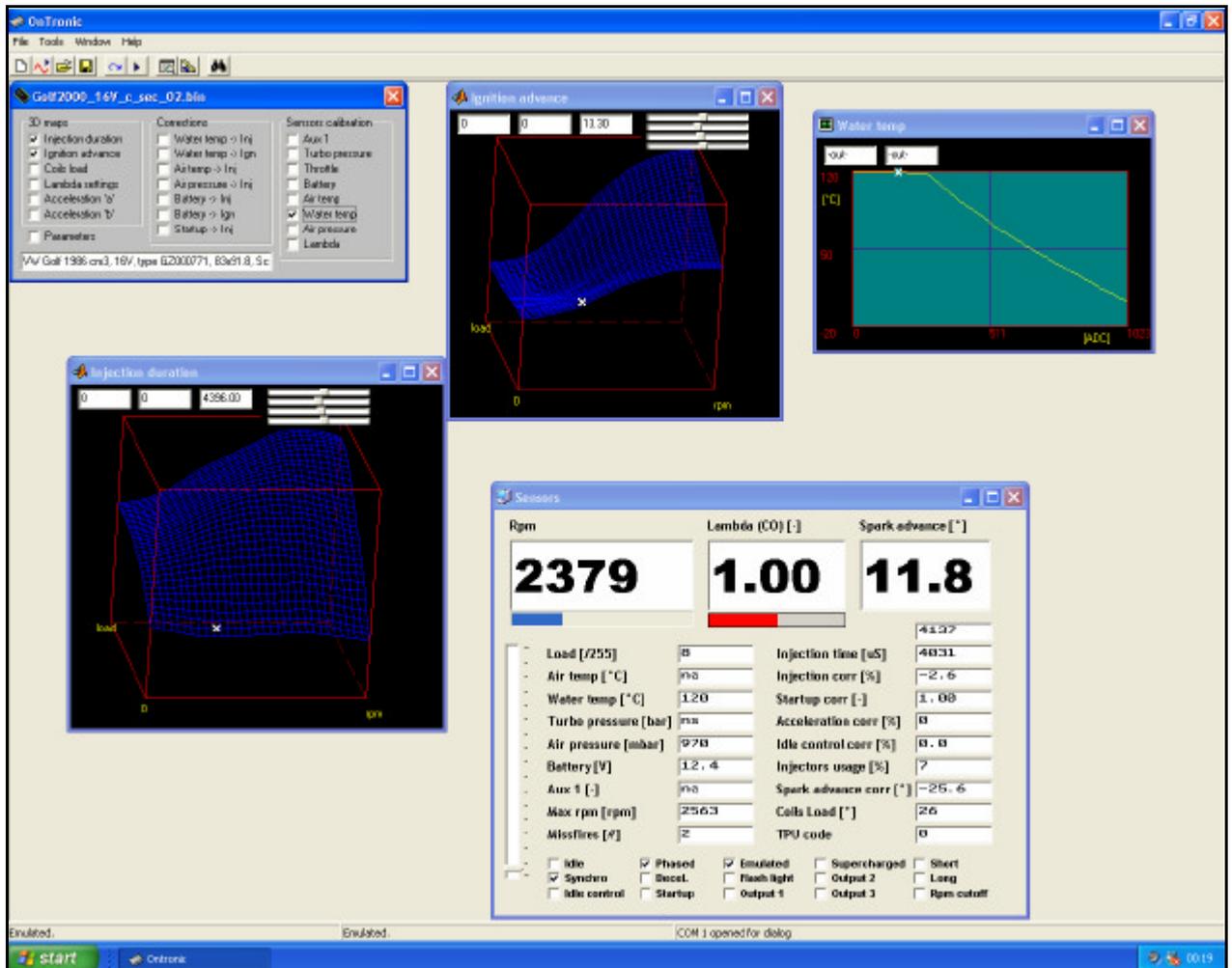


Figure 3-6: Emulation mode

3.4.6. Flash programming

Once satisfied with the engine settings, the emulated eprom code has to be programmed in the flash memory of Ontronic. Data retention is then ensured. To program the flash memory, use the option „Tools / Program Flash / Ok“.

