Operating Manual

Series 2500 & 2500-CM
Total Hydrocarbon Analyzer

Series 2500: 115 V, 60 Hz
Series 2502: 230 V, 50 Hz

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Rev. 9

READ INSTRUCTIONS BEFORE OPERATING

GOW-MAC® INSTRUMENT CO.

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IMPORTANT WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR INSTALLING, USING, OR SERVICING THE PRODUCT.
Like any piece of complex equipment, the TOTAL HYDROCARBON ANALYZER will perform as designed only if it is installed, used and serviced in accordance with the manufacturer's instructions. OTHERWISE IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE BODILY INJURY OR DEATH.

The warranties made by GOW-MAC Instrument Co. with respect to the product are voided if the product is not installed, used and serviced in accordance with the instructions in this manual.

Please protect yourself and your employees by following these operating instructions. We encourage our customers to write or call for any additional information relative to the use or repair of this instrument.

Technical Support

GOW-MAC Instrument Co.
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GENERAL WARNINGS AND SAFETY

1. The Series 2500 Total Hydrocarbon Analyzer should be installed, operated and maintained in strict accordance with its labels, cautions, warnings, instructions, and within the limitations stated.

2. The Total Hydrocarbon Analyzer housing must be located in a non-hazardous area.

3. Use genuine GOW-MAC replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the Total Hydrocarbon Analyzer, beyond the scope of these instructions or by anyone other than GOW-MAC or a GOW-MAC Representative could cause the product to fail to perform as designed, and persons who rely on this product for their safety could sustain severe bodily injury or death.

4. DISCONNECT the instrument from **ALL** power sources **BEFORE** removing chassis from instrument housing and exposing potentially dangerous voltages.

5. **DO NOT** overload the AC outlet with other electrical equipment.

6. Adhere to the color coding descriptions when hooking up electrical connections.

7. Repair or replace faulty or frayed wiring.

8. Ensure that the actual line voltage is the value for which the instrument was designed. Ensure that the power cord is plugged into the correct voltage source.

9. Perform periodic leak checks on all fitting areas.

10. **DO NOT** allow flammable and/or toxic wastes to accumulate.

11. Keep combustibles away from gas cylinders and eliminate ignition sources.

12. Maintain adequate ventilation around Total Hydrocarbon Analyzer.

13. Dispose of wastes properly.

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Compressed gases have properties that can cause serious accidents, injuries, and even death if proper precautions and safety practices are not followed. Therefore, during handling and use of these gases, be certain to use applicable safety precautions described by your local compressed gas supplier, the Compressed Gas Association, and/or O.S.H.A. regulations.

1. Read the label on all cylinders **BEFORE** using to identify the cylinder contents. If the label is illegible, return the cylinder to the supplier. **DO NOT ASSUME THE CONTENTS.**

2. Secure cylinders in storage and in use to an immovable structure to prevent accidental falling or movement. Read the relevant safety codes.

3. Store or move cylinders ONLY in the vertical position. **DO NOT** move or transport cylinders with regulators attached.

4. Store cylinders in a well ventilated area away from heat or ignition sources.

5. When installing tubing, provide ONLY approved, adequate pressure reducing regulators and pressure relief devices to prevent over-pressurizing of tubing and equipment.

6. Never drop cylinders or permit them to strike each other violently.

7. Cylinders may be stored in the open but, in such cases, should be protected against extremes of weather and from damp ground (to prevent rusting). In areas where extreme temperatures are prevalent, store cylinders in the shade.

8. The valve protection cap should be left on each cylinder until cylinder has been secured against a wall or bench, or placed in a cylinder stand and is ready for use.

9. Avoid dragging, rolling or sliding cylinders even for a short distance. Move cylinders by using a suitable hand truck.

10. Never tamper with safety devices in valves or cylinders.

11. Do not store full and empty cylinders together. Serious suck-back can occur when an empty cylinder is attached to a pressurized system.

12. No part of a cylinder should be subjected to a temperature higher than 52 °C (125 °F). Do not permit flame to come in contact with any part of a compressed gas cylinder.

1. Connect gases to back panel (sample, span, zero, fuel, and air). The allowable range for gas pressures is 15 to 100 psig. If installing a 2500-CM, one additional requirement is non-condensing compressed air at 40-60 psig to actuate the methanizer switching valve. Connect to ACT AIR IN. Please observe recommended gas supply pressures in this table:

Recommended Gas Inlet Pressure			
Service	**Gas Type**	**Supply Pressure Range (psig)**	**Supply Pressure Recommended (psig)**
sample	various	15-100	20-30
zero	Match the sample gas	15-100	For 2500 model: 20-30 For 2500-CM model: 20 for light to medium gases (He, H_2, N_2) 30 for heavy gases (Ar, CO_2)
span	Match the sample gas	15-100	20-30
FID air	UPH Air, 99.999%	15-100	20-30
FID fuel	UHP H_2, 99.999%	15-100	20-30
	FID mix 40/60 H_2/He	15-100	20-30
	FID mix 40/60 H_2/ N_2	15-100	20-30
Actuator for methanizer valve, Model 2500-CM only	Air or N_2	40-60	40-60

2. Turn on the instrument using the switch on the back panel.

3. Go to the FID tab on the bottom of the screen and set the detector temperature to 140°C Wait one hour for temperature to stabilize.

4. In the Gas tab, select your fuel gas on the left-hand side, and your sample gas on the right-hand side. (Sometimes defaults will show 0 for flows; this can be fixed by reselecting sample)

5. Go back into the FID tab and choose your fuel rates for the fuel, air, and sample by touching the buttons below each gas. Default flows are stored in the instrument.

6. Touch the ignite button located near the top of the screen. This will begin the igniting process. The ignition cycle may have to be run more than once. Multiple attempts may be required if the detector is still heating and when fuel mix is used. The flame lighting may be accompanied by a soft popping noise. Verification of successful detector flame ignition is rapid rise of the number in the Flame Temp window next to the Ignite button and water vapor flowing out from the FID EXHAUST tube.

7. Once the flame is lit and the flows are stable, allow at least 2 hours for the signal to stabilize before running the Zero and Span Calibration cycles.

8. Before calibration, choose your range in the Control tab. Select the range according to these values.

   Range 1: 0 to 25 ppm
   Range 2: 0 to 250 ppm
   Range 3: 0 to 2,500 ppm
   Range 4: 0 to 25,000 ppm

9. Navigate to the Calibration tab to start the calibration process. To calibrate your zero gas, enter the total amount of hydrocarbons present in your zero gas in the Zero ppm box. If this value is unknown, just enter zero. Then, touch the Zero button to start the zeroing process, which runs for 6 minutes. Status bar turns green when complete.

10. To calibrate the span, enter the total amount of hydrocarbons into the Span ppm box and then touch the Span button. This starts the spanning process which also takes 6 minutes to complete. Status bar turns green when complete.

11. Once the zero and span are done, go to the Control tab and touch the Sample button to open the sample gas valve and start analysis. Analyze tab shows measured ppm in whichever gas is selected from the control tab.

Detector	Flame Ionization (FID)
Ranges	User selectable nominal ranges. Upper limits are functions of signal. Range 1: 0 - 25.00 ppm Range 2: 0 - 250.0 ppm Range 3: 0 - 2,500 ppm Range 4: 0 - 25,000 ppm
Linear Range (+/-5%)	0.0034 g/sec (12,750 ppm CH_4)
Dynamic Range	0.0095 g/sec (0 to 35,560 ppm CH_4)
High Concentration Analysis	Limits are a function of lower sample flow. Range 4: 0 – 10% CH_4 Dynamic Range: 0 – 10% CH_4 Linear Range: 4% CH_4
Sensitivity	Average of various samples: 3630 Asec/g Best case CH_4 in N_2: 2916 Asec/g
Minimum Detectability	Average of various samples: 0.02 ppm CH_4
Repeatability	± 1% of full scale for 5 successive samples
Accuracy	99.9% per individual linear range/99.45% per full scale
Drift	Zero and span, 24 hr. constant ambient temperature, spanned at 10 ppm: < 0.2% of span Zero and span, variable ambient temperature from 18 to 32 °C, spanned at 10 ppm: < 0.2% of span
Response Time	(Measured between 0 and 1007 ppm CH_4 in N_2 on range 3. Independent of inlet pressure) Rising to 90% of final reading (sec): 16 Rising to 95% of final reading (sec): 18 Rising to 100% of final reading: < 4 min. Falling to 10% of starting reading (sec): 16 Falling to 5% of starting reading (sec): 18 Falling to 0% of starting reading: < 6 min.
Communications	Analog: 4-20 mA, 0-5 VDC Digital: RS-232 serial, USB data logging
Relays	Programmable relays for two (2) high/low concentration alarms (2) 1A alarm relays and (1) ready relay
User Interface	7-inch graphical resistive LCD touchscreen
Gas Parameters	Sample: 25 ccpm typical flow to FID. Inlet pressure range 10 - 100 psig. Sample bypass flow minimum at 10 psig to about 1 lpm at 100 psig inlet pressure. Air for FID: 500 ccpm maximum flow, UHP grade (99.999%), supplied at 10 - 100 psig. Fuel for FID: Safety and minimum detectability are among considerations when selecting fuel gas type. Fuel mix is required for oxygen sample. UHP grade (99.999%), supply pressure 10 - 100 psig. • 100% hydrogen, 30 ccpm or • 40% H_2- 60% N_2, 100 ccpm or • 40% H_2- 60% He, 100 ccpm Actuation air for 2500-CM only: Non-condensing compressed air or inert N_2/Ar at 40-60 psig.
Gas Process Connections	1/8-inch compression fitting
Ambient Temperature	15 °C to 35 °C (59 °F to 95 °F) stable ambient temperature for best performance
Power Requirement	2500: 120 W at 115 VAC, 60 Hz, 2500-CM: 180 W at 115 VAC, 60 Hz 2502: 120 W at 230 VAC, 50 Hz, 2502-CM: 180 W at 230 VAC, 50 Hz
Dimensions	7 in (17.8 cm) H x 17 in (48.3 cm) W x 21 in (53.4 cm) D Front panel height 4U fits 19-inch-wide EIA standard rack
Weight	2500 or 2502: 24 pounds (11 kg) 2500-CM or 2502-CM: 27 pounds (13 kg)

