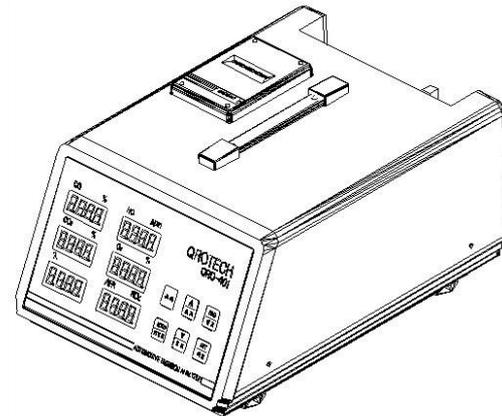


AUTOMOTIVE EMISSION ANALYZER

QRO - 401

OPERATING MANUAL



QROTECH CO., LTD.

Notes for User

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

This manual applies to the product model QRO-401(4/5gas analyzer).

1. This manual should be referred with regard to the product design and safety assurance of the configuration.
2. For the purpose of safety conformity, 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.

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

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◆ If you want more information, you can see the detail in the attached CD.

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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 within 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 | <p>This product is not designed for outdoor installation so that a damage or fault originated from the outdoor installation may not be guaranteed.</p> |
|---|--|

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 | <p>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.</p> |
|---|---|

- 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

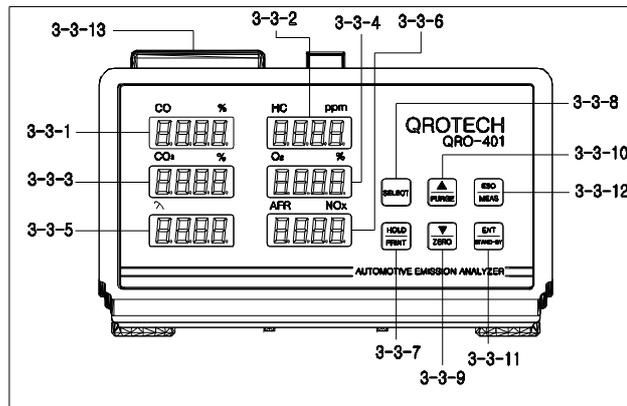
- ① This analyzer is designed for the use of AC110V only or AC220V only. Please verify the power sources prior to the usage.
- ② The probe is so hot by emitted gas. Therefore, you need to pay high attention not to be burned during when you insert or remove.
- ③ During the analysis, please do not stay 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 QRO-401

3-1 Specification

| | | QRO-401(4/5GAS) | |
|----------------------------|---|------------------------|----------------|
| Measuring item | CO, HC, CO ₂ , O ₂ , λ(air surplus rate), AFR, NOX (optional) | | |
| Measuring method | CO, HC, CO ₂ : NDIR Method O ₂ , NOx : Electrochemical Cell | | |
| Measuring range | CO | 0.00 ~ 9.99% | HC |
| Resolution | | 0.01% | |
| Display | | 4 digit 7segment LED | |
| Measuring range | CO ₂ | 0.0 ~ 20.0% | O ₂ |
| Resolution | | 0.1% | |
| Display | | 4 digit 7segment LED | |
| Measuring range | λ | 0 ~ 2.000 | NOx |
| Resolution | | 0.001 | |
| 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 | AC110V only or AC220V only ±10%, 50/60Hz | | |
| Power consumption | About 50 W | | |
| Operation temperature | 0°C ~ 40°C | | |
| Dimensions | 285 (W) × 410 (D) × 155 (H) mm | | |
| Weight | About 4.5 kg | | |
| Basic accessories | Probe, Probe hose, Spare fuse, Leak test cap, Spare filter, Operation manual, Power cord, | | |
| Options | RS232 Communication cable, Printer, Printer paper | | |

3-2/3. 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 λ display window
This displays the λ(air over surplus rate) value and program proceeding status.
- 3-3-6 AFR/NO_x display window
This displays the AFR, NO_x, and program proceeding status.