After each flash programming, it is worse verifying the flash content. To do this:

- Quit emulation mode („Tools/Emulation Mode“)
- Compare the virtual eprom code of the computer with the internal flash content („Tools/Compare to internal code“)

3.5. Tuning

3.5.1. Engine configuration

Prior to any engine startup, the general engine parameters need to be defined. The general engine parameters window comprises all basis engine parameters (number of cylinders, number of coils, flywheel configuration, cutoff etc). To do this, click on „parameters” from the main eprom code window. The general engine parameters window opens (Figure 3-7).

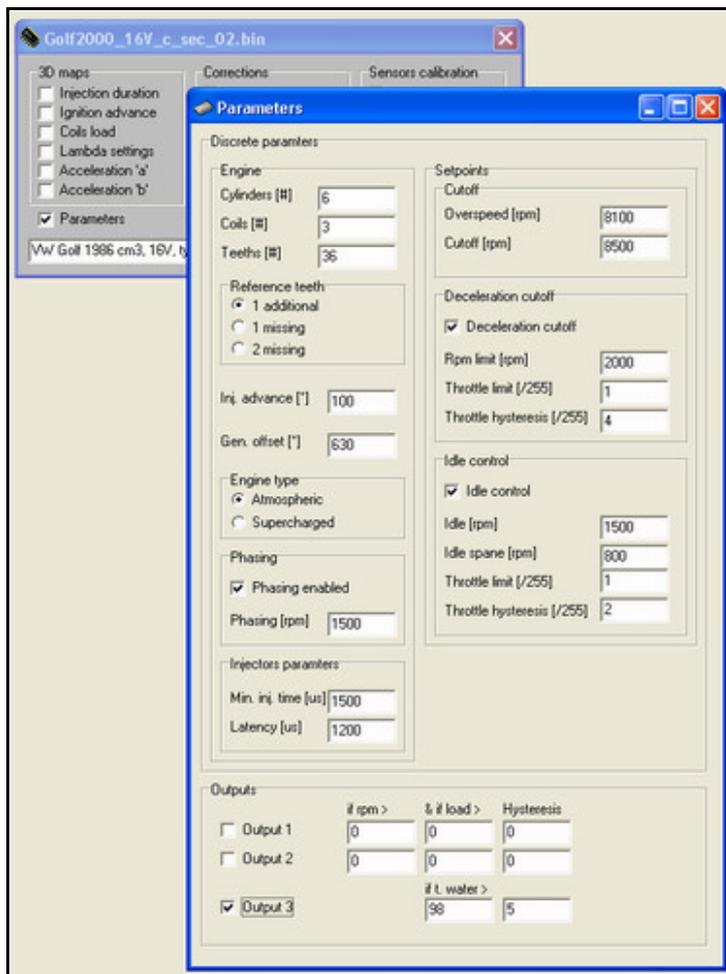


Figure 3-7 : General engine parameters window

The following parameters need to be defined (see below). After having changed any numerical data, the data need to be validated by pressing the „return” or „enter” key on the keyboard, in order to prevent any intermediate garbage data to be sent while typing the new value (for example while changing the cutoff).

General engine parameters:

- **Cylinders [#]**
Number of cylinders (1..12)
Default value: 4

- **Coils [#]**
Number of coils

When using double-coils, this value is the cylinder number divided by 2.
For single coil engine (distributed ignition), this value is the number of cylinders. In this configuration, the coil wires (ign 1...6) have to be connected together on the single coil, each connections loading the coil for a specific cylinder. This limits therefore the number of cylinders to 6 for single coil.
Moreover, the engine needs to be always phased (see „phasing [rpm]“ below).
Default value: 4

- **Reference teeth**
Type of reference teeth for tdc detection, refer to chapter 2.1.1.
Default value: additional

- **Injection advance [°]**
Injection advance (injection calibration). Angle at which the injector opens (cylinder specific).
Default value: 100°

- **General offset [°]**
General offset angle, tdc relative to the teeth just after the reference teeth (additional or missing), refer to chapter 2.1.1.
This angle can be arbitrary chosen and programmed. It is however useful to choose it as far as possible from any cylinder top dead centers. As a matter of a fact, high compression ratio engines see their engine rotation speed significantly decreasing in this region, leading to wrong reference teeth detection, especially at very low revs (e.g. during startup). It is therefore recommended to shift the reference teeth far from any tdc. For 4 cylinders engines, a general offset angle of 90° is suggested (Figure 2-6).
Default value: 90°

- **Engine type**
Engine type, atmospheric or supercharged. The „load“ criterion is defined as the throttle position for atmospheric engines, or as the turbo pressure for supercharged engines.
Default value: atmospheric

- **Phasing enabled**

Engine phasing. Ontronic features a special procedure to accommodate for quick and efficient engine startup. During startup, engine phasing can be disabled. Engine synchronization is therefore achieved after only one crankshaft rotation instead of 4 if Ontronic should wait for the camshaft signal (phase sensor). This allows for efficient startup at very low rpm.

