Operating Manual

5100 Series Continuous
TC Binary Gas Analyzer

5100 Series: 110 V, 60 Hz
5102 Series: 230 V, 50 Hz

August 2021
Rev. 7

READ INSTRUCTIONS BEFORE OPERATING

277 Brodhead Road, Bethlehem, PA 18017- 8600 U.S.A. Tel: (610) 954-9000

DISCLAIMERS

The information in this document is subject to change without notice. This manual could include technical inaccuracies or typographical errors. Changes are made periodically to the information herein; these changes will be incorporated in subsequent revisions of the manual. GOW-MAC® Instrument Co. reserves the right to make improvements and/or changes to the product(s) and/or programs described in this manual at any time and without notice.

All information referred to and/or included in this report is current as of the original issue date of this manual. GOW-MAC® Instrument Co. makes no warranty or representation with respect to the accuracy of the information or with respect to the suitability of the use of such information outside GOW-MAC® Instrument Co., nor does GOW-MAC® Instrument Co. assume responsibility for any injury or damage which may result, directly or indirectly, from the use of such information.

The warranties made by GOW-MAC® Instrument Co. with respect to the product are voided if the product is not 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.

TRADEMARK AND PATENT INFORMATION

TERMS AND CONDITIONS OF SALE

WARRANTIES THE 5100 SERIES ANALYZERS 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, filaments, etc., are expendable in normal use, and their service life is unpredictable. Such items are not covered by this warranty.

3. 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.

4. All repairs, adjustments, and other service 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. This warranty shall be governed by the laws of the Commonwealth of Pennsylvania.

LIABILITY Buyer assumes all responsibility for warning and protecting its employees and independent contractors with respect to all hazards to persons and property in any way connected with the Equipment and the use thereof. Seller's liability for any claim of any kind hereunder, whether or not based on contract, tort (including negligence), strict liability, warranty, or any other grounds, shall not exceed the purchase price of the Equipment or the portion of the purchase price attributable to any part or parts of the Equipment in respect to which such claim is made. Seller shall not be liable for any special, indirect, incidental, or consequential damages. Without limiting the generality of the foregoing, Seller shall have no liability with respect to the results obtained by use of the Equipment, whether in terms of product condition, operating cost, general effectiveness, success or failure, or regardless of any statement made in any written proposal submitted by Seller. It is expressly understood that any technical advice furnished by Seller with reference to the Equipment is given gratis and Seller assumes no obligation or liability for the advice given or results obtained, all such advice being given and accepted at Buyer's risk. Each party hereby agrees to indemnify and hold the other party harmless from any actions, lawsuits, demands, claims, losses, expenses, costs, including but not limited to legal fees, and damages arising from the injury, illness or death of the indemnifying party's employees in any way related to the Equipment, whether or not such injury, illness, or death is claimed to have been caused by, resulted from, or was in any way connected with the negligence of the party to be indemnified.

PROPRIETARY INFORMATION Buyer agrees to maintain all proprietary information disclosed by Seller, including such proprietary information obtainable upon examination of the Equipment, in confidence and to refrain from any disclosure thereof to any third party (including any affiliate of Buyer), for any purpose, without the prior written consent of Seller. Buyer agrees to use said proprietary information solely for purposes of maintaining and operating the Equipment, and to refrain from any use thereof to design, construct, have constructed and/or operate any duplication or modification of the Equipment, or from any other use thereof, without the prior written consent of Seller.

IMPORTANT INFORMATION

These instructions are written for personnel operating the GOW-MAC® 5100 Series Continuous TC Binary Gas Analyzer. Read and understand the safety precautions in this manual to become familiar with the safe practices for operating this equipment.

Dangers, Warnings, Cautions, and Notes
Dangers, Warnings, Cautions, and Notes appear throughout this manual. A sample of each statement appears below. Within each sample, a definition of the statement type and its purpose is given.

DANGERS alert you to an immediate hazard that causes serious injury or death and requires special precautions to be taken.

WARNINGS alert you to a potential hazard that causes serious injury or death *under certain conditions.*

CAUTIONS alert you to a non-immediate or potential hazard or an unsafe practice that presents a minor threat of personal injury or damage to equipment, data, or processes.


NOTE

NOTES emphasize or remind you of an important piece of information.

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5100 SERIES CONTINUOUS THERMAL CONDUCTIVITY GAS ANALYZER OPERATION & MAINTENANCE MANUAL

This manual provides operating instructions and maintenance requirements for the 5100 Series Continuous TC Gas Analyzer to permit safe and efficient use of your instrument. It is important that you thoroughly read this manual BEFORE operating your instrument. Failure to do so could result in damaging the instrument and/or yourself. Certain sections of this manual pertain to specific options you may or may not have chosen for your instrument. Please read them carefully and check the enclosed schematics to ensure proper operation. Operate the 5100 Series Continuous TC Gas Analyzer according to the operating procedures stated herein. Any questions concerning the safe and proper use of your instrument should be addressed to:

Mail: GOW-MAC Instrument Co.
277 Brodhead Road
Bethlehem, PA 18017

Tel: (610) 954-9000
Fax: (610) 954-0599
E-mail: sales@gow-mac.com


NOTE

This chapter contains information to promote safety in the operation and maintenance of this equipment. It is not intended to supersede, replicate, or replace any safety documentation or procedures provided from or established by official safety sources.

Do NOT operate the GOW-MAC® 5100 Series Continuous TC Binary Gas Analyzer until you read and understand the operating, maintenance, and safety instructions included in this manual.

All persons involved with the operation of this equipment including plant engineering, operations, and management-must understand the potential hazards involved, and know and observe all required safety precautions.

Your safety and the safety of equipment, nearby facilities, and personnel require a proper safety attitude and emphasis on safe work procedures. This is the essence of any good safety program. If at any time you identify safety deficiencies, immediately correct them and bring them to the attention of management.

Before an accident can be prevented, it must be anticipated. Use pre-job discussions with your coworkers and supervisors to identify hazards and the means to avoid them. At your facility, various gases may exist in liquid and/or gaseous states. Familiarize yourself with the hazards associated with each gas found at your facility.


NOTE

Read and understand the Safety Data Sheets (SDS) for the materials used with this equipment. All personnel who work in the vicinity of this equipment should read, understand, and follow all safety information contained in the SDS, in addition to following all government and facility safety regulations.

A. Emergency Procedures

The 5100 Series Analyzer is designed to operate safely, efficiently, and reliably. However, as with any analytical equipment involving gases, an emergency can occur at any time. The emergency response could involve calling for medical assistance, management notification, fire assistance, or evacuation from the vicinity of the analyzer. **Obtain the following phone numbers and post them at the site telephone locations.** Periodically review the numbers and update them as required.

EMERGENCY PHONE NUMBERS		
Ambulance	( )	_____
Fire Department	( )	_____
Sheriff or Police Department	( )	_____
On-Site Operations Representative	( )	_____

Training and education are the most important parts of any safety program. For every possible emergency, establish an Emergency Response Plan and maintain it for immediate use.

B. Basic Safety Requirements

The following safety guidelines apply at all times when working with the 5100 Series:

- **Prevent electrical shock —** Unplug and remove the AC power cord from the rear panel before opening and working on the analyzer. Use tools designed for work on electrical equipment.

- **Prevent injury —** Always wear safety glasses and appropriate safety protection. Ensure that all tools and instruments used during installation and maintenance are in good condition. Be aware that high-velocity gas may be released at vents and safety relief valves.

- **Follow posted precautions** — Read all precautionary labels attached to the equipment. Be sure to read all cylinder labels and warnings. Comply with all precautions before handling the equipment.

  Situations may develop for which no written procedures exist. Think carefully before acting. Know the function of each valve and switch, and its effect on the equipment. Carefully review all operating procedures before starting up this equipment to ensure knowledge and understanding.

C. Precautionary Labels

To avoid serious injury, read all precautionary labels attached to equipment, cylinders, containers, and boxes prior to startup.

Labels attached in appropriate areas of the analyzer warn you of inherent hazards associated with the system. For personal safety, read the labels and perform directed precautions **before** handling the equipment.

D. Summary of Known Hazards

This equipment is designed to minimize your exposure to the process gases and other known hazards. Read and thoroughly understand all safety aspects of this system and its operation before operating or maintaining the equipment.

1. Electrocution

DANGER !

DO NOT OPERATE THE ANALYZER WITHOUT THE CHASSIS SECURED IN PLACE. TO GUARD AGAINST ELECTRICAL SHOCK AND POSSIBLE ELECTROCUTION, THE ANALYZER SHOULD BE SERVICED ONLY BY A GOW-MAC SERVICE TECHNICIAN.

Adherence to the following guidelines helps guard against electrical shock:

- For safety and proper performance, this analyzer must be connected to a properly grounded three-wire source of electrical power.
- Tampering or unauthorized substitution of components may adversely affect the safety of this instrument. Use only factory-approved components for repair.
- Before checking or replacing any chassis component, turn off the power and remove the AC power cord from the rear panel.

2. Pressure

DANGER !

MISHANDLING OF GAS CYLINDERS COULD RESULT IN DEATH, SERIOUS INJURY, OR PROPERTY DAMAGE. HANDLE AND STORE GAS CYLINDERS WITH EXTREME CARE AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

Sudden or uncontrolled release of pressurized gas can cause serious injury. The hazards of high pressure can be avoided through careful inspection and handling of cylinders and equipment with proper regulation. Read and understand the MSDS for the process gases used before operating this analyzer. For more detailed information on the precautions and safe practices to follow when handling cylinders, obtain and read CGA pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders.*

E. 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.

F. Safe Repair Procedures

Any repair work must be performed by a GOW-MAC service technician.

Analyzer manifold purging must be performed by experienced personnel.

Ventilate working area to prevent any leaking supply gas from accumulating.

Vent all gases to the outside.

Vent all pressure relief valves out of enclosed areas. Piping must be properly sized to allow safety devices to operate according to specifications.

De-pressurize supply gas piping before working on it.

A. Detectors

1. Thermal Conductivity Detector (TCD)

The thermal conductivity detector (TCD) consists of a relatively large mass of metal to provide a stable heat sink. Stainless steel is generally used because of its compatibility with most sample gases and its high thermal conductivity. Through the metal block flow passages and recessed cavities are drilled for the detector elements, such as a hot wire filament.

Detector elements used in the 5100 Series Gas Analyzer are fabricated from either rhenium-tungsten (WX) or tungsten (W2). The filaments are connected to form a Wheatstone Bridge, then powered by a high-quality constant current source. The output of the bridge is then electrically zeroed. When a sample with a lower thermal conductivity than the balance (or zero standard) gas is introduced, an unbalance in the Wheatstone Bridge occurs. This unbalance is displayed on the readout and can be calibrated in terms of the composition (Figure 2-1).

GOW-MAC uses reference filaments in the “opposite” legs of the bridge in all its 5100 Series Gas Analyzers in order to provide better stability due to variations in temperature and barometric pressure. Small temperature changes in the detector will affect both elements equally and cancel out. Therefore, a “sealed reference” gas can be provided (Single Pass Unit). A “flowing reference” Dual Pass Unit) provides the additional cancellation effects for slight variations. The sealed/flowing reference gas is usually a single-component gas representing the major component in the sample gas.