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The Series 2500 Total Hydrocarbon Gas Analyzer with flame ionization detector continuously measures the total concentrations of hydrocarbons in a gas stream.

The Series 2500-CM flow system adds a catalytic methanizer and actuated valve to switch sample flow through the methanizer. The 2500-CM can operate in basic THA only mode and as a THA with methanizer, which converts CO and CO_2 to CH_4 providing total concentration of CO plus CO_2.

Series 2500 analyzers utilize the flame ionization (FID) method of detection. Ionized carbon atoms are produced when hydrocarbons are burned in the hydrogen flame. The ionized electrons formed in the flame enter space near an electrically charged electrode. The gap resistance at the electrode changes in the presence of ions and the subsequent current is measured by an electrometer amplifier. This current is linearly proportional to the hydrocarbon concentration in the flame. The electrometer amp puts out a DC voltage signal.

This manual contains operating information for the Total Hydrocarbon Analyzer Models shown below. Identify your model, and disregard those portions that do not apply to your unit.

Total Hydrocarbon Analyzer Models

115 V	230 V	Model
2500	2502	Total Hydrocarbon Analyzer
2500-CM	2502-CM	Total Hydrocarbon Analyzer with catalytic methanizer

GOW-MAC Installation and Training Service
GOW-MAC provides installation and training (in person and remote) services.
Please contact GOW-MAC Sales at (610) 954-9000 or email sales@gow-mac.com.

Unpacking and Inspection

1. When unpacking the instrument, check it carefully for evidence of shipping damage or rough handling. Check to ensure that all components ordered have either been supplied or backordered. ***Report any damage or discrepancies immediately to GOW-MAC Instrument Company.***

2. Remove all plastic and/or paper shipping caps and restraints before operating.

Site Prep and Installation

1. **Electrical Connections**
   Connect the supplied AC power cord between the receptacle on the back panel and voltage specified for the model.

   Series 2500 - 120 Watts at 115 V, 60 Hz
   Series 2500-CM - 180 Watts at 115 V, 60 Hz

   Series 2502 - 120 Watts at 230 V, 50 Hz
   Series 2502-CM - 180 Watts at 230 V, 50 Hz

   A grounded electric outlet should be in the installation area within reach of the included power cord. The instrument was shipped with a power cord plug that is specific for the destination country noted on the equipment order.

   An extension cord should NOT be used for the 2500 because extension cords may not be rated for the instrument power. For best results, use a dedicated service receptacle to prevent disruption from transient loads. The electric power must be steady to provide optimum instrument stability. If necessary, install a stabilizing power transformer between the receptacle and the 2500. In addition, a surge/noise suppressor with lightning arrestor should be installed between the receptacle and the 2500. The minimum capacity/ratings for a surge/noise suppressor are 2 A at 115 V and 1 A at 230 V.

   Grounding: A proper earth ground is required for instrument operation. Any interruption of the grounding conductor or disconnection of the power cord could cause a shock that could result in personal injury. The metal instrument panels and cabinet are grounded through the three-conductor power cord that, when plugged into a properly grounded receptacle, grounds the instrument and minimizes shock hazard. A properly grounded receptacle is one that is connected to a suitable earth ground. Be sure to verify proper receptacle grounding.

2. **Environmental**

The Series 2500 THA can be installed on a table or in a 19-inch rack. Use a shelf or similar support for installation in a rack due to the instrument's weight and depth. Allow about 12 inches clear space from the instrument back panel for gas tubing and electrical connections. The FID exhaust tube is the detector vent for noncondensing water vapor formed by the hydrogen flame.

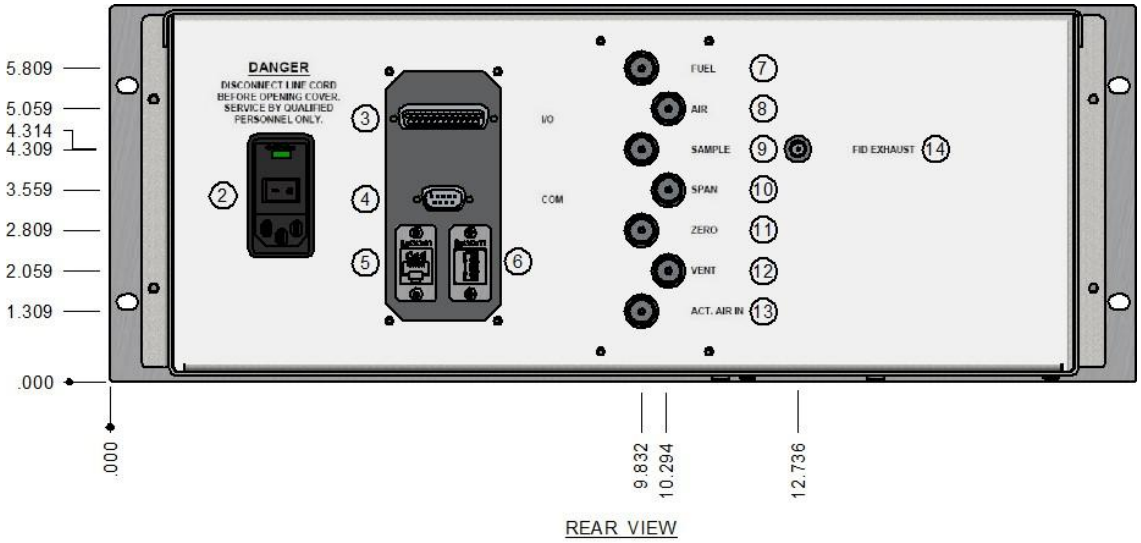
Install the analyzer in a location that is secure, vibration free, and has a stable ambient temperature. For optimum instrument stability, the ambient operating air temperature should be maintained as steady as possible within the range 15 to 35 °C (59 to 95 °F). Ambient temperature change does cause drift of the calibration.

There must be full access and easy viewing of the front panel of the analyzer. In addition, provisions should be made for access to the rear panel (gas, electrical and comm interfaces). Infrequent access for maintenance (Chapter 8) requires removal of the instrument top cover.

The height and width of the front panel are designed to fit into an EIA standard 19-inch rack. The 7-inch touchscreen is the display and user interface. The only instrument power switch is on the back panel.

Model 2500 THA front panel, dimensions in inches

3. **Gas Connections**
   Gas connections are on the back panel. All are 1/8” diameter compression fittings. FID exhaust is a 1/4-inch tube. Make no connection to FID exhaust as it should vent to atmostphere. Gases required to operate the Series 2500 THA are specified in the following table.



NOTES
1.TOUCH SCREEN DISPLAY
2. POWER
3. 25-PIN USER I/O CONNECTION
4. 9-PIN SERIAL CONNECTION
5. ETHERNET CONNECTION
6. USB CONNECTION
7. FUEL (1/8" COMPRESSION)
8. AIR (1/8" COMPRESSION)
9. SAMPLE IN (1/8" COMPRESSION)
10. SPAN (1/8" COMPRESSION)
11. ZERO (1/8" COMPRESSION)
12. VENT (1/8" COMPRESSION)
13. ACTUATOR GAS IN (1/8" COMPRESSION)
14. FID EXHAUST

Model 2500 back panel and connections, dimensions in inches

Gas Selection and Purity

2500 THA Gas Specifications

Service	**Gas Type**	**Gas Grade or Quality**	**Supply Pressure (psig)**	**Flow Rate (ccpm)** NOTE 1
sample	various	Non-condensing	15-100	30 plus 0 ccpm bypass at 10 psi supply to 30 plus 1 lpm bypass at 100 psi supply NOTE 2
zero, 2500	Match the sample gas	99.999 % pure with known total hydrocarbon content	15-100	30 plus 0 ccpm bypass at 10 psi supply to 30 plus 1 lpm bypass at 100 psi supply NOTE 2
zero, 2500-CM			20 (He, H_2, N_2) 30 (Ar, CO_2)	
span	Match the sample gas	Methane content about 120 % of average THC content in sample	15-100	30 plus 0 ccpm bypass at 10 psi supply to 30 plus 1 lpm bypass at 100 psi supply NOTE 2 & 3
FID air	air	99.999 % pure	15-100	225-300
FID fuel	hydrogen	99.999 % pure	15-100	20-40
	Fuel mix	FID fuel 40% H_2 + 60 %He	15-100	65-90
		FID fuel 40% H_2 + 60 % N_2	15-100	65-75
Actuator for methanizer valve (only model 2500-CM)	Air or N_2	99.99 % pure if from a cylinder. Non-condensing if from an air compressor	40-60	negligible

NOTE 1: Gas Flows: Flow ranges are listed because the detector ouput can be optimized for each set of selected sample and fuel. Recommended flows appear on the Gas tab after gas selections are made. Recommended flows by sample gas are listed in Appendix 2.