- 3-3-7

| |
|-------|
| HOLD |
| PRINT |

 KEY
Used in time of holding or printing.
- 3-2-8

| |
|--------|
| SELECT |
|--------|

 KEY
Used in choosing a supplementary function.
- 3-2-9

| |
|------|
| ▼ |
| ZERO |

 KEY
Used in time of correcting the datum point or moving a figure or digit.
- 3-2-10

| |
|-------|
| ▲ |
| PURGE |

 KEY
Used in time of doing a purge or executing a value increase.
- 3-2-11

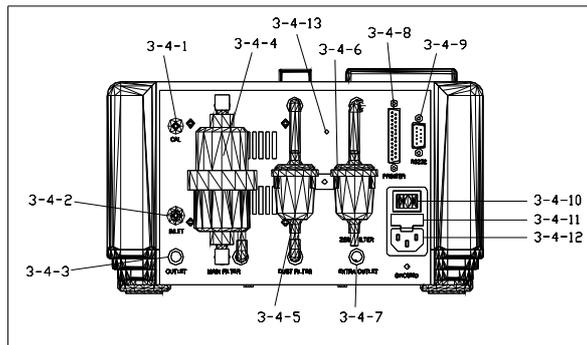
| |
|------|
| ENT |
| MEAS |

 KEY
Used in time of measuring or approving a supplementary function.
- 3-2-12

| |
|----------|
| ESC |
| STAND-BY |

 KEY
Used in time of returning to ready mode.
- 3-2-13 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 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 a activate charcoal filter to purify the analyzer cell in the time of correcting the zero point.

3-4-7 EXTRA 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 25 PIN PRINTER PORT

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 PC can operate the program.

3-4-10 POWER SWITCH

A power on/off terminal of this analyzer.

3-4-11 FUSE BOX

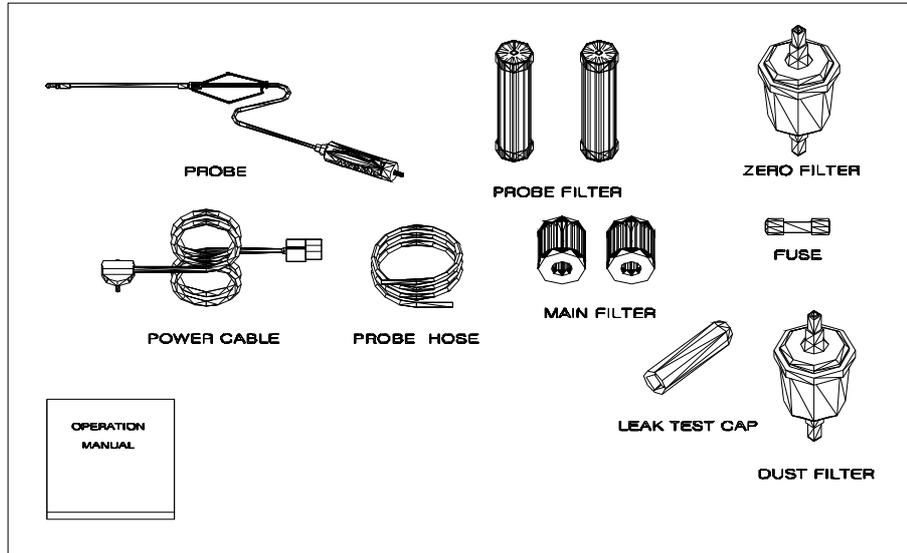
A fuse terminal which will prevent a damage from external voltage overflow.