For engines with 8 cylinders or more, this option shall not be activated, since double-coils are used.

For distributed ignition with only 1 coil, this option should be activated and „phasing [rpm]” set to 0 (see „phasing [rpm] below).

Default value: activated

- **Phasing [rpm]**

Rpm where Ontronic enters phasing. The injectors will then open and close only 1 time per cycle (720° crankshaft). This value corresponds to the rpm where it is absolutely sure that engine has started.

Default value: 700 rpm

- **Minimum injection time [us]**

Minimal allowable injection time in microseconds [us].

Refer to the injectors' technical documentation. Generally, this value is between 1200 and 1500 us.

Default value: 1500 us

- **Latency [us]**

Injector latency in microseconds [us]. Refer to the injectors' technical documentation. Generally, this value is between 800 and 1200 us.

Default value: 800 us

- **Overspeed [rpm]**

Threshold rpm where the gear lamp flashes (flash light).

Default value: 8100 rpm

- **Cutoff [rpm]**

Cutoff rpm. Rpm at which Ontronic cuts injection to prevent exceeding this limit.

Default value: 8500 rpm

- **Deceleration cutoff**

Deceleration cutoff. This function allows the activation of the total closure of the injectors when the throttle is closed, as long as engine rpm exceed a defined limit. This economy measure is useful when the car is going down hill and where no motional power is needed. Activating this function prevents undesired high fuel ratio combustion. If rpm decreases below „rpm limit”, the injection is re-activated (see „rpm limit [rpm]”).

Default value: activated

- **Rpm limit**
Threshold rpm where deceleration cutoff is deactivated.
If rpm decreases below this limit, the injection is re-activated (see „deceleration cutoff“).
Default value: 3000 rpm
- **Throttle limit [/255]**
Throttle position where deceleration cutoff is activated.
Default value: 1
- **Throttle hysteresis [/255]**
Deceleration cutoff throttle position hysteresis. Injection is re-activated if the throttle position exceeds „throttle limit“ + „throttle hysteresis“. This prevents any sporadic cutoff activation/deactivation effects.
Default value: 4
- **Idle control**
Idle control. Idle rpm is controlled by reducing the injection time and reducing ignition advance if the engine rpm exceeds „idle rpm“ and if the throttle position remains below defined limits.
This helps maintaining the idle rpm within acceptable limits.
Default value: activated
- **Idle rpm**
Threshold rpm at which idle control is activated, if the throttle position is below „throttle limit“.
Default value: 1500 rpm
- **Idle span [rpm]**
Rpm span (rpm window) where idle is controlled. Rpm is maintained between „idle rpm“ and „idle rpm“ + „idle span“. From that limit, the injection duration and ignition advance are progressively decreased.
Default value: 800 rpm
- **Throttle limit**
Threshold throttle position where idle control is activated.
Default value: 1
- **Throttle hysteresis**
Throttle hysteresis value for idle control. Idle control is deactivated when the throttle position exceeds „throttle limit“ + „throttle hysteresis“. This prevents any sporadic activation/deactivation effects.
Default value: 2

- **Output 1**
External controller.
When rpm and load (throttle position / boost pressure) exceeds the programmed values, a signal is activated on „output #1” (Figure 2-14). A relay can be activated to activate external systems, for example a water injection pump.
Default value: Deactivated

- **Output 2**
External controller.
When rpm and load (throttle position / boost pressure) exceeds the programmed values, a signal is activated on „output #2” (Figure 2-14). A relay can be activated to activate external systems, for example a water injection pump.
Default value: Deactivated

- **Output 3**
External controller.
When the coolant temperature exceeds the programmed value, a signal is activated on output #3 (Figure 2-14). A relay can be activated to activate external systems, for example a fan.
Default value: Activated

3.5.2. Sensor calibration

The different sensors are to be calibrated. Each sensor has its own specific calibration curve within an eeprom object (Figure 3-8).