NOTE 2: Bypass flow exits the 2500 at the Vent port. Flow rates depend on gas density and inlet pressure. The Vent port must be near atmospheric pressure if tubing is connected for venting away from the analyzer.

NOTE 3: Ionization in the FID flame is a function of the sample gas molecule and of all flowrates to the detector. For accurate analysis, zero and span gases must be the same base or matrix as the sample. Example: when testing argon sample, the Series 2500 should be zeroed and spanned with an argon-bases zero and span gas, for example a certified ppm of CH_4 in argon.

NOTE 4: Reference for compressed air condition is ISO8573-1:2010 (7:4:4).

Allow adequate space for the safe and compliant installation of gas cylinders where used. **Cylinders should be secured to the wall or a table at all times.**

CAUTION

FOLLOW THE "GENERAL WARNINGS AND CAUTIONS" AND "GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS" LOCATED AT THE FRONT OF THIS MANUAL; CONTACT YOUR LOCAL GAS SUPPLIER TO ENSURE PROPER HANDLING OF CYLINDERS.

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4. Gas Control Components

Tubing and fittings. Connect to the 2500 instrument with only hydrocarbon-free tubing. Tubing that is cleaned for oxygen service will be adequately hydrocarbon-free. It is particularly important to use clean tubing for trace hydrocarbon analysis in Range 1.
Compression tube fittings with front and rear ferrules should be used for installation. Use stainless steel fittings when connecting to stainless steel tubing.

Cylinder Regulators

Install the 2500 gas supply system with two-stage gas regulators with metal diaphragm seals made for high purity service.

Traps and Filters

Particle filters are built into the 2500 to prevent damage to fine flow control surfaces and components. Depending on the analysis and certified purity of zero gas, FID air and FID fuel, an external hydrocarbon trap may be used to cleanse zero gas for a more accurate calibration. For the 2500-CM model only, a trap or filter may be needed to clean compressed air.

Gas Flow Measurement

All flows are read out directly in cc per minute units on the FID screen. Flow through the vent is bypass (excess) sample gas as well as zero and span gases when selected. Vent flow is gas that has passed through the back pressure regulator and is not measured on the instrument. A meter can be connected to the Vent at the 2500 installation however the meter and any user-installed vent system must impose no back pressure at the Vent port.

Leak Testing

After all gas connections have been made and tightened, test each connection for leaks. Leaks in the system will cause baseline drift and noise, and may reduce sensitivity.

WARNING
LEAKS IN THE HYDROGEN LINE (FUEL) ARE HAZARDOUS.
HYDROGEN IS AN EXTREMELY EXPLOSIVE GAS.

The lower explosive limit (LEL) of hydrogen in air is 4% and the upper explosive limit (UEL) in air is 75%. When oxygen is used, the LEL remains the same but the UEL increases to 94%. CARE MUST BE EXERCISED in handling this gas and the system must be free of leaks. When using a hydrogen or oxygen span/zero gas the sample vent MUST be vented according to regulation(s).

WARNING

HYDROGEN SHOULD BE TURNED OFF AT THE CYLINDER WHEN NOT IN USE

This instrument has been completely leak-tested and checked out prior to shipping. It is possible, but unlikely, that internal leaks have developed during shipment. The most likely source of leaks will be where subsequent connections or reconnections are made by the user.

NOTE: ALL CONNECTIONS SHOULD BE LEAK-TESTED, WITH THE GASES FLOWING, BEFORE THE INSTRUMENT IS OPERATED

Each gas must be flowing to check for leaks. The use of soap or other organic substances to check for leaks ARE NOT recommended. If there are leaks, the soap and/or organic substances will be aspirated into the leak and contaminate the system. The easiest way to locate leaks is with the GOW-MAC Model 21-080 Mini Gas Leak Detector if the tubing can be pressurized with helium.

NOTE: DO NOT ATTEMPT TO PRESSURIZE THE SYSTEM BY CAPPING THE FID EXHAUST PORT AT THE BACK PANEL. THE FID IS NOT GAS TIGHT UNDER PRESSURE.

5. Instrument Communication Connection Descriptions

a. 25-pin user I/O connection. D-SUB female receptacle with 25 positions described in the following table. Also see Chapter 4.

POS.#	POSITION NAME	SPECIFICATION
1	READY (NC)	30VDC @ 300mA
2	ALARM 1 (NO)	30VDC @ 300mA
3	ALARM 1 (COM)	30VDC @ 300mA
4	ALARM 2 (NC)	30VDC @ 300mA
5	NOT USED	
6	NOT USED	
7	NOT USED	
8	NOT USED	
9	FLAMEOUT TTL -	TTL Logic, 0-5V
10	REMOTE CALIBRATION INPUT -	apply 0-5V TTL “low” or contact closure to act
11	4-20 mA (LO)	Output protection 240V RMS, 1000ohm maximum load
12	0-5 V (LO)	5V compliance, 10Kohm minimum load
13	NOT USED	30VDC @ 300mA
14	READY (NO)	30VDC @ 300mA
15	READY (COM)	30VDC @ 300mA
16	ALARM 1 (NC)	30VDC @ 300mA
17	ALARM 2 (NO)	30VDC @ 300mA
18	ALARM 2 (COM)	30VDC @ 300mA
19	NOT USED	
20	NOT USED	
21	NOT USED	
22	FLAMEOUT TTL +	TTL Logic, 0-5V
23	REMOTE CALIBRATION INPUT +	apply 0-5V TTL “low” or contact closure to act
24	4-20 mA (HI)	Output protection 240V RMS, 1000ohm maximum load
25	0-5 V (HI)	5V compliance, 10Kohm minimum load

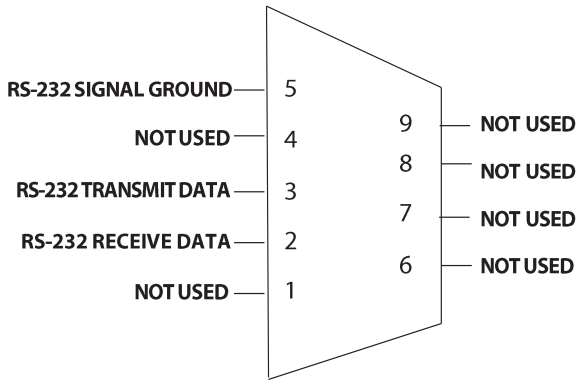
b. 9-pin serial connection. D-SUB male receptacle with 9 positions described in the following table. Also see Chapter 4.

POS. #	POSITION NAME
1	NOT USED
2	RS-232 RECEIVE DATA
3	RS-232 TRANSMIT DATA
4	NOT USED
5	RS-232 SIGNAL GROUND
6	NOT USED
7	NOT USED
8	NOT USED
9	NOT USED

1. USB Connection

The USB port can be used for Data Logging storage and future GOW-MAC firmware updates. A thumb drive or external hard drive can be connected here to save the Data Log text files. It is important to keep track of how much space is used when collecting data. Once the storage device is full, the data log will STOP collecting data. A red "USB" light will appear in status bar when a USB is mounted.