3-4-12 POWER SOCKET

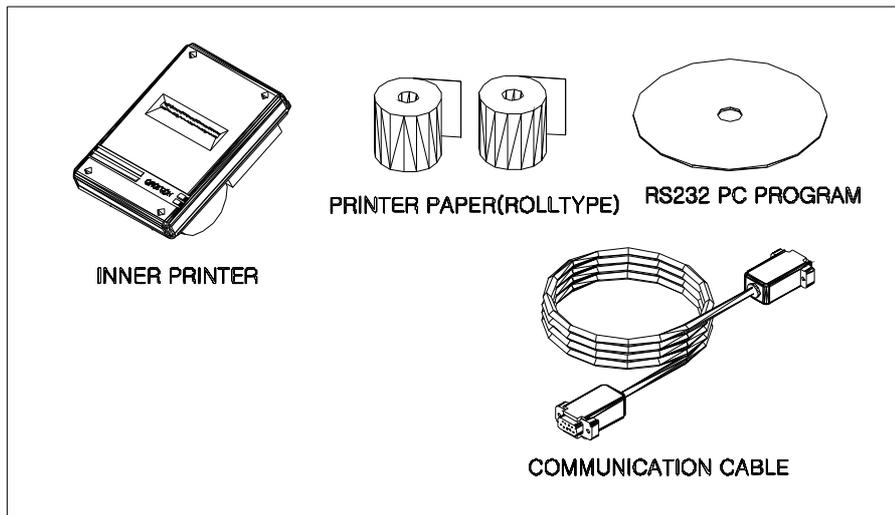
3-4-13 An assembling bolt for upper cover case and rear panel case.

3-5 Basic accessory and option

3-5-1 Basic accessory



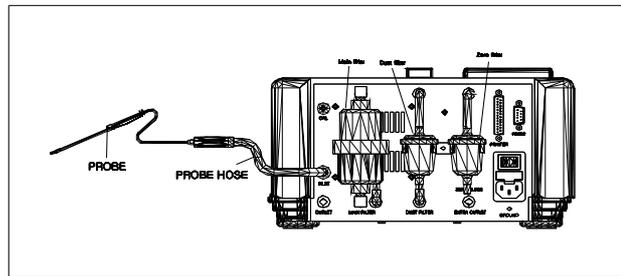
3-5-2 Option



Chapter 4. Installation Methods and Notes

4-1 Installation

4-1-1 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.

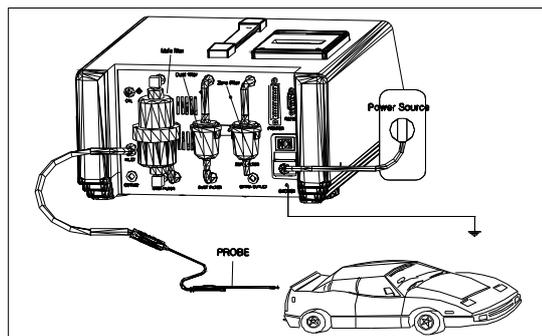


4-1-2 Turn off the power switch and then connect the power cable to the power socket located in the rear of the analyzer

4-1-3 Verify the fitting conditions of measuring probe filter and various filters located in the rear of the analyzer.

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

| | |
|---|--|
|  Warning | <p>This analyzer supports AC110V only or AC220V only. (Please confirm the power source to use.)</p> |
|---|--|



4-2 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.)
- ▶ The 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.

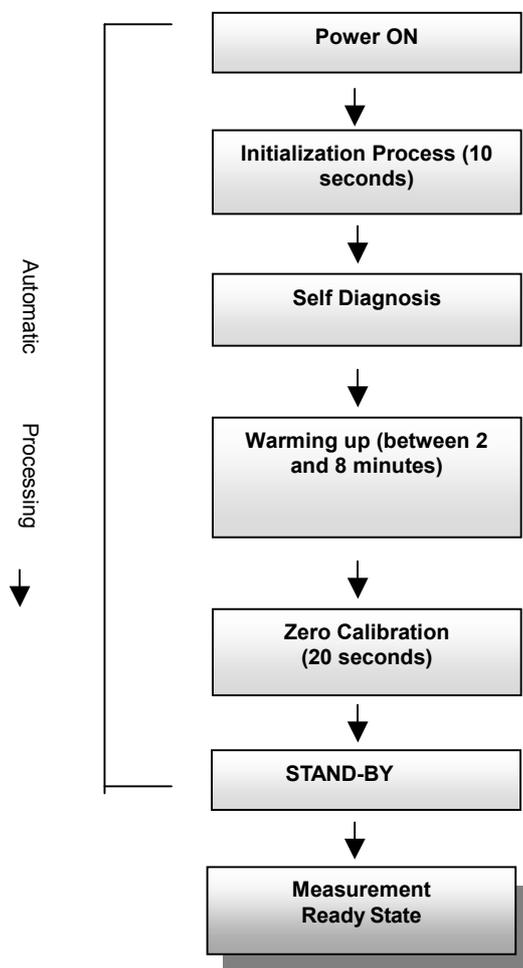
*** O2/NOx sensor's life span : about 1~2 years.**

