5-Gas Analyzer

16 & 16P Operator's Manual

Table of Contents

Specifications

Measurement Ranges

Hydrocarbons (HC)	0 to 15,000 ppm
Carbon Monoxide (CO)	0 to 15.00%
Carbon Dioxide (CO2)	0 to 20.0%
Oxygen	0 to 25.0%
Nitric Oxide (NOx)	0 to 5,000 ppm
Lambda	0 to 10.00
AFR	0 to 99.9
Tachometer	100 to 5,000 RPM
Warmup Time - Diagnostic Mode	3 Minutes
Warmup Time - Full Stability	15 Minutes

Physical Dimensions

Operating Temp	2° to 54°C	35° to 120° F
Storage Temp	-29° to 54°C	-20° to 130° F
Case Size	28x33x9 cm	11x13x3.5 in.
Lead Length	1.5 m	8 Feet
Weight	4.5 kg	10 Pounds
Power Requirements		12 Volt Vehicle Battery
		Optional A/C Adapter

Replacement Parts & Accessories

Exhaust Probe Flex Extension	H014-74
Upper & Lower Filter	H020-57
Calibration Gas	H020-71
NOx Sensor	M022-52
O2 Sensor	M022-50
Extension Lead	W000-03
Power Lead	W004-02
Cigarette Lighter Adapter	W014-30
Temperature Probe	W022-21
Spark Pickup	X008-01
In-line Filter Element	H016-19
AC Power Adapter	X016-20
Thermal Printer	V555-01

Introduction

The GasLink II™ is the ultimate in portable gas analyzers. Small and portable, it can easily be taken on road tests and stored in a toolbox.

Buttons & Controls

Next Button
Press this button to make a selection, or to access the main menu.

Rec/Pause/Play Button
Press this button to activate the record and playback functions of the analyzer. See the record section of the manual for more information.

*** Message**
Whenever you see a flashing message signal, press the message button to display the message. Messages are used to tell you when zeroing is required or a fault is detected.

? Help
Press this button to display context sensitive help.

Print Button
Press this button to print what is on the screen.

Connecting to the Vehicle

Battery Power Leads
Connect the RED lead to the Battery Positive, and the BLACK lead to Battery Negative post. The analyzer is protected in case you connect the leads improperly.

Exhaust Sample Hose
Insert the sample hose into the tailpipe. Be sure to route the sample hose away from the exhaust flow. The water separator should not be vertical or horizontal, and should not be directly in the exhaust flow. When used during a road test, use a hose clamp to secure the probe in the tailpipe.

Spark Pickup
Clamp the RED spark pickup around any sparkplug wire with the “Spark Plug” label facing towards the sparkplug. On systems where no spark plug wires are available, the pickup may be placed around the wire feeding the coil primary.

Start-Up & Warm-Up

When power is applied to the unit, the start-up screen appears for a few seconds. This screen shows the date of the last gas calibration and what fuel type and RPM input the analyzer is going to use. The analyzer then proceeds automatically to the warm-up screen. After a two minute warm-up and a thirty second zero, you are ready to begin measuring gases. The analyzer defaults to the composite screen. If the extended warm-up is selected, then analyzer has a 15 minute warm-up and a one minute zero.

To change the setup for the analyzer, press the NEXT Key.

Displaying Exhaust Measurements

Main Selection Menu

Use the SELECT buttons to move the selection arrow, then press the NEXT button to make your selection.

Composite Screen

The composite screen displays all five gases, air fuel ration (AFR), Lambda (l), and RPM. The screen also shows the status of the memory used during the record functions. Press the NEXT button to go to the main selection screen.

Big Digit Screen

Press either the Up or Down select buttons to alternate between the composite, Grams per Mile and Big Digit screens. The big digit screen displays the five gases and RPM in a large format. Press the NEXT button to go to the main selection screen.