2. Serial Data Output



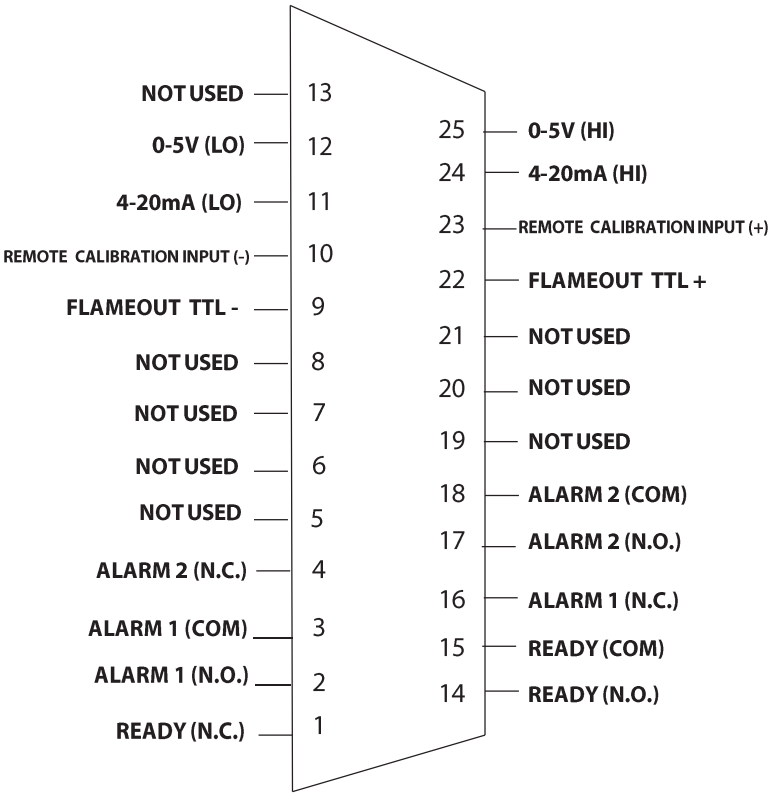
DB9M Pin connections

Use terminal program, such as Putty for Windows, using the following settings.
Communication Settings:
Baud Rate: 9600
Number of data bits: 8
Parity: None
Number of Stop Bits: 1

Data Format: (5 data fields, space delimited)
1 Date
2 Time (24hr)
3 ppm (display reading only no unit)
4 Alarm1_state
5 Alarm2_state

Example set @ 10min Interval
****
7/01/21 11:10:30 103.018 A1_High A2_Low
7/01/21 11:20:30 105.374 A1_High A2_High
****
Ethernet Connection Factory use only.

3. Comms In/Out



DB25 I/O Connector

a. **Analog Outputs**
Description: For connection to external data system

i. 4-20mA analog output
Rating: output protection 240V RMS, 1000 Ohm maximum load

Connections:
Pin 11 (4-20mA) Lo
Pin 24 (4-20mA) Hi

ii. 0-5 Volt analog output
Rating, Analog Signal Output: 5V compliance w/ 10Kohm minimum load

Connections:
Pin 12 (0-5V) Lo-(gnd)
Pin 25 (0-5V) Hi

b. **Status Relay Outputs**
Description: For monitoring system status
Ratings: 30VDC @ 300mA

i. High / Low alarms

Connections:
Pin 2 Alarm 1 N.O.
Pin 16 Alarm 1 N.C.
Pin 3 Alarm 1 Common

Connections:
Pin 4 Alarm 2 N.C.
Pin 17 Alarm 2 N.O.
Pin 18 Alarm 2 Common

ii. Ready Status Relay - Ready is indicated when calibrated and sample gas flowing
Description: Instrument operational status indicator
Operation: Normally Open contact
Normally Open Relay contact will be closed when the 2500 system is in ready state (see above)

Connections:
Pin 1 Ready N.C.
Pin 14 Ready N.O.
Pin 15 Ready Common

iii. **Flame Monitor Output**
Description : TTL Logic (0-5V) Indicator of flame status

Operation:
TTL (0-5V) “low” – When flame is lit
TTL (0-5V) “high” – When the flame is not lit

Connections:
Pin 9 Flameout TTL –
Pin 22 Flameout TTL +

iv. **Remote Calibration Input**
Description: Used to initiate calibration sequence remotely
Operation: Toggled (0-5V) TTL signal from high to low

Connections:
Pin 10 Calibration input –
Pin 23 Calibration input +

User Interface Screens

The Series 2500 uses a touchscreen for user interface control. Tabs along the screen bottom are to navigate between screens.

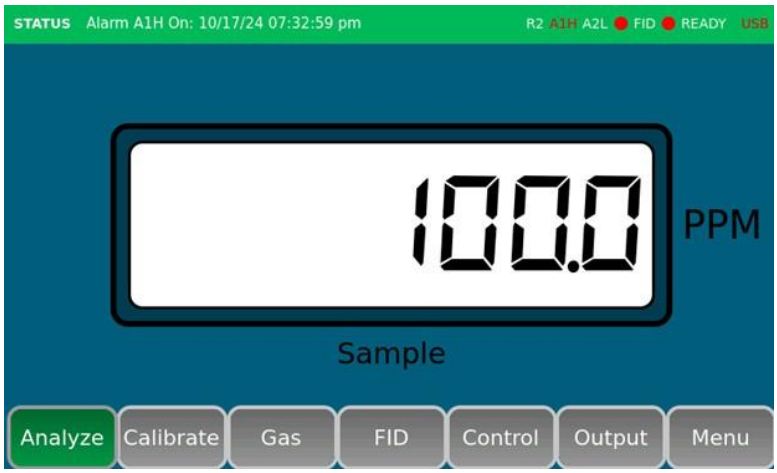
NOTE ABOUT UNITS USED ON THE SCREENS - When not labeled on the screen, default units are:

Gas flow = ccpm

Temperature = °C

Signal (on the Control screen) = volts

STATUS BAR



1. **Analyze Screen**

Displays concentration in ppm of the detector output. The number of decimal places depends on the selected range. The nominal ranges are:

- Range 1: 0 - 25 ppm
- Range 2: 0 - 250.0 ppm
- Range 3: 0 - 2,500 ppm
- Range 4: 0 - 25,000 ppm

Range upper limits are functions of FID generated signal, therefore will not strictly follow the nominal ranges. Also see Control Screen description.

Status Bar features. A communication field across the top of the screen indicates instrument status and messages.

- The current state of the instrument. Background color brown if not ready or if there are errors and green when ready and analyzing.
- Range setting indicated by R(1-4).
- METH indicator light is red when methanizer mode is selected (2500-CM only).
- FID indicator light is red when the flame is lit.
- READY Red light when all actual temperatures match setpoints, all flows match setpoints, successful Zero and Span have been done, and sample gas is selected. The instrument is ready for analysis.

- USB indicator light. The “USB” turns red when a properly formatted USB is mounted and recognized.

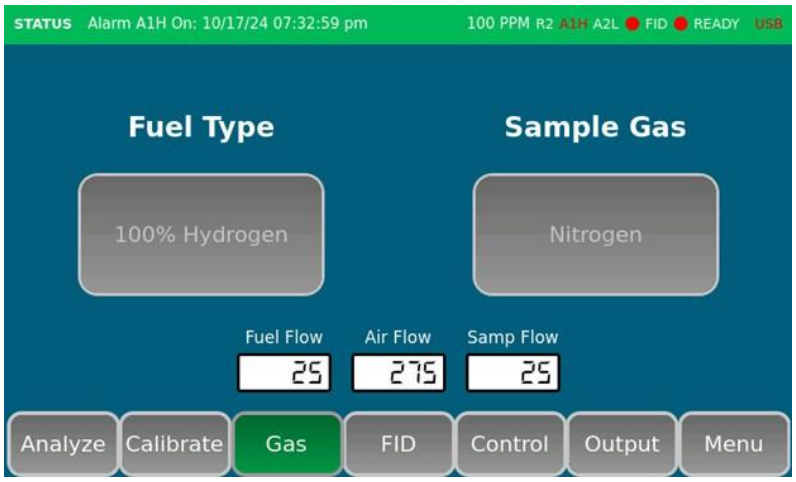
- Error messages appear to describe a fault. Touch the message bar to expand to a list of the most recent status and error messages. Press “X” to collapse the list.

2. Calibrate Screen features:

- Date, time, and range of current calibration.
- Buttons to manually start zero, span and span check cycles.
- Span Check. Touch Span Check to initiate a cycle that introduces span gas and compares the signal to the saved span value. If the two values are within 2% of each other, then the span is considered good, and the check span light is green. If more than 2% different, the light is red.
- Below the Zero and Span buttons are fields to enter the total hydrocarbon content (certified if possible) of zero and span gases. Touch the field to open a keyboard to enter values and return to the active screen.
- A stabilization timer appears in the calibration message box during zero and span cycles, as well as the span check.
- The calibration process of zero and span can be remotedly triggered via the DB25 I/O connector on the back panel. Please refer to Chapter 4 Communications.

3. Gas Screens' features:

- Buttons to select fuel and sample gases.
- Fields that show the stored (recommended) flow settings for the fuel-sample combination.

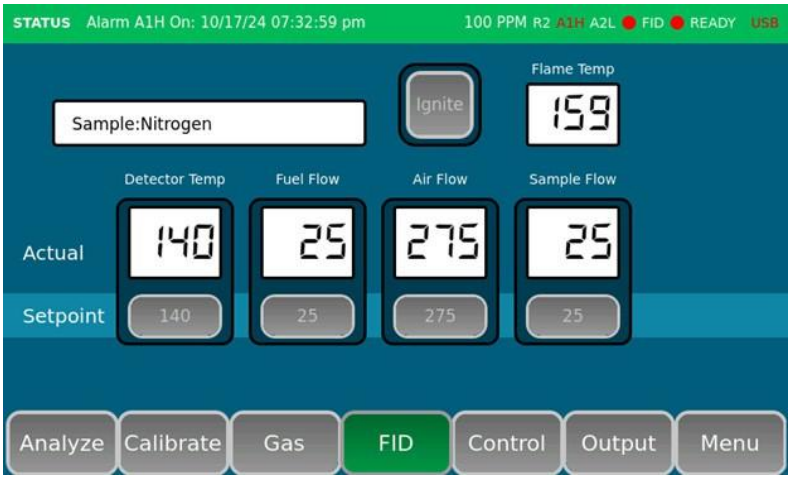


Gas screen fuel selection. Select FID fuel gas with this screen.

