

Calibration Manual

Hana Prime || Gas Injection System

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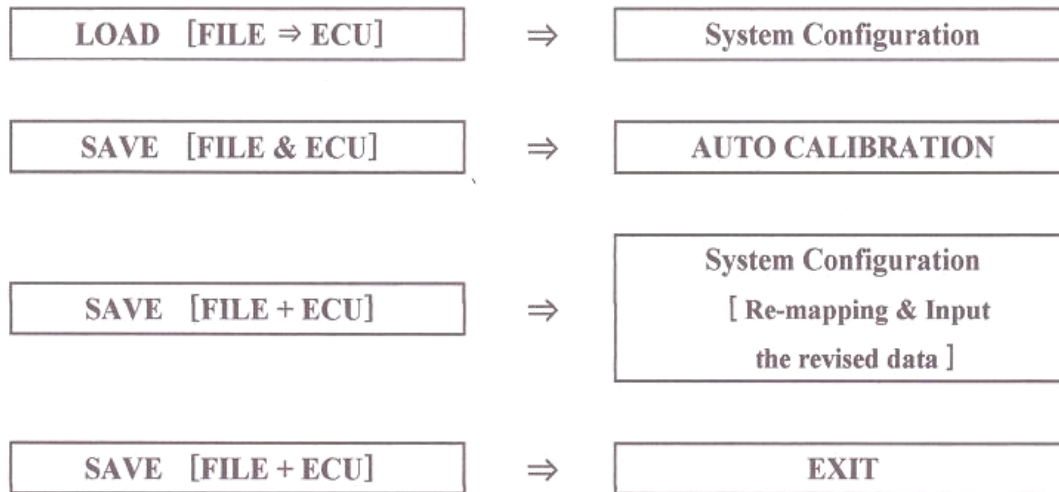
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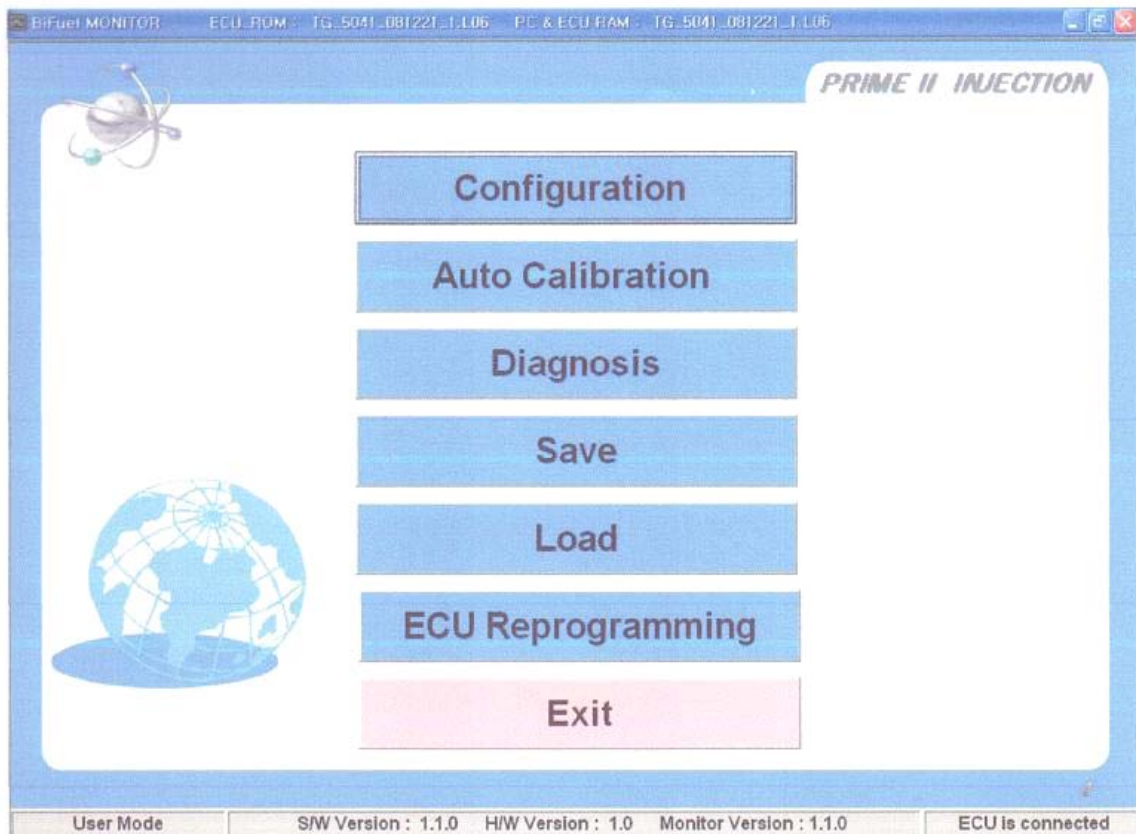
Conception and Procedure of Data Mapping

