Notes for User

To use this analyzer with safety and effectiveness, please read this manual before usage.

This manual applies to the product model NGA 6000.

1. This manual should be referred with regard to the product design and safety assurance of the configuration.

2. For the purpose of safe confirmation, this manual should be provided to the end user at the same time with the supply of the product.

3. Please use only in well-ventilated place.

4. This product should not be washed/polished by volatile or toxic chemical materials like thinner.

5. Please don't use the printer until the printing paper is prepared.

6. If the equipment is wiped with a piece of moistened gauze, dry the equipment thoroughly before use.
   Using the monitor while it is wet may result in an electric shock.

7. Do not clean the terminals or the AC power inlet. Otherwise, deformation or corrosion of contacts could occur,
   which may result in contact failure and/or malfunction of the equipment.

- The contents of this manual may be changed without notice for the purpose of functional improvement.

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Chapter 1. Quality Guarantee Provision

1-1 Guarantee provision

If the product is handled according to this manual but there occurs a failure with in the guaranteed period, it will be repaired free of charge by our company. However, the compensation from the secondary damage and the following cases may not be guaranteed and repaired without fee:

(1) A damage or fault, which occurs due to mishandling in use and negligence in maintenance and keeping.
(2) A damage or fault, which originates from a change or reconstruction.
(3) When the parts and consuming materials that naturally wear out become damaged and needed to be exchanged.
(4) A damage or fault, which originates from an environmental factor such as a fire, earthquake, storm and flood, or other natural disasters.
(5) A damage or fault, which occurs as the designated pure part is not used.
(6) A mistaken guarantee claim procedure
(for example, absence of type or serial number).

1-2 Guarantee claim procedure

※ Warning	This product is not designed for outdoor installation so that a damage or fault originated from the outdoor installation may not be guaranteed.

When you issue a claim against this product in accordance with above provision, please contact the agent where you purchased:

(1) When you get a fault : Please verify the product by referring Chapter 8. fault diagnosis and troubleshooting.
(2) Still in bad operation : Please request a repair to the agent where you purchased.
(3) Repair after guaranteed period: After the guaranteed period, the repair cost will be charged.
(4) Repair within guaranteed period : The guaranteed period is for 12 months from the purchase and within this period the product will be repaired in accordance with our quality guarantee provision.
(5) For details or questions on the after service, please contact our local agent.
(6) When you contact our local agent, please inform us your product type, serial number, date of purchasing, and fault conditions in detail.

Chapter 2. Safety Instructions

2-1. Purpose of usage

This analyzer is a equipment to measure the gas emission density of an automobile enabling to diagnose the automobile status and its preventive maintenance so that it can provide a function to prevent the air pollution in advance.

2-2. Usage condition

(1) No emitted/polluted environment.
(2) Less than 1000m in height and less than 85% in relative humidity.
(3) No direct ray of sunlight, vibration and abrupt temperature change.
(4) Well-ventilated place.
(5) It should be setup at least 25cm from the ground surface.

2-3. Caution and warning

(1) General safety requirement

※ Warning	This item includes some critical contents to prevent safety accident and product damage so that it needs to be read through and properly understood for correct usage.

① This analyzer should be manipulated only by the trained personnel who well understood the usage.
② A spot check or periodical check should be executed in accordance with this manual prior to a measurement.
③ The probe should be installed in a place where not affected by a wind.
④ If there occurs a unusual case during operation, please stop the operation and contact us for its inspection and verification.

(2) Warning

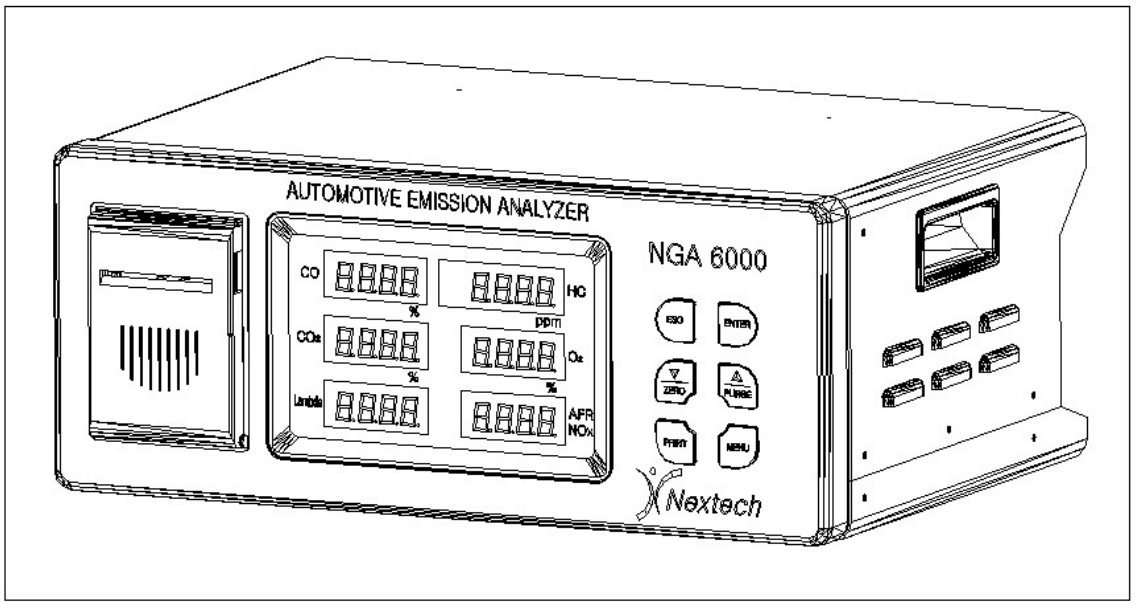
① This analyzer is designed for the use of AC110V only or AC220V only. Please verify the power sources prior to the usage.
② The probe is so hot by emitted gas. Therefore, you need to pay high attention not to be burned during when you insert or remove.
③ During the analysis, please do not stay long in the place to which the gas is being emitted.
④ The emitted gas normally includes the CO, which may induce a fatal damage to a human body, so that it must be used only in well-ventilated place .

Chapter 3. Introduction of NGA 6000

3-1 Specification

	NGA 6000			
Measuring item	CO, HC, CO2, O2, Lambda(air surplus rate), AFR, NOX (optional)			
Measuring method	CO, HC, CO2 : NDIR Method O2, NOx : Electrochemical Cell			
Measuring range	CO	0.00 ~ 9.99%	HC	0 ~ 9999 ppm
Resolution		0.01%		1 ppm
Display		4 digit 7segment LED		4 or 5 digit 7segment LED
Measuring range	CO_2	0.0 ~ 20.0%	O_2	0.00 ~ 25.00 %
Resolution		0.1%		0.01 %
Display		4 digit 7segment LED		4 digit 7segment LED
Measuring range	Lambda	0 ~ 2.000	AFR	0.0 ~ 99.0
Resolution		0.001		0.1
Display		4 digit 7segment LED		4 digit 7segment LED
Measuring range	NOx (Option)	0-5000 ppm		
Resolution		1 ppm		
Display		4 digit 7segment LED		
Repeatability	Less than ±2% FS			
Response time	Within 10 seconds (more than 90%)			
Warming up time	About 2 ~ 8 minutes			
Sample collecting quantity	4 ~ 6 L/min			
Power	220V AC or 110V AC ±10% 50 / 60Hz			
Power consumption	About 50 W			
Operation temperature	0℃ ~ 40℃			
Dimensions	420 (W) × 298 (D) × 180 (H) mm			
Weight	About 6.9 kg			
Basic accessories	Probe, Probe hose, Spare fuse, Leak test cap, Spare filter, Operation manual, Power cord, RS232, Communication cable, Printer, Printer paper			

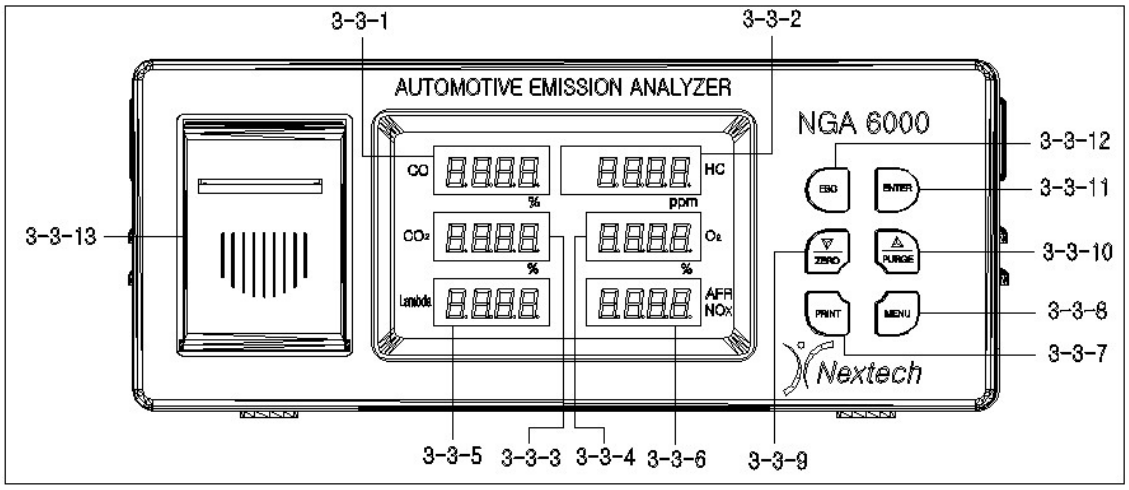
3-2 Appearance



This manual is explaining mainly HOW TO USE 4GAS analyzer. 5GAS analyzer is just added with NO sensor on 4GAS analyzer. So, for 5GAS analyzer, use this same manual. You also can use the same manual for motorcycle which emits high density of HC. Measuring range of the HC is 0 – 20,000 ppm and display window is specially custom-made in order to indicate 5 digits segments, and for CO, CO2, O2, the display window is indicating 4 digit segments as in general.

Other features such as the sequence and a series of procedures including GAS calibration is same as those for 4GAS analyzer. So, you can use the same manuals as well.

3-3. Front view and description



3-3-1 CO display window

This displays the CO density and program proceeding status.

3-3-2 HC display window

This displays the HC density and program proceeding status.

3-3-3 CO2 display window

This displays the CO2 density and program proceeding status.

3-3-4 O2 display window

This displays the O2 density and program proceeding status.

3-3-5 Lambda display window

This displays the Lambda(air over surplus rate) value and program proceeding status.

3-3-6 AFR/NOx display window

This displays the AFR, NOx, and program proceeding status.

3-3-7 PRINT KEY

Used in time of holding or printing.

3-3-8 MENU KEY

Used in choosing a supplementary function.

3-3-9 ▼ / ZERO KEY

Used in time of correcting the datum point or moving a figure or digit.

3-3-10 ▲ / PURGE KEY

Used in time of doing a purge or executing a value increase.

3-3-11 ENTER KEY

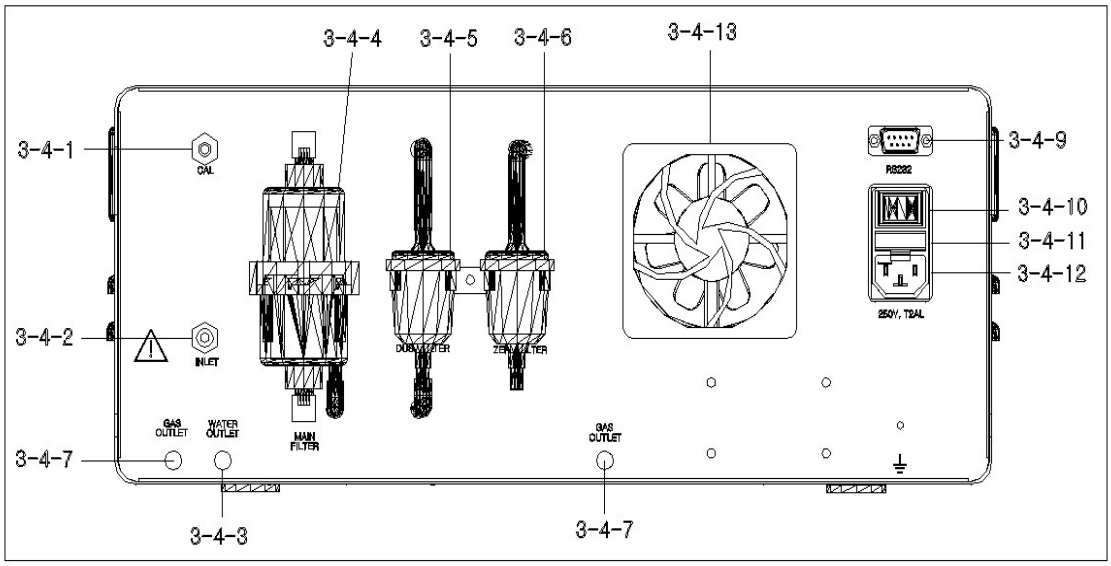
Used in time of measuring or approving a supplementary function.

3-3-12 ESC KEY

Used in time of returning to ready mode.

3-3-13 Internal printer case: The print paper comes out this case.

3-4 Rear view and description



3-4-1 CAL(Calibration)

This is a gas inflow gate used in time of standard gas adjustment.

3-4-2 INLET

This is a measuring inlet where one end of the probe mounted into this inlet in time of gas emission measurement.

3-4-3 WATER OUTLET

This is an emitting outlet where the gas produced in the time of measuring the emitted gas (4GAS Analyzer) and water to correct the gas is outcome.

3-4-4 MAIN FILTER

This condenses the vapor contained in the automobile emitting gas so that it prevents other materials from incoming to inside the analyzer at the same time with the water and measuring gas.

3-4-5 DUST FILTER

This prevents fine dusts and materials from incoming inside the analyzer in the time of measuring.

3-4-6 ZERO FILTER

This is an activate charcoal filter to purify the analyzer cell in the time of correcting the zero point.

3-4-7 GAS OUTLET

This is a emitting outlet where the emitting gas and standard gas is outcome in the time of adding the NOx.

3-4-8 OPTION

This is a terminal to be directly connected with a normal PC printer.

3-4-9 RS232 PORT

This is a communication terminal through which a PC can operate the program.

3-4-10 POWER SWITCH

A power on/off terminal of this analyzer.

3-4-11 FUSE BOX

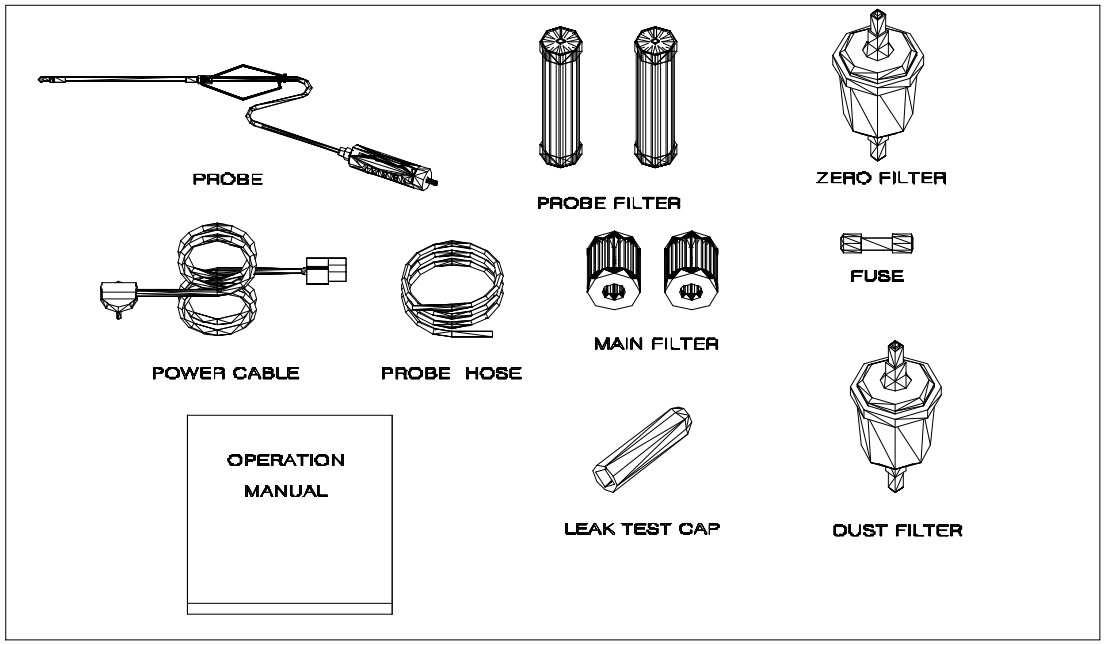
A fuse terminal which will prevent a damage from external voltage overflow.