*** Standard gas calibration's cycle : every about 6 ~ 12 months.**

Chapter 5. Fault diagnosis and troubleshooting

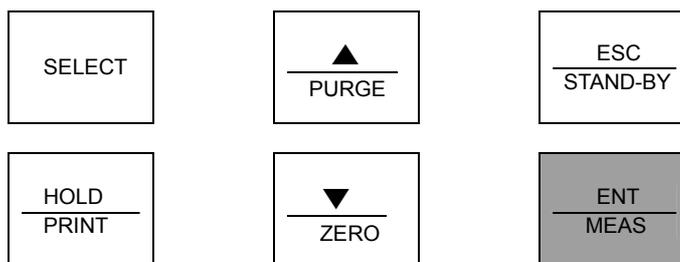
| Fault | Verification | Troubleshooting |
|---|--|--|
| Unable to power switch ON | Is the power cord properly connected? | Connect the power cord. |
| | Is the fuse cut? | Replace the fuse and check the cause of power overflow. |
| Unable to measure (Measuring value stays in "0" and does not move) | Do you 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? Please check the main filter housing's O ring. | Especially this could openly happen in the winter due to water-icing. Verify the probe filter, hoses, and filters. |
| λ or O ₂ values is high/ NO _x value is low. | Check the O ₂ sensor or leak. Check the NO _x sensor (with NO _x gas). | Replace the O ₂ /NO _x sensor (Life span: 1~2 years). |
| Flow ERR (Flow error) | Is any of probe, hose or filter blocked? Please check the main filter housing's nipple is blocked. | Verify the probes, hoses, and filters. |
| Zero ERR (Zero Calibration error) | Is remaining gas in the analyzer? | Press the Purge key to clean the inside of QRO-401 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. |

Chapter 6. Measurement Mode



6-1. 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 30 minutes and the pump is automatically stopped by the activation of the power-saving mode. Press **[MEAS]** key again to measure the exhaust gas for more than 30 minutes.

③ Pull the probe out of the exhaust outlet of the vehicle. Then clean the inside of QRO-401 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 **[STAND-BY]** key to maintain QRO-401 in a standby mode.

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

※ PRINT key operates only in measurement mode.

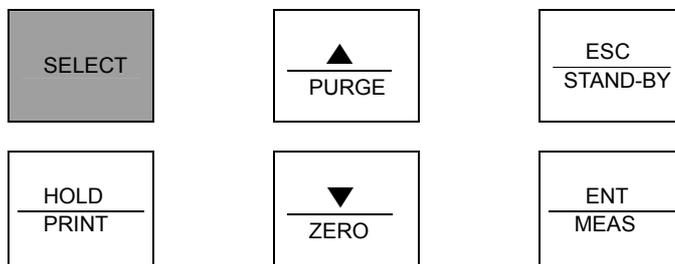
(Press the print key 1(hold)/2(car number)/3(printing) times)

6-2. Key functions

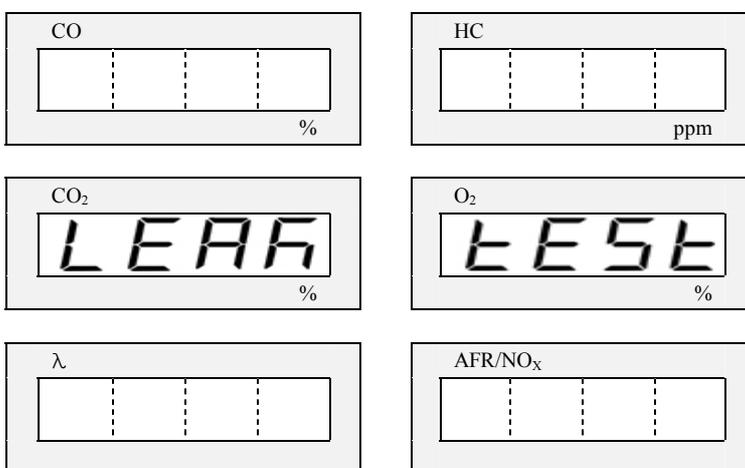
| Key | Contents |
|-----------------|---|
| [SELECT] | <p>Use the key to perform the leak test, the PEP value indication, the program version indication, and the standard gas calibration. Press the [Select] key and QRO-401 will operate as shown below.</p> <p>[Leak test] → [Remaining HC test] → [Used fuel] ⇔ → [HCV / OCV] → [PEF value indication] → [Time set up] → [NO_x measurement set up] → [Standard gas] → [Print set (density)]</p> <p>Press the [SELECT] key. QRO-401 will operate according to the contents ▼ , ▲ , [ESC] , [ENT] printed on the upper side of each key.</p> |
| ▼ | 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. |
| [ENT] | Use this key to select the present mode indicated, or to execute the number substituted. |