HANA Prime II [Main Menu]



- ◆ Should be checked whether the engine-condition would be normal or not by HI-SCAN under the gasoline-mode, after installation of Hana LPG Kits.
If vehicles-condition would not be normal one or damaged before, the stored data on Gasoline ECU should be deleted, and Gasoline ECU and ETC-monitor should be initialized necessarily.
- ◆ After the connection of Communication cable(USB connector type) to LPG/CNG ECU, Mapping program should be operated under Key-On(IG-ON) condition.
At this time, the communication with Bi-fuel ECU will be operated automatically when is showing the message of " ECU is connected / Not connected " on Main Menu.
- ◆ All of engine's specification should be checked, filed-up.
And will be saved them on LPG/CNG ECU automatically.
- ◆ The saved data can be applied on the same models on the next time by loading of data.
- ◆ Idling and the other's condition can be improved by the fuel-regulation repeatedly.
- ◆ The final data should be filed-up, saved on Laptop and LPG/CNG ECU respectively.

Characteristics and Process per Data Match-up



1. Main Menu

Should be checked whether the engine would be Normal or Not by HI-SCAN under the gasoline-mode after installation of Hana LPG Kits. If the vehicle's condition would not be normal one or damaged before, the stored data on gasoline ECU should be deleted.

And the gasoline ECU and ETC-monitor should be initialized necessarily.

After the connection of Communication cable(USB connector type) to LPG/CNG ECU, the Mapping program will be operated by Laptop under Key-On(IG-ON). And then, the communication with Bi-fuel ECU will be operated automatically when is showing " ECU is connected / Not connected " on Main Menu.

When the interface cable was connected to LPG/CNG ECU, the communicated information will be showed on the lower column, and the saved file-name will be showed on the upper-end as follows;

- Showing the communicated information on the lower-end

(1) When cable was off or wiring was not normal (Check the cable's condition)

Ex)

User Mode	Check USB Port	ECU is disconnected
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(2) The connection was correct, but the wiring was not normal (Checked the connected condition)

Ex)

User Mode	Check ECU Connection	ECU is disconnected
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(3) Normal connection

Ex)

User Mode	SW Version : 1.1.0 HW Version : 1.0 Monitor Version : 1.1.0	ECU is connected
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2. Load [File ⇒ PC & ECU RAM]



When is starting the mapping-works,

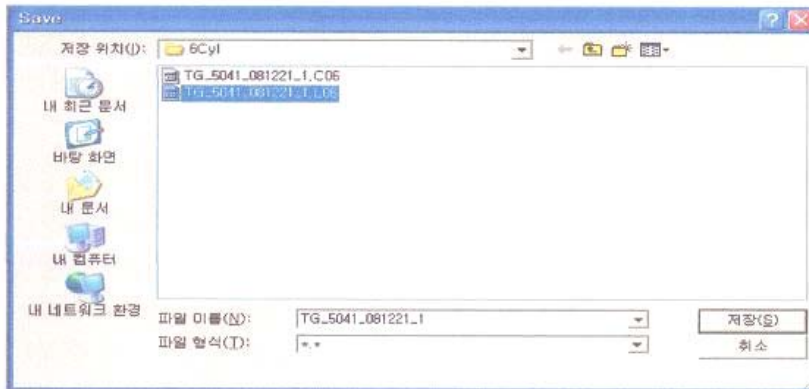
- (1) The stored data can be applied on the same models.
- (2) The mapping-works can be done manually and automatically by using of the standard data.
- (3) Process : Connected to the mapping-program.
 - ⇒ Loaded the saved data or the standard data [After opening the file]
 - ⇒ Loaded the data on [PC & ECU RAM] and start to mapping.

Ex) TG-5041-081221-1.L06

TG : Brand Name, 5041 : Plate No. 081221 : Year Month Date, 1 : Upgrade
L06 ⇒ L : LPG, C : CNG, 04/06/08 : Number of Cylinder

Note; Please click on "Save Mode" after set-up data. If not, all of data would be deleted.