Grams Per Mile Screen

Press either the Up or Down select buttons to alternate between the composite, Grams per Mile and Big Digit screens. The Grams Per Mile Screen displays the estimated grams per mile of all gases. This calculation is based on the miles per gallon constant that is set using the Engine Setup function. Combustion Efficiency is also calculated on this screen. It is displayed as CE. A number of .995 indicates the combustion efficiency is at 99.5% Use combustion efficiency with lambda to see if there is an adequate fuel charge and ignition in the combustion process. Press the NEXT button to go to the main selection screen.

Analyzer Setups

Analyzer Setup Screen

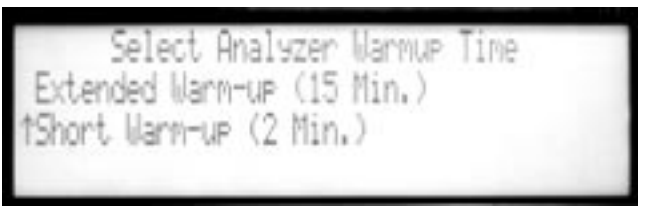
Use the SELECT buttons to move the selection arrow to Analyzer Setup then press the NEXT button. The following screen will appear

Use the SELECT button to select which analyzer setup you wish to change, then press the NEXT button. Select EXIT to return to the Setup Choices Screen.

Change the Contrast of the LCD

Use the SELECT buttons to move the select from one of 4 contrast levels. Press the NEXT button to return to the Engine Setup Screen.

Change the Warm-up Time



Use the SELECT buttons to move the select a standard or extended warm-up. The standard warm-up time is 2 minutes, while the extended warm-up time is 15 minutes.

Program a Custom Header

Up to four lines of header information can be entered. The header is created in the top two lines of the screen. The bottom two lines contain the characters that may be used in the header and the control characters. There are two cursors. The Placement Cursor is the flashing box that indicates where the next character will be placed. The Selection Cursor is the flashing underline. The arrows are control characters used to move the placement cursor on the header lines, and are not printable.

Use the arrow keys to move the Selection Cursor to one of the arrows, and press NEXT to move the Placement Cursor left, right, up or down. Use the arrow keys to move the Selection Cursor under the character that you want to add. Pressing the NEXT key places the character in the header at location of the Placement Cursor. The arrow keys may be held to move rapidly among the character choices. The NEXT key may be held to rapidly place many copies of the same symbol.

Selecting the return arrow, and pressing NEXT saves the header in memory and returns to the main menu.

Engine Setup

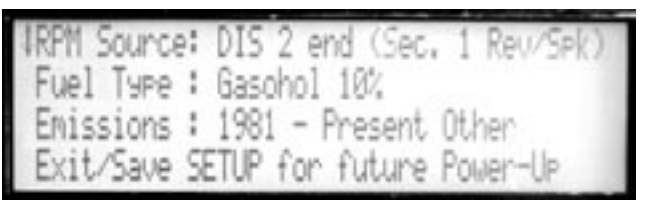
Main Menu Screen

From the Main Menu, use the SELECT buttons to move the arrow up to Analyzer & Engine Setups then press the NEXT button. The following screen will appear.

Setup Choices Screen

Use the SELECT buttons to move the selection arrow to Engine Setup then press the NEXT button. Select EXIT to return to the Main Menu.

Engine Setup Screen

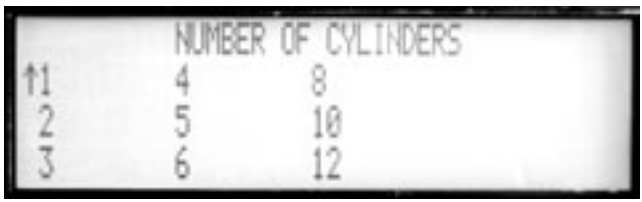


Use the SELECT button to select which engine setup you wish to change, then press the NEXT button. Select EXIT to return to the Main menu. You will be given a choice to save the setup into the EEPROM for future use. Only one setup is saved at a time.

RPM Source

Use the SELECT buttons to choose the RPM source, then press the NEXT button. You will be returned to the analyzer setup screen. Selecting Distributor or DIS requires that the RED Inductive Pickup be connect around the sparkplug wire. For vehicles that do not have spark plug wires use the No Spark Wire selection.