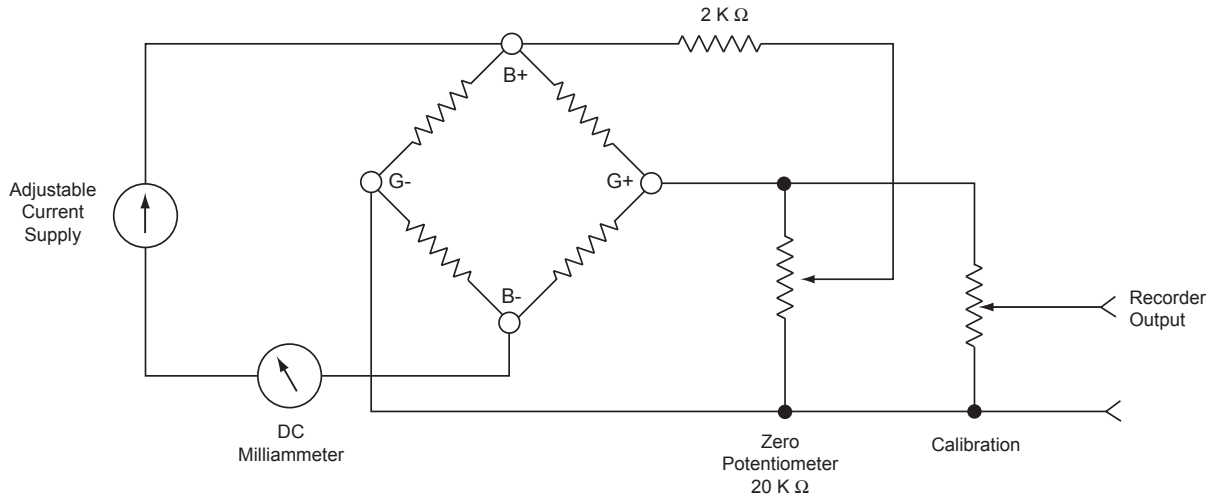


Figure 2-1: Thermal Conductivity Cell

2. Detector Selection

The detector in your 5100 Series Continuous TC Gas Analyzer is one of the following (check Section 3 - Specifications for more details):

a. Our diffusion type TCDs are relatively insensitive to flow changes and are suitable for sample flows of approximately 200-250 cm^3/min. Response time is less than 2 seconds. Either a 4 or an 8 element detector is available. Check Section 3 - Specifications for more details.

b. The flow-through TCD has a low internal volume and a response time of less than one second. It is suitable for sample flows of approximately 50-100 cm^3/min.

c. Our nanokatharometer TCD is of flow-through design and has a response time of less than one second. It is suitable for sample flow rates of 50-100 cm^3/min. and is slightly more sensitive than the flow-through TCD.

d. The Model TE II semi-diffusion TCD has a lower volume than the diffusion TCD, therefore, response time is slightly faster and the sample flow rate is slower, 100-200 cm^3/min.

B. Flow System

The flow system in a single pass unit has a flowing sample and either a static air reference or hermetically sealed reference gas. A dual pass unit has a flowing sample and a flowing reference gas. The reference, sample, and calibration gas connections are made at the rear of the instrument. One-eighth inch (1/8”) tube connectors are provided at the rear of the instrument to enable the customer to make tubing connections. The metering valves located on the front panel are used to regulate the sample, reference, or calibration gas flows through the detector.

C. Electronics

All electrical controls for the detector are on the front panel. A digital display is provided for the analysis readout. Amplification of the signal increases the sensitivity of the instrument and allows the operator to run the detector at a lower filament current which greatly increases the life of the filaments. A solid state constant current power supply is used for increased stability. All detectors are enclosed in an insulated enclosure which is controlled at 100 °C by a proportional temperature controller, which is located on the front panel.

Customer:	
Job #:	
Instrument Part Number:	
Instrument Serial Number:	
Power Requirements:	5100 Series: 600 W at 115 V, 60 Hz 5102 Series: 600 W at 230 V, 50 Hz
Gas Connections:	1/8 inch compression
Detector:	
Type:	
Filaments:	
Bridge Current:	
Zero Gas:	
Operating Temp:	
Normal Flow Rate:	
Response Time:	<15 seconds @ 200 ccpm flowrate
Readout Meter:	Vacuum fluorescent display
Calibrated Range:	
Recorder:	4-20 mA
Dimensions (inches):	W 17.12 without panel-mount bracket W 19.0 with panel-mount bracket H 15.75 D 23.0 with fittings
Weight:	Net: approx. 75 lbs. Shipping: approx. 80 lbs.
Schematics	Drawing #_____ Flow Diagram Drawing #_____ Wiring Schematic

A. Additional Equipment Required

1. AC power source: 5100 Series Analyzer: 600 W at 115 V, 60 Hz
   5102 Series Analyzer: 600 W at 230 V, 50 Hz

OPERATING INSTRUCTIONS FOR BOTH MODELS ARE THE SAME, EXCEPT FOR LINE VOLTAGE REQUIREMENTS. TO PREVENT DAMAGE TO THE INSTRUMENT, MAKE SURE THAT AC ELECTRICAL OUTLET IS THE CORRECT VOLTAGE FOR YOUR INSTRUMENT BEFORE PLUGGING IT INTO THE OUTLET.

2. Clean 1/8-inch tubing;
   - Refrigerant-grade copper tubing is acceptable for percent % level analysis.
   - Stainless steel must be used if performing low ppm level detection.

   See Section 4.E.2 for cleaning procedure.

   Tubing MUST be cleaned and hydrocarbon free. The selection of tubing may vary depending upon the intended application.

3. Cylinders: (1) Zero Gas
   (2) Calibration Gas (also referred to as Span Gas)
   (3) Sample Gas

4. Data Recorder with 4-20 mA, <1 second response.

B. Unpacking & 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 back ordered. Notify the company of any discrepancies. The packing box should be retained for use should the instrument ever need to be returned to the factory for repair or modification. GOW-MAC does not supply field repair service. All repairs are made at Bethlehem, PA or by an authorized representative.

2. Remove all plastic shipping caps from gas INLET and OUTLET PORTS.

C. Location

1. The 5100 Series Continuous TC Gas Analyzer should be placed in a location that is secure, vibration-free, and protected from abrupt temperature changes and drafts (ambient operating temperature range: 20-30 °C). Irregular changes in the instruments' environment may upset the temperature stability in the course of an analysis or preparation.

2. Enough adjacent table-top space should be allowed for the installation of recorders and any other equipment necessary.

3. Allow adequate space for the installation of the necessary gas cylinders. Cylinders should be securely fastened to the wall or table.

READ "SECTION 1-SAFETY" AND CONTACT YOUR LOCAL GAS SUPPLIER TO ENSURE PROPER HANDLING OF CYLINDERS.

4. An (AC) electrical outlet should be near the location where the analyzer is to be installed. If the outlet is not a 3-pin type, make sure that a good ground connection is available, since a good ground is necessary for proper operation. The ac outlet should be connected to a circuit that is not heavily loaded with other electrical equipment. Input voltage to the instrument should be steady for optimum operating stability. If the line voltage varies more than ±10%, a voltage regulating transformer is recommended.


NOTE

If a recorder or other data acquisition system/device is being used with the instrument, it is recommended that it be connected to the same circuit as the analyzer. This may prevent ground loops.

D. Mounting (if applicable)

Space and materials required:

- 19-inch rack space or bench top
- Service access space behind and in front of the analyzer.
- Metal bracket to support the rear side of the cabinet if the analyzer is installed in a cabinet without side support brackets.

E. Gas Connections

External Lines: The use of refrigerant-grade, cleaned, copper tubing is fine for percent level analysis. Stainless steel tubing must be used for low ppm analysis. Stainless steel tubing may contain hydrocarbon contaminants, therefore ***it is imperative that the tubing be cleaned and hydrocarbon free***. The selection of tubing used may vary depending upon the intended application.


NOTE

Plastic tubing is NOT recommended, since all plastics are permeable to air.

All gas connections to the cylinder regulators and inlet ports should be made as follows:

1. Remove all plastic shipping caps from gas INLET and OUTLET PORTS if not already done.


NOTE

When using your own supply lines, first purge lines to ensure they are clean, then select the union or reducing union that will make the line compatible with the fittings on the analyzer. Torque the unions as specified by the manufacturer. Go on to Step 5.

2. To prevent contamination of the analyzer by grease, oil, or chemical residue, the following cleaning procedure should be performed on all tubing prior to connecting it to the analyzer:

   a. Clean copper tubing pieces by flushing with acceptable solvent, such as chloroform or acetone, to remove any oil residue that may be present (acetone is preferred).

   b. After washing, let tubing drain and dry.

3. Using a piece of cleaned 1/8-inch o.d. tubing, connect one end of the tubing to the appropriate gas outlet located on the gas cylinder regulator.

4. Purge tubing with a flow of gas from cylinder for 1 - 2 minutes at low flow (<30 sccm). It is also important to cycle purge any regulators to remove air impurities from dead legs.

5. Connect the appropriate 1/8-inch o.d. tubing to the external ZERO, SPAN, and SAMPLE gas inlet ports on the back of the case (Figure 4-3).

6. After all connections have been made, it is IMPORTANT to check for leaks. Refer to Section F for leak testing.

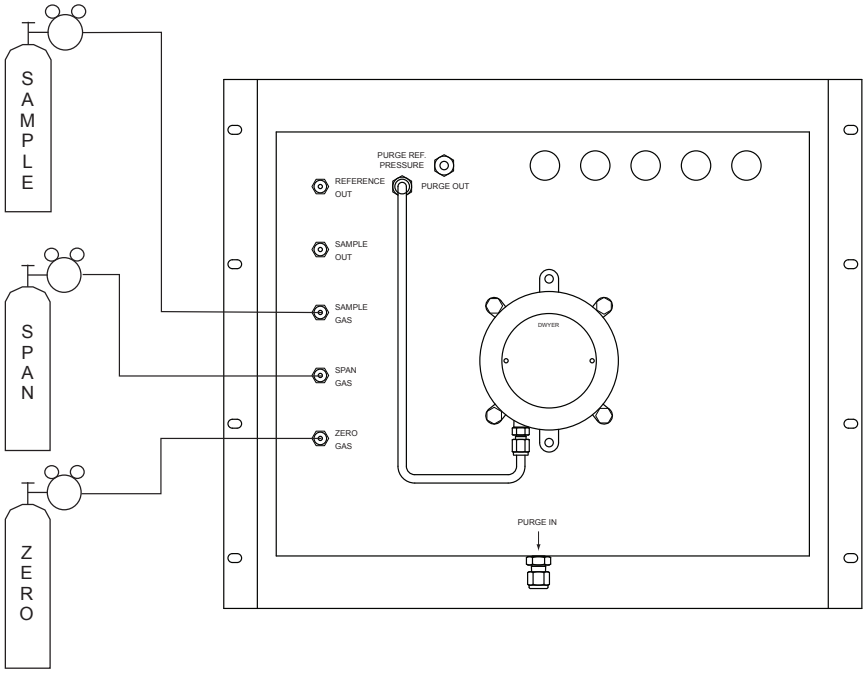


FIGURE 4-1: Gas Connections (typical)
5100 Series rear panel shown with optional Purge Pressure Switch

F. Leak Testing

After all connections have been made, it is IMPORTANT that they be tight and free from leaks. Leaks in the system will cause baseline drift, noise and may reduce sensitivity or damage the detector.

LEAKS IN THE LINES MAY BE HAZARDOUS!