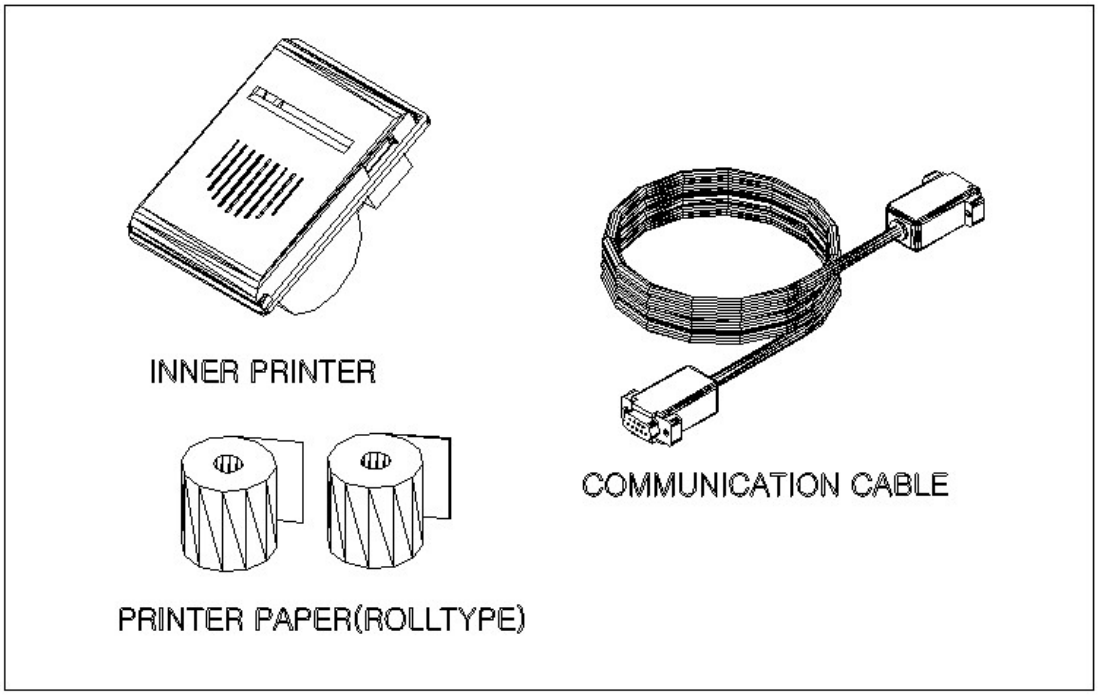
3-4-12 POWER SOCKET

3-4-13 FAN

3-5 Basic accessory

3-5-1 Basic accessory





3-5-2 Basic accessory lists

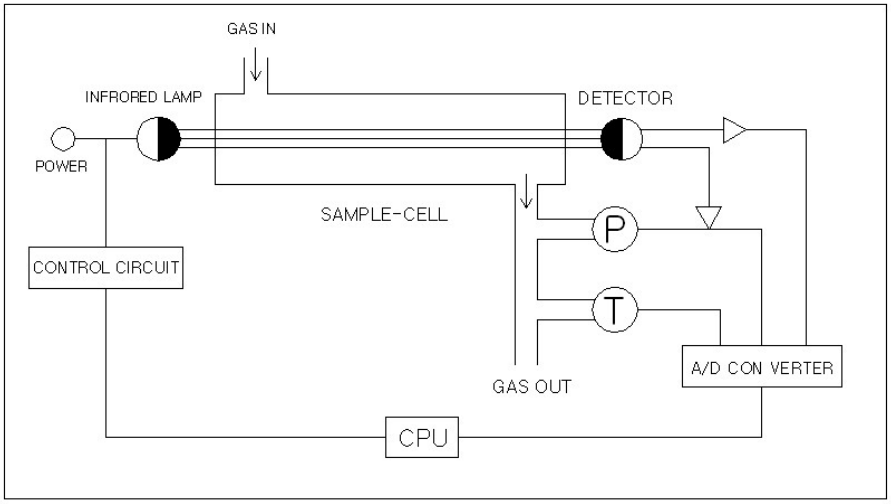
NO.	PART NAME	PART NUMBER	Q'TY
1.	PROBE	QG0-M026	1PC
2.	PROBE HOSE	QG0-A015	1PC
3.	LEAK TEST CAP	QG0-A122	1PC
4.	OPERATION MANUAL	QG4-M071	1 COPY
5.	MAIN FILTER	QG0-A017	10PC
6.	DUST FILTER	QG0-A013	5PC
7.	ZERO FILTER	QG0-A014	2PC
8.	PROBE FILTER	QG0-A021	10PC
10.	FUSE (250V 2A)	QG0-E022	2PC
11.	POWER CABLE	QG0-E019	1PC
14.	INNER PRINTER	QG4-M026	1PC
15.	PRINTER PAPER (ROLL TYPE)	QG4-A062	5PC
16.	COMMUNICATION CABLE	QG4-E080	1PC

** As for the standard gas, we recommend you to buy it from local dealers.

Chapter 4. Circuits of NGA 6000

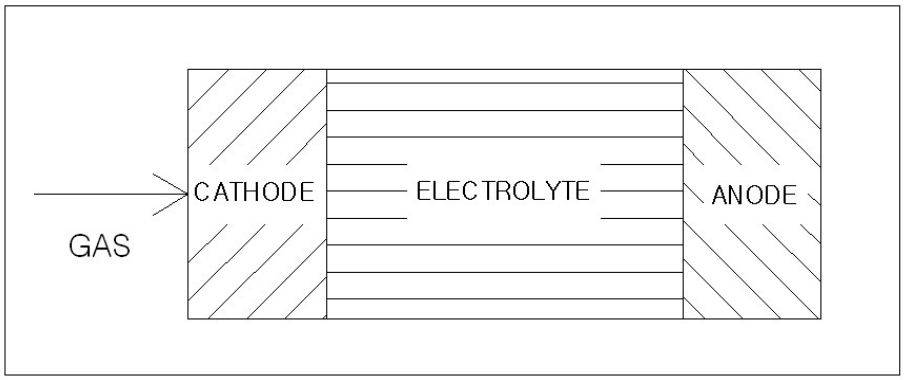
4-1 Measuring principal

This analyzer is configured to perform a measurement by applying Non Dispersive Infra-Red (NDIR) method for analyzing CO, HC, and CO2, and electrochemical method for analyzing O2 and NOx. In the NDIR analyzing method, a flashing ramp which flashes the infrared rays is attached at the one end of the sample cell and at the other end a detecting sensor is attached so that it can detect the component of a gas and then calculate the gas density.



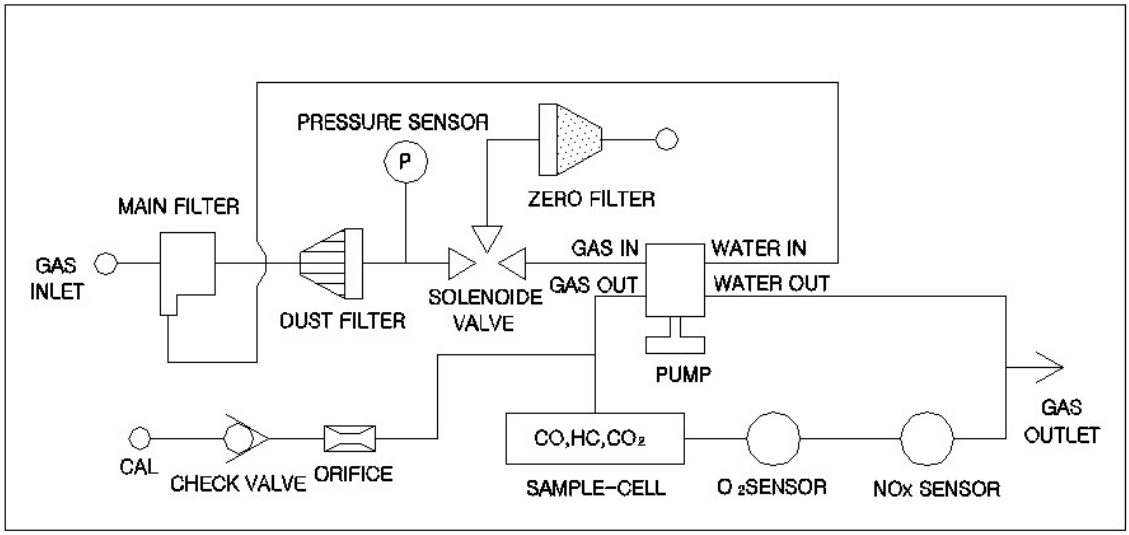
<NDIR method diagram>

The electrochemical method measures the gas density by using the quantity of electron which produced in the time of oxidation and reducing reaction of the gas.

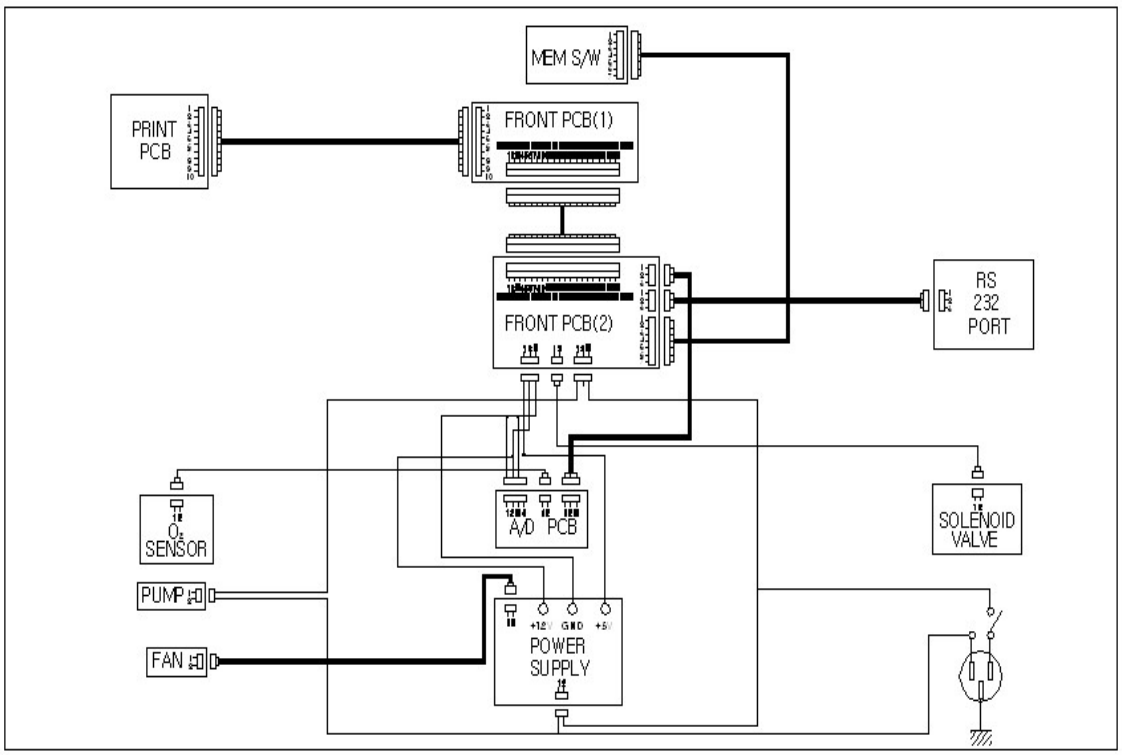


<Electrochemical method diagram>

4-2 Guiding diagram



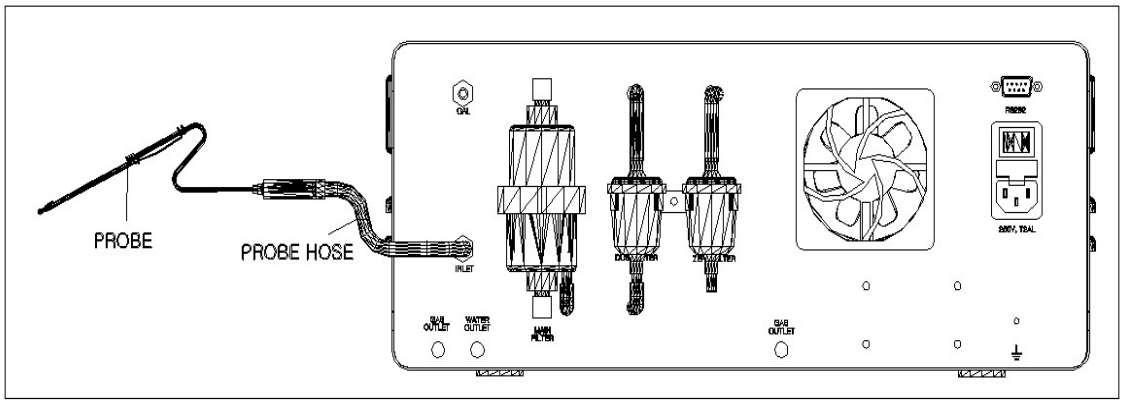
4-3 Electrical circuit diagram



Chapter 5. Installation Methods and Notes

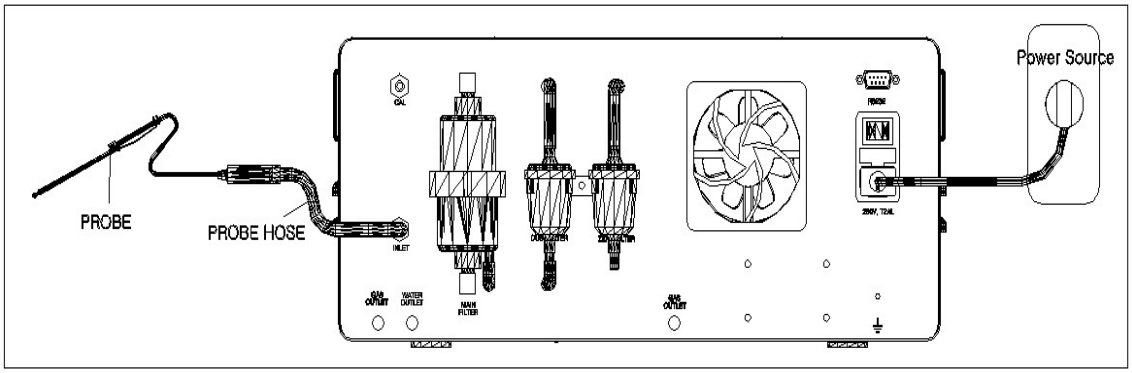
5-1 Installation

5-1-1 Fit end of the probe hose into the measuring probe and the other end of the hose into the gas inlet in the rear of the analyzer. If the fitting condition is not good and the air comes into flow from outside, it may yield an incorrect measured value.
Therefore, please carefully verify the fitting condition before use.



5-1-2 Turn off the power switch and then connect the power cable to the power socket located in the rear of the analyzer

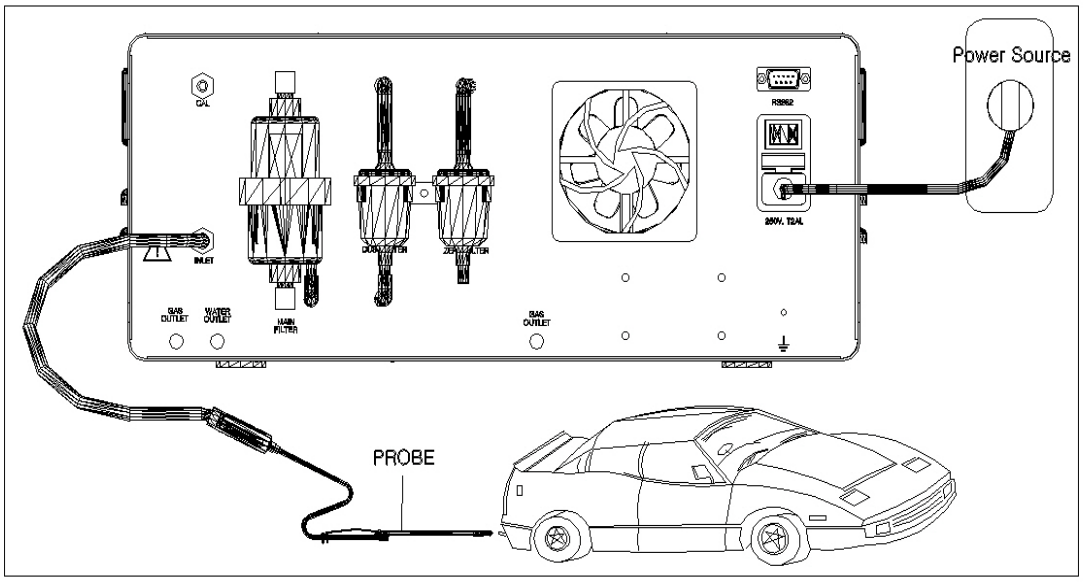
※ Warning	**This analyzer supports AC110V only or AC220V only. (Please confirm the power source to use.)**



5-1-3 Verify the fitting conditions of measuring probe filter and various filters located in the rear of the analyzer.

5-1-4 Verify again the connection status of the analyzer and then turn on the power switch.

5-1-5 Connect the ground cable to GROUND on the rear of the analyzer.



5-2 Notes

▶ This analyzer is operated with AC110V only or AC220V only. Please verify the power source before use. (Note that you can not change power source which is fixed upon supplying this analyzer.)

▶ **T**he following factors should be considered to properly locate the analyzer body :

— To be setup in a place of no direct light rays, humidity, vibration and abrupt temperature change.

— To be setup in a indoor place where no emitted gas inflows.

— To be setup in a height higher than 25cm from the ground.

▶ The analyzer should not be moved during the operation. It may cause an incorrectness in the measured value.

▶ The probe should be located in a place where not affected by the wind.

▶ The probe may be so hot during the operation so that it should be carefully handled not to be burned in insertion or removal.

▶ It needs to be noted that you should not stay in the gas emitting place during the operation.

▶ The analyzer should be used in a well-ventilated place only because the emitting gas contains the CO and it can cause a fatal damage to a human body.

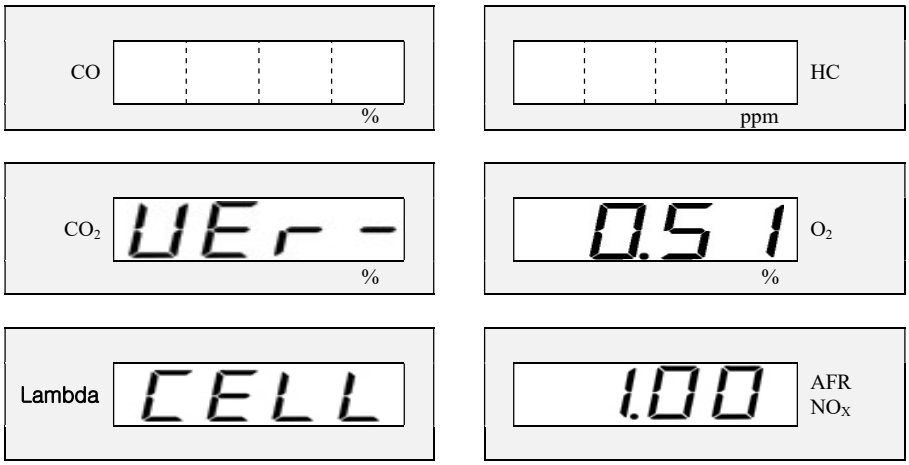
▶ This analyzer is Type-approved in accordance with the related government laws so that it is extremely prohibited to disassemble, change, or rebuild the analyzer and also if you disassemble the NDIR Module, you may not be guaranteed for the repair.

▶ NDIR module is the core part of the analyzer. Disassembly or assembly work is possible only by the manufacturer's technician. In any circumstance, you or anyone else should not attempt to disassemble it. If disassembled or re-assembled, proper A/S is not going to be possible.