6-3. Leak test

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

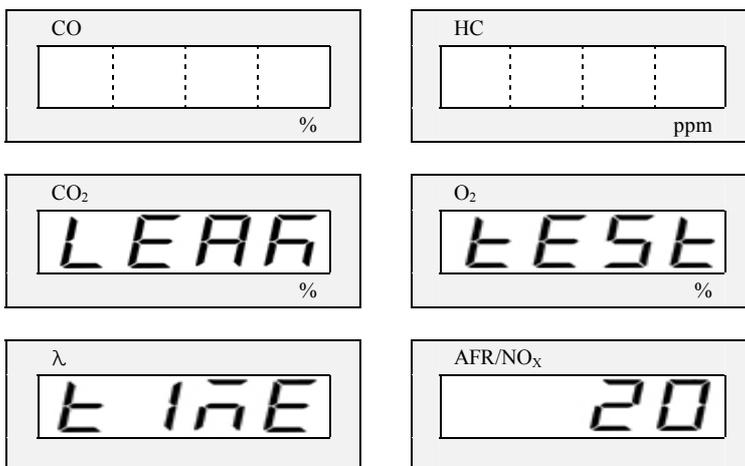


- ① Press the **SELECT** key once in the stand-by mode to select the Leak Test mode.



- 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 **ENT** key. The pump operates and the count values decrease by 1 from 20 during the 20-second leak test.



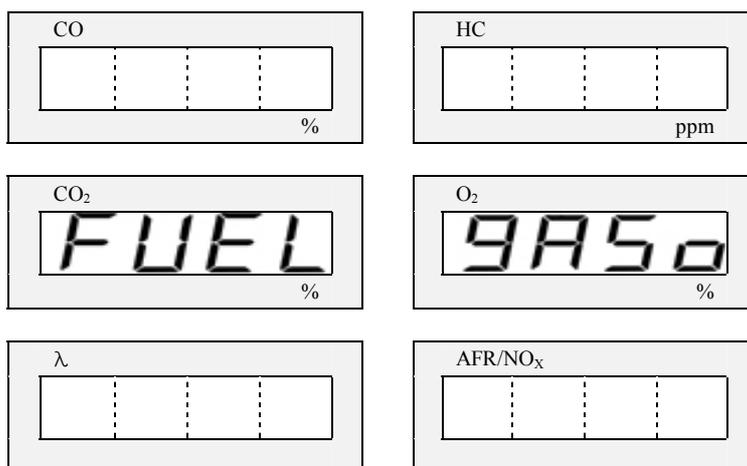
- ④ If the test turns out normal without any leak after 20 seconds, a message is indicated as 'PASS'. If the leak is identified, the message is indicated as 'FAIL'.