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

Each gas must be flowing to check for leaks. Stop-off the OUTLETS and pressurize the system to 30 psig and check for leaks at each rear fitting and at the connections made at the cylinder. If leaks are found, tighten fittings. If no leaks are found, the instrument is ready for start-up.

The use of soap or other organic substances to check for leaks IS NOT RECOMMENDED. They may contaminate the system.

The easiest way to locate leaks in the system is through the use of a GOW-MAC Gas Leak Detector (Model 21-070).

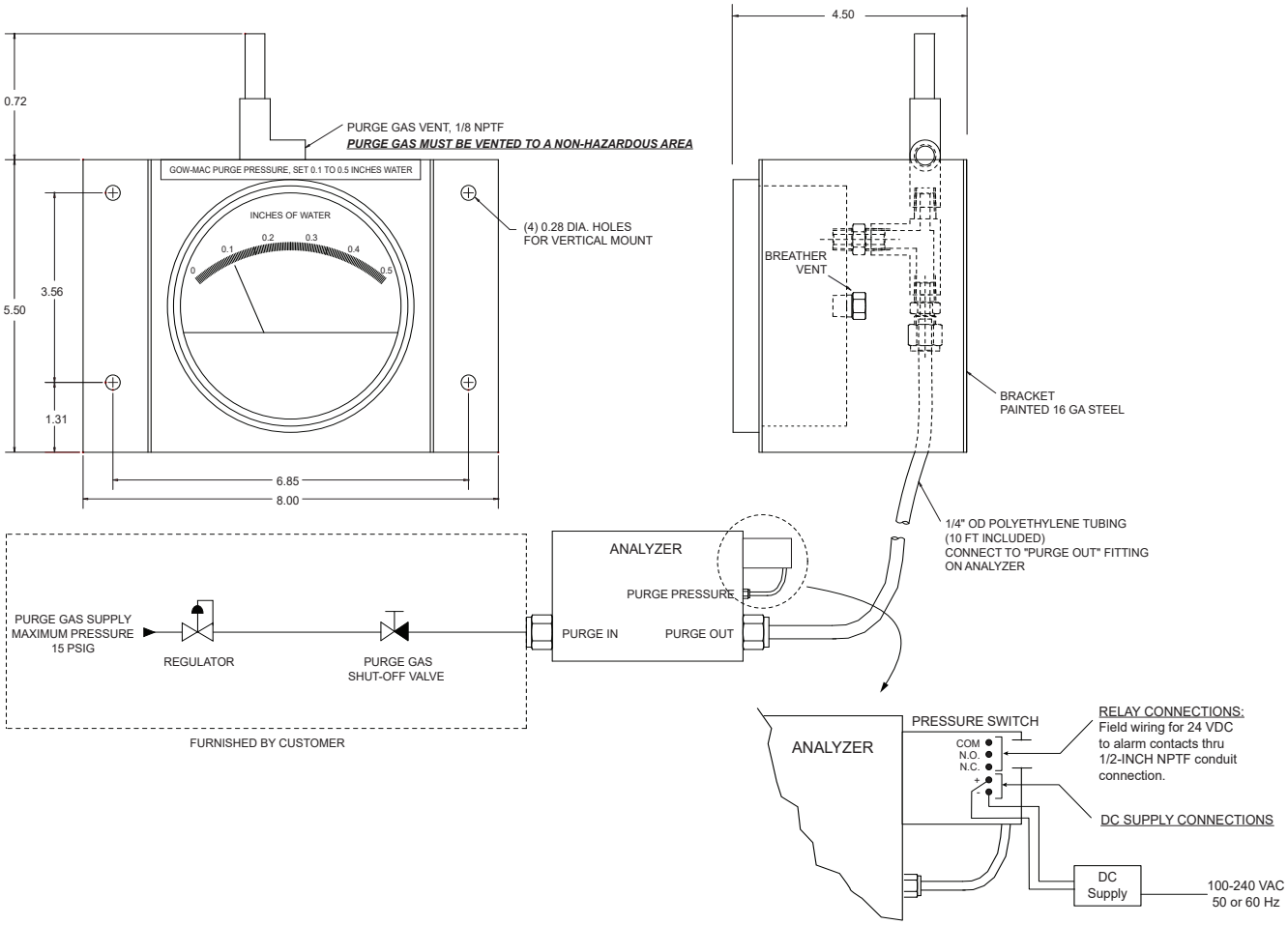

NOTE

Leak checks should be run periodically, but MUST be completed when new tubing and fittings are installed.

G. Purge Gauge Assembly (Optional and Ordered Separately)


NOTE

This instrument purge gauge assembly, part number 152-474, is designed to meet the instrument pressurization requirements set forth by the NFPA 496 standard for installation in a Class I Division 2 area. It is not suitable for use in Class I Division 1 or other classified areas. The customer or end-user is responsible for the installation meeting all aspects of the NFPA 496 code. The following information is provided only to assist the end user. NFPA 496 or similar code in effect at the installation site should be understood by the end user before operating equipment in a hazardous or classified area. The terms purge, protective, and pressurization are used interchangeably herein when referring to the instrument purge gas.



4-2: Installation Diagram (dimensions in inches)

1. Installation (refer to Figure 4-2)

   a. The purge gas may be compressed air if it has been filtered for moisture, oil, and particles. Unfiltered compressed air may contain contaminants that will damage the instrument electronics. The purge gas supply should include a pressure regulator with 0-30 psi output gauge and a shut-off valve.

   b. Locate the purge gas supply shut-off valve either immediately adjacent to or remotely from the analyzer.

      i. If immediately adjacent: Need label for purge gas supply valve ***(both label and valve are customer-furnished)*** if such valve is located immediately adjacent to protected enclosure. The valve label shall read as follows:

WARNING

Protective Gas Supply Valve: This valve must be kept open unless the area is known to be nonflammable or unless all equipment within the protected enclosure is de-energized.

      ii. If remote: Alarm must be used upon loss of pressure if the shut-off valve is located remotely from the enclosure.

iii. An indicator may be used if shut-off valve is immediately adjacent to the enclosure and valve is intended for use only during servicing of the enclosure. The 0 - 0.5 inches water pressure gauge included in part number 152-474 meets the indicator requirement.

c. Connect the purge gas supply to the PURGE IN fitting on the instrument. Connect the enclosed 1/4-inch poly hose between the instrument PURGE OUT fitting and the 1/4-inch tube fitting on the purge gauge assembly, located below the valve. The meter must be oriented vertically for accurate operation. There is a sintered insert behind the meter which serves as dust filter for the atmospheric pressure reference. The sintered area must be kept clean and in still air for accurate gauge performance.

d. The valve on the purge gauge assembly provides a degree of pressure control. There may be greater control with the purge supply pressure regulator. The valve outlet is 1/8-inch NPT female pipe thread. The purge flow gas exits though this port. The purge gas outflow can be discharged to the Division 2 location because the analyzer does not create ignition-capable particles during normal operation.

e. A differential pressure switch is installed on the back of the 5100 Series cabinet. The switch high pressure port is connected to the cabinet interior via 1/4-inch tubing. The switch uses atmospheric pressure as a reference at the low pressure port. A flame arrestor is installed in both the high and low pressure ports. Electrical connections to the switch are made by removing the cover, which is attached with four (4) 7/16-inch hex screws. Use the correct wire gauge for the alarm circuit current rating (maximum 15 A). Protect the switch from the atmosphere by running the wires to the switch in conduit. The conduit connection on the switch is 1/2-inch NPT female thread. The switch set point is factory set to 0.1 inches water pressure. Adjustment of this pressure switch is not recommended but if necessary, the set point can be adjusted with a screw located on top of the switch under a protective cover. Turn clockwise to increase the set point and counter-clockwise to decrease the setpoint.

2. Operation

a. The protected enclosure shall be constantly maintained at a positive pressure of at least 0.1 inches water above the surrounding atmosphere during operation of the protected equipment. The GOW-MAC 5100 Series enclosure requires purge gas supply pressure at about 5 psig to maintain 0.1 inches water. The purge gas supply pressure should be controllable between 0 to 10 psig to maintain analyzer cabinet pressure in the range between 0.1 to 0.5 inches water.

b. Failure to maintain positive pressure within a protected enclosure shall be detected by an alarm or indicator. Automatic de-energizing of the analyzer is not required in a Class I, Div 2 area.

c. The enclosure shall ***NOT*** be opened unless the area is known to be free of flammable materials or unless all devices within have been de-energized.

d. Power shall ***NOT*** be restored after enclosure has been opened ***until*** the enclosure has been purged for 10 minutes at an enclosed purge pressure of 0.5 inches water.

3. Purge Option Specifications

Differential Pressure Switch	
Power Requirements	24 VDC ± 10%
Temperature Limit on 50 Series Analyzer	-40 °F to 140 °F (-40 °C to 60 °C)
Operating Pressure Range	0.07 to 0.15 inches water
Rated Pressure	45 inches water (0.1 bar)
Maximum Surge Pressure	10 psig
Dead Band	0.05 inches water
Switch Electrical Rating	10 A, 120/240 VAC, 28 VDC, Resistive 50 mA, 125 VDC
Wiring Connections	Five (5) #6 screws: common, norm. open, norm. closed, (+), (-)
Conduit Connection	1/2-inch NPT female
Housing	Anodized cast aluminum, explosion-proof, drip-proof
Diaphragm	silicone on nylon
Breather Vent on Low Pressure Port	304 stainless steel housing, 316 stainless steel, 100 micron sintered element
Differential Pressure Gauge	
Temperature Limit	20 °F to 140 °F (-7 °C to 60 °C)
Operating Pressure Range	0 to .50 inches water
Accuracy	+/- 3% of full scale at 70 °F (21 °C)
Breather Vent on Low Pressure Port	304 stainless steel housing, 316 stainless steel, 100 micron sintered element

4. Purge Option Replacement Parts

Part Number	Description
120-239-24	Differential Pressure Switch, set 0.07-0.15 inches water, 24 VDC
128-269	Differential Pressure Gauge, 0-0.5 inches water
141-163	Bracket for gauge 128-269
163-174	Polyethylene tubing, 1/4-inch OD, 0.062 inch wall
171-392	Breather, 100 micron sintered 316 stainless steel, 1/8-inch NPT male (installed in low pressure ports in pressure gauge and pressure switch)
180-756	Metering valve on pressure gauge
198-213	Label, Warning for opening purged enclosure

Reference: NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment, 2021 Edition

G. Electrical Connections

Materials required:

- Power Cord
- 4-20 mA Recorder Cable*
- TCP Ethernet (read only)*
- Profibus (read only)*
- RS232 Cable (if necessary)*
- Input Cable (if necessary)*
- Ready Output Cable (if necessary)*
- Remote Zero (if necessary)*
- Remote Calibration (if necessary)*
- Calibration Indication (if necessary)*

*There should be no AC or unexpected signals on these lines.

NOTE

If the purged housing option was ordered, all cables and/or wiring which pass through the knock-outs and strain reliefs should be carefully selected and passed through so that the strain relief maintains it' seal around the cables and/or wiring so as to be able to achieve and maintain the indicated pressure. Example: as stated in Section 4F in this manual.