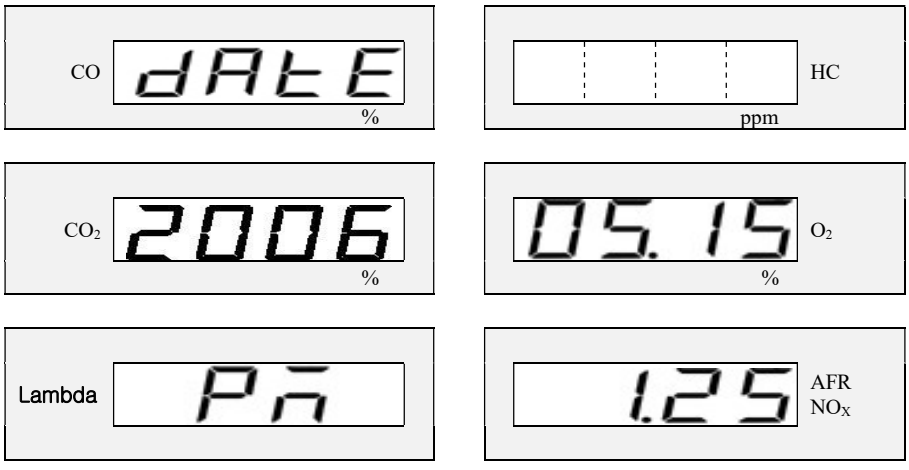
6. Measurement Mode

6-1. Warming- Up

① Switch the power [ON]. NGA 6000 will perform the initialization process for 10 seconds, displaying the following.



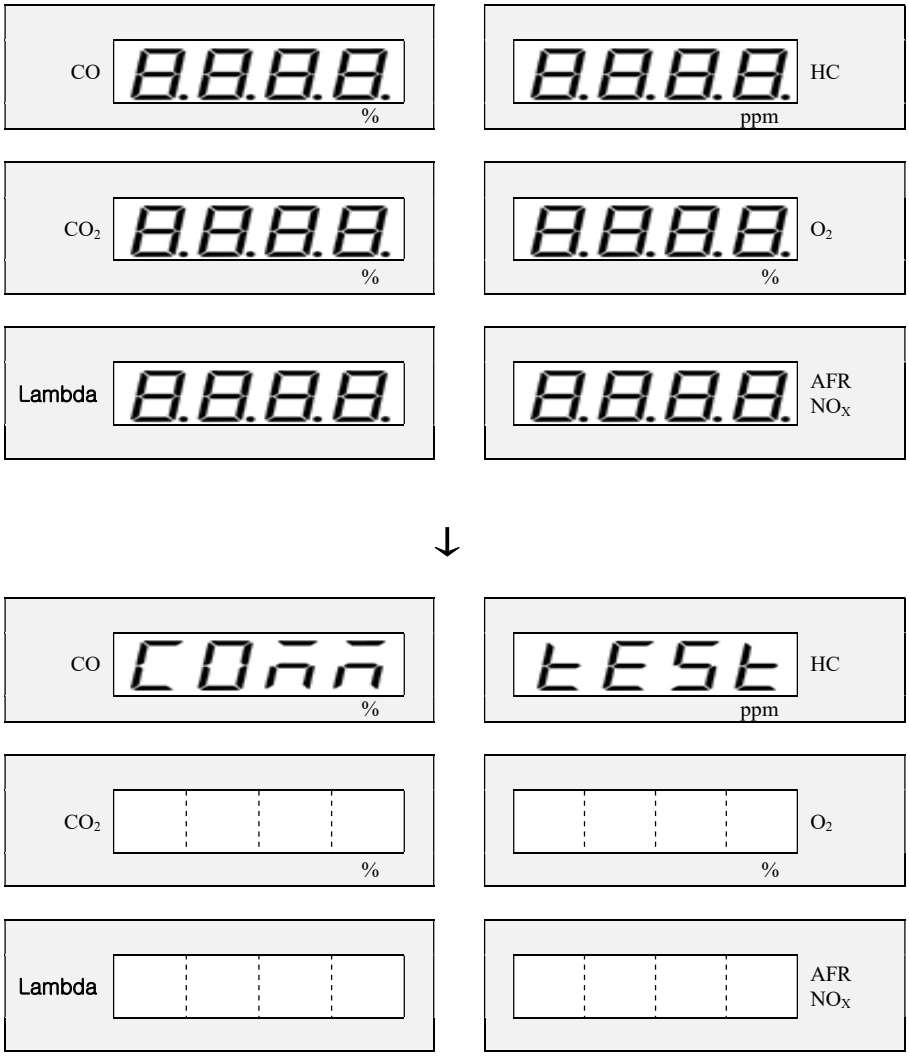
② NGA 6000 will display current set date and time for about five seconds.

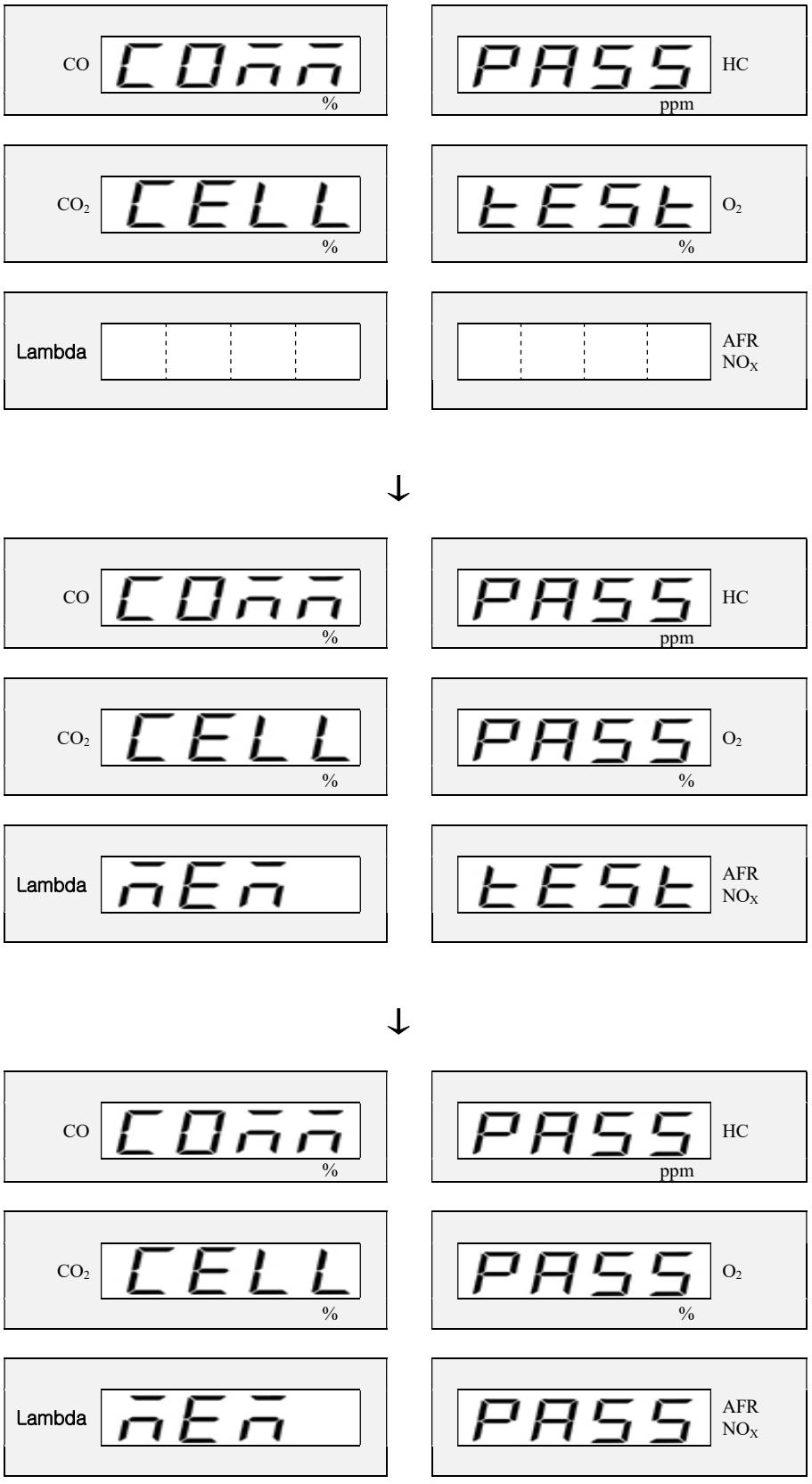


(E.g: May 15th, 2006, PM 1 : 25)

③ After displaying the current date and time, NGA 6000 will perform the self-diagnosis in the order of display window verification, communication, internal sensor, and memory as follows. If the items diagnosed are normal, NGA 6000 will display the [PASS] message.

(Self-diagnosis execution screen)



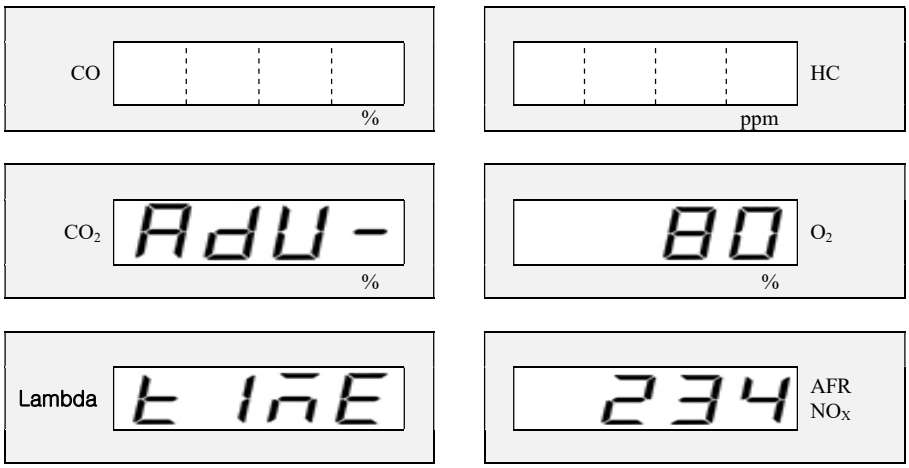

CO
%
HC
ppm
CO2
%
O2
%
Lambda
AFR
NOX
CO
%
HC
ppm
CO2
%
O2
%
Lambda
AFR
NOX
CO
%
HC
ppm
CO2
%
O2
%
Lambda
AFR
NOX

④ Upon completing the self-diagnosis, the screen displays as shown in the figure below.

⑤ The warming-up will be performed while the counter-value decreases by 1 between 120 and 480.

(Perform the warming-up for 2 through 8 minutes according to the neighboring temperature or the status of equipment use.)

Activate the pump one minute before ending the warming-up and clear up the inside of equipment with the clean air.

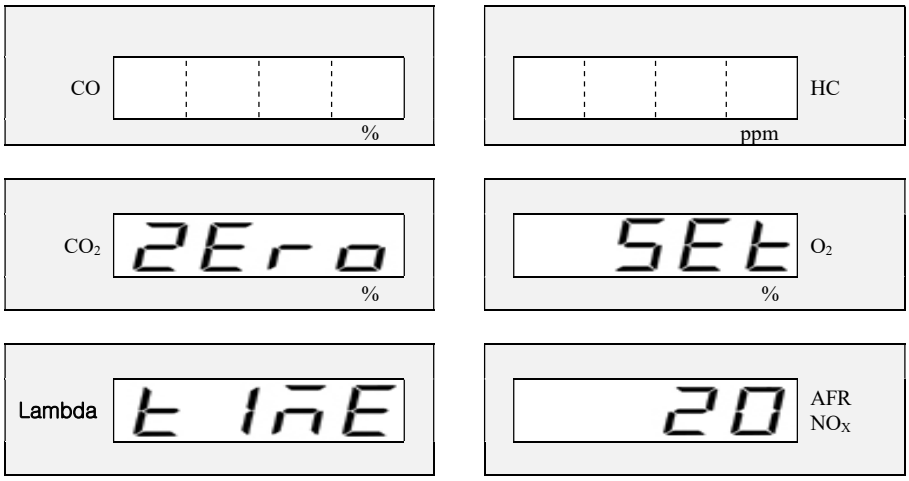


☞ **Precaution**
Be sure to place the end of probe in the clear air during processor.

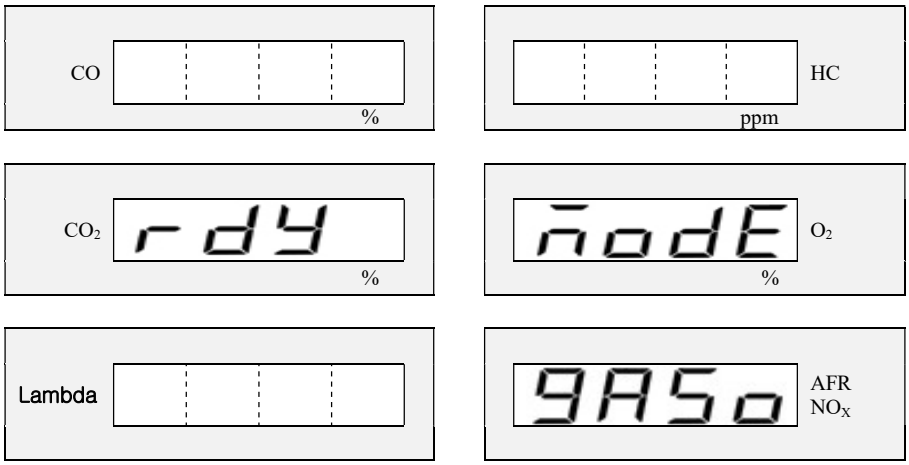
⑥ The initial calibration is automatically performed once the warming up is over.

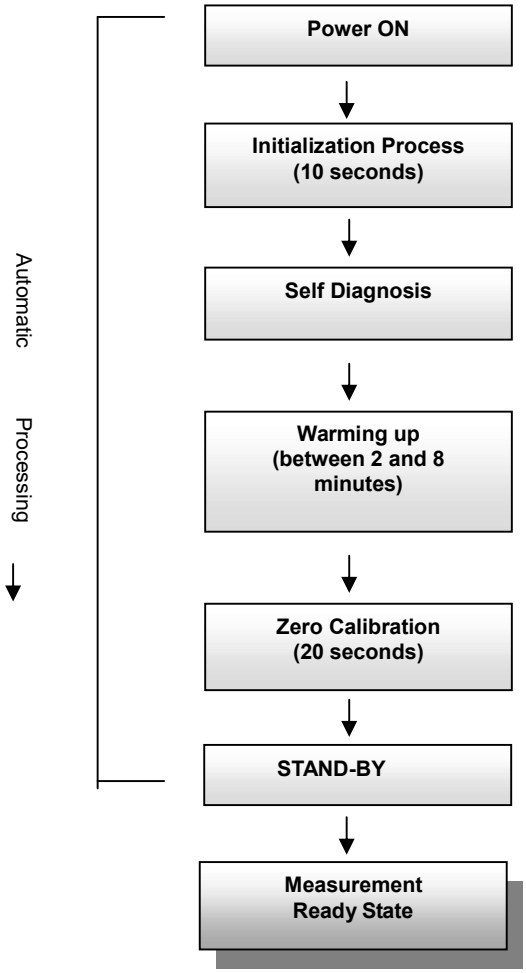
The counter-value will decrease by 1 from 20 as shown in the figure below.

Then zero calibration will be performed for 20 seconds.



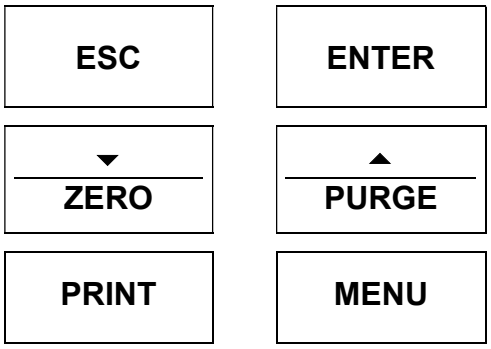
⑦ Upon completion of the zero calibration, the following messages will be indicated on the window showing that NGA 6000 is in a ready for measurement.



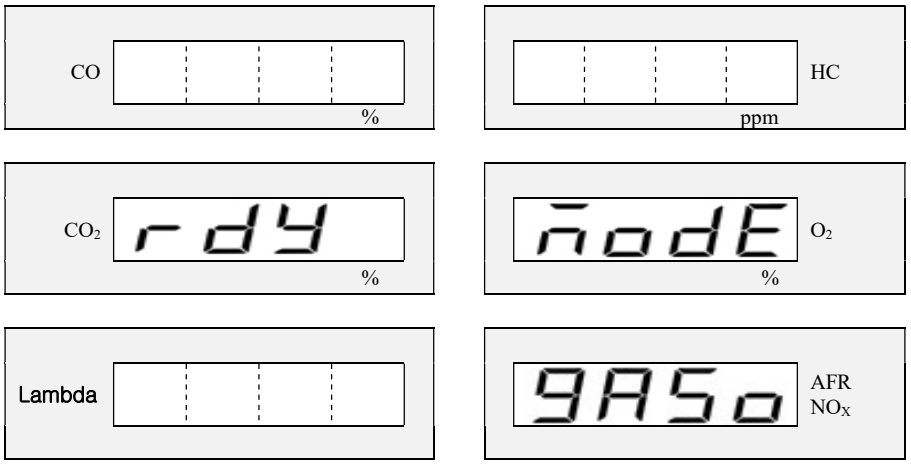


6-2. Stand-By

The standby means when NGA 6000 is in a non-measurement state for a long period of time. In this state, the power is switched [ON] while the suction pump is switched [OFF].



Press the [ESC] key after the measurement or the purge function. And the suction pump will be deactivated.



If the window displays as shown above, rdy mode(ready mode) means the stand-by state and the sign of “gASo” means the selected fuel to calculate the Lambda value.

Please refer to 7-4 and 7-5 to fully understand.

NGA 6000 has the power-saving software in it. It operates in a measurement mode and then turns into a standby mode after 10 minutes as the pump automatically switches itself OFF.

It is also programmed to operate in a purge mode for just 10 minutes and turns to be in a standby mode automatically.