The default calibrations correspond to the sensors delivered with Ontronic (<http://www.ontronic.ch>).

If a different type of sensor is utilized, it is required to calibrate them using the corresponding calibration curve. It may also be that some sensors deviate from their generic characteristics. In such a case, some corrections may be required.

It is recommended to enter emulation mode in order to calibrate a sensor (3.4.5.).

In this mode, the values read by Ontronic are displayed in real time by a white cross on all graphs and maps. It is thus easy to adjust the curve for different input values (e.g. temperature, pressure, position etc.).

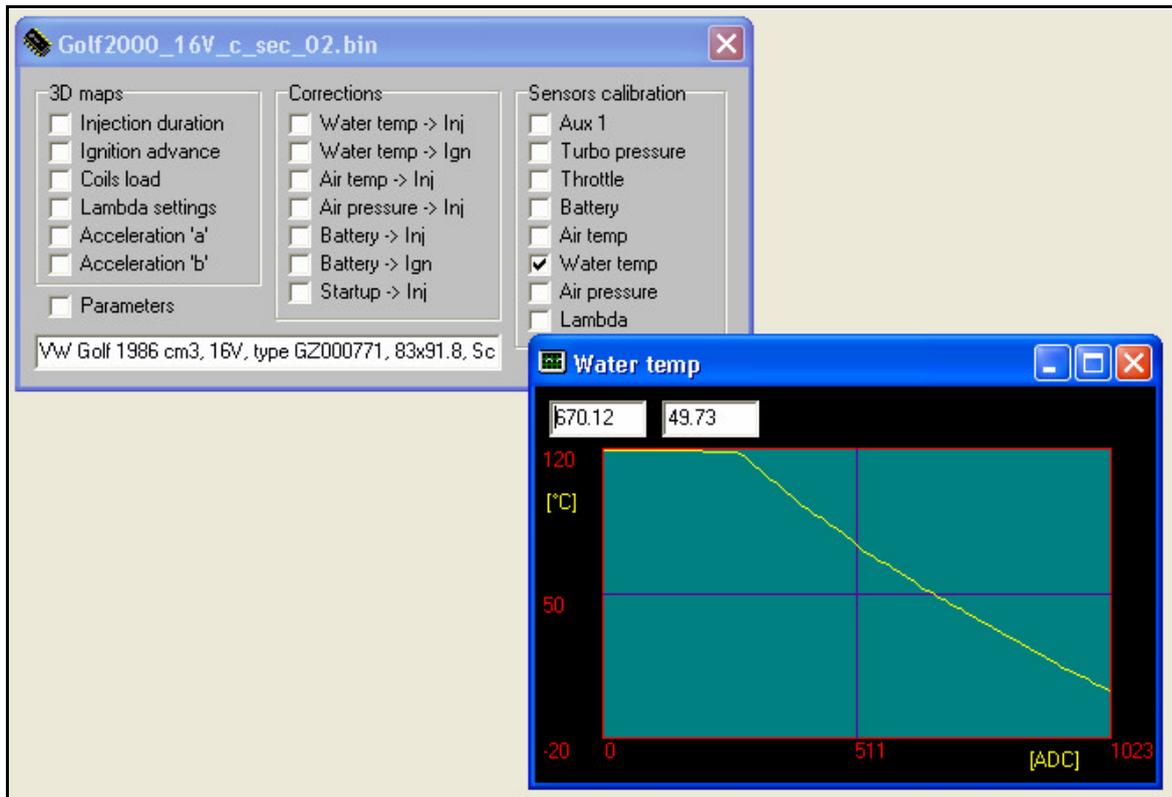


Figure 3-8 : Sensor specific calibration curve

Each sensor (temperature, pressure, tension, position) returns a the actual operating position on the [ADC] axis (Analog to Digital Converter). This specific point can then be adjusted accordingly (Y-axis). The settings are performed using:

- The keyboard arrows (right / left) to move along the curve
- The mouse to select a target point
- The keyboard function keys F1-F4 to increase the value(s), and F5-F8 to decrease the value(s).
- With the „Edit” menu where several useful amplification (relative or absolute), reset, smoothing (CTRL-A) and interpolation functions are available.