No Spark Wire RPM input



Use the SELECT buttons to choose the number of cylinders, then press the NEXT button. Connect the Spark Pickup to the wire that supplies battery power to the coil(s) or coil pack(s) to read RPMs.

Fuel Type Selection

Use the SELECT button to select the fuel type used in the engine, then press the NEXT button. You will be returned to the analyzer setup screen. Selecting the proper fuel will ensure that the CO2, AFR, and Lambda measurements are calculated properly.

Report Printing

From the Main Menu, use the SELECT buttons to move the selection arrow to REPORT then press the NEXT button. The following screen will appear.

Report Screen

Use the SELECT buttons to move the selection arrow to select one of two report functions, or perform a Visual Inspection. Press NEXT to begin printing the report. Print Report (All Results) will print the entire record of recorded data. Print Report (Marked Results) will print only those data points that you marked during recording and playback.

Visual Inspection Screen

Use the SELECT buttons to move the arrow to choose one of the visual inspection sections or quit the program. Use the SELECT buttons choose the item, then press the NEXT button. Use the SELECT buttons to select N/A, OK, or BAD. If N/A is selected that item will not appear on the printout.

Maintenance - Zero & Purge

Zero

Use the SELECT buttons to move the selection arrow to select one of the Calibration and Maintenance program.

When you select Zero, the analyzer will stop sampling gas from the sample hose and will perform a zero of the bench. There is no need to remove the sample hose from the tailpipe. Zeroing the analyzer periodically will maintain the accuracy of the unit during testing.

Purge

Use the SELECT buttons to move the selection arrow to select one of the Calibration and Maintenance program.

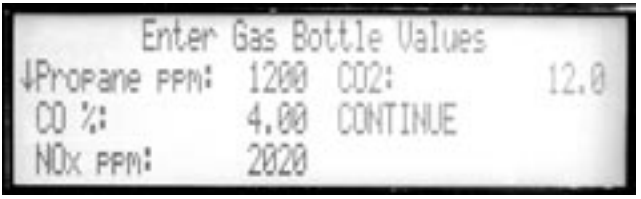
There are two Purge choices. One Purge function will purge for 1 minute, the other will purge for 5 minutes. Regardless of the purge time selected, the analyzer will stop sampling gas from the sample hose and will perform a purge of the bench and hose. There is no need to remove the sample hose from the tailpipe. Purging clears water and contaminants from the sample hose.

Maintenance - Calibrate

The calibrate program is used to gas calibrate the analyzer. Gas calibration should be performed monthly. This procedure will require the use of the calibration adapter that was included with the unit. Connect the long end of the hose directly to the gas analyzer and connect the filter end of the adapter to the Gas bottle. When you first enter the Calibrate program you will be asked to confirm or change the gas values to match the bottle of calibration gas you are using.

The bottle provides a large quantity of gas at a high pressure. The regulator reduces the flow of gas to the low level required for calibration. The connection to the analyzer is made in place of the sample hose.

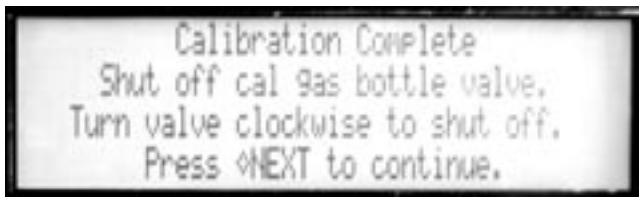
The ideal calibration gas to be used with the analyzer contains the following concentrations of gas: Propane - 1,200 PPM, CO - 4.0%, CO2 - 12.0%, NOx - 1000 PPM. Other concentrations of gas can be used, but be sure the NOx concentration is above 500 ppm and less than 3000 ppm.



Use the SELECT and NEXT buttons to change the gas values. You will then be asked to connect the calibration adapter to the analyzer. See the picture at the right to see how to connect the gas bottle to the analyzer.

The analyzer will zero the gas bench then ask you to turn on the gas valve on and adjust the pressure regulator until the bar graph is between the two arrows.

The analyzer will display a 60 second count down message. If the calibration was successful you will see the following screen.