1. Ensure you have the proper line voltage specified for the model of analyzer.

2. Ensure that the Power Switch located on the rear of the analyzer is in the OFF position.

3. ***Connect the AC power cord to the proper line voltage. This voltage must be stable, transient free, and have a stable frequency for optimum operation. The unit must also be properly grounded.***

4. Connect the 4-20 mA analog recorder output terminals to a recording system, if desired. The recorder output terminals are located on the terminal strip on the back of the analyzer.

5. RS232 (refer to wiring schematic for connections): Records continuously in CAPTURE Mode. Marks OVER-RANGE readings, Day Count*, Time (24 hour clock — Hours:Minutes:Seconds), ZERO, and SPAN on recorded concentration readings.

   *Not functional

6. Alarms (refer to wiring schematic for connections):

Type	
Contact Closure	>100000 cycles
Switching Voltage	28 VDC
Current	5 A

CAUTION

ALL SWITCHES SHOULD BE IN THE "OFF" POSITION BEFORE ANY ELECTRICAL CONNECTIONS ARE MADE.

7. Strip Chart Recorder Cable Connection (4-20 mA Signal)*

   In order to attach the recorder cable, extend the recorder cable, or if a cable is not attached, you will have to remove the chassis from the case and punch out two (2) knock out holes in the back of the case.

   a. Remove the five (5) screws on the back of the case.

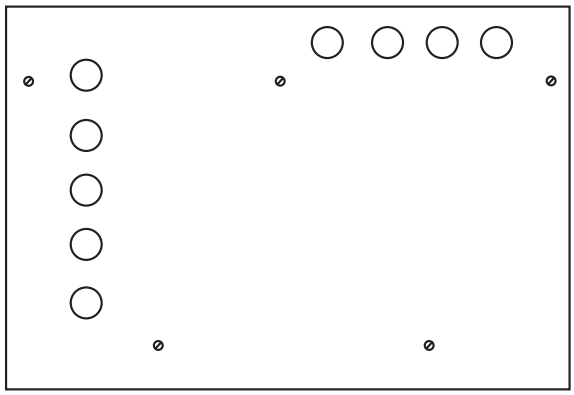


Figure 4-3: Back of analyzer (typical)

b. Remove the three (3) screws from along the top of the front panel.

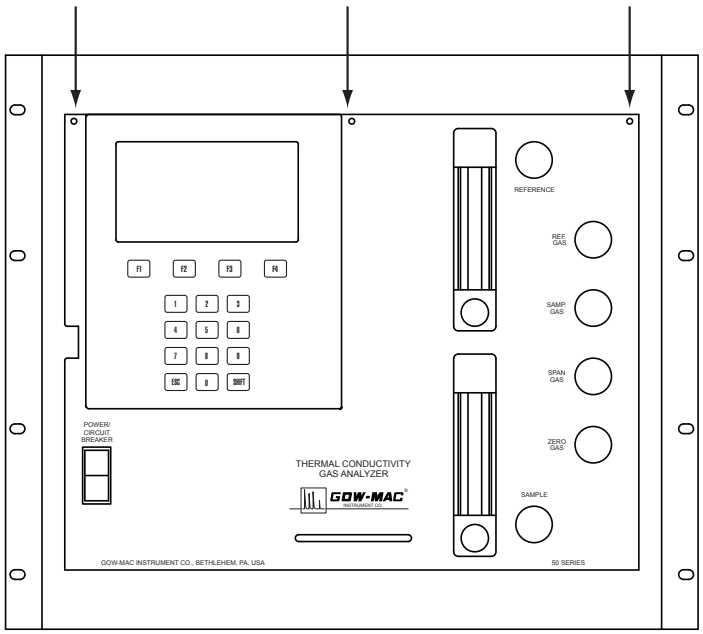


Figure 4-4: Front panel (typical)

c. Carefully slide the chassis out of the case.

d. Locate the terminal strip at the back of the chassis (shown in schematic).

e. Attach the recorder cable to the terminal strip as specified by the schematic (terminal strip is usually located in the upper left corner of wiring schematic).

f. Feed the other end of the recorder cable through a knockout hole in the back of the case.

NOTE

It is strongly recommended that strain reliefs be installed in knockout holes to help prevent wire chafing.

If purge option is applicable, the strain reliefs will already be installed.

8. Power Cable Connection

   a. While chassis is still out of the case, locate the terminal strip for the ac power cord.

   b. Feed the end of the power cable through a second knockout hole punched in the back of the chassis.

   c. Attach the power cable to the terminal strip as specified by your schematic.

   d. Replace the chassis in case.

NOTE

Depending upon how many options were ordered, there may be several groups of terminals mounted to a rail.

*READ THE WIRING SCHEMATIC CAREFULLY TO ENSURE PROPER CABLE INSTALLATION. **DO NOT** PLUG THE INSTRUMENT INTO AN OUTLET AT THIS TIME.*

NOTE

Leak checks should be run periodically and are a MUST when new tubing and fittings are installed.

I. Installation Checklist

After installing the system, confirm that:

1. All gas and liquid lines are connected to the instrument as indicated on the supplied flow diagram.

2. All connections are tight and leak-free.

3. The vent line on the back panel of the instrument is appropriately vented to safely exhaust any hazardous gas samples or standards. The exhaust should not have a large negative pressure as this can pull sample through analyzer at an uncontrolled rate and affect the results.

Depending upon which options were ordered, this section will vary between instruments. It is suggested that you sit directly in front of your instrument when reading this section. As you go over a feature, locate it on the instrument and become familiar with its' function.

A. Front Panel shown in Fig. 5-1

1. Display and tactile keypad: Set up instrument operating parameters and monitor progress of calibration and analysis.

2. Power "ON/OFF" switch: Switch on and off AC power to the instrument. Switch has a built-in magnetic circuit breaker.

3. Reference rotameter: Displays the reference gas flow rate to the detector.

4. Reference manual pressure regulator.

5. Reference metering valve: Adjusts the reference gas flow rate including shut-off.

Always have inert gas flowing through the detector before applying bridge current.

6. Sample rotameter: Displays the sample gas flow rate to the detector.

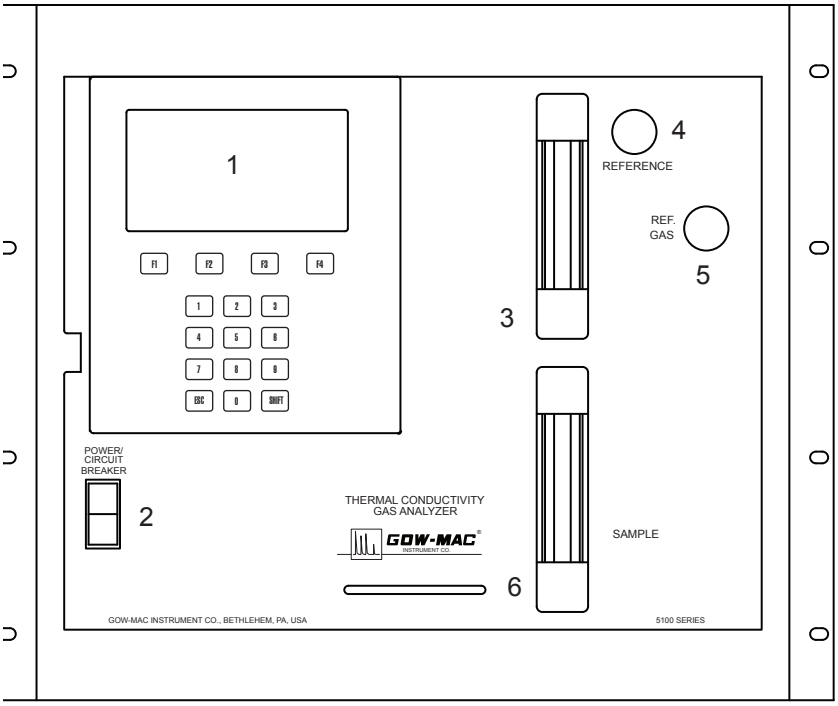


Figure 5-1: Front Panel

B. Back Panel shown in Fig. 5-2

1. Reference Out (1/8-inch compression)
2. Sample Out (1/8-inch compression)
3. Sample Gas In (1/8-inch compression)
4. Span Gas In (1/8-inch compression)
5. Zero Gas In (1/8-inch compression)
6. Purge Out (optional) [1/4-inch compression]
7. Purge In (optional) [1/4-inch compression]
8. Purge Reference Pressure [1/4-inch compression] with tube to transfer purge pressure to pressure switch (optional, part of purge option)
9. Pressure Switch (optional, part of purge option)