Exit fuel selection screen by touching the "X" button.

Gas screen sample selection. Select sample gas with this screen.

Exit sample selection screen by touching the “X” button.



4. FID Screen features:

- Field shows the selected sample gas.
- FID Ignite button.
- Flame Temp field shows the internal FID temperature which is used by the flame-out circuit. This is a useful indicator of flame status.
- Detector Temp is the FID temperature. The detector is heated above 100 °C to prevent condensation from the hydrogen flame. The high limit and recommended detector temperature is 140 °C.
- Fuel, air and sample flows indicate actual flows in ccpm. Buttons below each field show the settings. Press the buttons to open a keyboard to change settings.

Detector. The 2500 Series analyzer uses a flame ionization detector. The FID is heated from the base where the sample, fuel and air enter the detector. Temperature is controlled by a cartridge heater and 100-ohm RTD connected to a control board in the electronics

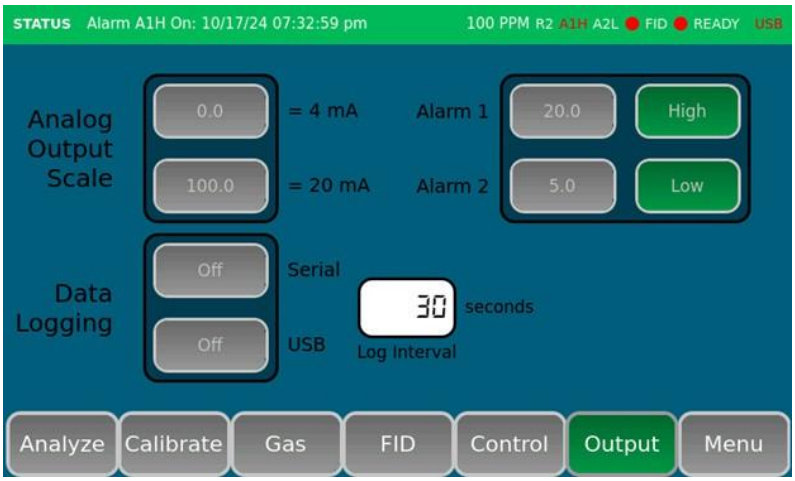
area. Polarization voltage and ionization current connect through the lower and upper arms, respectively. Gas and water vapor vent through the chimney tube and out of the instrument at the back panel. The igniter coil is located on the side. The FID top houses the Flame Temp sensor, A J-type thermocouple. The FID is insulated to keep internal surfaces warm enough to prevent water vapor condensation.

Note that the detector is not gas-tight and therefore any of the connected gases can enter the instrument interior. A hazardous condition can be minimized by checking these:

- Set gas flows to minimum flow rates that provide adequate performance.
- Verify that during detector flame-out condition, actual flows of sample, air and fuel are zero. The flow controllers' set points go to zero when the Flame Temp falls below 124 °C. There will be a period from actual flame out (Flame Temp above 124 °C) to where Flame Temp cools to 124 °C. Gas flows into the detector without flame during this interval.
- FID fuel has a secondary fail-safe; during flame out condition, a shut-off condition closes independent of the shut-off condition in the fuel flow controller.

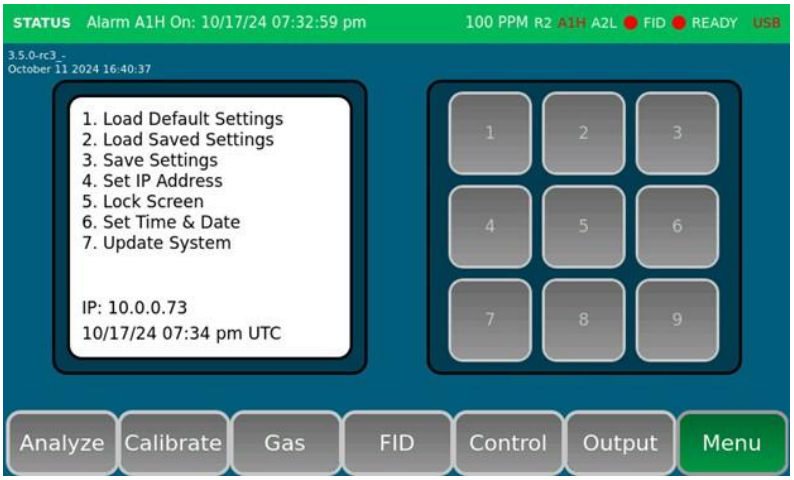
5. Control Screen features:

- GAS buttons can be touched to manually select zero, span and sample gases to flow to the detector. Unselected gases do not flow because their manifold-mounted shutoff valves are closed.
- A set zero interval can be set to ensure the 2500 maintains its zero by correcting for baseline drift. This is enabled by pressing the "Zero Interval" button which turns green when enabled. The zeroing frequency is user-settable with an available range of 30 to 9999 minutes. The frequency is set by touching the minutes field (white box) entering the time in minutes, and then touching enter. Auto zero can be disabled by pressing the Zero Interval button, which turns back to gray when disabled.
- Ranges. There are four ranges to select with R1 for lowest concentrations (approximately 0-25 ppm), R2 (approximately 0-250 ppm), R3 (approximately 0-2,500 ppm) and R4 (approximately 0-25,000 ppm).
- The software will calculate the raw signal versus known set values and assign the best calculated range. The result will be values that are close to the expected 0-25, 25-250, 250-2,500, and 2,500-25,000 ppm, but will not be those exact values. (Example: Range 1 may be 0-35 ppm with optimal calculation)
- The active range is displayed in the Status Bar as R1, R2, R3 or R4.



6. **Output Screen features:**

- Alarms. There are 2 alarms that can be set on the THA. Alarm 1 and Alarm 2 each have a Low and High value. The desired values can be entered and enabled by pressing the gray button beside each alarm. It will set to either low or high and can be reset by toggling the button. The active alarm is displayed in the Status bar as A1L (Alarm 1 Low), A1H (Alarm 1 High), A2L (Alarm 2 Low), and A2H (Alarm 2 High). When alarm is triggered, these indicators will turn red. To turn off alarms, press the low/high buttons until they turn gray and indicate “off”.
- 4-20 mA Output. Enter the 4 to 20 mA output concentrations based on the desired range of measurement.
- Data Logging. Data logging is an option for users to collect data from the instrument while it is running. It can be collected either using a USB or serial output and can be collected down to every second. The data collected while data logging is on includes the date, time, concentration in ppm, and whether an alarm was triggered. When taking data on a USB, the USB must be plugged into a computer to access the files which will be in a .txt format. When USB logging, a USB indicator light will appear in the status bar when USB is properly mounted.



7. Menu Screen features:

The MENU lists indexed actions that can be selected at any time. Select the action with a touch of the corresponding numbered key.

Menu Options:

1. **Load default settings.** Restores factory defaults.
2. **Load saved settings.** Loads last saved settings. Settings are saved on a successful calibration or when the save settings option is used.
3. **Save settings.** Saves the current operating settings.
4. **Set IP address**. If network cable is plugged in, the instrument will get the IP address from DHCP server on same subnet. Alternately, manually enter an IP address in format X.X.X.X.
5. **Lock screen.** Locks screen so only menu and analyze are available.
6. **Set Time and Date.** Allows the current date and time to be updated.
7. **Update system.** A firmware update to the Series 2500 can be installed via USB flash drive. Download the latest firmware on a flash drive. Power off the 2500 at back panel power switch. Plug the drive into the USB port on the back of instrument. Press key #7. The installed software revision is displayed on the Menu Screen after the reboot. A message in the Status Bar indicates the update is in progress. Follow prompt to reboot the system.

1. **Select gases on the Gas screen.**
   a. Select Fuel gas. There are three possible FID fuel gases:
      i. 100% hydrogen. Specifications are in the Installation section. Pure hydrogen fuel yields the highest signal to noise for the instrument, however it's use may be restricted in some locations. Pure hydrogen is required when operating the 2500-CM in the methanizer mode because the catalytic conversion of CO and CO_2 to CH_4 requires the presence of hydrogen.
      ii. FID fuel mix 40% hydrogen with 60% nitrogen specifications are in the installation section. H_2-N_2 fuel mix is an option when pure hydrogen is not permitted. Signal to noise is lower with fuel mix than with pure hydrogen. More flame ignition cycles may be required to successfully ignite the flame.
      iii. FID fuel mix 40% hydrogen with 60% helium specifications are in the installation section. H_2-He fuel mix is an option when pure hydrogen is not permitted. Signal to noise is lower with fuel mix than with pure hydrogen. More flame ignition cycles may be required to successfully ignite the flame.

   b. Select Sample gas. This is the matrix gas of the sample, also described as the balance or main component of a gas mixture. The selected sample gas is communicated to the sample flow meter, which corrects from a stored gas list. Sample flow readings on the FID page are true provided the supplied gas matches the Sample Gas Type selected on the Gas page.