In this manner, in short term NGA 6000 will elongate life cycle of a filter exchange period and in long term, will elongate the life cycle of pump and other parts as well.

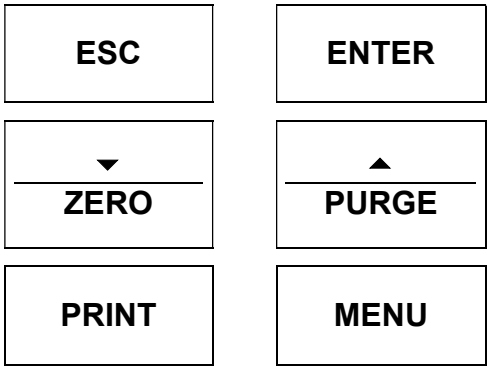
Note

It is recommended against the measurement of the exhaust gas in a highly humid weather such as a rainy day. If it is unavoidable, reuse the filter attached to the probe handle with the air blow. In addition, perform visible verification of the main filter and the dust filter attached to the rear of NGA 6000 whether they have a lot of moisture accumulated, and exchange them with new ones, if possible.

6-3. Purge

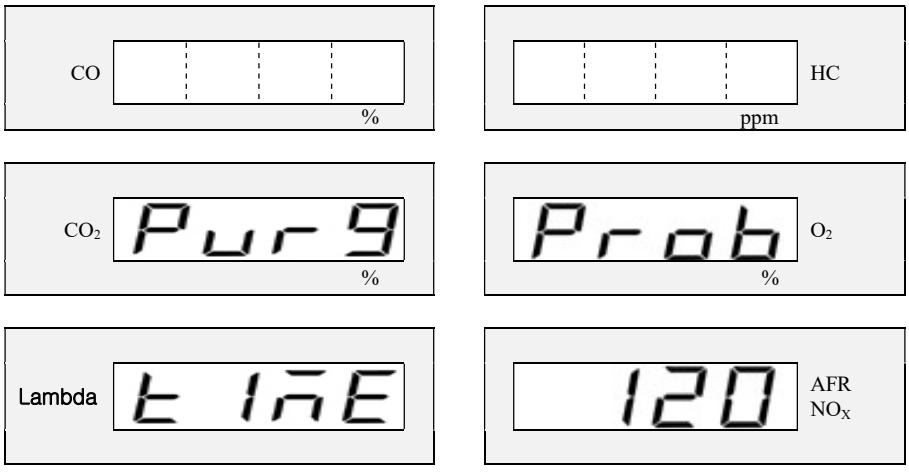
The [PURGE] mode indicates that the gas remaining in the sample-cell in NGA 6000 is being cleared up with a clean air from the probe.

PURGE mode of NGA 6000 cleans the probe for about 120 seconds and internal sample cell for 20 seconds.

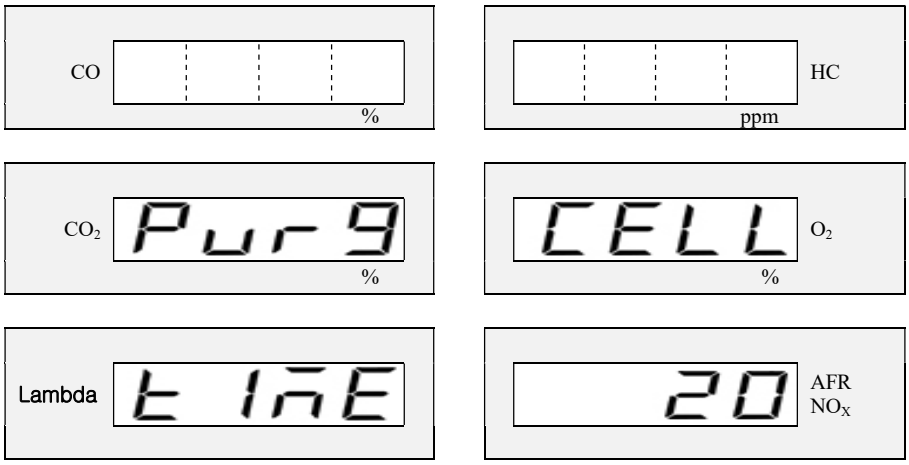


① Press [PURGE] key and the following will be displayed. The probe is cleaned for two minutes.

★ Place the employing end of probe on a clear air.



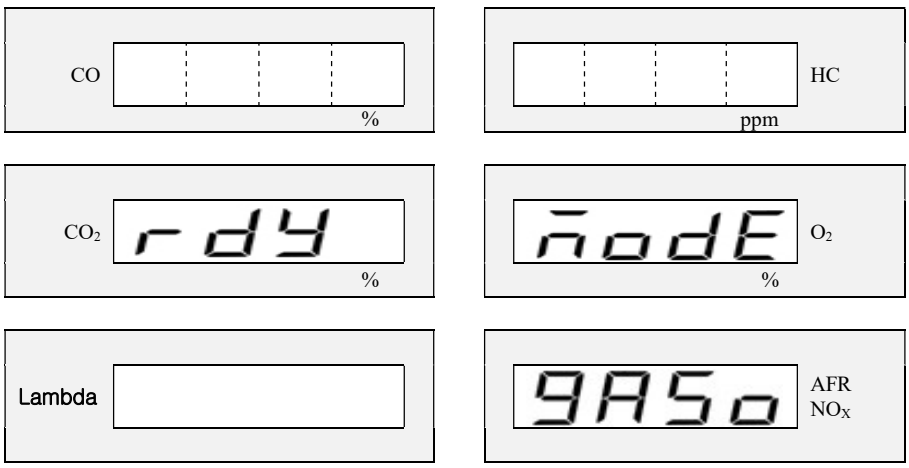
② After the probe clearance, zero calibration is automatically performed as follows for 20 seconds, and cleaning process of sample cell starts.



③ When zero calibration is finished, it is automatically switched to standby mode.

★Press the [PURGE] key one more time during the PURGE operation, and the PURGE function is performed for 30 minutes.

After continuously using the exhaust gas of a vehicle for a long time, there may be lots of remaining gas in the probe and sample-cell. If the HC value indicates over 10 ppm after the zero calibration, use this function.

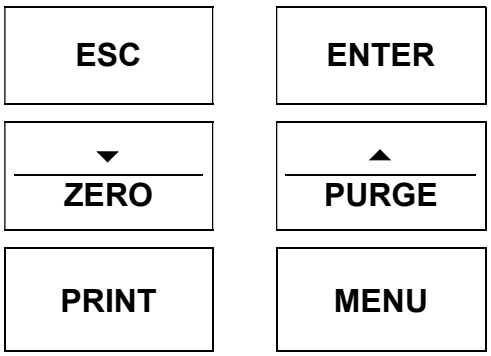


This preparation process is for the next accurate measurement and for the protection of sample-cell in the equipment. Therefore, after the continuous operation for a long time, please clean up the inside of equipment by pressing the [PURGE] key.

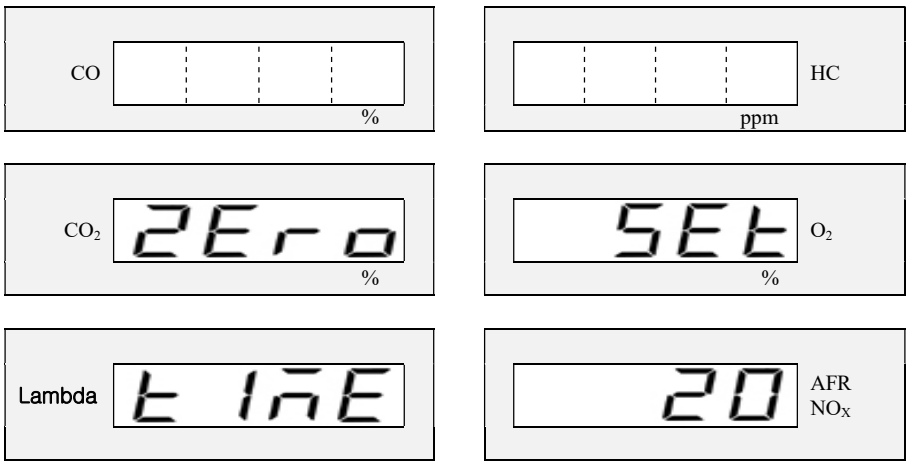
Note
Build up a habit to clean NGA 6000 with the [PURGE] function for at least 10 minutes upon completion of the daily routine operation before switching the power off.
It maintains the accuracy of NGA 6000 and prolongs the life cycle of the equipment.

6-4. Zero calibration

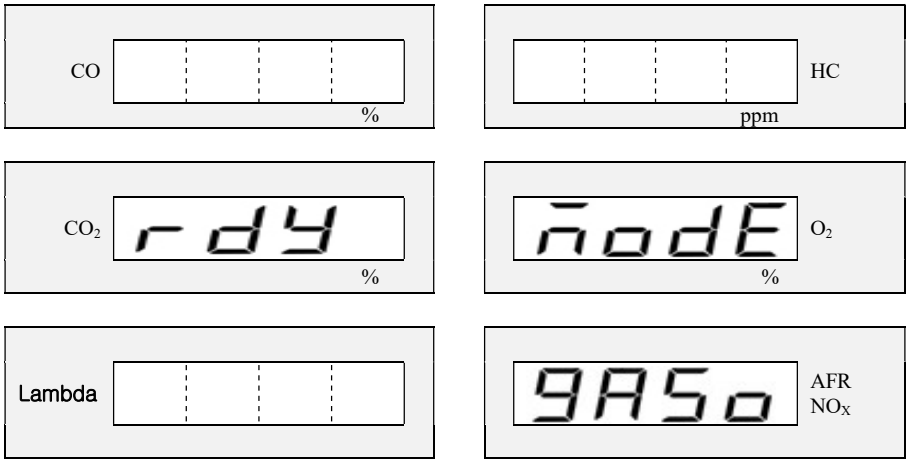
Press the [PURGE] key to clean the inside of NGA 6000 with a clean air before pressing the Zero key.



① Press the [ZERO] key. The counter values will be decreased by 1 from 20 as shown in the figure below during the 20-seconds process of the zero calibration.



② After the zero calibration followed by indicated messages, NGA 6000 is in a measurement ready state.



Note 1

If the values are indicated as more than CO: 0.05%, HC: 30ppm even after the zero calibration, press the PURGE key again to clean the inside of NGA 6000 with a clean air for about 2~3 minutes. And then perform the zero calibration again.

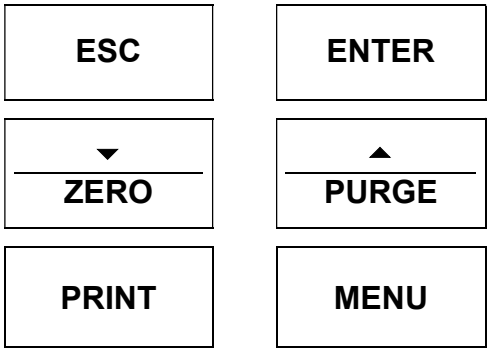
Note 2

Activated Charcoal Filter: It is also known as ZERO filter.
It either neutralizes or combines the HC in the surrounding atmosphere during the zero calibration adjustment to prevent distortion of the actual HC measurement during the measurement.
Please exchange the filter in a six-month interval but the life of that depends on utility frequency.

6-5. Measurement

① Place the probe in the clean air to perform the [Zero calibration].

② Push the probe deep into the exhaust outlet of the vehicle and measure exhaust gas by pressing measurement key.

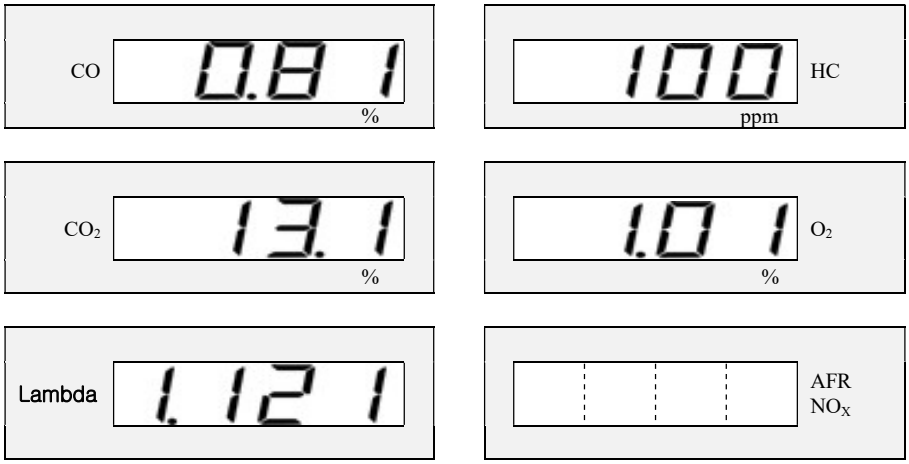


※ The measurement operates for 10 minutes and the pump is automatically stopped by the activation of the power-saving mode. Press [ENTER] key again to measure the exhaust gas for more than 10 minutes.

③ Pull the probe out of the exhaust outlet of the vehicle. Then clean the inside of NGA 6000 with the clean air by pressing the [PURGE] key until the measurement values drop to 0.

④ If all the measurements fall close to 0, press [ESC] key to maintain NGA 6000 in a stand-by mode.

⑤ Press the [ZERO] key for a series of measurement. Then, repeat ②, ③, and ④.

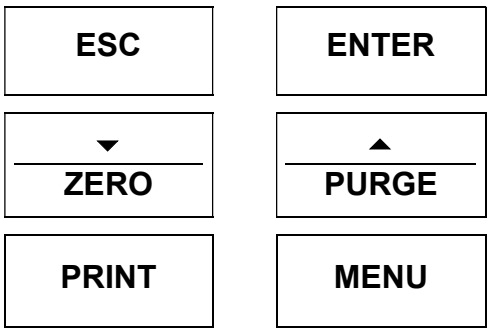


Example of exhaust gas measurement display

6-6. Hold

① This function stops measurement screen temporarily.

② This operates only in measuring state.



③ If you press [PRINT] key once, measurement screen stops.

* If you return to measurements state, press [ESC] key.

6-7. Print

A function to print out the measurement result of the exhaust gas.

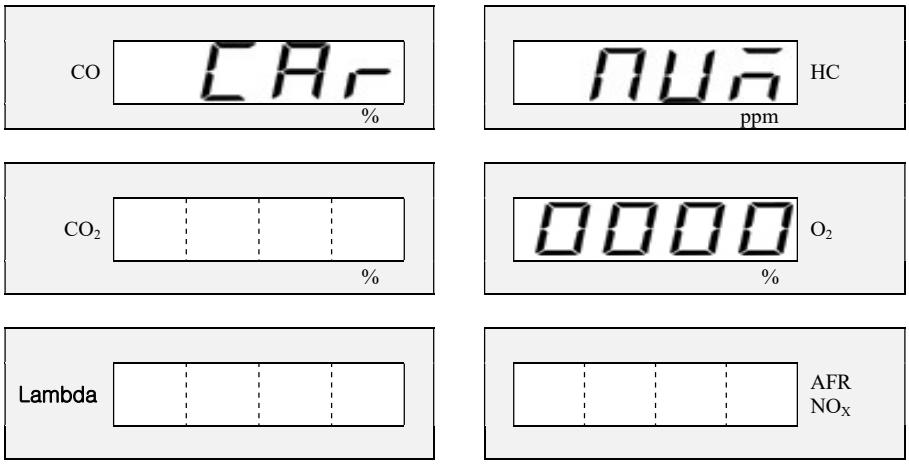
Analyzer's inner printer is thermal printer.

① Turn the printer on, and be ready to print.

② Press [PRINT] key when measuring value is stabilized.

[PRINT] key operates only in measurement mode.

③ If the measurement board is in Hold mode, press the [PRINT] key one more time in the Hold mode, and the car number registration screen is displayed as shown in the Figure above and the figure in the highest digit blinks.



④ Press the [▲] key, and the blinking figure increases. After adjusting the desired figure, press the [▼] key and the figure in the next digit blinks. After registering the car number by using the [▼] and [▲] keys, press the [PRINT] key. Then the print starts.

Automotive
Emission
Analyzer

2006/05/15
PM 01:30

CAR NUMBER : 1234

CO	:	%
HC	:	ppm
CO2	:	%
O2	:	%
NOX	:	ppm
LAMBDA	:	
AFR	:	
FUEL	:	
H/C	:	
O/C	:	

.

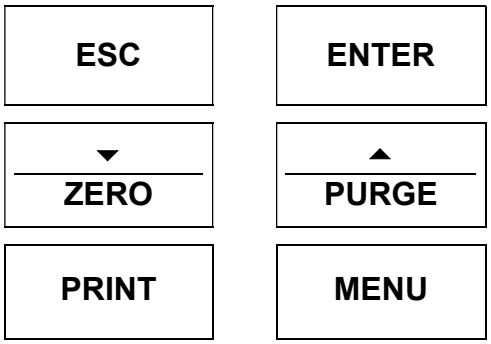
7. Selection Mode

7-1. Key functions

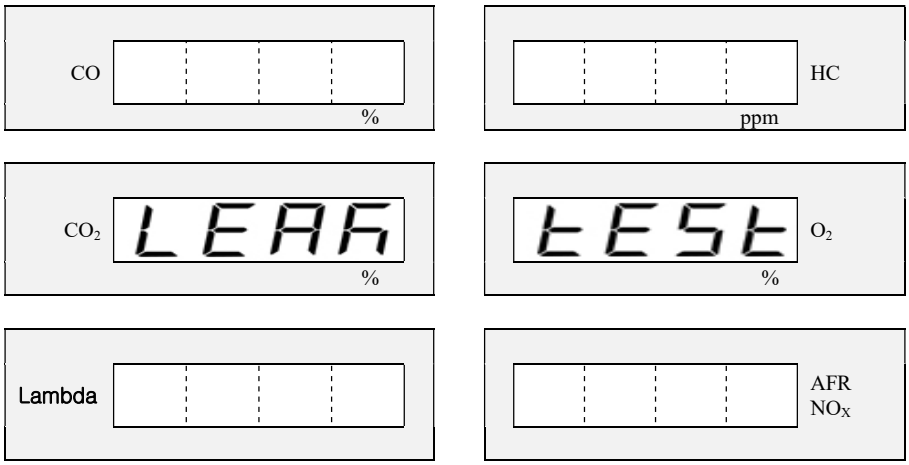
Key	Contents
MENU	Use the key to perform the leak test, the PEP value indication, the program version indication, and the standard gas calibration. Press the [MENU] key and NGA 6000 will operate as shown below. Leak test → Remaining HC test → Used fuel → HCV / OCV → PEF value indication → Time set up → NO_X measurement set up → Gas calibration → Printer set-up Press the [MENU] key. NGA 6000 will operate according to the contents ▼ , ▲ , ESC , ENT printed on the upper side of each key.
▼	Use this key to change the setup positions.
HOLD	When you stops measurement value temporarily, use it
▲	Use this key to increase the setup values.
ESC	Use this key to end the selection mode and change into a measurement mode.
ENTER	Use this key to select the present mode indicated, or to execute the number substituted.