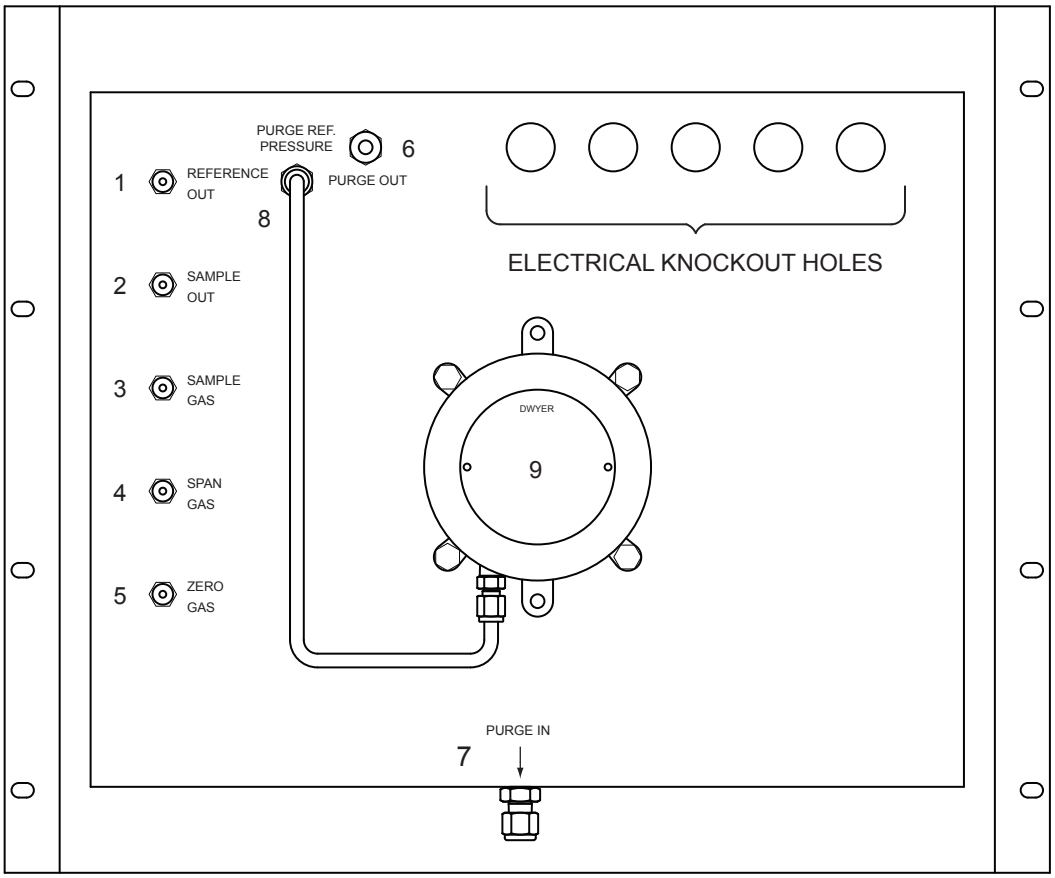


Figure 5-2: Back Panel

C. Bottom shown in Fig. 5-3

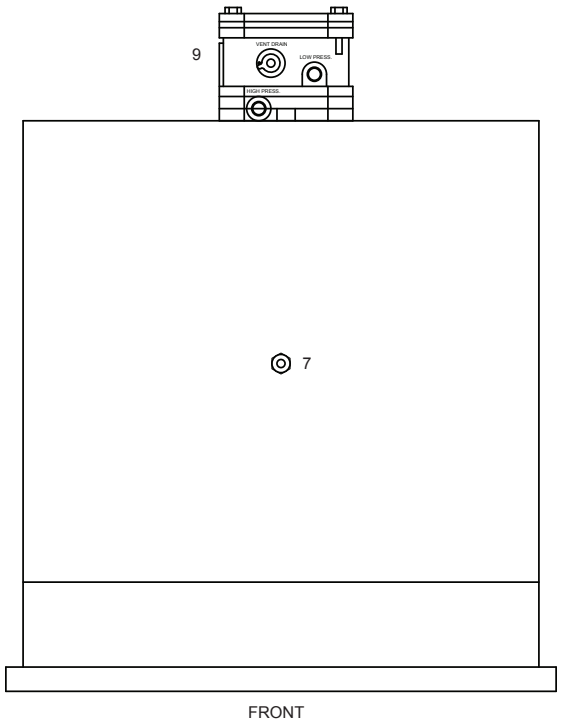


Figure 5-3: Bottom of chassis

7. Purge In (optional) [1/4-inch compression]

9. Pressure Switch (optional, part of purge option)

The following instructions should be adhered to for the initial start-up procedure of the analyzer. ***PLEASE FAMILIARIZE YOURSELF WITH THE OPERATING INSTRUCTIONS IN THEIR ENTIRETY BEFORE APPLYING POWER TO THE INSTRUMENT!!***

Refer to Appendix A: "Quick Start Reference Flow Chart" for assistance.

A. Initial Start-up Procedure

WARNING

DO NOT PLUG IN ANALYZER AT THIS TIME.

1. Make the necessary ZERO, CALIBRATION, and SAMPLE GAS connections to their respective bulkhead fittings on the rear of the analyzer. Refer to Section 4, paragraph E. BE SURE TO PURGE LINES BEFORE CONNECTING TO INSTRUMENT — ESPECIALLY THE SAMPLE LINE.

2. The gas regulators on the cylinders for CALIBRATION, SAMPLE, and ZERO GASES should be set between 60-120 psig.

3. Make sure REFERENCE GAS VALVE is OPEN by turning the black knob on the front panel labeled "Ref. Gas" COUNTER-CLOCKWISE to the fully-open position.

4. Adjust flow rate of REFERENCE GASES with Reference METERING VALVES to approximately mid-scale.

NOTE

Sample, Span, and Zero gases all flow through the "SAMPLE FLOW METER" on front panel. Reference gas flows through the "REFERENCE FLOW METER".

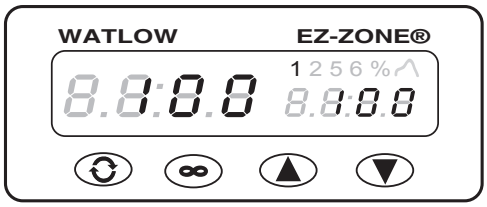
5. Purge analyzer for five (5) minutes.

B. Keypad Electronics Startup

1. Switch power to "ON" AFTER all the cleaned lines have been purged, gas supply connections have been made, and the Reference Gas has been flowing for at least five (5) minutes. Ensure the external valves for span and sample are open.

2. The detector will begin to heat up to 100 °C when the power is turned on. The controller is located inside the instrument and cannot be seen during normal operations. It is factory set and cannot be changed.

When the display reads “100”, the Gas Analyzer is ready for operation.



NOTE

After the detector is turned “ON”, the initial warm-up may take 3-4 hours for complete detector stability to be reached. Longer time may be required. For ppm level analysis, OVERNIGHT warm-up is recommended.

3. Start-up screen reveals Firmware Revision Number (V-xxxxxx), and Model Number (GOW-MAC xxxxxxxx). ***Record these for future reference.***

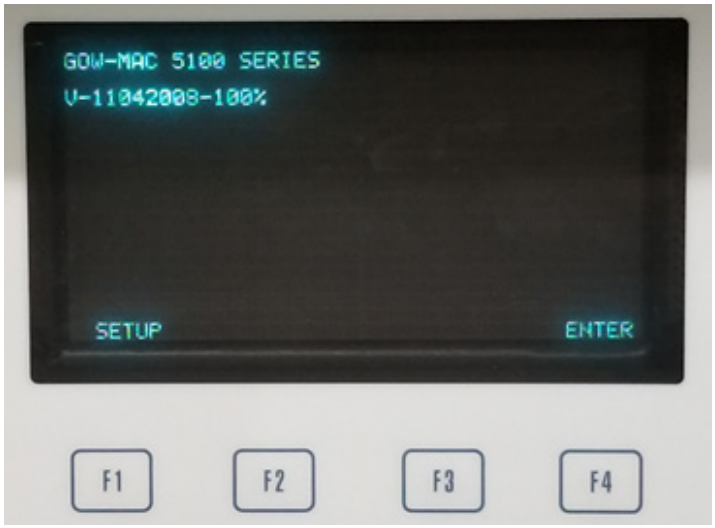
   Firmware Revision Number:_____

   GOW-MAC Model Number:_____

IMPORTANT

Use F1 to F4 buttons below screen to enter calibration parameters as instructed in the following directions. Function descriptions will appear on-screen directly above buttons.

4. HOME SCREEN



After logo clears from screen, press “***SETUP***” (F1) button at bottom left of screen.

THIS PROCEDURE MUST BE PERFORMED UPON EVERY POWER-UP.

5. INITIAL SETUP

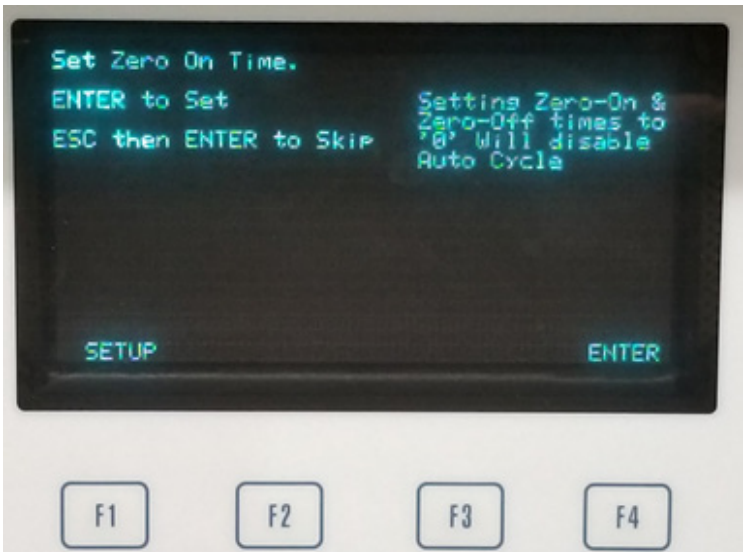
To accommodate different application sensitivities and sampling conditions, the 5100 Series Gas Analyzer is equipped with two sampling modes: *AUTO CYCLE* and *CONTINUOUS SAMPLE*.

AUTO CYCLE mode, the analyzer will cycle between ZERO and SAMPLE gas for user-programmed intervals from 0 - 59:59 for each. During the ZERO GAS interval, the instrument will continuously auto-zero over the entire programmed ZERO GAS interval before proceeding to the SAMPLE GAS analysis interval.

Sample analysis and data collection can occur only during the SAMPLE interval. After the SAMPLE interval, the instrument cycles back to the AUTO-ZERO interval to continue the sequence. This mode is especially practical for users with highly-sensitive applications whose environmental conditions are subject to variations over time — such as temperature and humidity fluctuations — which could affect the analysis results. During auto-zero, the instrument switches to a “NOT READY” state, and the instrument output signals should not be read.

CONTINUOUS SAMPLE mode, the sample gas is analyzed constantly, without auto-zeroing. This mode is designed for users whose sampling conditions are more controlled and remain very stable.

At this point, the user must choose which sampling mode they would like to utilize.



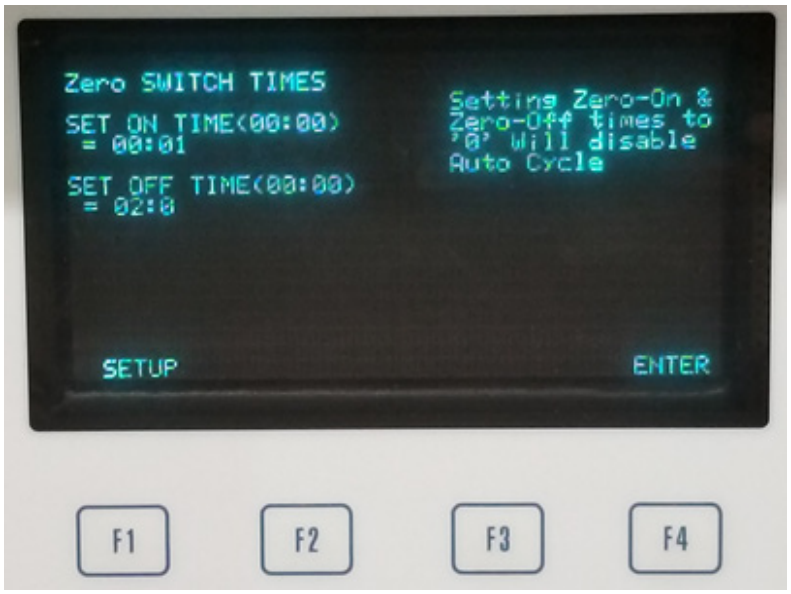
If an incorrect value is entered during any portion of SETUP, you MUST proceed through the rest of the SETUP procedure until the “RUN” button is displayed on the screen before you can make any changes. At that point, you have the option to press the “SETUP” button (F1), and re-enter the SETUP procedure. ALL values MUST BE RE-ENTERED as they are not saved from previous SETUP.

1) Set ZERO GAS FLOW interval

Press “***ENTER”*** (F4) to continue. (***ESC*** then ***ENTER*** to skip)

AUTO CYCLE mode, enter ZERO SWITCH-ON time in format XX:XX. The times entered must be greater than “0” and no higher than “59:59”. For example “0001” will set ZERO SET-ON time to 1 second, or 00:01.

Set the duration of the ZERO GAS flow interval by entering a SET-OFF time in the same format. For example, entering 0201 (or 02:01) would create an interval of 2:00 minutes (02:00 minus 00:01 = 01:59) over which the **ZERO Gas** will flow and the instrument will auto-zero. Be sure to leave enough time for the instrument to return to a stable zero-state.