      Selection of fuel and sample recalls the default set of fuel, air and sample flows that have been determined in factory testing. The default flows are written in the Gas screen fields and copied to the FID screen when the ignition sequence is started. The setting can be changed on the FID screen to user-customized values. These user settings will be saved after a successful calibration (Zero and Span) or when the user saves the settings from the menu page. These saved settings can be recalled by selecting the "Restore saved settings" option on the menu page.

      NOTE: Oxygen is not available when 100% hydrogen fuel is selected. A hydrogen-oxygen flame burns so hot that the signal to noise ratio is too low for analysis. Use one of the fuel mixes for oxygen sample.

2. **On the FID screen**, set the FID temperature to 140 °C. The FID temperature and the flame temperature (Flame Temp) are measured by two different sensors. Setting the FID temperature to 140 °C prevents condensation in the detector. The Flame Temp temperature is input to the flame detection circuit. It is not controlled but is a convenient indicator of flame on or off. Allow 1 hour for detector temperature to reach steady state at the setpoint.

3. **Go to the FID screen**. When detector temperature is steady at 140 °C, touch the Ignite button. It changes color to red indicating the ignition process is underway. During the ignite process, air purges the FID before fuel flows. The fuel-air mixture is enriched to light the flame, then returns to the lower fuel setting before introduction of sample gas.

a. Note the Flame Temperature indicator. A thermocouple inside the FID monitors the presence of a flame by measuring the detector internal temperature. The flame temperature when no flame is lit should be less than the detector temperature. When the flame is lit, Flame Temp rapidly rises above 200 °C to a high level that varies depending on the sample gas and combined gas flows.

b. Flame Detection Circuit. The 2500 has a failsafe to shut the flows of fuel and sample gases in the event of flame out, which is triggered when the flame temperature is below 124 °C. Detector air is also shut off in event of flame out.

c. Successful flame ignition is indicated when the status bar color changes to green as Flame Temp rises through 124 °C and all actual gas flows match their set points.

d. If the flame does not light in the flame ignite cycle, wait for the ignition process to complete and all flows shut off. The ignite cycle **MUST** finish before a new cycle can be started.

4. When the flame successfully lights and gas is flowing (zero, span, or sample), the ppm concentration will be shown on the Analyze page and in the Status Bar. The ready light will only turn on when sample is flowing.

5. **Go to the Control screen**.
   a. Note that the raw signal in volts is displayed in the Signal field. The corresponding ppm value is shown on the Analyze screen and repeated in the status bar.

   b. Zero Interval can be used to set an interval for automatically resetting the signal to zero. The interval can be set for 30 – 99,999 minutes. Zero interval is turned on/off by toggling the button that says “zero interval”. It will turn green when it is on and active, and it will be gray when turned off. Please note that while a zero interval is occurring, gases cannot be edited until the process is over, similar to calibration.

   c. Select range on the Control screen. Nominal ranges are:

      Range 1: 0 to 25 ppm
      Range 2: 0 to 250 ppm
      Range 3: 0 to 2,500 ppm
      Range 4: 0 to 25,000 ppm

If your analysis and calibration will be limited to less than 25 ppm, then select Range 1. If limited to less than 250 ppm, then select Range 2, and so on. The upper range values are in fact variable because they are affected by detector signal. For example, with a higher signal, the upper range values will be lower. This is because each range can only go up to 2.5V of signal, so more signal per ppm means that the highest ppm will be more limited.

Select Auto Range by touching the Auto Range button on the Control screen. Auto range mode is used to continue uninterrupted analysis when the sample concentration goes below or above the range of the calibration. Do not calibrate/span instrument when Auto Range is active.

Note that available decimal places for displayed concentrations in ppm are related to the selected range. Range 1 shows two decimal places, Range 2 shows one, and Ranges 3 and 4 show no decimal places.
The active range is indicated in the message bar.

6. **Output screen**. Set up the signal output scale, alarms, and data logging.
    a. **Signal Output Scale.** The 4-20 mA output concentrations are entered based on the expected range of measurement.

    b. **Alarms.** There are 2 alarms that can be set on the 2500. Alarm 1 and Alarm 2 each have a low and high value. These can be activated by touching the gray buttons next to each alarm. They will first turn on as Low but can be turned to High by touching the button again. To edit the values, the alarms must be turned on. To turn off, press the low/high button until it says off and turns gray again. Active alarm codes appear in the Status Bar as A1L (Alarm 1 Low), A1H (Alarm 1 High), A2L (Alarm 2 Low), and A2H (Alarm 2 High) and they turn red when triggered.

    c. **Data logging.** The 2500 provides a data logger option via serial output or USB port. For USB data logging, a flash drive must be inserted into the USB port on the back of the instrument. The USB logging can be turned on in the Output screen by touching the button next to data logging and USB. The flash drive must be FAT format. The recording interval must be set in seconds and can be changed by using the box next to the data logging options. The available range for data logging frequency is 1 - 99,999 seconds. Make sure the USB indicator light in status bar is red when using USB logging. If USB is in instrument and the light is gray, the USB might not be formatted properly.

7. **Zero**. The Zero gas should have a certified assay that lists the methane or total hydro carbon content. If necessary, the assay values may be traceable to a measuring authority such as NIST. To analyze Zero gas, go to the Calibrate screen, enter hydrocarbon content of the zero gas in the ppm field, touch the Zero button which then turns green and initiates the zero gas analysis. While analysis and save of zero values runs, instrument outputs are unavailable.

8. **Span.** The recommended span gas for each range must have a minimum signal of 0.6V in order to have a successful span calibration. A guideline to meet this signal require ment is 10 ppm CH_4 in range 1, 100 ppm CH_4 in Range 2, 1000 ppm CH_4 in Range 3, and 10,000 ppm CH_4 in range 4 although you can use any gas that meets the 0.6V calibration threshold. Also, it is recommended that the span gas will have a methane or total hydrocarbon concentration at about 20% higher than the expected content in the sample. For example, span at about 120 ppm when the sample is around 100 ppm. Please note that fuel mixtures generally produce lower signals. 10ppm CH_4 is required to calibrate in Range 1 **especially** when using fuel mix. To analyze Span gas, go to the Calibrate screen, enter hydrocarbon content of the span gas in the ppm box, touch the Span button which then turns green and initiates the span gas analysis. While analysis and save of the span value runs, instrument outputs are unavailable.

9. Go to the Calibrate screen to set up instrument zero and span reference points. After lighting the flame, allow time (about 2 hours) to stabilize the zero signal (volts) shown on the Control screen. The smallest digits of the displayed volts never get completely steady. Look at the largest digits for the absence of drift. Once stable,

the instrument can be accurately calibrated. Zero and span cannot run when Auto Range is selected. De-select on the Control screen.

a. Zero must be performed first. Enter the actual hydrocarbon content of the zero gas from the gas certification assay. If not known, enter 0.0 however the analysis accuracy will be off by the actual THC in the zero gas. To enter a zero value, touch the field below the Zero button to open a keypad.

b. Enter the actual total hydrocarbon content of the span gas in the box below the Span button.

c. Touch the Zero button to initiate the zeroing process. The zero reference is set in each range. When complete, the status bar indicates completion of the zero process and its color changes to green.

d. Touch the Span button to initiate the span set process. The span reference is set in each range. When complete, the status bar indicates completion of the span process and its color changes to green. The date and time stamp is updated on the Calibrate screen.

e. Touch the Check Span button to initiate a span check process. The 2500 performs a verification of the saved span value. The span gas is sent to the detector and the resulting signal must be within 2% of the saved value to be considered good. A green light indicates a good span check and a red light indicates that the checked value and the saved value differ by more than 2%. In this case, a new span should be performed.

10. To analyze sample, go to the Control screen and touch the Sample button. Sample is flowing to the detector when the Sample button turns green.

11. Go to Analyze screen to start analysis.

12. **Linearity.** FID detector output is linear within 5% over the specified linear range. The instrument operator should verify linearity through trial with gases of known or certified methane concentrations. The 2500 has better linear output when 100% hydrogen is the fuel and when analysis is limited to one range.

13. **Standby and Overnight Conditions.** The 2500 can be operated continuously. However, to conserve gas, the flame can be extinguished by setting fuel flow to zero. The flame out circuit responds to no flame by shutting off all gas flows. The detector temperature can be left on at 140 °C overnight with no gas flow.

14. **Shutdown Procedure.** As in the standby and overnight description, shut down the flame and gas flows. Switch off instrument power at the back panel.

15. Daily Set-up Check List

- Gas supply/cylinder pressures adequate for the analysis session.
- Detector temperature at 140 °C.
- Check zero and re-zero if necessary.
- Check span and re-span if necessary.