3. Save [PC & ECU RAM ⇒ File & ECU ROM]



Click on "SAVE" on Main Menu,

- (1) When the configuration and the data-matching was finished.
- (2) When is going to save the system's data and match-up the fuel-data in a moment,
- (3) Function : The saved data on PC and LPG/ECU RAM [the final system's data and the matched fuel's data] ⇒ Saved on File and ECU ROM respectively.

Note; If do not click on "SAVE Mode" after the finishing of the final system's data and the fuel's data all of these data would be deleted.

However, the saved data will be showed when the engine is re-starting.

4. Configuration - System

[1] "System" on Configuration / Showing the vehicle's status

The screenshot shows the 'System' configuration window in the BiFuel MONITOR software. The window title is 'BiFuel MONITOR' and it displays various configuration options for the vehicle's fuel system. The 'Vehicle Status' section includes settings for Switch (2 Mode), Fuel (LPG), Injector (Hana A(Large)), No. of Cylinder (6), MAP Sensor (Kefico 0~110kPa), and Fuel Pressure (Kefico TMAP(0~1.5b.)). The 'RPM' section has Signal Type (Standard) and Ignition Type (Tacho). The 'Gauge Level' section shows Type (Empty) and Korea 110-0 ohm. The 'Change Over Condition' section includes Pet -> Gas and Gas -> Pet settings. The 'O2 Sensor' section has Type (0 - 1 Volt) and Number (2). A status bar at the bottom displays various vehicle parameters like Pet Inj. T, Gas Inj. T, Bat Volt, Gas Volt, T.water, T.gas, Press.gas, MAP, O2_1, O2_2, RPM, Gauge, T.ecu, and a fuel mode indicator for LPG.

① Switch : Select the type of switch (Click on it and setup it automatically)

- 2 Mode : 2-steps switch - 3 Mode : 3-steps switch - On Touch : For Domestic

② Fuel Type : Select the using of fuel (Click on it and setup it automatically)

- LPG : Butane + Propane - Methane : CNG, LNG

③ Injectors : Select the specification of Injectors(H2000)

- HANA A TYPE [Large] : 175 ± 1 L/min
 - HANA B TYPE [Medium] : 150 ± 1 L/min
 - HANA C TYPE [Small] : 130 ± 1 L/min

④ No. of Cylinder : Select the number of cylinders

- 4 [4 cylinder] - 6 [6 cylinder] - 8 [8 cylinder]

⑤ MAP Sensor : Select having or not having MAP Sensor and the specifications of it.

- Not Use(on Hana Kit) - Kefico [0 ~ 110 kPa]

⑥ Fuel Pressure : Select using or not using the temperature sensor and the specification of it.

- Not Use - Kefico TMAP [0 ~ 1.5 bar]

⑦ RPM Signal Type : Select the volatge level of RPM Signal

- Standard : 0 ~ 12V - Weak : 0 ~ 5V

⑧ RPM Ignition Type : Select the RPM according to the igniton mechanism

- 1 coil - 2 coil - Tacho

⑨ Gauge Type(Click on it or the figure can be changeable)

- Korea 100 ~ 0 Ohm
- Resistor [Increase]
- Voltage [Increase]
- Chian(China) CNG
- Inverted Resistor [Decrease]
- Inverted Voltage [Decrease]

⑩ Change Over Condition [Gasoline ⇒ Gas]

- Vgas 'on' W.Temp :
According to Vaporizer's temp, the opening time of sol-valve on tank will be decided. Ex) 30 °C
- Water Temp :
The converting-point 1 ⇒ Water Temp > Condition [45 °C] Ex) 45 °C
- Gas Pressure :
The converting-point 2 ⇒ Press. Gas > Condition [0.6bar] Ex) 0.6bar
- Change delay :
The converting-point 3 ⇒ Waiting time after the satisfaction of the conditions of 1 & 2 the above.
- RPM :
The converting-point 4 ⇒ RPM after satisfied the conditions of 1 & 2 & 3 > Condition [1500rpm]
- Overlap Segment :
The number of injection-overlap when is converting gasoline to gas. Ex) 0

⑪ Change Over Condition [Gas ⇒ Gasoline]

- Gas Pressure : Press. Gas < Condition [0.4 bar] Ex) 0.4bar
Ex) The converting-point will be happened on the conditions that the pressure of gas is 0.4 bar under.
- Change over again to Gas :
 - Enable
 - DisableThe re-converting of gasoline to gas will be possible or impossible while running.
[Sometimes, Gas is converting to Gasoline due to the condition of gas pressure while running.
and re-converting will be possible on ' Enable ']
- Wait time :
It means that the waiting-time of re-converting when you select " Enable " the above.