CONTINUOUS SAMPLE mode, the user must enter “0000” for both of these times. Esc then Enter can be pressed to skip this step and default to 00:00

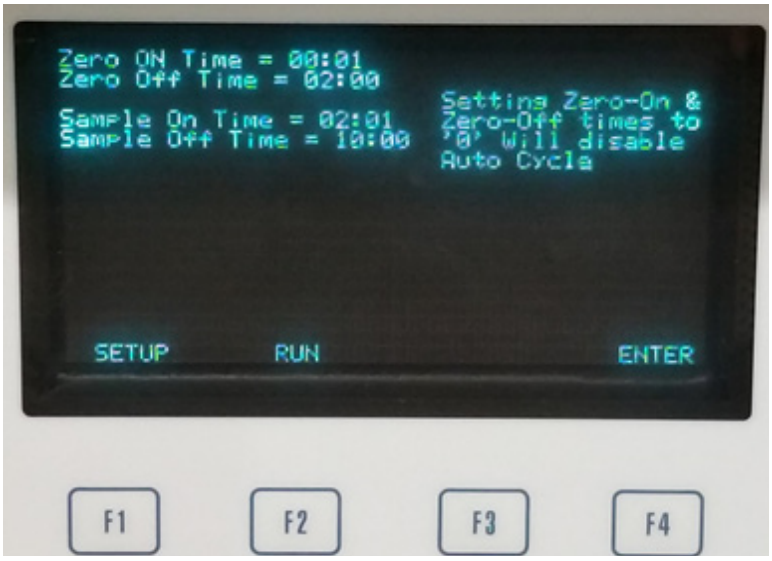
2) Set SAMPLE GAS FLOW interval

Press “***ENTER***” (F4) to continue. (***ESC*** then ***ENTER*** to skip)

AUTO CYCLE mode:

a) Enter SAMPLE VALVE SWITCH-ON time (CW1) in format XX:XX. The times entered must again be greater than “00:00” and no higher than“59:59”. For example “0201” will set SAMPLE VALVE SWITCH-ON time to 02:01.

b) Set the duration of the SAMPLE GAS flow interval by entering a SWITCH-OFF time in the same format. For example, entering 1000 (or 10:00) would create an interval of 7:59 minutes (10:00 minus 02:01 = 07:59) over which the SAMPLE Gas will flow and be analyzed.



CONTINUOUS SAMPLE mode, the user must enter “0000” for both of these times. Esc then Enter can be pressed to skip this step and default to 00:00

3) Standard Concentration (STD CONC)

Input the concentration of your SPAN Standard as “STANDARD CONCENTRATION 1”. Next to “STD CONC 1=”, enter the concentration value in format “XXX.XX”. (For example, if your SPAN Standard concentration is 200.00 ppm, enter: 20000).

* NOTE: The entry format may change depending upon the concentration range requested.

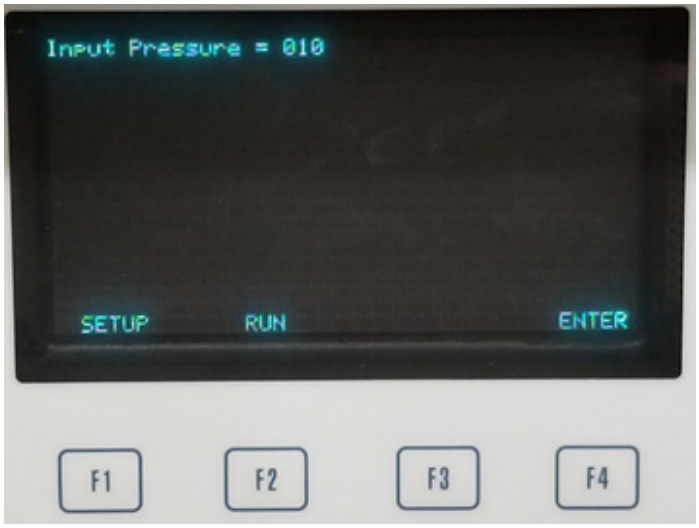
This value **MUST** be entered and cannot be skipped.

Press “***ENTER***” (F4) to continue.

4) EPC Pressure

Press “***ENTER*** (F4)” to SET. (***ESC*** then ***ENTER*** to skip)

Set the EPC pressure for the Sample, Span, and Zero gases in format “XXX”. A pressure setting of 10 psi should produce a flow rate of roughly 100 mL/min (20 » 200 mL/min), as indicated on flow meter (lower meter) on front of instrument.



Adjust the REFERENCE GAS flow rate to match the SAMPLE GAS flow rate by adjusting the black knob on the front panel labeled “Reference”. Observe the Reference Gas flow rate on the upper flow meter on the front panel.

5) Alarm Control

If you wish to activate the Alarm Control, enter “***1***”, which will reveal the Alarm Menu. If you do not wish to activate the Alarm Control, enter “***0***”, which will skip the Alarm Menu, and advance to Filament Fail-Safe Setting. (Skip to #10)

a. Alarm Menu

Alarm 1 Type

i. Enter “***0***” to designate Alarm 1 as a LOW ALARM, which will be activated if measured concentration value falls ***below*** alarm setting value.

ii. Enter “***1***” to designate Alarm 1 as a HIGH ALARM, which will be activated if measured concentration value increases ***above*** alarm setting value.

iii. Enter “***2***” to turn Alarm 1 OFF.

Alarm 2 Type

i. Enter "***0***" to designate Alarm 2 as a LOW ALARM, which will be activated if measured concentration value falls ***below*** alarm setting value.

ii. Enter "***1***" to designate Alarm 2 as a HIGH ALARM, which will be activated if measured concentration value increases ***above*** alarm setting value.

iii. Enter "***2***" to turn Alarm 2 OFF.

Alarm 3 Type

i. Enter "***0***" to designate Alarm 3 as a LOW ALARM, which will be activated if measured concentration value falls ***below*** alarm setting value.

ii. Enter "***1***" to designate Alarm 3 as a HIGH ALARM, which will be activated if measured concentration value increases ***above*** alarm setting value.

iii. Enter "***2***" to turn Alarm 3 off.

Alarm 4 Type

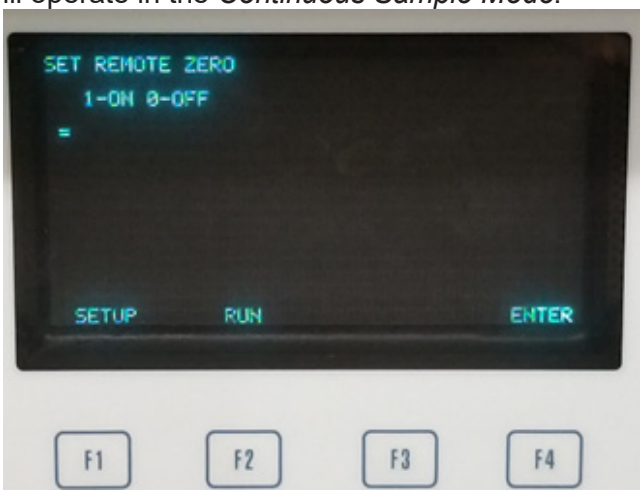
i. Enter "***0***" to designate Alarm 4 as a LOW ALARM, which will be activated if measured concentration value falls ***below*** alarm setting value.

ii. Enter "***1***" to designate Alarm 4 as a HIGH ALARM, which will be activated if measured concentration value increases ***above*** alarm setting value.

iii. Enter "***2***" to turn Alarm 4 off.

6) Remote Zero (if applicable)

With the cycle times programmed to "**00:00**" for the *Zero* and the *Span* cycle times, the instrument will operate in the *Continuous Sample Mode*.



During the programming setup of the instrument, there is an option to activate the *"Remote Zero"* function.

Program a ***'1'*** to activate the option and a ***'0'*** to disable the option. Within the instrument, located on the terminal-strip on the inside back panel of the chassis, are two (2) terminals labeled "INPUT". These terminals will be used to apply a contact closure. This closure will put the instrument into a ***'NOT READY'*** state and will automatically change to the zero gas and begin to zero the instrument as long as the contact closure remains. The duration the contact closure is applied to sufficiently zero the instrument will depend upon your environment and application for the instrument. When the contact closure is released the instrument will return to the *'Continuous Sample Mode'*.

There will not be a need to re-span (calibrate) the instrument as long as the current applied to the detector has not changed or something has not affected the detector directly. Re-spanning frequency will also depend on your environment and application for the instrument. Re-spanning the instrument would require following the original procedure(s) as stated within this manual.

7) Filament Fail-Safe (if applicable)

Enter "***1***" to turn on "Filament Fail-Safe". (0 = OFF)

If turned-on, the Filament Fail-Safe will shut-off the detector current, and the instrument will switch to a "NOT READY" state (as indicated through the READY OUTPUT CONTACTS), if activated by an external device. Examples of devices that could trigger the Filament Fail-Safe are pressure or flow sensors that monitor the reference or sample gas line flows. (These devices may be purchased as optional equipment, or supplied by the user.)

The screen will indicate Filament Fail-Safe activation with the following statements:

"CURRENT OFF", "PLEASE SERVICE SYSTEM"

Turn "OFF" power and correct the condition that triggered the Filament Fail-Safe, if this occurs.

If no alarms were selected, skip to #13.

8) Remote Calibration (if applicable)

A remote calibration can be started by a 2-5 second contact closure on terminals 22 and 23. These are located inside the instrument and must be wired before instrument operation.

A calibration sequence can be initiated within either of the run modes (continuous or timed cycle). The instrument will zero for approximately 10 minutes and then span for approximately 10 minutes. After the calibration sequence is complete, the selected run mode will start again.

The remote calibration comes with an additional option called "Cal. Ind." The "Cal. Ind." is located inside the instrument terminal strip at terminals 33 & 34.

Calibration Indicator

The Calibration Indicator (labeled “Cal. Ind”) is a normally open relay. When in calibration it closes & when not in calibration it opens.

Type	
Contact Closure	>100000 cycles
Switching Voltage	28 VDC
Current	5 A

NOTE

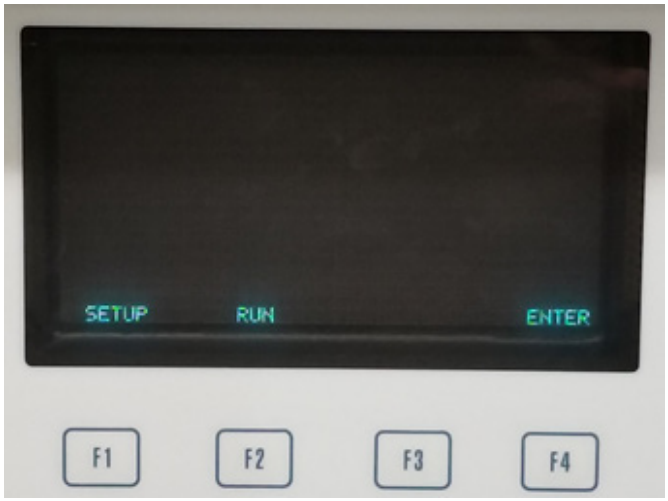
The “Cal. Ind.” Option must be included if the “Remote Cal.” Option is ordered. However, it can be ordered by itself.

9) At this point, you may re-enter the SET UP procedure if you wish to make any changes or corrections. If you choose to re-enter SET UP, **go back to step 1 under initial Setup.**

C. Quick Start-up for Calibration and Sample Analysis

Section C will provide the information to set-up and start the analysis with minimal details.
Section D will provide extensive details on menu options and screen values.