7-2. Leak test

A function that looks for any possible air leakage from the sample-cell in order to indicate the result.

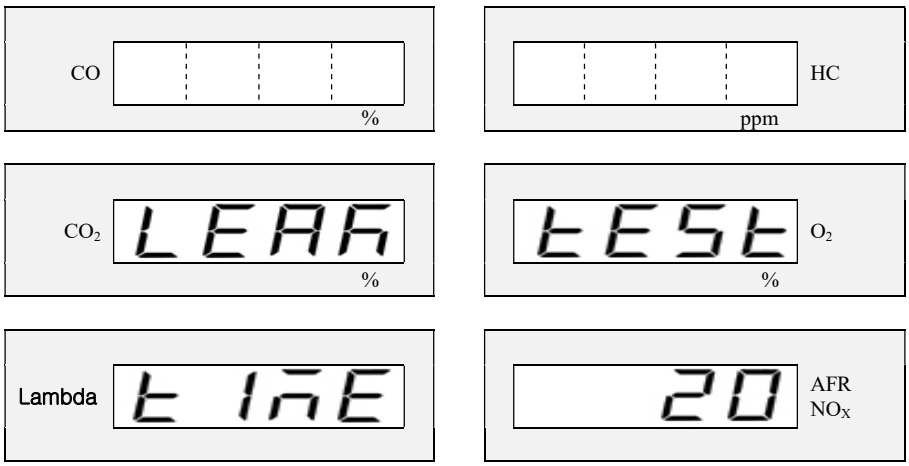


① Press the [MENU] key once in the stand-by mode to select the Leak Test mode.

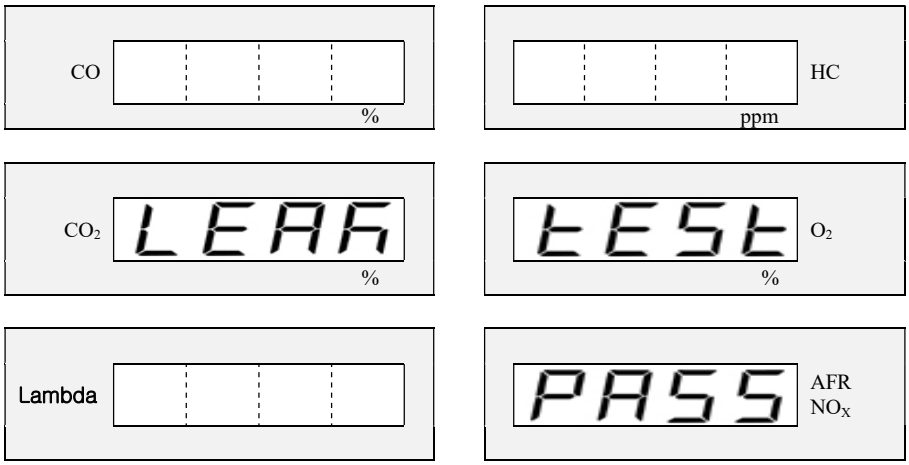


② If the message 'Leak test' is indicated on the indication window as shown above, mount the leak test cap on the front side of the probe.

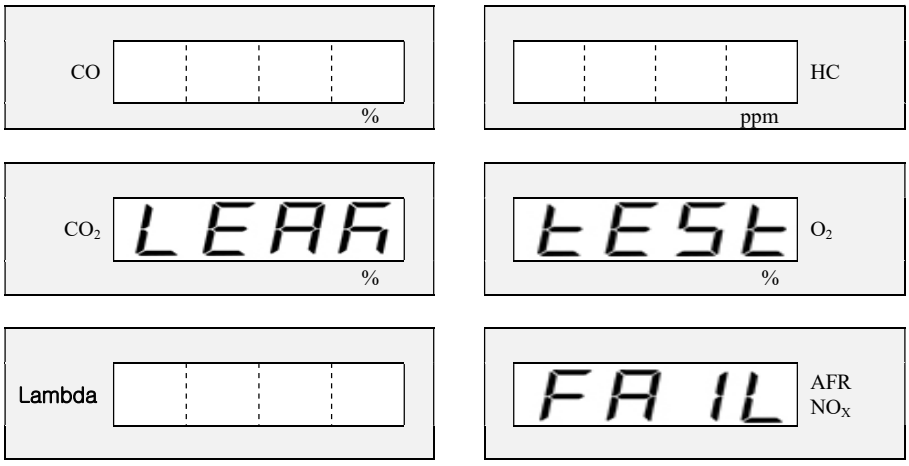
③ Press [ENTER] key. The pump operates and the count values decrease by 1 from 20 during the 20-second leak test.



④ If the test turns out normal without any leak after 20 seconds, a message is indicated as 'PASS". If the leak is identified, the message is indicated as 'FAIL'.



(When leak test is fine)



(When leak is identified)

④ NGA 6000 returns to the Standby mode automatically unless other keys are pressed within 30 seconds after the leak test.

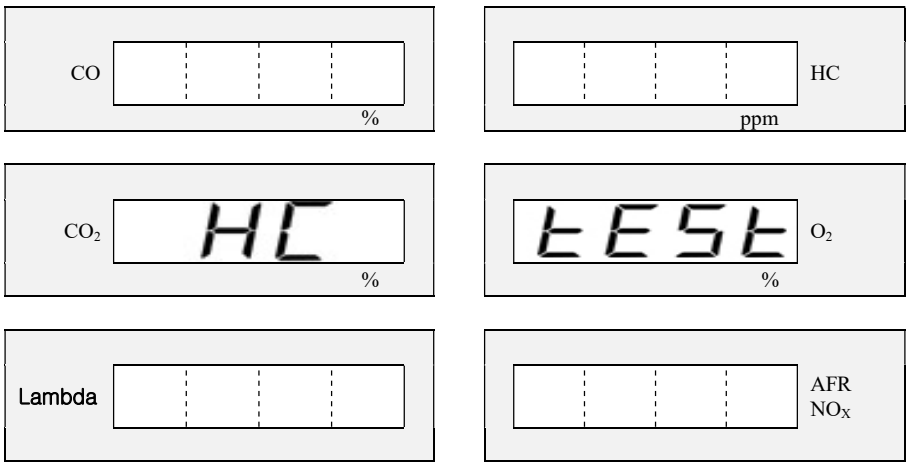
When the result is indicated as FAIL

- **Check if the leak test cap is normally mounted.**
- **Check the probe and hose, and perform the leak test again to check if the leak is caused from the probe or the hose.**
- **Check if various filters are correctly connected.**

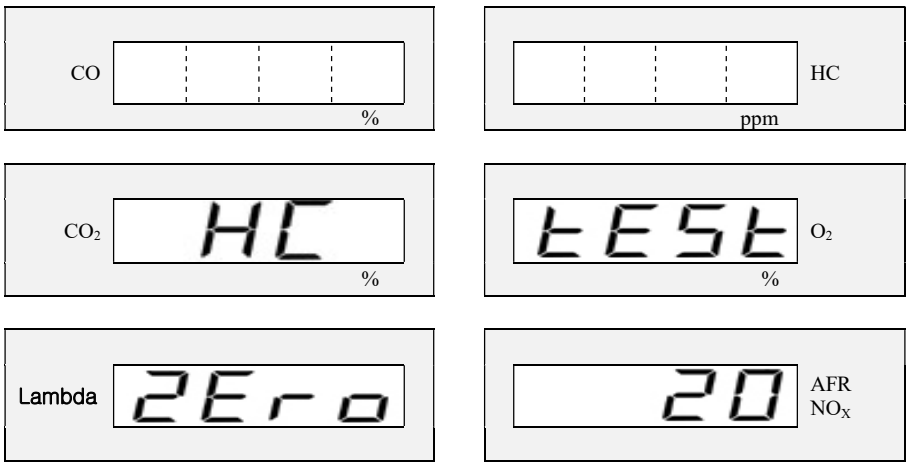
7-3. Remaining HC test

This test measures HC element accumulated in sample extract probe line and inside this analyzer. The function is to indicate the degree of pollution.

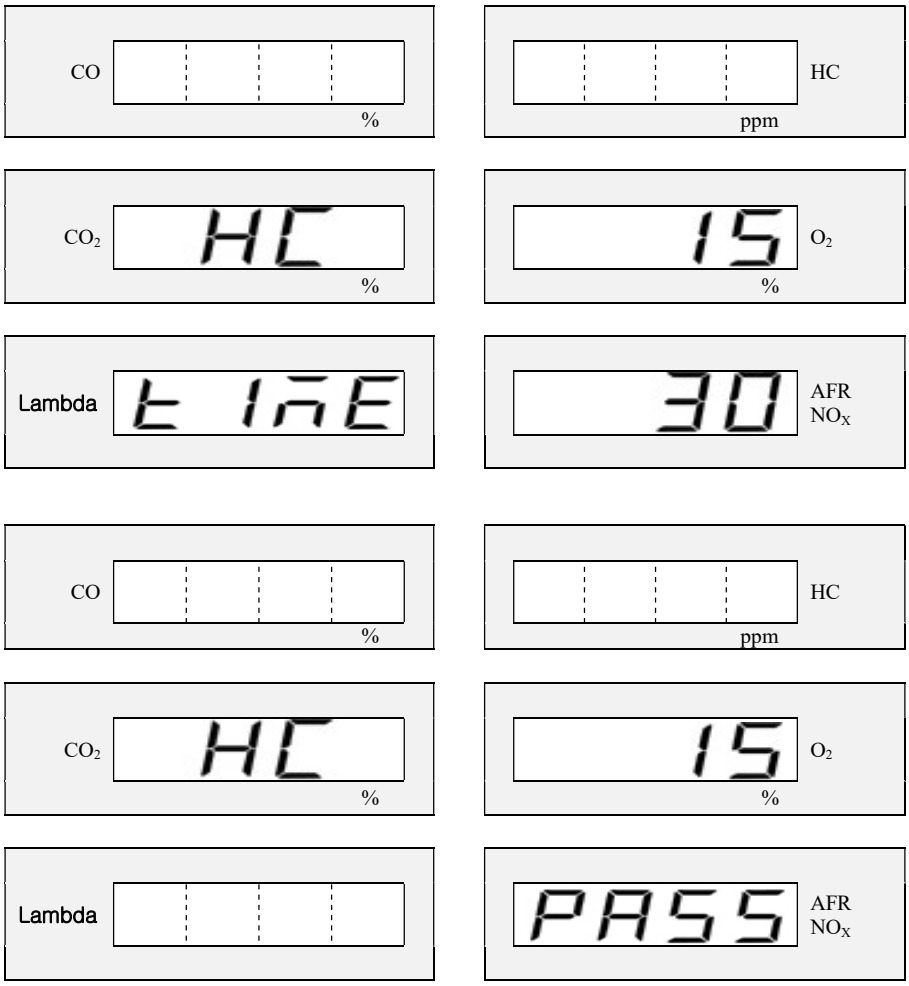
① Press Select key twice in standby mode.



② Press [ENT] key. Perform the zero calibration for 20 seconds as shown below.



③ As the pump starts operating, the counter value is decreased by one from 30 as shown in the following and the remaining HC test is performed for 30 seconds. During the test, HC density is displayed.



④ If HC value is below 20ppm for 30 seconds, it means normal, and displays 'PASS'.

If HC value is over 20ppm for 30 seconds, give another try from above ③.

If the result of the second try is over 20ppm, 'FAIL' sign is displayed.

⑤ Clean inside this analyzer by pressing the PURGE key when "Fail" is indicated because remaining gas leaves from the end of the probe to inside this analyzer. But if "Fail" is indicated again after the purge mode process, please exchange various expendables filters to have a remaining HC test again

7-4. Selection of fuel

This is the function that selects fuel for testing vehicle. It is used to calculate air surplus rate (Lambda) and AFR. This analyzer can select the fuel such Gasoline, LPG, CNG, and Alcohol.

GASOLIN ⇨ LPG ⇨ CNG ⇨ ALCOHOL

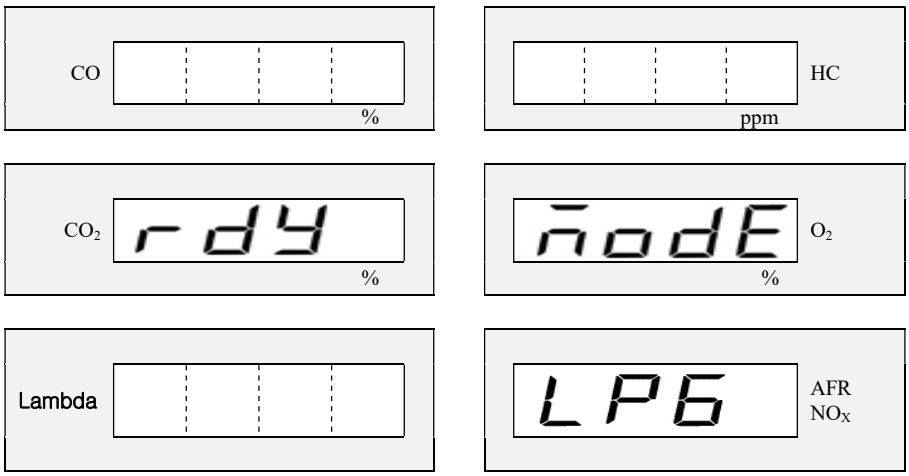
① Press MENU key three times from standby mode.

② Selected fuel is indicated as in the above. Use ▼ , ▲ keys until it indicates the fuel to select.

③ Press ENTER key to setup the selected fuel.

④ For Example, If the “LPG” fuel is selected, the window indicates as shown in the below.

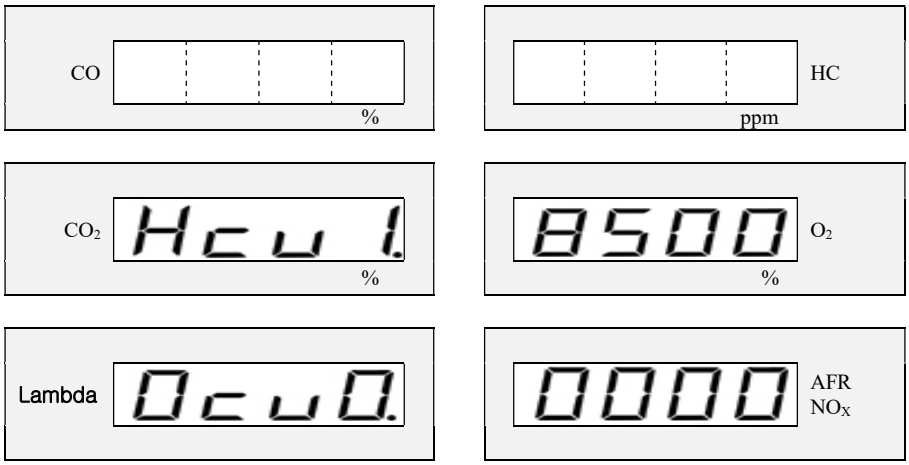
⑤ The selected fuel display will remain as set until the power supply is switched off in the standby mode. It is programmed to display gASo (gasoline), the most commonly used fuel, when the power supply is switched off and then on.



7-5. HCV and OCV setup

This is the function that selects ratio between hydrogen and carbon (Hcv) and ratio between oxygen and carbon (Ocv) for the fuel. This function is used to calculate Lambda value which is defined by the ratio of actual AFR and theoretical AFR through Brettschneider formula. Following table is for normal Hcv and Ocv, but there are cases to apply other values depending on formulation of fuels and country to use. Once Hcv and Ocv values are setup, they are stored in memory and are maintained even after rebooting.

① Press [MENU] key four times from standby mode.



CAUTION	**Random change of Hcv and Ocv can distort air surplus rate and AFR. So maintain the values in the following table. However, in case fuel composition differs and you require to change it temporarily, note that you have to enter a precise value. If not so, this analyzer may display any error value of Lambda(air surplus rate) and AFR.**

The value of Hcv and Ocv is not possible to change. If it requires to change the value of Hcv and Ocv due to the difference of molecular structure of the fuel, please contact those whom you purchased the analyzer from.

	Gasoline	LPG	CNG	Alcohol
Hcv	1.8500	2.5000	3.830	3.000
Ocv	0.0000	0.0000	0.000	0.5000
AFR	14.7	15.5	16.9	9.0

7-6. PEF Indication

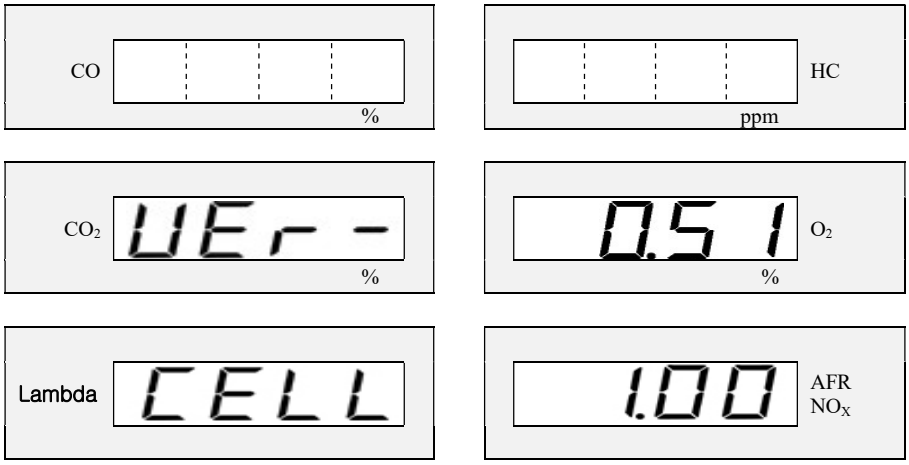
Propane Equivalency Factor (PEF) indication function indicates the figure to convert from the propane gas into the N-Hexane. The value is the unique constant of relevant measurement cell and should not be modified or adjusted at random. Multiple the propane density by the PEF values to convert into the N-Hexane density.