⑫ O₂ Sensor Type

- 0 ~ 1 [V] : Zirconia Sensor(General type)
- 5 ~ 0 [V] : Titania Sensor
- 0 ~ 5 [V] : Titania Sensor
- Uego Sensor : For Lean burn

⑬ O₂ Sensor Number

- 1 [4 cylinder, Serial 6 cylinder]
- 2 [V6, V8]

There will be happened troubles with RPM due to the incorrected data on the menu of System - Configuration. In this time, LPG/CNG ECU could not control engine accurately due to the irregular RPM. For the solution of this troubles, please confirm whether the RPM showed on the lower-end would be the same as or the different one on gauge-board. If it would be different, please re-check System-data after clicking on " SAVE ".
[SAVE : Save on File & ECU ROM] of Main Menu.

[2] "MAP" on Configuration

<Re-regulation of all data and some of fuel-data >

	500	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	5000	6000
1.5	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
2.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
2.5	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
3.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
3.5	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
4.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
5.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
6.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
8.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
10.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
12.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
14.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
16.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
18.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
20.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
22.0	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110

Adjustment
P.gas 7.0
T.gas -10.0
T.water 0.0
Accel 0.0
SUM 107.0

WRITE

Relative(+)
Relative(-)
Multi

Pet Inj. T 2.69 2.58 2.93 2.55 2.55 2.73 0.00 0.00 mS O2_1 20 mV
Gas Inj. T 2.88 2.76 3.13 2.73 2.73 2.96 0.00 0.00 mS O2_2 17 mV
Bat Volt 13.1 V T.water 81.6°C Press.gas 0.00 Bar RPM 457
Gas Volt 13.1 V T.gas -30.0°C MAP 72.1 KPa Gauge 101 mV T.ecu 24.3°C

LPG Manual

The MAP's data is being transferred from the standard data and the existing matched-data. However, the MAP-data will be set up according to the matched-result manually or automatically. Thus, the air/fuel ratio and the best engine performance will be set up by a repeated road testing. While the road-testing, you can find out the section of poor conditions per each RPM & Injection-time.

① The revision of Idling-stability

If there will be a little higher gap between the gasoline injection-time(Pet_Inj.T) under Petrol-mode and the gasoline injection-time(Pet_Inj.T) under LPG-mode every loaded, the higher gap should be reduced(However, a little lower gap could be disregarded).

Ex) When the loading was nothing(Non Loaded)

Gasoline Injection-time(Pet_Inj.T)=3.0ms(Under the gasoline-mode)

Gasoline Injection-time(Pet_Inj.T)=2.5ms(Under the LPG-mode)

In this case, the flowing quantity of LPG would be more than gasoline.

Thus, the section data of Idle-loading should be reduced by input of minus(-) figures.

And then, two kind of injection-time will be closed nearly.

※ How to point the revised-section?

Click on the start-point and drag with the right side of mouse and input the figure after marking on Relative(+) or (-). Whenever one click on the section, the input-figure will be up or down.

② Confirmation of Engine Power

Please do it same as the above ① repeatedly, and match-up data also.

③ Control of Air/Fuel Ratio in specified gas-temp, gas-pressure and water coolant-temp

- Click on the next menu of " Adjustment ". And can be increased or decreased the revised figures of them.

- Do road-test per each gas-temperature repeatedly at first.

After that, the mapping-data should be satisfied with the control of Air/Fuel and Engine-performance in all the temp-range of gas and water-coolant respectively.

That is why a good engine-performance will be kept against a change of season.

As you know well, the fuel-consumption & engine-power could not be satisfied perfectly per each section at the same time. Thus, you need this procedure.