6-4. Selection of fuel

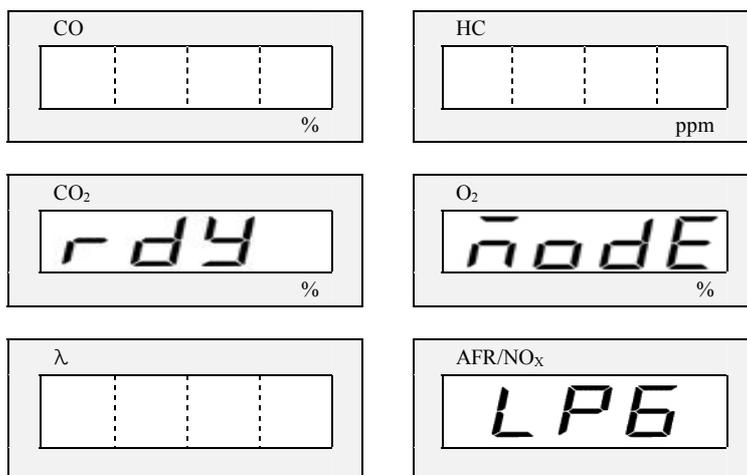
This is the function that selects fuel for testing vehicle. It is used to calculate air surplus rate (λ) and AFR. This analyzer can select the fuel such Gasoline, LPG, CNG, and Alcohol.

GASOLIN ⇒ LPG ⇒ CNG ⇒ ALCOHOL

- ① Press **SELECT** key three times from standby mode.



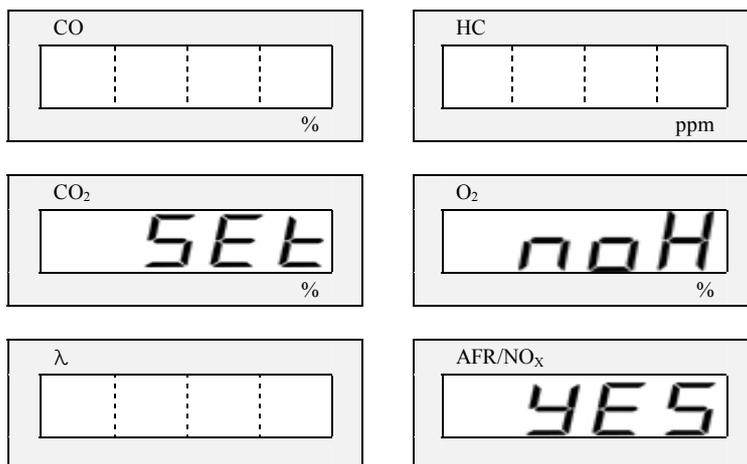
- ② Selected fuel is indicated as in the above. Use **▼** , **▲** keys until it indicates the fuel to select.
- ③ Press **ENT** key to setup the selected fuel.
- ④ For Example, If the "LPG" fuel is selected, the window indicates as shown in the below.



6-5. NO_x setup

It is a function selecting where to attach NO_x sensor.

- ① Press select key for eight times in standby mode.

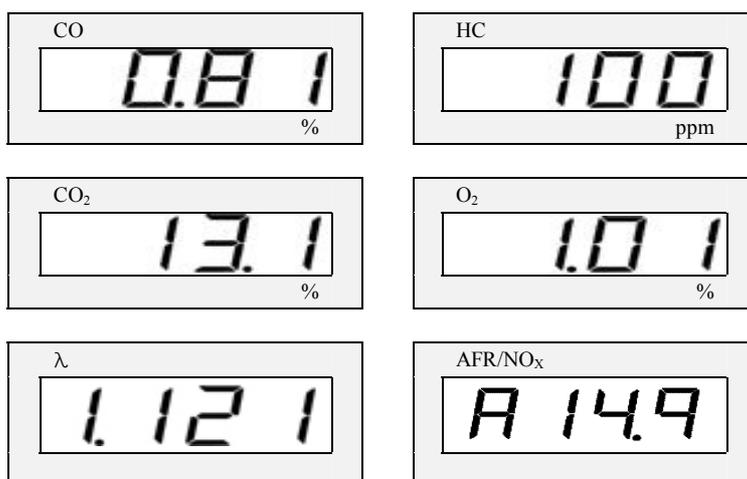


(When it is set up to NO_x display)

- ② key changes display to YES or to NO.

- ③ Select YES for NO_x display mode, NO for non-NO_x display mode, then press

※ “A” is attached as shown below in the AFR(Air/fuel rate) display mode and disappears in the NO_x display mode. NO_x/AFR mode is changed as the key is pressed in measurement mode.



Example of exhaust gas measurement display



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