① Press [MENU] key for five times. Then, the PEF values are indicated as the following.

7-7. Program version indication

It is possible to indicate the version of NGA 6000 with this function.

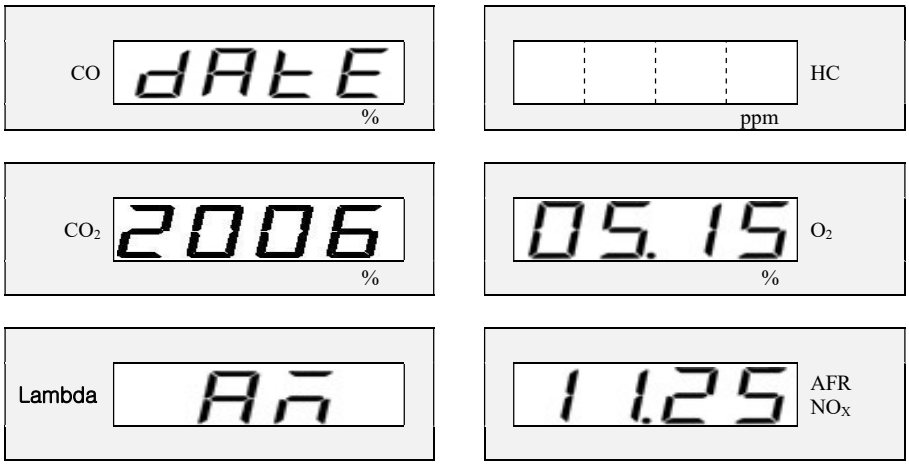
Press the [MENU] key six times in the Standby mode. The program and internal sensor version is indicated as below.



7-8. Time setup

Date and time is displayed and can be set

① Press [MENU] key seven times in standby mode. Then current time is displayed as shown below.



(E.g.: May 15th, 2000, AM 11:25)

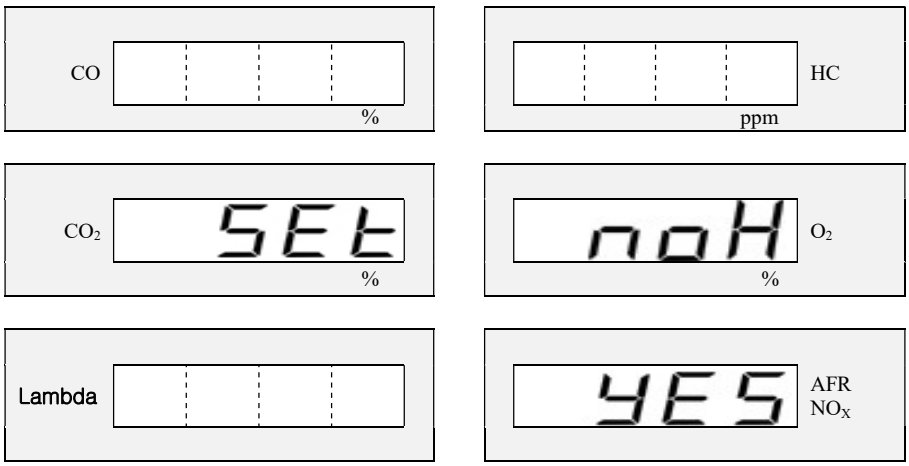
② The values of date and time are set in the order of **Year→Month→Day→ → AM/PM→Hour→Minute,** and are increased or moved with the [▼] and [▲] keys. Upon completing the setup, press the [ENTER] key to store it.
The range of setup value is shown in the Table below.

Setup	Contents
Year	Increase or decrease between three years before and after the set up year.
Month	Increase or decrease between Jan ~ Dec.
Day	Increase or decrease by one.
AM/PM	AM and PM rotates. Select one from both.
Hour	Increase or decrease between 1 ~ 12 o'clock.
Minute	Increase or decrease by one.
[▼]	Move the setup location.
[▲]	Increase the setup value.

7-9. NO_X setup

It is a function selecting where to attach NO_X sensor.

① Press select key for eight times in standby mode.

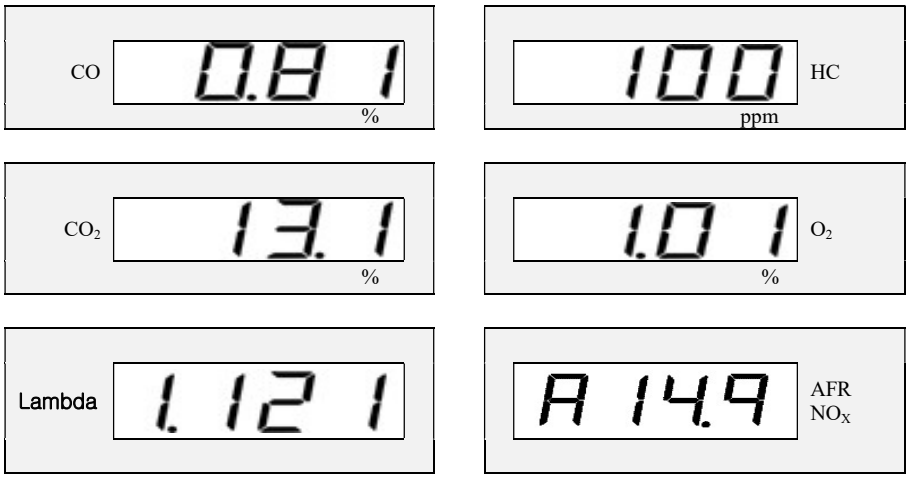


(When it is set up to NO_X display)

② [▲] key changes display to YES or to NO.

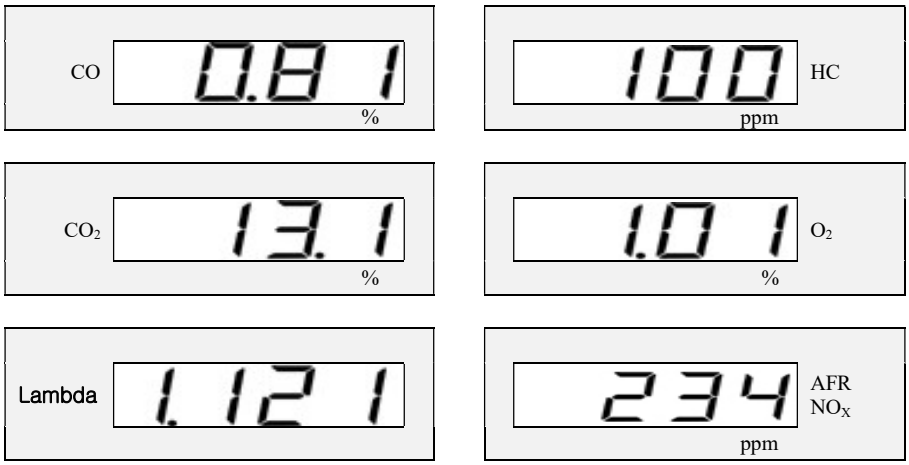
③ Select YES for NOX display mode, NO for non-NOX display mode, then press [ENTER]

※ "A" is attached as shown below in the AFR(Air/fuel rate) display mode and disappears in the NOx display mode.



Example of exhaust gas measurement display

Indication of NO value on 5GAS analyzer will be as below. Measuring unit of NO value is ppm and the measuring range of NO value is 0 - 5,000 ppm.



7-10. Standard gas calibration

This analyzer is supplied after accurate calibration with the standard gas (the gas authenticated by the government-authorized organization). However, it is recommended to adjust the gas at any time (at least once in every six months) to maintain the accuracy of this analyzer.

This analyzer is designed to prevent any the faulty calibration due to mishandling. Try to fully understand these manuals and operate NGA 6000 according to the specified procedure, for it has a great influence on accuracy of a standard gas calibration.

7-10-1. Precautions for the standard gas calibration

① The gas used for the standard gas contains poisonous compositions and causes a fatal damage to human body. Perform the calibration process in a well-ventilated place to prevent any accident caused by the gas poisoning.

② If the mixed gas that has no test record or that is expired has been on use, the accuracy of this analyzer can be seriously deteriorated. Therefore, it is recommended to use the standard gas authenticated by the authorized organization.

③ In the NDIR type analyzer, the change of the pressure and the flow may influence the measurement values in its principle of measurement. So, the standard gas with its pressure and flow out of the specified range may lower the accuracy of the equipment.

④ The standard gas calibration process is complicated and may affect measurement values. It is recommended to request the service center for the process, if possible.

7-10-2. Preparatory materials

Items	Contents
Standard gas	The standard gas with the attached test record from the authorized organization
Density range of the standard gas	C_3H_8 : 250～3000 ppm, CO: 2.00～6.00 %, CO_2 : 10～15 % N_2 balance
Recommended density of the standard gas	C_3H_8 : 2000 ppm, CO : 5.00 %, CO_2 : 14 % N_2 balance
Pressure supplied (Secondary pressure)	2GAS : 0.5 kgf/㎠±0.1 4GAS : 0.5 kgf/㎠±0.1 5GAS : 0.7 kgf/㎠±0.1
Flow supplied	4～5 ℓ /min
Pressure controller	Use the device with the flow-meter, the flow adjustment valve and the pressure gauge indicating both the first pressure and the secondary pressure.

7-10-3. Connection method

7-10-3-1 Connection method by Standard gas Cylinder

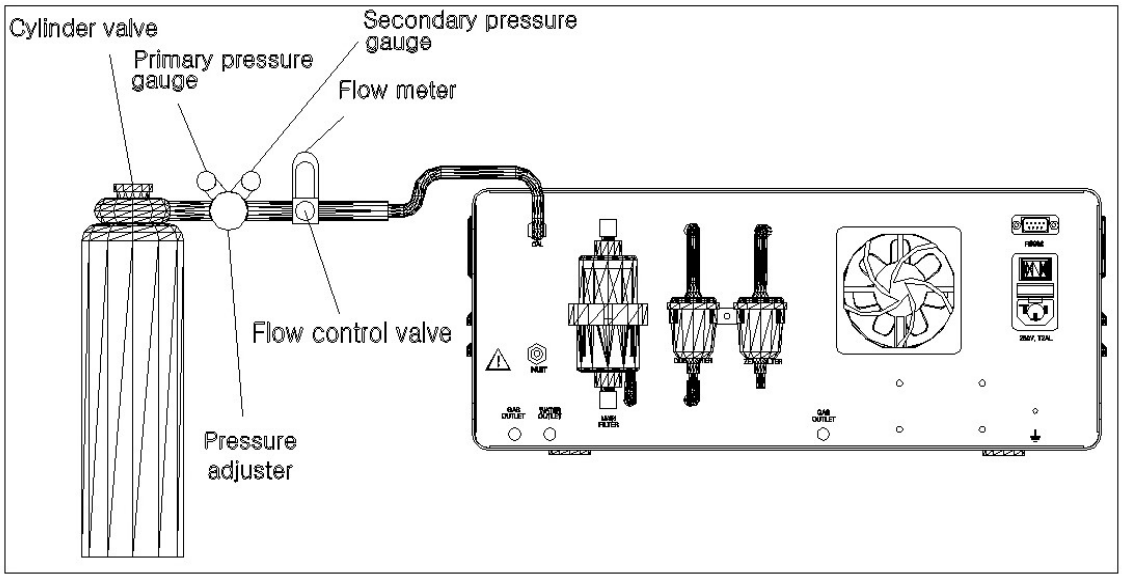
① Connect the standard gas cylinder to the CAL (standard gas suction nipple) in the rear of this analyzer main frame. Be sure to close all the gas valves of the gas tank by turning them in the [Close] direction to cut off the gas. The standard gas is only to be injected under the message indicated at this analyzer.

② Unwind the pressure controller counterclockwise to cut off the pressure, and open the valve of the standard gas cylinder counterclockwise. If the first pressure falls to 10kgf/cm^2 or below, exchange the gas cylinder with a new one.

③ Return the exhaust gas analyzer to its normal measurement state.

④ Close the flow control valve and turn the control adjuster clockwise little by little to adjust the secondary pressure to 0.5～1.0 Kgf/㎠.

⑤ Open the flow control valve little by little to control the flow to 4～5 ℓ/min. Control the flow by using the pressure controller because the secondary pressure may change during the minute control of the flow.



[Figure 1]

7-10-4. Standard gas calibration

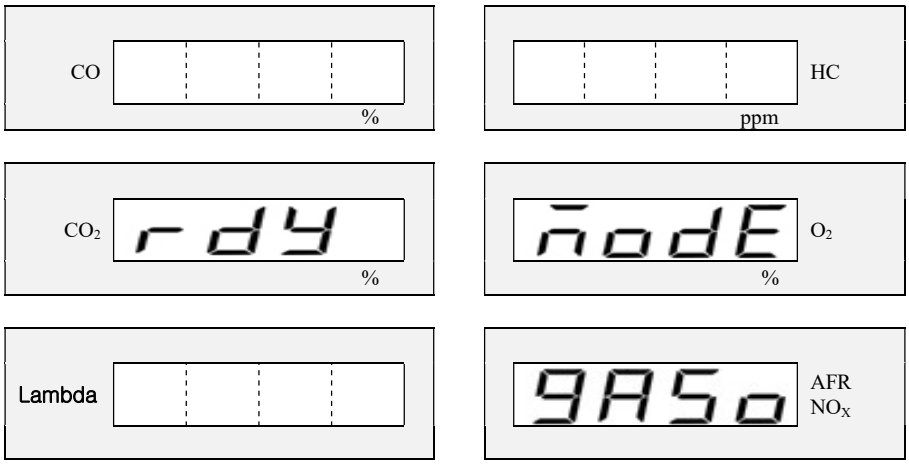
☞ **Precautions**

- **Read the manual and adjust the standard gas in the following order.**
- **Check if all the preparatory materials are ready.**
- **Check if the gas pressure is controlled to the requirements.**
- **This analyzer is designed to prevent NGA 6000 from being wrongly controlled due to poor manipulation of unskilled person. However, since the standard gas calibration severely affects the accuracy of analyzer, the operator must fully understand the contents of this operation manual and observe the specified procedures.**

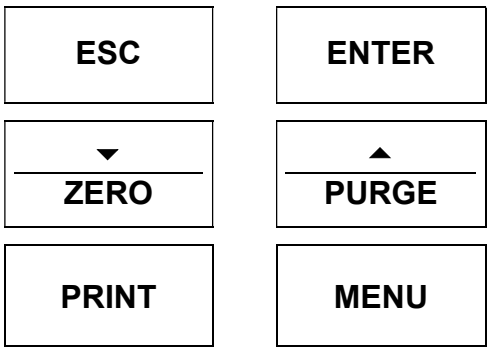
Note

- **NGA 6000 is converted into the standby mode unless you convert into other modes within 30 seconds during the standard gas calibration.**
- **If you decide that the standard gas calibration is in the wrong process, press [ESC] key to restart the process.**

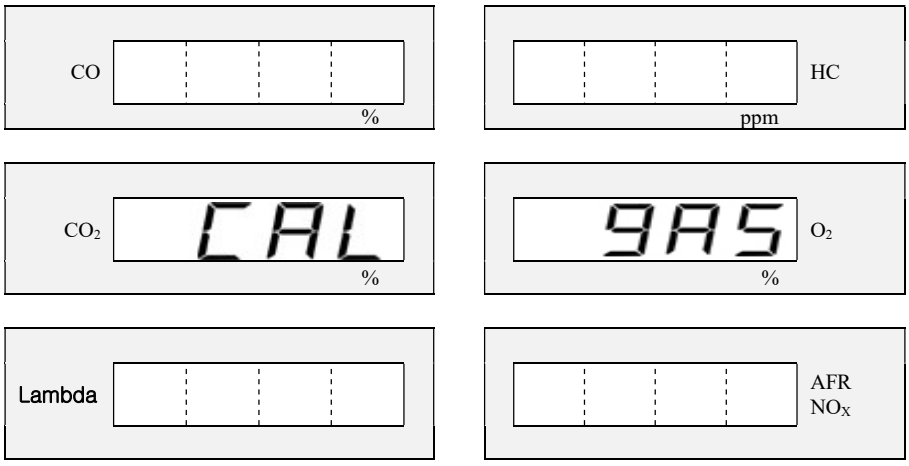
① Set this analyzer in [STAND-BY] mode.



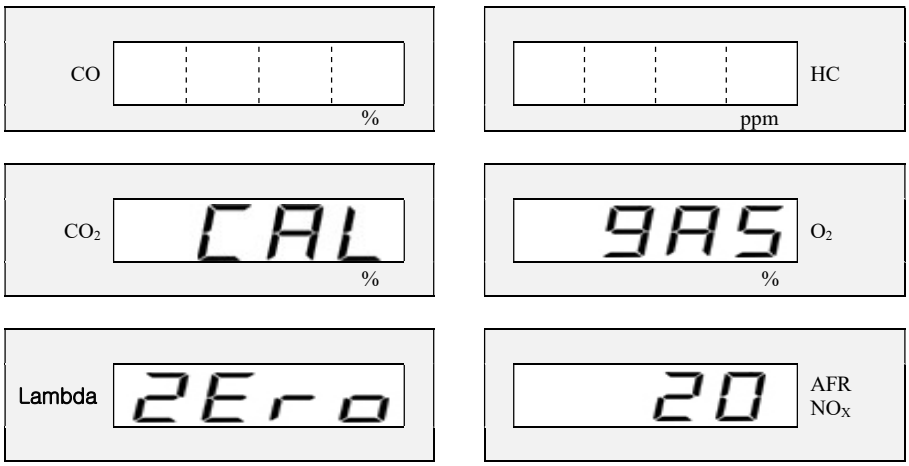
② Press [MENU] key nine times.