Principle of Operation

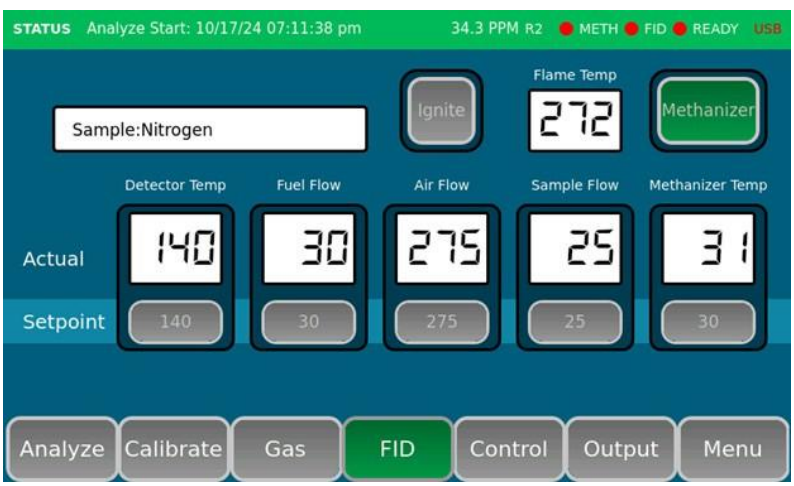
The GOW-MAC ruthenium methanizer is designed to be used with an FID for the in-line conversion and sensitive determination of CO and CO_2. CO and CO_2 convert to CH_4 in the presence of ruthenium and hydrogen at high temperature. The conversion does not work with fuel mix. The conversion formulas are:

$$CO + 3H_2 \rightarrow CH_4 + H_2O$$
$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

CAUTION: SAMPLES CONTAINING HIGH CONCENTRATIONS OF OXYGEN (% LEVEL) CAUSE IRREPARABLE DAMAGE TO THE HOT METHANIZER CATALYST.

The 2500-CM model has an actuated 4-port stream selection valve to switch between operating modes methanizer and non-methanizer. Refer to flow diagram B-22746. The rotary actuator is powered by compressed air or inert gas.

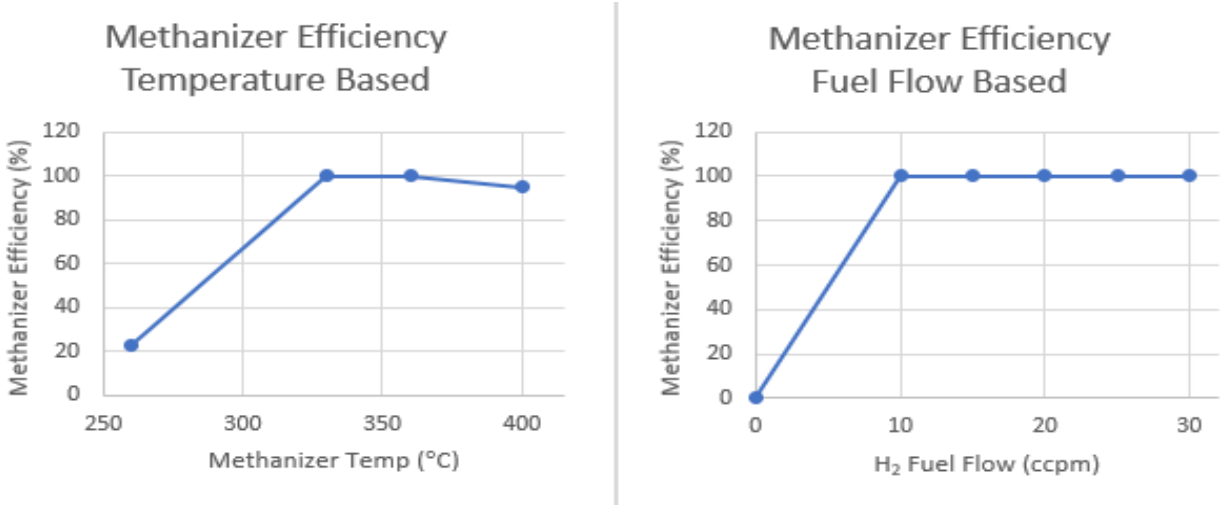
Verify that actuation gas is connected to the ACTUATOR GAS IN fitting on the back panel. Actuation gas specs are in the gas specifications table. Switching the 2500-CM between THA-only and methanizer modes is manually done by touching the methanizer button on the FID screen.



FID screen for 2500-CM models with catalytic methanizer

Conversion efficiency of the GOW-MAC methanizer. Catalytic conversion efficiency of the methanizer is a function of temperature, hydrogen flow, and hours of use. See the nearby charts. The recommended minimum hydrogen flow rate is 20 ccpm. While maximum conversion requires 10 or more ccpm of hydrogen, 20 to 30 ccpm flow is needed for a strong flame and for optimal signal. **Conversion of CO or CO2 to methane works only with hydrogen fuel.** Along with the flows, the methanizer temperature must be set to 350 °C for 100% efficient conversion.

Switching between Methanizer and THA-only modes of the 2500 creates a momentary pressure spike in the detector flame jet that may blow out the flame. Flame loss can be avoided by increasing flows to 30 ccpm sample, 30 ccpm hydrogen and 300 ccpm air.



Curves of methanizer efficiency vs H2 flow and vs temperature

Using the methanizer

The methanizer mode selection button and temperature controls are on the FID screen on 2500-CM models. Set the methanizer temperature to 350 °C for analysis. The methanizer temperature can only be edited when the methanizer is selected, which is done by touching the methanizer button on the top right of the FID page. The button will turn green. An error message will be displayed in the status bar until the methanizer set temperatures has been reached, after which the message will indicate “Ready”.

CAUTION: THE METHANIZER TEMPERATURE SHOULD NEVER EXCEED 400 °C.
THE 2500-CM DOES NOT ALLOW TEMPERATURE SET POINTS ABOVE 400 °C.

FID fuel. Verify that the FID fuel selected for analysis with methanizer is 100% hydrogen.

NOTE: FLOW RATES ARE CONTROLLED TO REMAIN UNCHANGED WHEN SWITCHING BETWEEN THA-ONLY AND METH MODES. THERE IS A SEVERAL SECOND LONG PAUSE AFTER SWITCHING IN OR OUT OF METH MODE WHILE THE ANALYZER REGAINS STEADY STATE SAMPLE FLOW CONTROL. INSTRUMENT CONTROLS ARE LOCKED DURING THIS PERIOD.

Calibration and Analysis

Two procedures can be used to calibrate the 2500-CM for use with the methanizer. One is to Zero the 2500-CM in non-meth mode with methane in the same base gas as the sample. The span gas may contain CO and/or CO_2 as they will be invisible to the FID in the THA-only mode. Following calibration, switch the instrument to METH mode. Introduce sample containing CO/CO_2. Readout directly in ppm will be CO + CO_2 plus any hydrocarbon in the sample.

The second method is to leave the 2500-CM in METH mode for calibration and analysis. Calibrate using a certified standard containing CO and/or CO_2. If the standard contains both compounds, the calibration point should include both concentrations together. For example, if the standard contains 2ppm CO and 2ppm CO_2, the calibration point will be 4ppm total. Introduce sample. Readout directly in ppm will be CO + CO_2 plus any hydrocarbon in the sample.

Contaminants

Compounds will contaminate the ruthenium catalyst and render it inoperative are sulfur and hydrocarbon related compounds, for example SO_2, H_2S and ethylene. Replace the methanizer if it becomes contaminated by these compounds.

All Models

Lighting the flame. Ensure the detector temperature has reached a steady state at its setpoint. Also, wait until flame temperature (shown on the FID screen) reaches a steady state condition. The flame ignition process includes a period of fuel enrichment which is especially important when lighting with fuel mix.

If you are still having trouble lighting with default settings with fuel mix, reduce the air flow setpoint and re-try. Once you see the flame temperature rising, you can reset the air to the recommended operating flow. Having the sample flow off until the flame is established may make for easier ignition.

For example, lighting with H_2/N_2 fuel mix: set the flows to fuel = 75, air = 110, and sample = 22 and press ignite. Once you hear the flame pop and/or see the Flame Temp rising, then reset the airflow back up to 265.

If the flame is still not igniting, check that the glow plug connections are firmly connected to the detector.

Not Calibrating. There are two known causes of a failure to calibrate the 2500. First, the instrument might not calibrate if set to the wrong range. Ensure the range is correct for the span gas. Second, the voltage signal shown on the Control screen may be too low to calibrate. The threshold for a successful span calibration and good analysis is a signal of 0.6V or greater. Ensure that your span signal is greater than 0.6V. A guideline to meet this signal requirement is 10 ppm CH_4 in range 1, 100 ppm CH_4 in Range 2, 1000 ppm CH_4 in Range 3, and 10,000 ppm CH_4 in range 4 although you can use any gas that meets the 0.6V calibration threshold.

Sample gas button does not appear on the sample gas screen.
This happens when all gas flows are set to zero on the FID screen AND the fuel gas type is changed on the fuel gas screen. Restore the sample gas button by selecting #1. Load default settings on the Menu Screen.

Models with Methanizer (-CM) only

Methanizer valve not switching
Ensure that actuator air is connected to the back panel before trying to operate the valve. Compressed air or any inert gas can be used at 40 to 60 psig.