If you experience an error in performing a Gas Calibration, please retry the procedure again. If you still have trouble, contract customer service at (800) 627-5655 for additional help.

Printing

The GasLink II supports printing to a custom thermal printer. Connections for power and data are made through the RJ-45 connector found on the back of the analyzer. Simply plug in the printer and press the PRINT button on the front panel.

Internal Batteries

The GasLink II has three AA batteries that maintain the clock. If the batteries need to be replaced, remove the back panel of the analyzer to gain access. The date and time can be set by accessing the Date and Time functions found in the analyzer setup.

Record & Playback

You may press the REC/PAUSE/PLAY button any time you are measuring emissions. If you are using the Big Digit display, and press Record the display will revert to the Bar Graph Display.

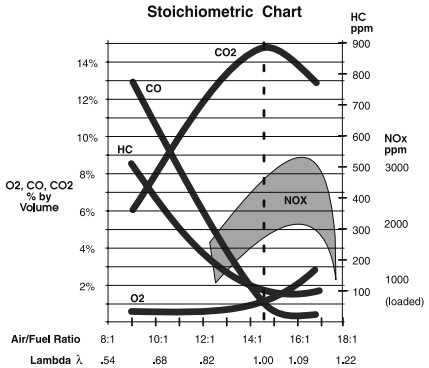
The word RECORDING will appear on the display when the analyzer is recording. When you reenter the emissions test, the following screen will appear.

If you select EXAMINE data you can choose from different sections. Up to six different sections can be held in memory.

When playing recorded data, PLAY or PAUSE will appear in the screen. When replaying data, pressing the NEXT button will cause a MARK (a diamond) to appear on the screen at that time reference. Marks are made to help reduce the length of the printout. When you mark the data and use the Print Report (Marked Results) function you will get a printout with the exact piece of data you marked plus the two samples before and after the mark. Playback must be stopped before you can press the NEXT button and return to the main menu.

Gas Theory

The content of an engine's exhaust stream depends on the efficiency of the combustion process. Ideally, pure fuel (hydrogen and carbon) and oxygen would enter the combustion chamber in precisely the right amounts (called stoichiometry), and the mixture would be ignited at just the right moment so that all of the oxygen would combine with all of the fuel. In this perfect example, the hydrogen (H) in the fuel would combine with oxygen (O2) to form water (H2O) and the carbon (C) in the fuel would combine with oxygen to form carbon dioxide (CO2). Those two compounds and heat would be the only products of combustion. Combustion would be complete.



In reality, the air we breath and the fuel used are not pure, and the spark may not occur at precisely the right moment. Subsequently, the exhaust stream will contain hydrocarbons (HC), and carbon monoxide (CO), in addition to Carbon Dioxide (CO2) and traces of Oxygen (O2), Oxides of Nitrogen (NOx), Sulfur Dioxides (SO2) and soot.

The analyzer will measure HC, CO, CO2, O2, and NOx levels in the exhaust stream. The relative amounts of these compounds will provide information about the combustion process and clues about the causes of abnormal levels.

There are a lot of things that can go wrong with an engine, and understanding the results of different component failures will go a long way toward helping you use your analyzer to its full potential.

Gas Theory

AFR (Air Fuel Ratio), Lambda and Stoichiometry
Stoichiometry is where air and fuel are in the proportions that provide the greatest combustion efficiency. The AFR (air to fuel ratio) is a number that describes the proportions of air and fuel. For gasoline, the AFR that represents the stoichiometric point is 14.7 parts of air to 1 part of fuel. Lambda is a normalized scale where 1.0 is the stoichiometric point for the fuel being used. So, for gasoline, you can multiply lambda by 14.7 to get the air fuel ratio. Why have both? It turns out that other fuels have a different air/fuel ratio for the stoichiometric point. For example, the stoichiometric point of propane occurs at approximately 11.8 Air/Fuel Ratio. The Lambda is still 1.0 at stoichiometry for propane as with **any other fuel**.