[3] "Adjustment" on Configuration

<Re-regulation of data according to Vaporizer's temp, Gas's pressure and temp>

The screenshot shows the 'Adjustment' menu with the following data tables:

Fuel Gas Pressure Correction Factors [bar]																
[Bar]	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
[%-100%]	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0	4.0	3.0	2.0	1.0	0.0	0.0	0.0	0.0

Fuel Gas Temp Correction Factors [°C]																
[°C]	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0
[%-100%]	-10.0	-10.0	-10.0	-10.0	-8.0	-6.0	-4.0	-2.0	0.0	1.0	2.0	4.0	5.0	8.0	15.0	15.0

Water Temp Correction Factors [°C]																
[°C]	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0
[%-100%]	-15.0	-15.0	-15.0	-15.0	-15.0	-11.0	-8.0	-6.0	-4.5	-3.0	-2.0	0.0	0.0	0.0	0.0	0.0

Bottom status bar data:

Pet Inj. T	2.69	2.62	2.80	2.55	2.57	2.73	0.00	0.00 mS	O2_1	718 mV
Gas Inj. T	2.88	2.80	3.00	2.73	2.75	2.96	0.00	0.00 mS	O2_2	718 mV
Bat Volt	13.1 V	T.water	81.7 °C	Press.gas	0.00 Bar	RPM	456			
Gas Volt	13.0 V	T.gas	-30.0 °C	MAP	72.2 KPa	Gauge	100 mV	T.ecu	24.8 °C	

Some of data can be changeable according to Vaporizer's temperature, Gas's temp and pressure. On this menu, these data should be re-regulated for the prevent of engine-off, a poor running and a poor fuel-consumption being happened due to a wrong revised data.

Thus, after doing of auto-calibration,

the road test should be done per every the mode of Vaporizer's temp, Gas's temp and pressure. While the roading test, you have to check whether the variation of Oxygen-sensor and the engine-power would be Normal or Not.

After the responding of Oxygen-sensor five times, some of data will be matched up automatically. At this moment, the waveform of Oxygen-sensor will be showed on the below-end.

① Fuel Gas Pressure Correction Factors [bar]

: The revised figures according to the change of Gas's pressure

② Fuel Gas Temp Correction Factors [°C]

: The revised figures according to the change of Gas's temperature

③ Water Temp Correction Factors [°C]

: The revised figures according to the change of Vaporizer's temperature

Generally, you can get the standard data, that was the revised-result of road-test under the mode of vaporizer's temperature, gas's temperature and pressure respectively.

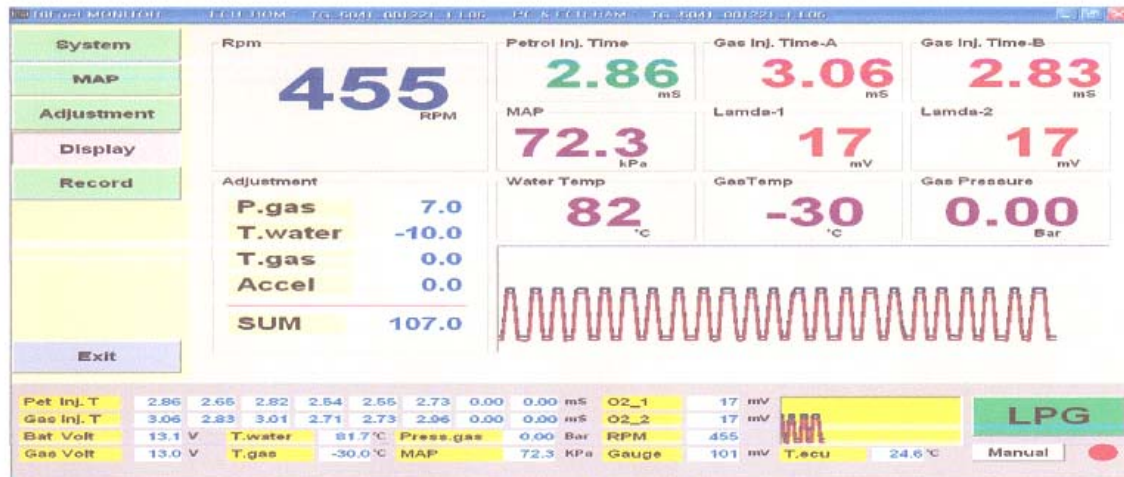
However, these standard data could not be applied on the specified vehicles sometimes.

Thus, the feedback control of air/fuel ratio, the lean/rich of gas and the temperature of gas should be checked while the road-testing. And you can get the revised figures.

The revised figures should be matched-up finally.