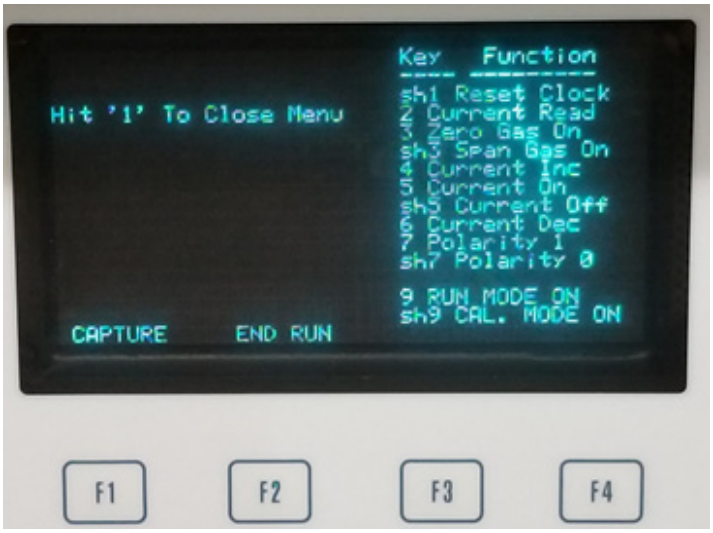
When SETUP is correct and complete, press "***RUN***" Button (***F2***) at bottom center of screen to enter "**RUN MODE**".



The Zero, Span and Sample Gases MUST be open at the cylinders and/ or source and flowing BEFORE continuing to the next step.

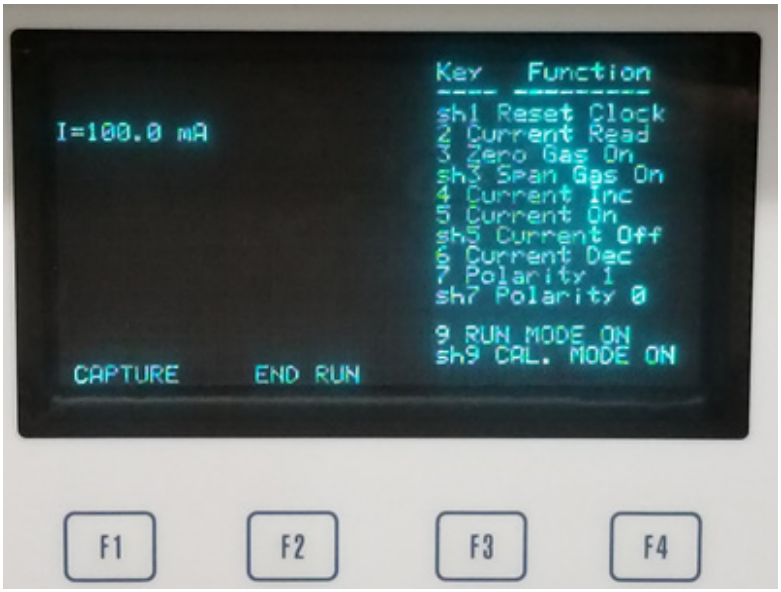
---

1. Press "1" on the keypad to display the Main Menu



2. Press "5" for "Current On" to turn ON the TCD current.

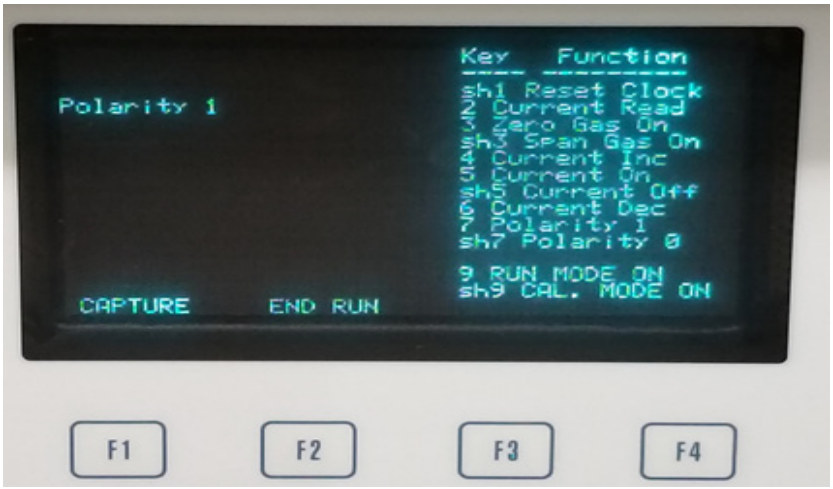
3. Press ”4” “Current Inc” repeatedly to increase TCD Current to desired setting. The digital component of the menu starts at zero (0) while the TCD has a starting current of approximately 22 mA. Due to this difference, the “4” key will need to be pressed 10 to 12 times before a current change is noticed on the screen.



Use the keypad to adjust it to the appropriate setting. See QC Record for recommended setting for your application. If the value for the current is exceeded, press “***6***” “Current Dec” to decrease TCD Current to desired setting.

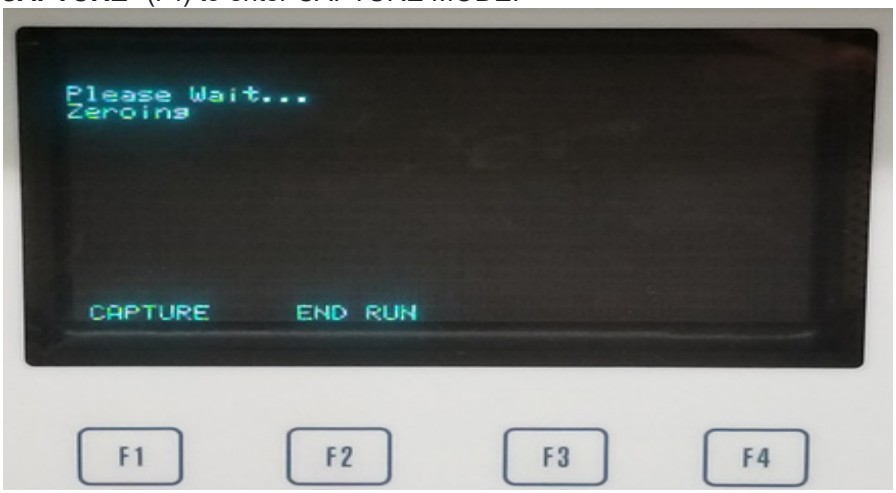
4. Press “***7***” to change Polarity to “1”. This setting should be used if the thermal conductivity of the Sample Gas is less than that of the Reference Gas (i.e. a “negative” concentration reading is displayed on the screen in Calibration Mode. An example would be Nitrogen impurity in Helium base gas.
Press “***Shift***”, then “***7***” to change Polarity to “0”. This is the default setting which is used in most applications where the thermal conductivity of the Sample Gas is greater than that of the Reference Gas. (i.e. a “positive” concentration reading is displayed on the screen in Calibration Mode). An example would be Helium impurity in Nitrogen base gas.

Anytime “***SHIFT***” is pressed, the word “SHIFT” should appear on the screen. If it does not, press “***SHIFT***” again.



NOTE: Must back out of HELP MENU before pressing "***CAPTURE***"

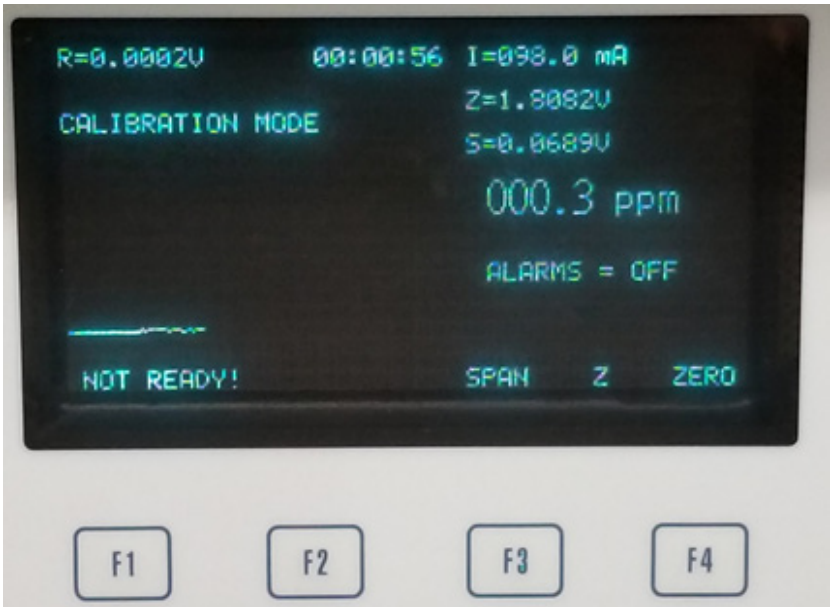
5. Once the TCD Current is ON, TCD Current is set to specified mA, and Polarity is selected, press "***CAPTURE***" (F1) to enter CAPTURE MODE.



- If AUTO CYCLE mode was selected, instrument will auto-zero for user-programmed interval.

- If CONTINUOUS SAMPLE mode was selected, "**CONT**" will appear at the bottom left of the screen. The sample will be continuously analyzed.

6. Press "**SHIFT**", then "9" to enter CAL mode to Calibrate. Be sure the screen displays : CALIBRATION MODE



(NOTE: In this mode, the instrument is "NOT READY"; 4-20 mA Output = 4 mA)

7. Press "***3***" to flow ZERO GAS. A "z" will be displayed on the screen between F3 and F4 to indicate zero gas flow. Wait for stable ZERO reading on Concentration display. This may take 5 to 10 minutes.

   Press & hold "***ZERO***" (F4) button for TWO SECONDS to set "ZERO" value. The display will change to 000 and the "Z Voltage" will be recorded on the display screen (Z = x.xxxx V).

   You may "Re-ZERO" with the F4 button as many times as needed until a zero equilibrium is achieved.

8. Press "SHIFT " then "3" to flow SPAN GAS. An "s" will be displayed on the screen between F3 and F4 to indicate span gas flow. Wait for stable SPAN reading on Concentration display. This may take 5 to 10 minutes.

   Press & hold "***SPAN***" (F3) button for TWO SECONDS to set "SPAN" value. The display will change to the Standard Concentration (STD CONC) that was entered in the SETUP section (Sec 6 Part B.7) and the "S Voltage" will be recorded on the display screen (S=x.xxxx V)

   You may "Re-SPAN" with the F3 button as many times as needed.

9. Verify Calibration settings

   a) Press "***3***" to flow ZERO GAS. A "z" will be displayed on the screen between F3 and F4 to indicate zero gas flow. Wait for stable ZERO reading on Concentration display, and compare to ZERO SET CONCENTRATION VALUE to confirm reproducibility. Concentration display should read very close to "000.0". Re-ZERO if outside the precision required for your application, if so desired. (See Section 6 C.7).

   b) Press "***SHIFT***", then "***3***" to flow SPAN GAS. An "s" will be displayed on the screen between F3 and F4 to indicate span gas flow. Wait for stable SPAN reading on Concentration display and compare to SPAN SET VALUE to confirm reproducibility. Re-set SPAN if outside the precision required for your application, if so desired. (See 6 C.8).

   c) Repeat calibration procedure until readings replicate within desired tolerance without having to Re-ZERO or Re-SPAN instrument.