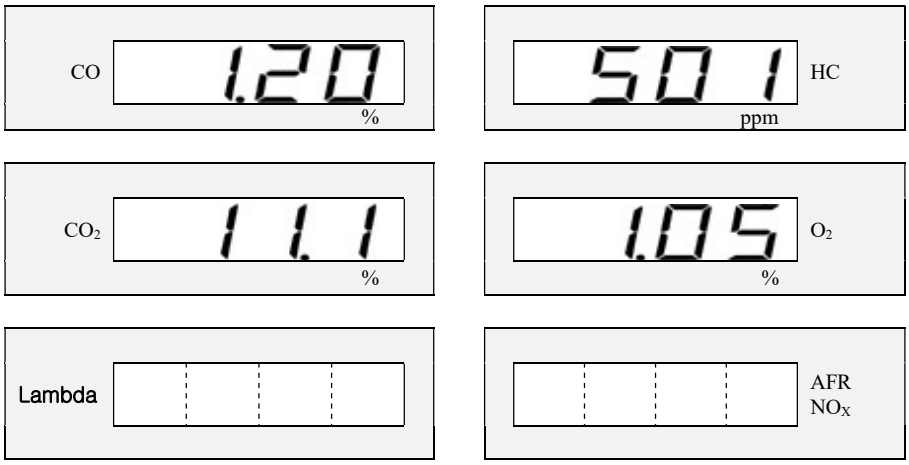
③ The following message is indicated. NGA 6000 operates according to the [▼] , [▲] , [ESC] , [ENTER] printed on the upper part of each key.



④ Press [ENTER] key in the above state. The [Zero calibration] starts automatically for once.



⑤ When the [Zero calibration] is completed, the values will be indicated on the indication window as shown and the value in the first digit will blink.

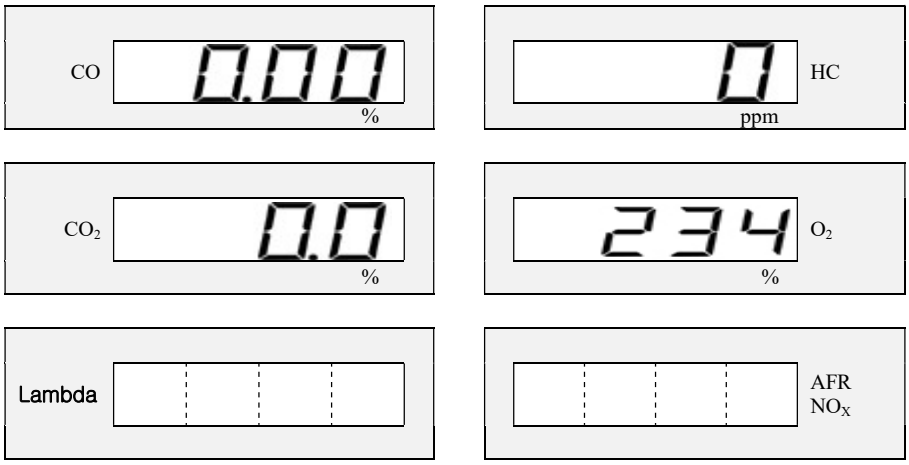


⑥ The [▲] key makes the blinking number increased. After the setup of the required number, press [▼] key to move the blinking part to the next field. Use [▼], [▲] keys to setup to standard gas value of gas cylinder, then press [ENTER] key. The each value of CO, CO2 and O2 is entered the one displayed on the gas cylinder, but the HC value is entered the N-Hexane value which is explained in 7-6. For example, HC value = the value is displayed on the gas cylinder (propane HC value) x PEF value.

If the HC value of the gas cylinder is 1002 ppm, multiply it by 0.5 of PEF value and the outcome value of 501 ppm is gas calibration.

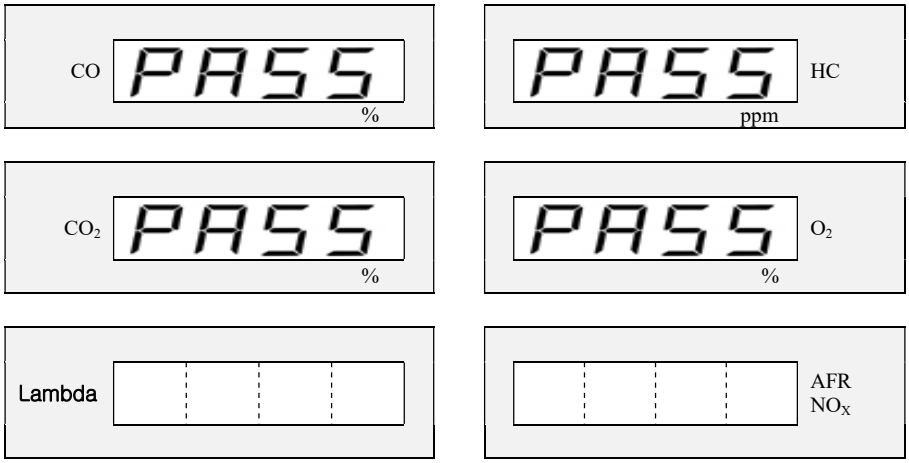
※ Adjustment of the NO value is just to input the value indicated on cylinder, then it will be adjusted. When you do this process, you should be very careful and perform it in the area where it has a good ventilation since NO gas is very toxic and dangerous.

If the NO value of the gas cylinder is 234 ppm, value of 234 ppm is gas calibration.



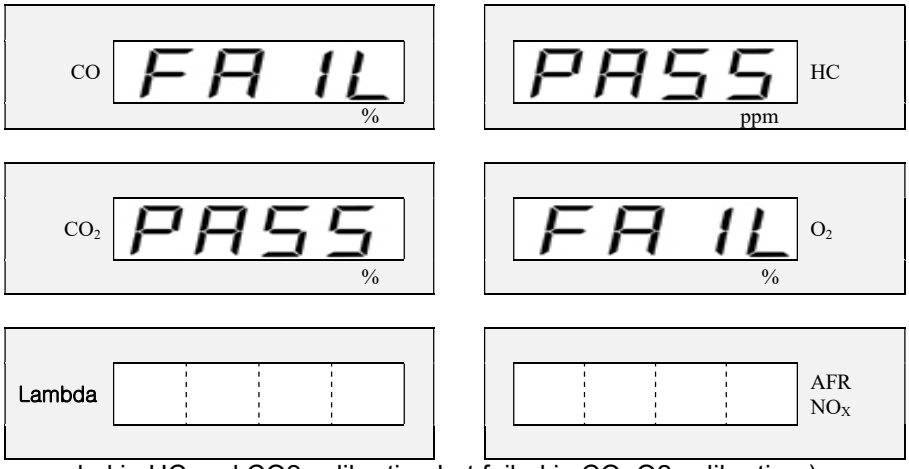
⑦ Open the valve of the standard gas cylinder to spill the standard gas in a constant pressure.

If the measurement values are in a stable state, press both the ENTER key and MENU key at the same time to start the gas calibration.



⑧ If the gas calibration is successfully completed, the message [PASS] will be indicated on each concerned window. If the gas calibration is successfully completed, the message [PASS] will be indicated on each concerned window. When ENTER key is pressed, the calibrated values indicate on each concerned window. When ENTER key is pressed one more time, this analyzer cleans the calibration line for about 120 seconds and performs the [Zero calibration] and returns to the standby mode.

⑨ If the gas calibration fails, the message [FAIL] is indicated on each concerned window. Press the [ENTER] key. NGA 6000 will perform the [Zero calibration] and will return to the standby mode.



(It is succeeded in HC and CO2 calibration but failed in CO, O2 calibration.)

* If the [FAIL] is displayed, return to the standby mode and press the [PURGE] key to clean the sample-cell with a clean air for two or three minutes. Then perform the gas calibration again.

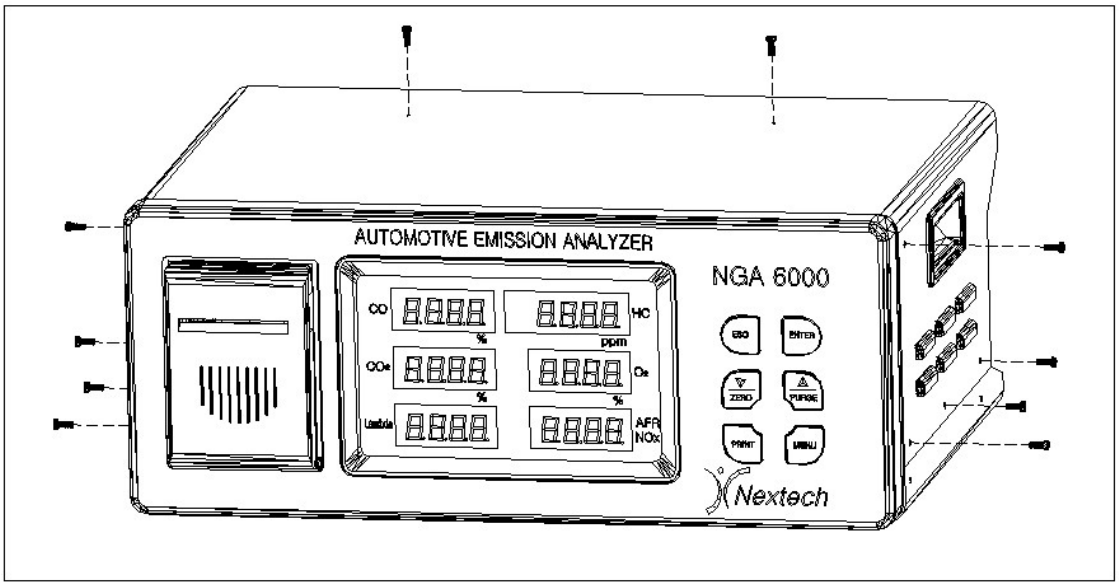
Chapter 8. Fault diagnosis and troubleshooting

Fault	Verification	Troubleshooting
Unable to power switch ON	Is the power cord properly connected?	Connect the power cord.
	Is the fuse cut?	Replace the fuse and check the cause of power overflow.
Unable to measure (Measuring value stays in "0" and does not move)	Do you finish the Warming-up?	Wait until the rdy mode and then measure again.
	Do you press the measurement key?	Press the measurement key in the rdy mode.
	Do you properly connect the probe to the analyzer?	Verify the connection status between the probe and hose (gas inlet).
	Is any of probe, hose or filter Blocked?	Especially this could openly happen in the winder due to water-icing. Verify the probes, hoses, and filters.
COM ERR (Communication error)	Is the input power source well purified?	Use the other power source.
Flow ERR (Flow error)	Is any of probe, hose or filter blocked?	Verify the probes, hoses, and filters.
Mem ERR (Memory error)	Is the input power source well purified?	Turn off the power and reboot.
Zero ERR (Zero Calibration error)	Is remaining gas in the analyzer?	Press the purge key to clean the inside of NGA 6000 with a clean air for about 2-3minute.
Leak Fail (Gas leakage fault)	Are the probe and hose properly connected?	Verify again the connection status of probes, hoses, and filters.
Screen stop (unable to press Key)	Has the analyzer seriously impacted?	Turn off the power and reboot.
Prt Err (Printer fault)	Is the connection cord inside the analyzer is disconnected or badly connected?	Disassemble the case of the analyzer and then re-connect the printer connection cord.
No printer paper output	Is it lack of printer paper?	Open the printer case and then exchange the paper.
	Has the paper hung up in the printer?	Open the printer case and then refill the paper.
No letter in the printer paper	Is the ink cartridge used too long and not working?	Replace the ink cartridge.

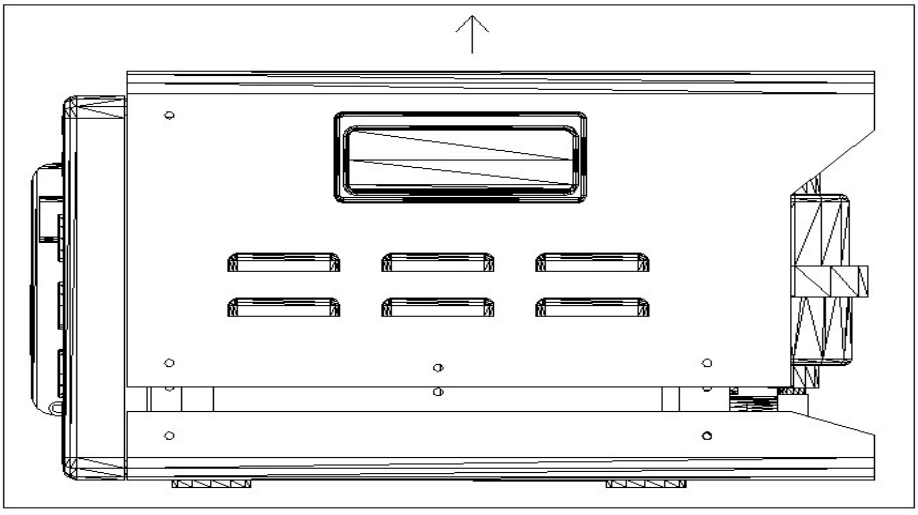
Chapter 9. Various Expendables Maintenance

※ Caution	Perform the maintenance basically after turning the power off. only if there is a necessity to turn the power on, turn it on.

9-1 Case separation diagram

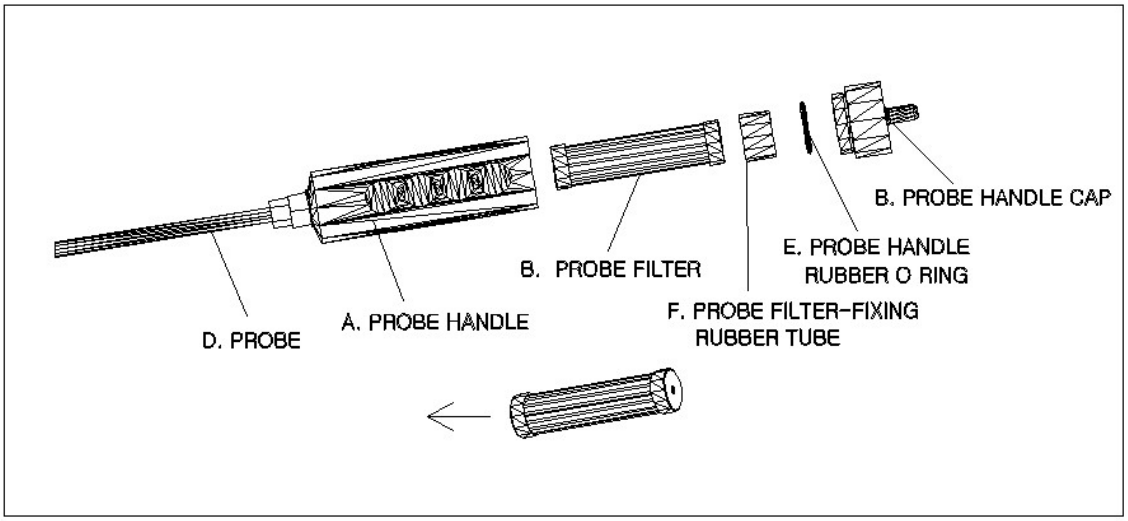


9-1-1 Loosen five screws (four in the side and one in the rear) by using the (+) screwdriver.



9-1-2 After lifting a little the upper cover case of analyzer, pull it back for dismounting.

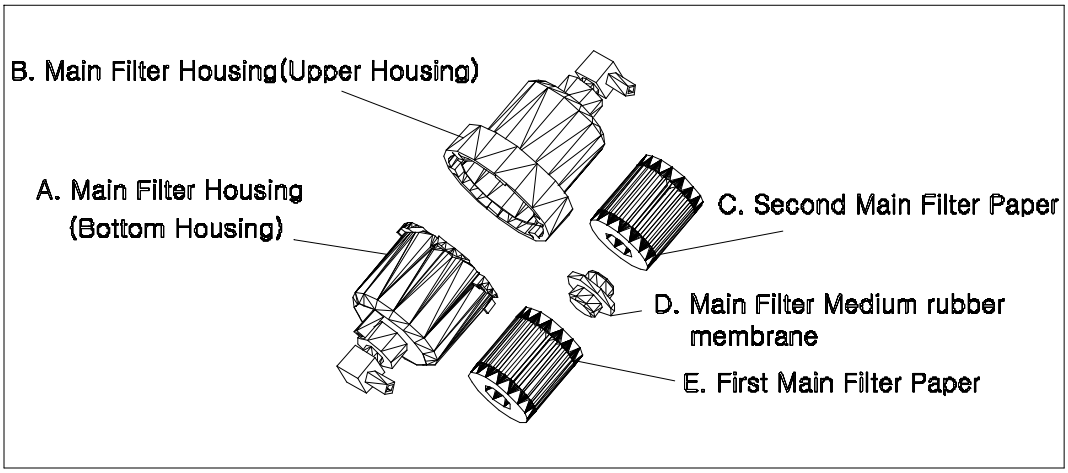
9-2 Probe filter



9-2-1 If the probe filter contains lots of moisture or is polluted through the visible verification, replace it.

9-2-2 How to replace the probe filter is as follows; Loosen B counterclockwise for separation. Then replace the probe filter with new one and assemble it again in the reverse order of disassembly.

9-3 Main filter



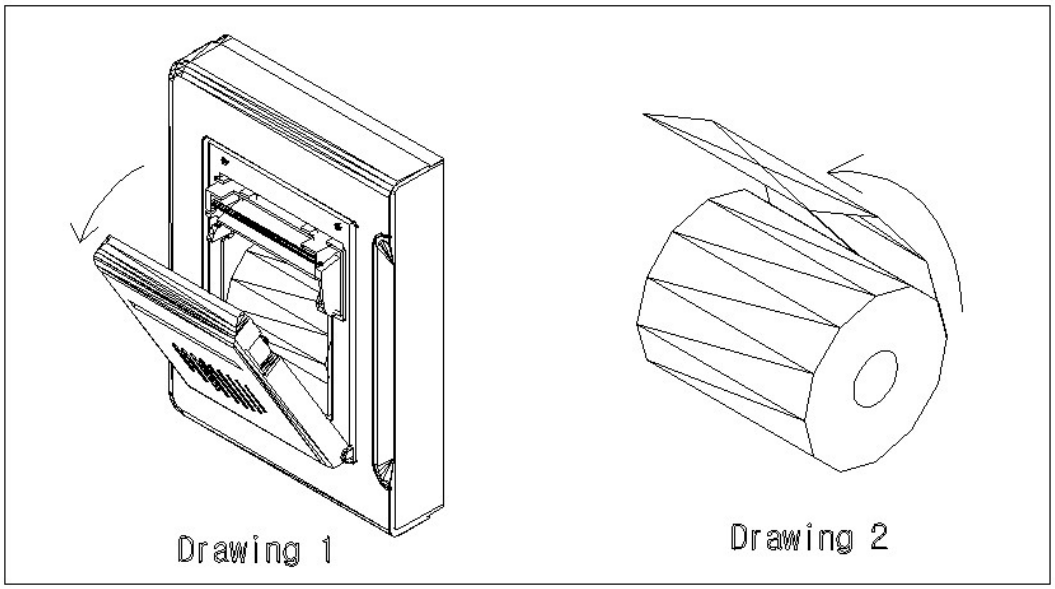
9-3-1 Loosen the main filter housing (A) and (B) counterclockwise.
9-3-2 Replace the first main filter and the second main filter with new ones.
9-3-3 Assemble them in the reverse order of disassembly.