[4] "Display" on Configuration

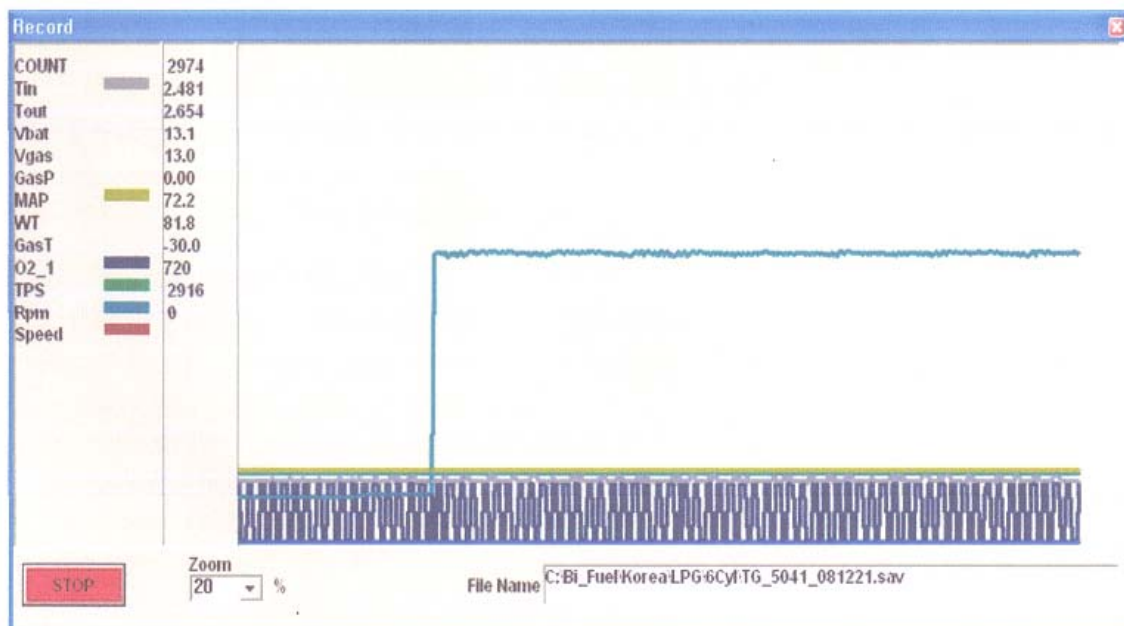
< Selection of Printing Screen >



During the running, you can check RPM, Gasoline/Gas Injection-time, Vaporizer's temperature, Gas-temperature, Gas-pressure, Variation of Oxygen-sensor within easy range of your eye this screen. The better of Air/Fuel ratio will be performed owing to the above data. It means that a good data of RPM, Gasoline/Gas Injection-time, Vaporizer-temp, Gas-temp, Gas-pressure, Variation of Oxygen-sensor make a good control of Air/Fuel ratio.

[5] "Record" on Configuration

< Saving File and Printing Picture >



As a functional screen, the screen of [4] can be checked with the naked eye easily. However, some of data should be saved on File when any troubles would be happened. These invisible data could be showed on " excel-version " as a graph for evaluation. The process of saving on File will be continued even the changing of other-mode. Also, this process of saving will be continued before the click on "Stop" or the finishing of program.

5. Auto Calibration

< Auto-matching under Zero-mode / None-loaded >



As one of Auto-matching mode under the idling,
Gasoline Injection-time [Petrol Inj.Time] and Gas Injection-time [Gas Inj. Time] could be matched-up automatically by own analysis of LPG/CNG ECU under the mode of regular RPM and Opened/Closed time of throttle valve after engine-warming.

[1] Ready Status for Auto-regulation of fuel-q'ty automatically

After the engine-warming sufficiently, the temperature of Vaporizer will be increased to 70 °C and Gas-temperature will be at 45 °C ~ 50 °C.

And click on " [Start] " on the above screen.

[2] Process of Auto-calibration

- At the idling-condition after engine-warming sufficiently,
Petrol [Idle] ⇒ Petrol [Idle + Full Load] ⇒ Petrol [High RPM] ⇒ Gas [High RPM]
⇒ Gas [Idle + Full Load] ⇒ Gas [Idle]
- After converting from Petrol to Gas automatically,
the auto-matching will be done under 2500 ~ 3000 RPM, the same as Gasoline-mode.
- If Automatic Calibration could not be done completely,
do re-load the saved data(file) at first, and then do repeat all of procedure by the current-position.
- If Automatic Calibration would not be gone smoothly,
the hand-operated calibration would be better go side by side with the automatic calibration.

※ Caution; When you are doing the Auto-matching under the idling-mode,

- The gas-leakage should be checked before the matching up.
- Whether the pressure of Vaporizer should be at 1.0bar ~ 1.2bar or Not.
- The engine-warming should be done sufficiently.
(Vaporizer-temp will be about 70 °C and Gas-temp will be about 40 °C ~ 50 °C respectively).