3 Way Catalytic Converter
The three-way catalyst uses precious metals to cause the reactions needed to lower emissions of HC, CO and Oxides of Nitrogen. HC and CO emissions are lowered by a chemical reaction called 'oxidation' and Carbon dioxide (CO2). Emissions of Oxides of Nitrogen (NOx) are lowered by a chemical reaction called 'reduction'.

The 'oxidation' of CO and HC works best when the mixture is lean and the 'reduction' of NOx into N2 and CO2 works best when the mixture is rich. The Engine Control Module controls the fuel delivery, and after the engine is warmed up, a properly operating system will alternate between rich and lean.

If the rate at which the system changes between rich and lean is too slow, the catalyst runs out of stored oxygen, leaving HC and CO not oxidized. If the rate is too fast, not enough time is allowed for oxygen to be stored, leaving HC and CO unoxidized in the following rich cycle. In either case, HC and CO emissions will be higher than expected. If the system is running mostly rich, NOx will be lowered at the expense of higher HC and CO. If it is running lean, HC and CO will be lowered at the cost of higher NOx.

Hydrocarbons (HC)
Petroleum based products are made up of hydrocarbons. Any fuel that is not burned in the combustion chamber will be pumped into the exhaust, where it may be converted to water and carbon dioxide in the catalytic converter. Any remaining fuel will show up as HC at the tailpipe. Hydrocarbons are measured in parts per million (ppm). Too many hydrocarbons in exhaust gas as are caused by: Incorrectly timed spark, Insufficient spark, Misfire due to rich or lean mixture. HC is an excellent indicator of problems in the ignition system.

Gas Theory

Carbon Monoxide (CO)
Carbon monoxide is formed when there is not enough oxygen to support combustion. Fuel system problems are the usual cause of high CO.

In carbureted engines high CO may be caused by: Dirty air filter, Sticking choke, Float not set properly, Idle mixture set too rich

In fuel injected engines high CO readings may be caused by: Dirty air filter, Leaky injectors, High fuel rail pressure, Engine computer control malfunction. Carbon monoxide is an excellent indicator of rich air/fuel ratio because it responds quickly and dramatically to changes in mixture.

Carbon Dioxide (CO2)
This is the only gas for which a high reading is desirable. Carbon Dioxide peaks when combustion is most efficient, so the higher the reading, the better. The usual range is from 12-15%, but the reading will fall off quickly when the mixture is **either** too rich or to lean. Carbon dioxide is an excellent indicator of overall combustion efficiency.

Oxygen (O2)
Ideally, all available oxygen will combine with all the fuel during combustion. If there is not enough fuel to combine with all the oxygen, excess O2 will be present at the tailpipe. For that reason, oxygen is an excellent leanness indicator.

It is possible to have a normal or a rich mixture and still get a high O2 reading. A leak in either the engine exhaust or the gas detector's sample path may allow air to enter and dilute the sample. To find leaks in the gas detector's sample path, follow the instructions in the MAINTENANCE section for performing a Leak Check.

Oxides Of Nitrogen
Since air is mostly nitrogen, the combustion taking place in the engine will be in the presence of surplus nitrogen. The high temperatures of combustion will cause oxidation of some of that nitrogen. This process also consumes some of the oxygen that would otherwise be available for combination with fuel components. In a properly functioning system the resulting oxides of nitrogen (NOx) are reduced back to nitrogen in the catalytic converter.

Routine Maintenance

Low Flow Message
The low flow message can be caused by clogged or dirty filters, excessive water moisture in the filters, or an extremely cold pump assembly. If you get a low flow indication, follow the directions below to clear the message.

If the Low Flow message goes away when the sample hose is disconnected, you have excessive water in the filter system, or the filters are dirty. Run the extended Purge a couple of times. Make sure there is no water in the sample probe handle assembly, or in the water separator.

If the Low Flow message still does not go away, disconnect the in-line filter that is connected directly to the analyzer, and reconnect the sample hose to the analyzer. This will take the in-line filter out of the sample hose circuit. If the Low Flow message goes away, replace the in-line filter. If the Low Flow message is still on, reconnect the in-line filter and replace the water separator filters.