9-4 Printer diagram

This analyzer's inner printer is thermal printing method-applying printer.

Replacement of printing paper.

9-4-1. Open the cover of the printer as shown on drawing 1.
When opening the cover of the printer, grab the handle and pull it forward as shown on drawing. Then the cover opens.



When replacing the printing paper, make sure the correct side, as the printing paper has pintable side.

9-4-2. Insert the paper as shown on drawing 2. If it inserted oppositely with wrong side of paper, it won't be printed, since only one side is printable.

9-4-3. When the rubber stick of printer falls off or when replacing the rubber stick, place it with correct direction to fit to the gear.

CAUTION : When rubber stick and printer parts is moistened or blemished, major parts of the printer could be damaged. When moistened, dry it before use.
When blemished, clean it before use.

9-5 Set of the printing density.

9-5-1 Prt Set in the Menu is to adjust the density of the printing letter. It is possible to adjust the density from 0 to 399. To set the density, press the [▼] and [▲] keys in Prt Set.
Upon completing the setup, press the [ENTER] key to store it.

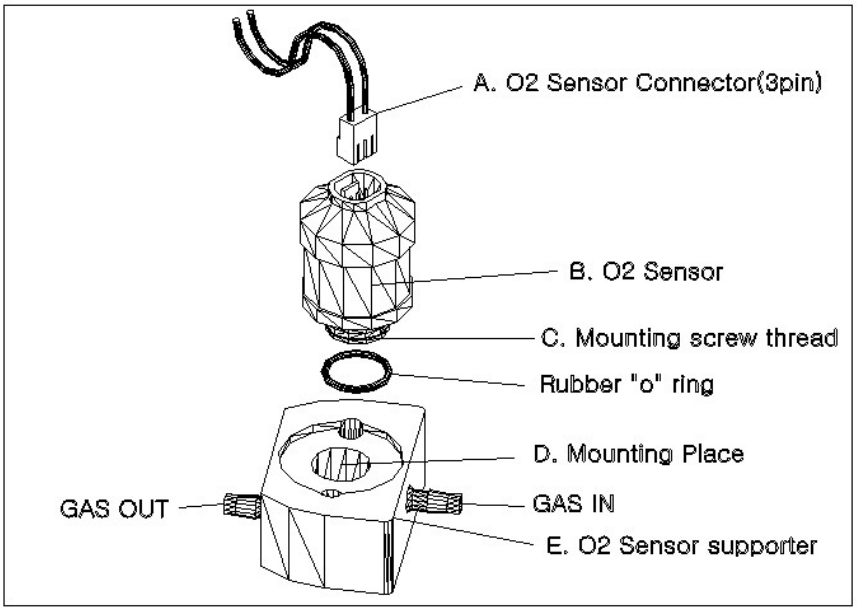
9-5-2 Normal density is around 100 and depending on the printing material or how much dark and light printing required, it could be adjusted. (At the time of delivery from factory, it is set at 100).

9-5-3 To set the density too high, it could shorten the printer's life span. So mind to set not too high.

CAUTION 1: Set Mode is generally used in winter time or very cold area since in cold temperature the printing is usually produced light. Unless it produces very light, it is better to keep density value at 100 in set mode.

CAUTION 2: Printing paper is thermal paper which is sensitive to the heat and bright light such as sunlight, and when it is exposed to such circumstances, the condition of the paper is turning to unprintable. So when keeping it in storage, store it in black plastic bag to avoid the contact from the light.

9-6 O2 sensor



9-6-1 It is recommended to replace the O2 sensor at the 12-month cycle.
If the O2 value is severely changed over 5 %, verify the contact defect of connector and replace the O2 sensor.

9-6-2 Turn the analyzer power off.

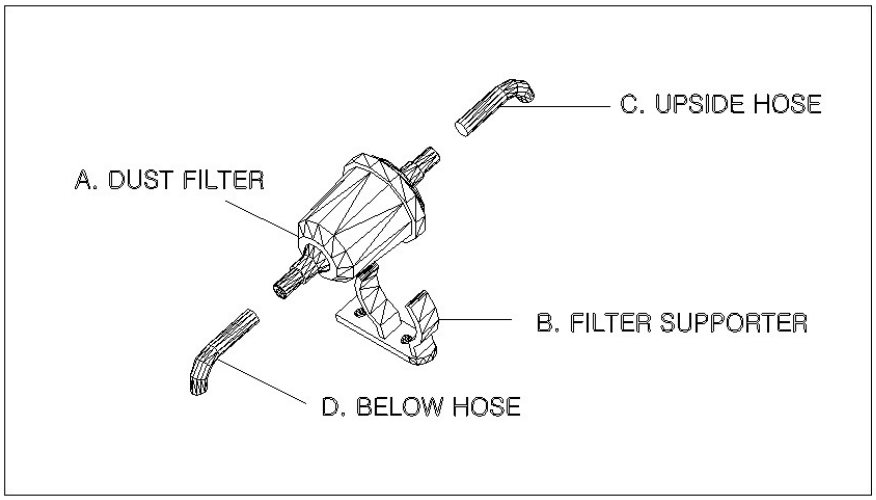
9-6-3 Split upper case of analyzer and dismount the O2 sensor connector.

9-6-4 Turn the O2 sensor counterclockwise for splitting.

9-6-5 After verifying that the rubber "O" ring is attached to new O2 sensor, mount it while matching it with the screw thread.

9-6-6 Perform the mounting in the reverse order of disassembly.

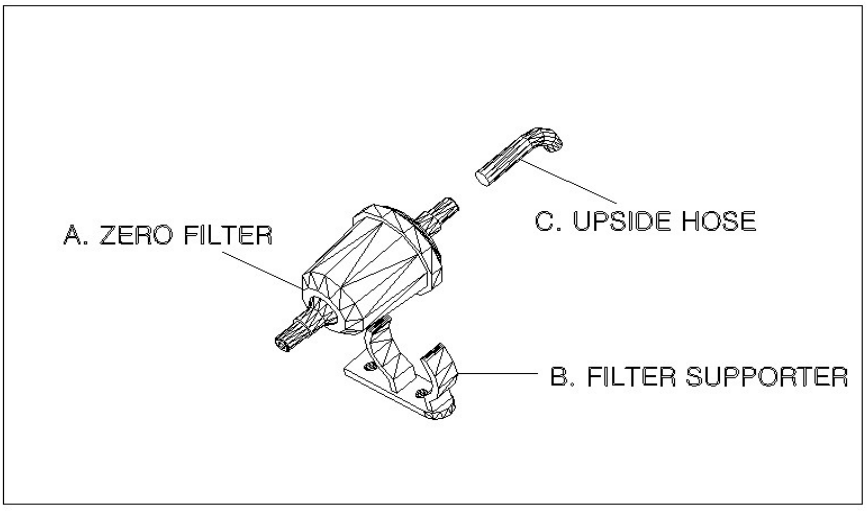
9-7 Dust filter



9-7-1 If the dust filter contains lots of moisture or is polluted through the visible verification, replace it.

9-7-2 Split the filter from B, and split C and D.

9-7-3 After replacing the filter with new one, re-assemble it in the reverse order of disassembly.



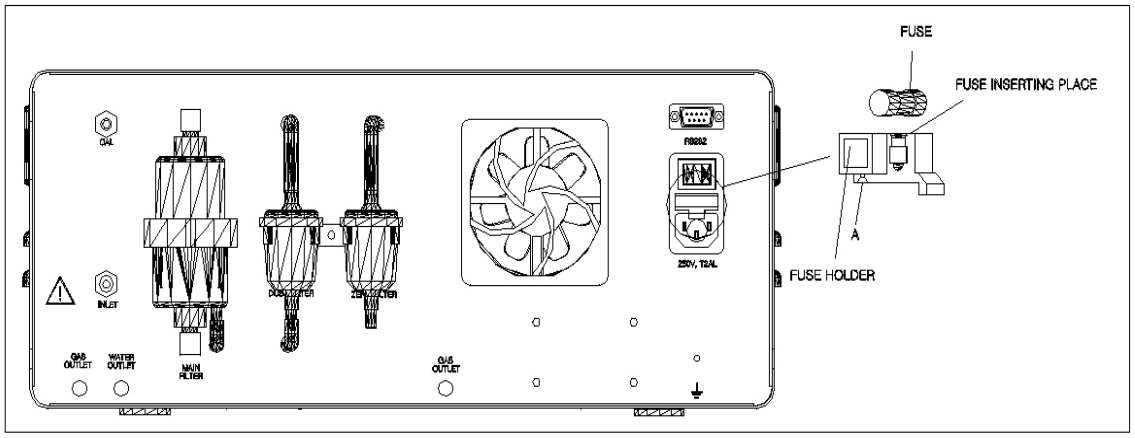
9-8 Zero filter(Activated charcoal filter)

9-8-1 It is recommended to replace the zero filter at the 6-month cycle.

9-8-2 Split the filter from B, and split C.

9-8-3 After replacing the filter with new one, re-assemble it in the reverse order of disassembly.

9-9 Power fuse



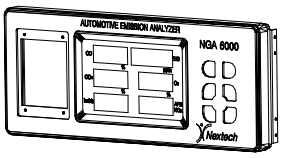
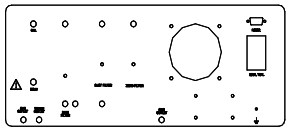
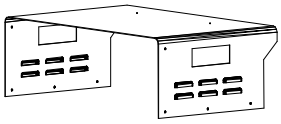
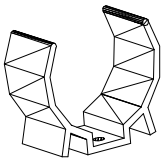
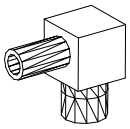
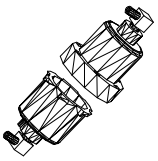
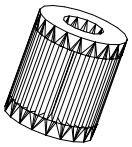
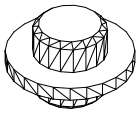
9-9-1 If the analyzer power is not turned on because the fuse is gone, replace it.

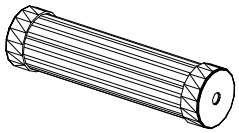
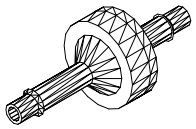
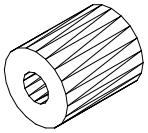
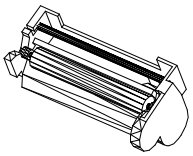
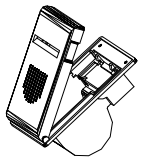
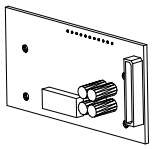
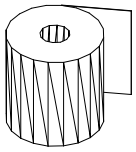
9-9-2 Turn the analyzer power off.

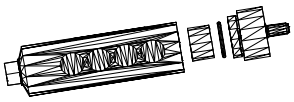
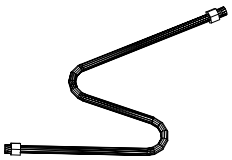
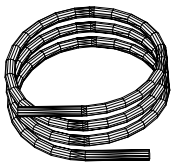
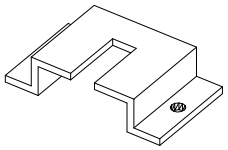
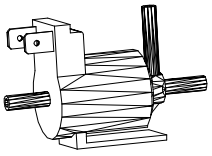
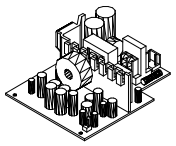
9-9-3 Insert the (-) screwdriver or pin to “A” part for dismounting.

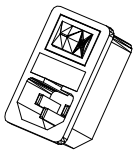
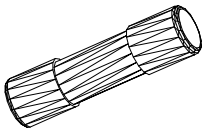
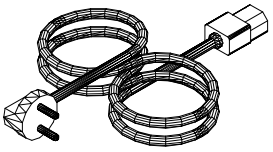
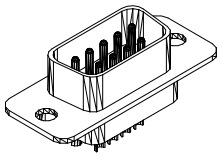
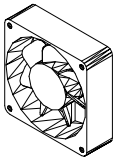
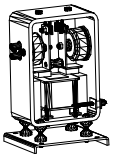
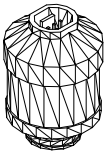
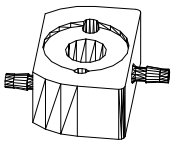
9-9-4 After replacing the fuse (250V 2A), re-assemble it in the reverse order of disassembly.

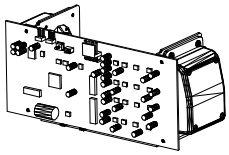
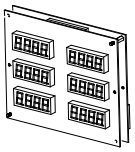
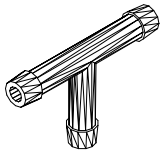
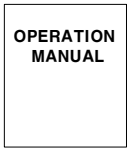
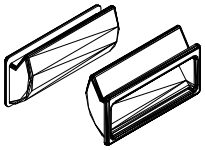
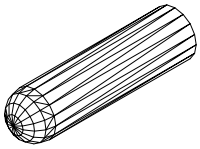
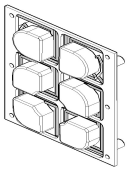
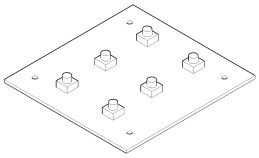
Chapter 10 Parts List

Product name	Product number Specification: W×D×H(mm)	Solid diagram	Remarks
Front panel case	QG0-M066 420×170×30		
Rear panel case	QG0-M067 417×167×20		
Upper cover case	QG0-M064 420×140×270		
Main filter supporter	QG0-M068 40×20×34		
Main filter "L" type nipple	QG0-M016 21×10×19		
Main filter housing	QG0-A009 ∅ 49×94		
Main filter	QG0-A017 ∅ 29×33		
Main filter medium rubber membrane	QG0-A019 ∅ 22×14		

Dust filter	QG0-A013 ∅ 35×81		
Product name	Product number Specification: W×D×H(mm)	Solid diagram	Remarks
Activated charcoal filter (Zero filter)	QG0-A014 ∅ 35×81		
Probe filter	QG0-A021 ∅ 23×82		
Check valve	QG0-A006 ∅ 19×43		
Orifice	QG0-A007 ∅ 5×6		
Printer	QG4-M023		
Printer case	QG0-M006		
Printer module	QG4-N011		
Printer paper	QG4-M062 ∅ 48×57		

Rubber stick	QG4-M070 ∅ 8×64		
Product name	Product number Specification: W×D×H(mm)	Solid diagram	Remarks
Probe handle	QG0-A022 ∅ 39×119		
Probe tip	QG0-M026 ∅ 8×345		
Probe (stainless steel)	QG0-M027		
Probe spring	QG0-M028		
Probe hose	QG0-A015 ∅ 6.5×7000		
Solenoid supporter	QG0-M069 39×22×9		
Solenoid	QG0-A002		
Power supply	QG0-E017 94×119×40		

Power socket	QG0-E021 30×22×49		
Product name	Product number Specification: W×D×H(mm)	Solid diagram	Remarks
Fuse	QG0-E022 (250V 2A)		
Power cable	QG0-E019 0.75SQMM×3C		
RS232 port	QG0-E002 53×12×15		
Fan	QG0-E009 80×25×80		
Pump	QG0-A001 80×70×128		
O2 sensor	QG4-E015 ∅ 29×41		
NOx sensor	QG4-E016 ∅ 29×42		
O2 sensor supporter	QG0-MO60 58×37×22		

NDIR module (Bench)	QG4-N001 224×74×102		
Product name	Product number Specification: W×D×H(mm)	Solid diagram	Remarks
Display PCB	QG4-N019 152×18×123		
T-type fitting	QG4-M006 ∅ 5×31×21		
Operation manual	QG4-M071		
Case handle	QG0-M150		
Leak test cap	QG0-A122		
Push Button	QG0-M65		
Push Button PCB	QG4-N020		

Appendix

1. Lambda (Lambda: air surplus rate) Calculation Formula

$$\lambda = \frac{CO2 + \frac{CO}{2} + O2 + \left[\frac{Hcv}{4} \times \frac{3.5}{3.5 + \frac{CO}{CO2}} - \frac{Ocv}{2}\right] \times (CO2 + CO)}{\left[1 + \frac{Hcv}{4} - \frac{Ocv}{2}\right] \times \left[CO2 + CO + K1 \times HC\right]}$$

Lambda is not the value measured from the vehicle exhaust gas, but is a constant calculated based on the Bretschineider formula that measures the density of **CO, HC, CO2 and O2** and applies the percentage of H, C, and O of vehicle gasoline.

Bretschineider formula

▶ **Enter the density (%) of CO, HC, CO2, and O2.**

▶ **K1** : Enter constant 6 or 8 for vapor in combustion stroke.
K1 is the constant that converts the value measured by Non Dispersed InfraRed (NDIR) into the value measured by **Flame Ignite Detect (FID)** and meets the specification of 4 gas analyzer manufacturer.

▶**Hcv** : Rate of C(carbon) to H(hydrogen) of the fuel

▶**Ocv** : Rate of C(carbon) to O(oxygen) of the fuel

Lambda is the value calculated based on the density of CO, HC, CO2, O2 of gasoline gas and percentage of gasoline (C8H18) elements. Therefore, measuring 4 gases accurately is prerequisite to the Lambda calculation.