As for throttle calibration, a special tool is available in the „edit” menu (Figure 3-9). Simply follow the instructions to calibrate the throttle.

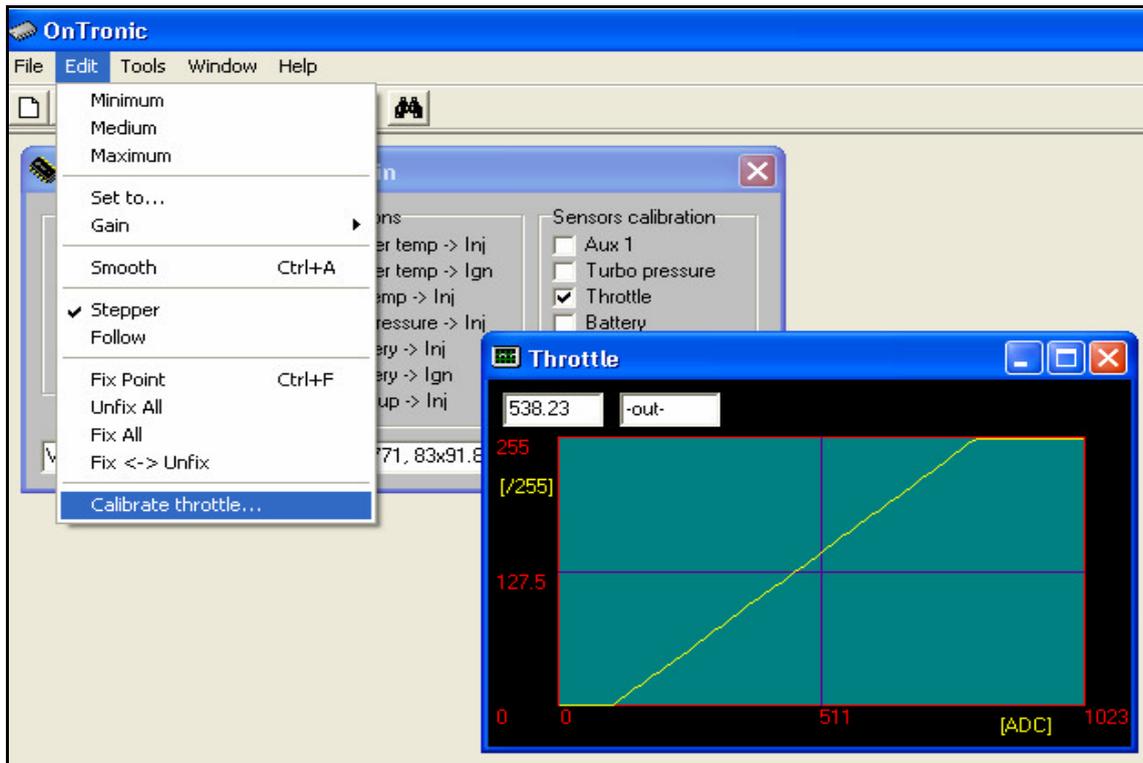


Figure 3-9 : Throttle calibration

The list of all calibration curves are shown in Table 3-3.

3.5.3. Correction graphs

Climatic factors significantly impact the nominal engine settings. For instance, as aspirated air is cold, the air density increases, leading to an higher aspirated mass flow (lower fuel / air ratio).

In order to overcome these effects, OnTronic continuously scans all climatic factors and automatically adjust all service parameters using two-dimensional „correction graphs”.

The default correction graphs should normally suit a wide variety of engines and may not need to be modified. It is however possible that some engines are more sensible to specific parameters, for example cold startup.

The list of all correction graphs are shown in Table 3-3.

The settings are performed using:

- The keyboard arrows (right / left) to move along the curve
- The mouse to select a target point
- The keyboard function keys F1-F4 to increase the value(s), and F5-F8 to decrease the value(s).

- With the „Edit” menu where several useful amplification (relative or absolute), reset, smoothing (CTRL-A) and interpolation functions are available.