Purging
During normal operation the bottom filter will be come damp and the upper filter should remain dry. Providing the bottom filter is damp enough, purging will clear the hose, upper filter and bowl of water. Purging will not clear the bottom filter and sample probe handle.

Filter Replacement
The in-line filter can be replaced by simply disconnecting it from the analyzer and fitting the replacement. The upper and lower filter in the water separator bowl need to be replaced as a unit. Do not lose the rubber separator that goes between the filter elements, without it, no filtering will occur. The filter with the Red Dot goes on the bottom.

Cleaning the Sample Hose
If it becomes necessary to clean the sample hose and handle, use clean, dry compressed air. Do not blow compressed air through the filter elements!

How to Extend the life of the NOx and O2 Sensor
The best way to extend the life of your NOx and O2 sensor is to simply use the analyzer. Leaving it plugged in continually does not extend the life. The units that are experiencing longer sensor life are used several time a week. Usage of less than once per month will shorten the life of the sensors.

Warranty

FERRET BRAND LIMITED PRODUCT WARRANTY

GxT, Inc. of Cheboygan Michigan, warrants to the original purchaser that FERRET brand products are free from defects in materials and workmanship for a period of two years from date of purchase. Our sole obligation for a product within the above warranties will be to repair or replace, at our option, any defective parts and return the product to the sender within the U.S.A., shipping prepaid, if it is sent to our Repair Department shipping prepaid and accompanied by proof of purchase.

This Warranty does not apply to products which have been altered outside the factory; or repaired by anyone other than the factory or its authorized service centers; or which have been damaged from accidents, negligence, or abuse; or have been used differently than described in the printed instructions. Please note that wear and tear on leads and replacement of consumable items such as: NOx Sensors, Oxygen Sensors, and paper, is not covered by warranty.

GxT Inc.'s sole liability and buyer's exclusive remedy is limited to repair or replacement of the product as stated in the Limited Product Warranty. THERE ARE NO OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THOSE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND GxT, INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM THE SALE OR USE OF THE PRODUCT.

Some states do not allow limitations on the length of implied warranties nor exclusion or limitations of incidental or consequential damages, so that the above limitations and/or exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which may vary from state to state.

Techincal Support & Service

Questions or inquiries about service can be answered by contacting GxT, Inc., at: Toll Free (800) 627-5655. Fax: (231) 627-2727, or by e-mail to repair@gxtauto.com

When sending an item to the factory address it to: GxT, Inc., 520 MM Riggs Drive., Cheboygan, MI 49721-1061 Include a note describing the problem.

SAFETY PRECAUTIONS

—Read All Instructions Before Using The Meter—

- Always wear eye protection when testing vehicles. Be extra careful near batteries and moving parts. Do not lay tools on a battery.

- Battery gas is highly explosive.

  a. If a battery explodes flush the acid away from persons skin with generous amounts of water. Follow up with a neutralizing solution of baking soda and then more water.

     Treat clothing, vehicle parts, and equipment similarly. Any acid traces inside equipment must be removed by generous rinsing. Dry equipment and place in a warm 50°C (120°F) oven until thoroughly dry.

  b. Never use a wrench on the ungrounded battery terminal until the grounded one has been disconnected. Contact between the vehicle body metal and the hot terminal can cause sparks to ignite gas or even weld tools into a battery short circuit.

  c. Keep the space around a battery well ventilated.

  d. Do not make sparks or allow flames near batteries.

- Before working on a vehicle set the brakes and block the wheels. Beware of automatic parking brake releases.

- Keep your work area well ventilated and free of exhaust. **Engine exhaust contains deadly poisons.** Treat Gas Detector exhaust and drain hoses the same as the vehicle tailpipe. Both give off deadly exhaust fumes.

- Avoid electrical shocks caused by getting close to live ignition wires or touching the coil TACH terminal. A person's reaction near a live engine can be more damaging than the shock.

- Keep spark producing devices at least 0.5m (18") above the floor to reduce the hazard of igniting gasoline vapor.

- Do not let test leads wind up in a moving fan or pulley. Route leads away.

- Remove finger rings and metal wrist bands. They can short terminals and become very hot from electric current.

Notes

E016-01