Methanizer Maintenance
A loss of methanizer conversion efficiency may indicate that the methanizer is contaminated. The catalyst can be regenerated in the instrument by following these steps; which can be done with the FID flame on.

1. Verify that the FID flame is “on” with fuel 100% hydrogen at 30 ccpm and air at 250-300 ccpm. Sample or zero gas can be flowing or shut off.

2. On the FID screen, select Methanizer by touching the Methanizer button. The button turns green and in the status bar, METH indicator turns red.

3. Set the methanizer temperature to 400 °C and verify that the actual temperature begins to rise.

4. Switch back to THA mode by deactivating the Methanizer button. This stops the flow of sample/zero gas to the methanizer, leaving only hydrogen flowing through the methanizer.

NOTE: The flame out safety circuit must detect a flame to allow flow of hydrogen.

5. Regenerate the methanizer for four hours at 400 °C with flame on in the THA mode.

6. Reset the methanizer temperature to 350 °C after a minimum of 4 hours.

7. Allow the system to stabilize, then run a sample. If conversion efficiency is less than 100%, then the methanizer should be replaced.

Description	Part Number
Fuse, 10A, 250V, 5mm X 20mm.	121-162
Touchscreen 7 inch for 2500 THA.	123-341-2
Heater for FID, 60W, 120VAC (2500 models)	124-152
Heater for FID, 60W, 240VAC (2502 models)	124-153
Platinum probe for FID.	124-175
Heater for methanizer, 50W, 120VAC (2500-CM models).	124-192
Heater for methanizer, 50W, 240VAC (2502-CM models).	124-196
Platinum probe for methanizer	124-204
Methanizer (-CM models).	012-53
Particle filter, 7 micron, stainless steel in brass housing	171-171
Glow Plug (FID igniter).	141-146
Control Kit 2500	155-157
Temp Kit, 2-Channel	155-160

Appendices

1. Error Message Glossary

Span Calibrate Error – Below Value. Signal for span gas is too low for calibration.

Please Recalibrate Device - The span or zero value was changed, instrument must be recalibrated.

Sample Set: Failed - There is an issue with your sample gas, check for pressure loss or leaks.

2. Default gas flows by sample and FID fuel type

	Recommended FID Gas Flows (ccpm) for 2500 THA by Sample								
Sample	**100% H_2**	**Air**	**Sample**	**40% H_2-60% He**	**Air**	**Sample**	**40% H_2-60% N_2**	**Air**	**Sample**
Air	25	275	30	80	250	25	70	250	25
Argon	25	275	25	65	250	25	75	275	20
CO	25	275	30	80	250	25	70	250	25
CO_2	25	275	30	80	250	25	70	250	25
*H_2	5	300	30	80	275	25	65	275	22
HCN	25	275	30	80	250	25	70	250	25
He	30	225	30	90	250	30	70	250	20
Krypton	30	225	30	90	250	30	70	250	20
N_2	25	275	25	65	250	25	75	275	25
N_2O	25	275	30	80	250	25	70	250	25
Neon	30	225	30	90	250	30	70	250	20
Oxygen	Not with 100% hydrogen			65	100	22	70	125	20
SF_6	25	275	30	80	250	25	70	250	25
Xenon	30	225	30	90	250	30	70	250	20

***Please note, to ignite when using a hydrogen sample, you must ignite using 30 ccpm for fuel. Once lit, increase sample flow to 30 ccpm and decrease fuel flow to 5 ccpm to match optimum flows.**

3. Drawings & Schematics

<u>Model 2500, 2502</u>

Flow Diagram B-22745

Electrical Schematic D-22744

<u>Model 2500-CM, 2502-CM</u>

Flow Diagram B-22746

Electrical Schematic D-22744-1

Warranty

ALL INSTRUMENTS SOLD BY GOW-MAC® INSTRUMENT CO. ARE WARRANTED FOR A PERIOD OF ONE YEAR AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP. THE TERMS OF THIS WARRANTY ARE AS FOLLOWS:

1. **The warranty period begins with the shipping date of the equipment to the original purchaser.**
2. Certain parts such as batteries, fuses, glass accessories, septa, columns, etc., are expendable in normal use, and their service life is unpredictable. Such items are not covered by this warranty.
3. Filaments of thermal conductivity detectors are not covered by this warranty.
4. Hydrogen Palladium Tubes are not covered by this warranty.
5. All requests for service or repair under this warranty must be received within the warranty period by GOW-MAC® or its authorized representative. All repairs are made at GOW-MAC plants or at the office of authorized representatives.
6. All repairs, adjustments, and other services under this warranty shall be performed free of charge to the purchaser. However, warranty service and repairs shall be limited to equipment malfunctions which, in the opinion of GOW-MAC®, are due or traceable to defects in original materials or workmanship. Instrument malfunctions caused by abuse or neglect of the equipment are expressly not covered by this warranty.
7. Instrument parts which have been repaired or replaced during the warranty period are themselves warranted only for the remaining unexpired portion of the original one-year warranty.
8. Repairs, adjustments, and service performed after expiration of the one-year warranty period shall be charged to the purchaser at the then current prices for parts, labor, and transportation.
9. This warranty attaches to the equipment itself and is not limited to the original purchaser. Unexpired portions of the warranty are thus transferable to subsequent owners.
10. GOW-MAC® expressly disclaims any liability to users of its products for consequential damages of any kind arising out of or connected with the use of its products.
11. Except as stated in Sections 1 through 8 above, GOW-MAC® makes no warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated in Sections 1 through 8 above, GOW-MAC® shall have no liability under any warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise.
12. Statements made by any person, including representatives of GOW-MAC® which are inconsistent or in conflict with the terms of this warranty shall not be binding upon GOW-MAC® unless reduced to writing and approved by an officer of the Company.
13. This warranty shall be governed by the laws of the Commonwealth of Pennsylvania.

7/8/24
kj

Health and Safety Declaration for the Return of GOW-MAC Instrument Co. Equipment

In order to protect our employees from exposure to various hazards, the following statements and/or questions **MUST** be answered by you. Fill out this document in its entirety and either fax or e-mail it to GOW-MAC Instrument Co., Attn: Repair Dept, **BEFORE** returning the product.

The instrument/part being returned **will not** be accepted into GOW-MAC's facility until we receive this completed document, along with a **PO or Credit Card**. Once approved for return by our Chemical Safety Officer, a **Return Materials Authorization (RMA) number** and shipping instructions will be issued. *All applicable regulations should be followed when returning instrumentation, and/or parts.*

Customer to Record the Following:

Model # / Part # _____

Serial #: _____

Service Technician spoken to: _____

Today's Date: _____

IF THIS FORM IS NOT APPROVED BY OUR CHEMICAL SAFETY OFFICER, THE INSTRUMENT/PART WILL NOT BE PERMITTED INTO OUR FACILITY FOR SERVICING!

A] Brief explanation of issue: _____

B] Briefly list the application(s) for which the instrument/part was used, as well as any and all chemicals, gases, and/or materials analyzed and their concentrations. (**Must be filled in**): _____

C] Is there the possibility of internal or external contamination on or in this instrument/part?

☐ Yes – see below ☐ No – proceed to D.

Please check the appropriate box.

☐ Chemicals or Substances That Are Hazardous to Health
☐ Blood, Body Fluids, (e.g. Urine, Secretions), Pathological Specimens
☐ Regulated Medical Wastes
☐ Infectious Substances or other Bio-Agents (e.g. Protein, Enzymes, Antibodies)
☐ Radioactive Isotopes used in the area. Detail type (ECD, Isotopic Labels, etc) and Activity in Micro Curies
☐ Biodegradable Material That Could Become Hazardous
☐ Other Hazards _____

If any of the above boxes are checked the following statements and/or questions must be answered.

1. Specifically describe where (on or in) the instrument/part there could be any residual contamination (for example: blood spill on the surface). _____
2. Provide details of these hazards. Include names, Material Safety Data Sheets (MSDS), and concentration of contaminants, where possible. _____
3. Describe the method of decontamination used. Attach Procedure. _____

D] I declare that the above information is true and complete to the best of my knowledge. I acknowledge that any inconsistencies between the condition of the instrument and the statements made on this form will delay the repair process.

Authorized signature _____ Date: _____

Name (Printed) _____ Phone number: _____

Company name: _____ Fax number: _____

Shipping address: _____

City: _____ State/Country: _____ Zip : _____

E-mail address: _____

BEFORE item can be shipped, fax completed form to: (610) 954-0599 or e-mail it to: repairs@gow-mac.com

For GOW-MAC Use Only: Signed: _____ Date ____/____/____

☐ **Passed** Safety Inspection. **OK** to proceed to Repair Dept. Chemical Safety Officer Comments: ( ) None

☐ **Failed safetyInspection. DO NOT** proceed to Repair Dept. **RMA No:** _____ ( ) On Back >>>>

GOW-MAC® INSTRUMENT CO.

REP-005
Health-Safety Declaration Doc – ONLINE
Rev.7 1/28/2022, kj