3.5.4. Injection and ignition tuning

The injection duration, the ignition advance and the coil load timing have to be tuned for all engines. It is the base task of the motor engineer. Ideally, tuning should be performed on a dynamometer, as all the engine can be maintained in steady state (static operation). On-road tuning can also be envisaged, but may lead to difficulties stabilizing the engine rpm. The corresponding maps are three-dimensional (rpm, load and value), as shown in Figure 3-10.

- The X-axis represents the engine rpm. Increasing rpm go the right direction.
- The Y-axis represents the engine load. Increasing engine load (throttle position or boost pressure) go to the depth.
- The Z-axis represents the parameter to be tuned (injection duration, ignition advance, coil load etc)

In emulation mode, the current positions read by Ontronic on the maps are displayed by a white cross. This allows the engine developer to easily figure out which points need to be modified (Figure 3-6).

The settings are performed using:

- The keyboard arrows (right / left) to move along the curve
- The mouse to select a target point
- The keyboard function keys F1-F4 to increase the value(s), and F5-F8 to decrease the value(s).
- With the „Edit” menu where several useful amplification (relative or absolute), reset, smoothing (CTRL-A) and interpolation functions are available.

The current position read can be automatically followed by the cursor activating the option „Edit / Follow”.

The cursor position is indicated in the 3 text boxes (rpm, load, value). The X, Y and Z values can be updated manually in the corresponding text box, The map can be turned in three dimensions and zoomed using the 4 slide bars (Figure 3-10).

The three-dimensional tuning maps, and their meaning, are shown in Table 3-3.

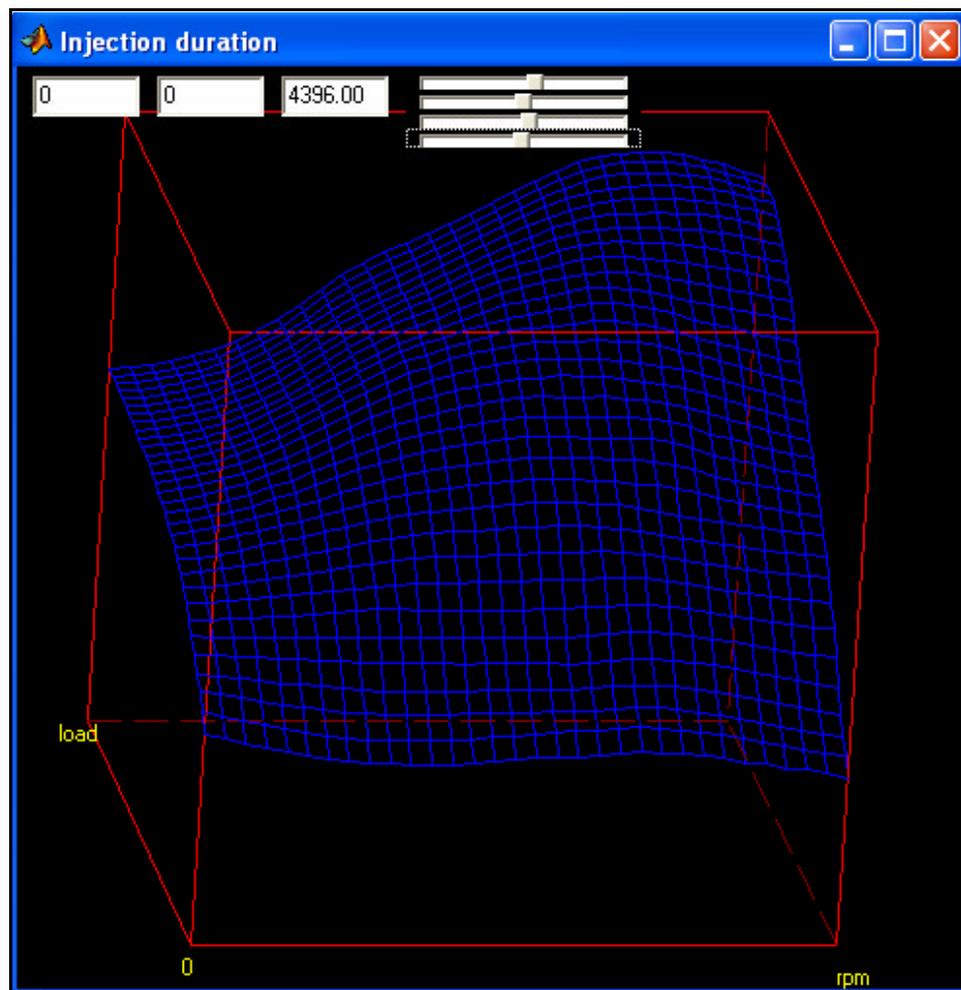


Figure 3-10: Three-dimensional map (injection duration)

3.5.5. Dynamic compensation (acceleration pump)

Dynamic compensation (acceleration pump) is required when the operation parameters (e.g. load) change rapidly. Dynamic compensation is automatically calculated by Ontronic. It dynamically increases the fuel quantity (injection duration) during fast transients, using state-of-the-art differential equations. As a result, the injected fuel quantity is increased during a specific time window (additional injection spike).

Two programmable factors are used to characterize the amplitude and time constant of the dynamic compensation (Figure 3-11).

- Factor „A“: Defines the amplitude of the additional injection spike. The higher this factor, the higher the additional spike.

- Factor „B“: Defines the time constant of the additional injection spike. The higher this factor, the longer the injection spike.

The „A“ and „B“ factors can be individually adjusted for all engine operating states using 2 dedicated three-dimensional maps (Table 3-3). Normally, the default settings suit almost all engines

The settings are performed using:

- The keyboard arrows (right / left) to move along the curve
- The mouse to select a target point
- The keyboard function keys F1-F4 to increase the value(s), and F5-F8 to decrease the value(s).
- With the „Edit“ menu where several useful amplification (relative or absolute), reset, smoothing (CTRL-A) and interpolation functions are available.

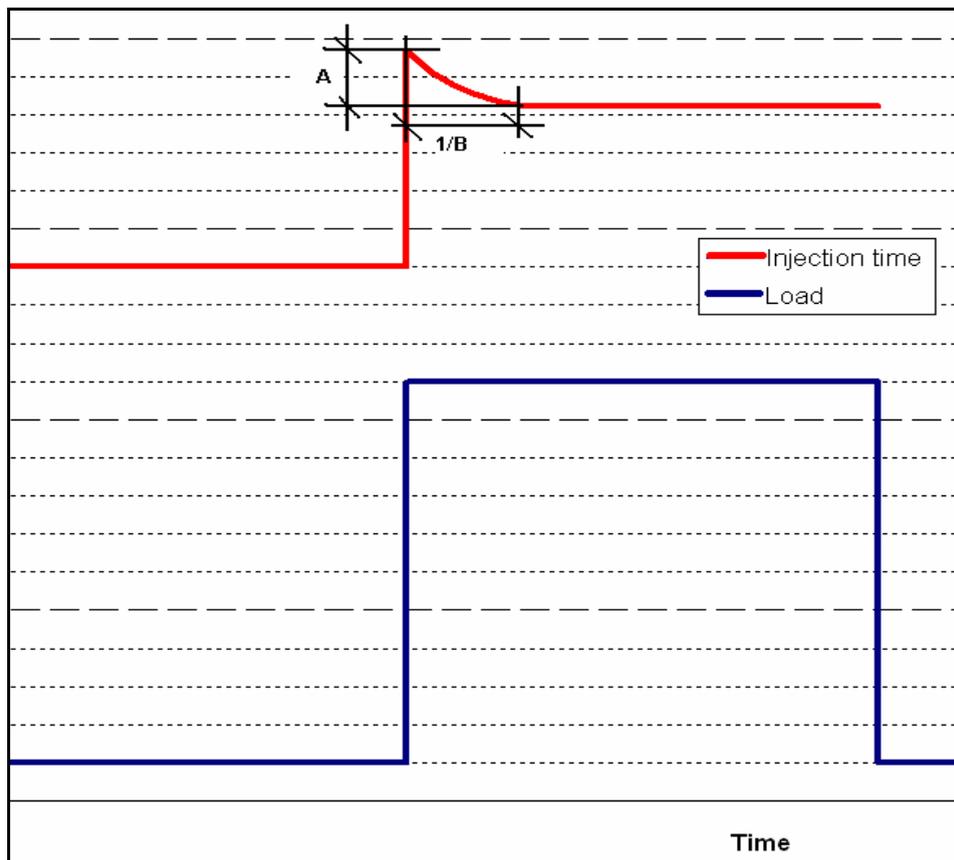


Figure 3-11: Dynamic operation compensation