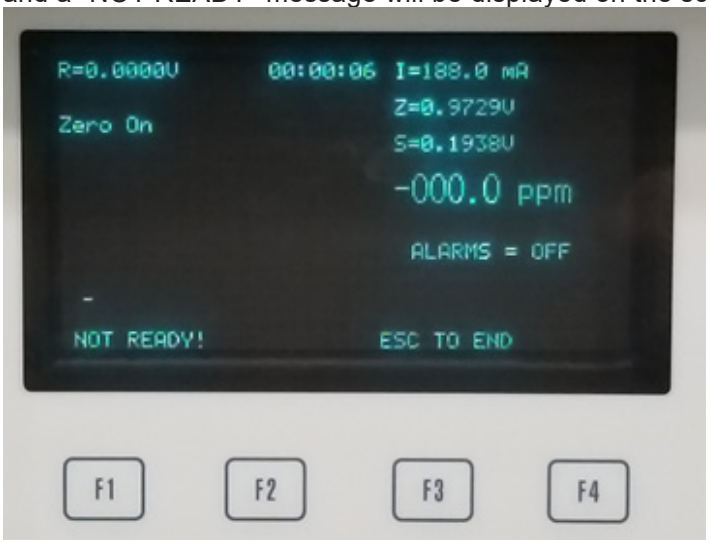
IMPORTANT

It is VERY important to wait for stable readings before zero or span calibration or verifying calibrations.

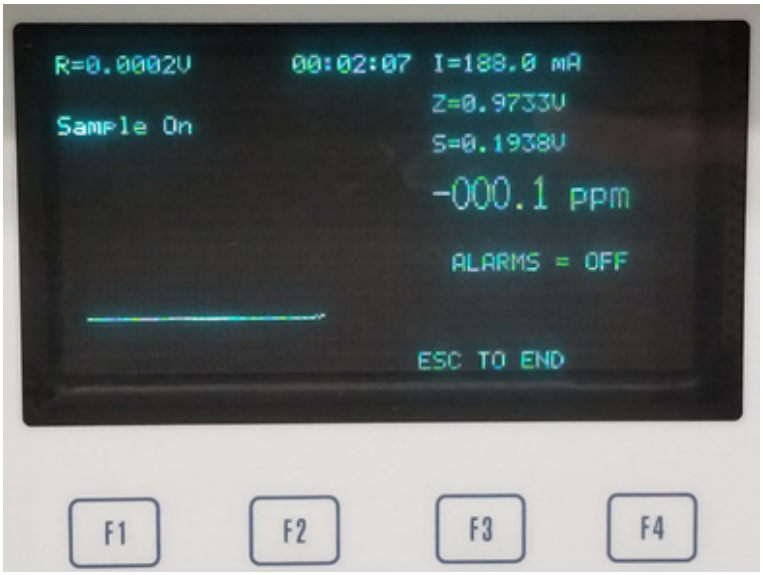
10. Press “9” to turn RUN MODE ON when calibration is completed. The Instrument is now analyzing sample.
(READY Output is now in “CLOSED” STATE, Alarms are active, and 4-20 mA output reflects recorded concentration on the screen.)

Begin collecting data.

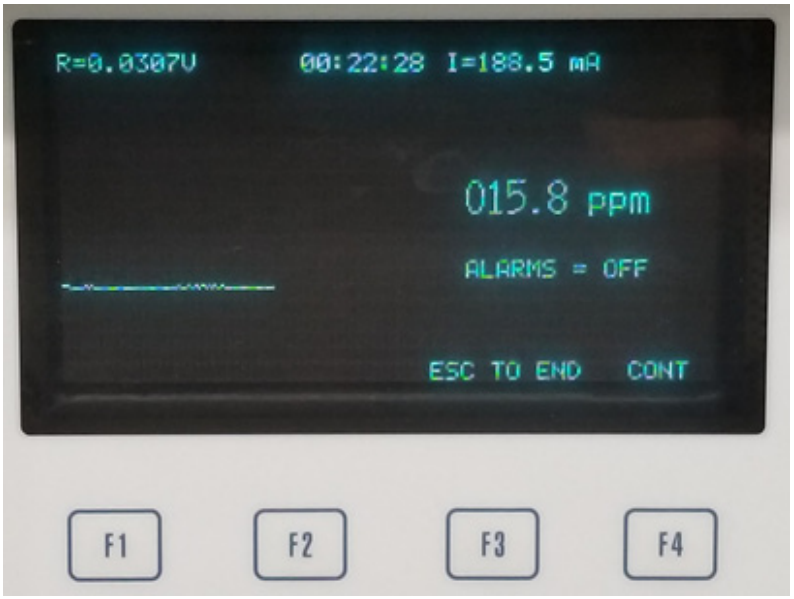
If **AUTO CYCLE** mode was selected and entered in the INITIAL SETUP, the analyzer will begin with ZERO ON for the designated timeframe. The 4-20 mA output and alarms will be disabled and a “NOT READY” message will be displayed on the screen.



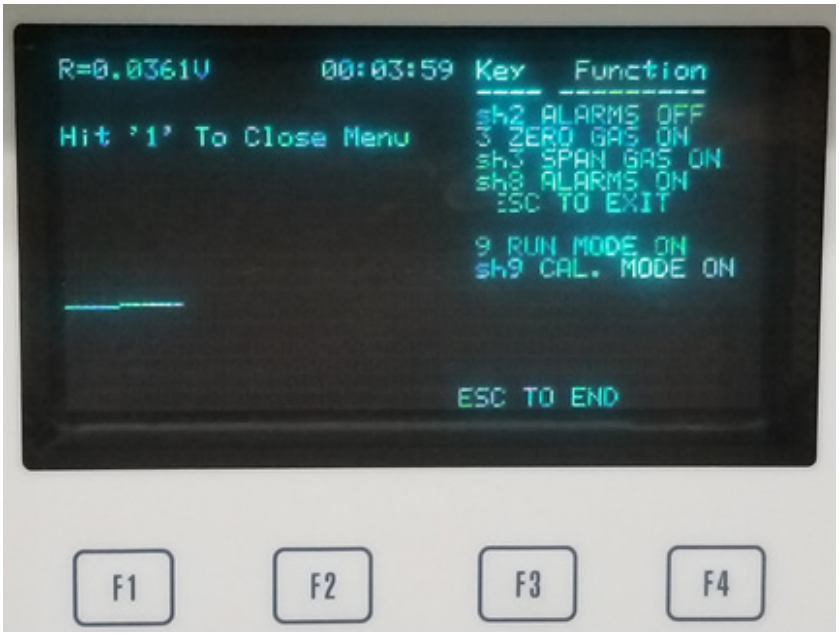
The instrument will turn off zero gas and return to sample gas at the programmed time. The 4-20 mA output and alarms will be active.



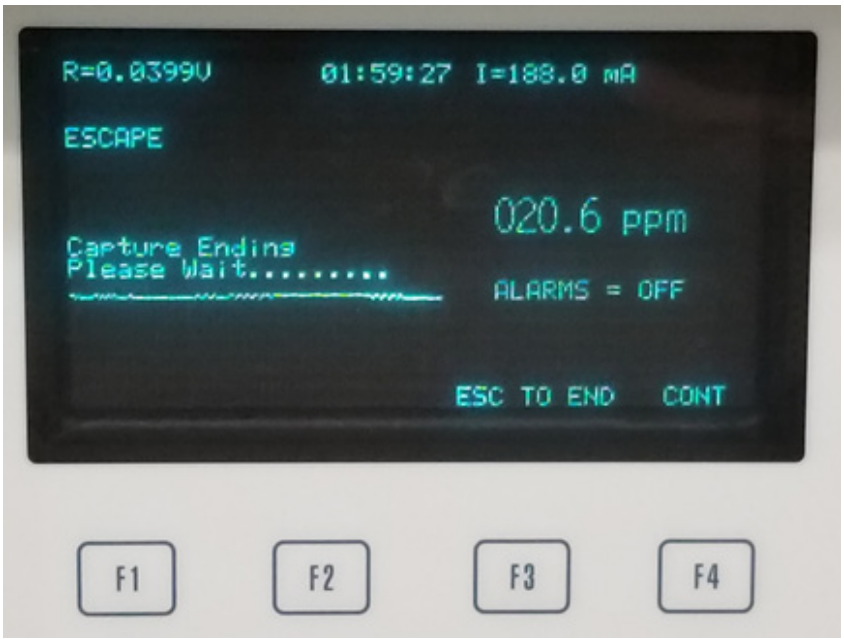
If CONTINUOUS SAMPLE mode was selected and entered in the INITIAL SETUP, the analyzer will begin with sample gas flowing. the 4-20 mA output and alarms will be active and a “CONT” message will be displayed on the screen above the F4 key (not active).



Press “1” on the keypad at any time to display the Main Menu. The menu will show you reminder key strokes, but will not allow you to make changes while the menu is displayed. Press “1” again to close the menu and key the function you wish to execute.



Press ***ESCAPE (ESC)*** at any time if you wish to exit CAPTURE Mode, change run parameters, or change settings. This step takes approximately 30 secs to finalize and shut down the capture process.



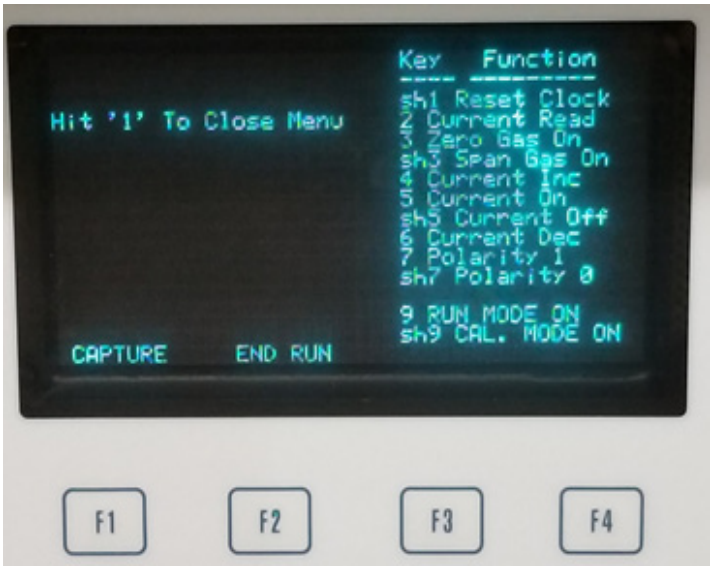
D. Detailed Start-up for Calibration and Sample Analysis

This section provides extensive details on menu options and screen values.
Please see Section C for a quick set-up and start-up of the analyzer.

The Zero, Span and Sample Gases MUST be open at the cylinders and/ or source and flowing BEFORE continuing to the next step.

---

1. Press “1” on the keypad to display the Main Menu



MENU OPTIONS

- Press “***Shift***”, then “***1***” to Reset CLOCK (Timer). This is located at the top of the Run Mode display screen and is a running timer from start of sample analysis.
- Press “***2***” for CURRENTREAD. This is displayed as I=xxx.x mA and real time bridge current
- Press “***3***” for ZERO GAS ON. This will activate the solenoid valve to allow zero gas to flow to TCD.
- Press “***Shift***”, then “***3***” for SPAN GAS ON. This will activate the solenoid valve to allow span (calibration) gas to flow to TCD.
- Press “***4***” CURRENT INC to increase TCD bridge current setting to desired value. The “4” key should be pressed repeatedly to obtain the current value. It will need to be pressed 10 to 12 times before a current change is noticed on the screen. (Current can only be adjusted in the “RUN” mode. Once “CAPTURE” begins, the current cannot be adjusted. “ESC” must be pressed to end “CAPTURE” process to return to the main menu. This is indicated by “CAPTURE” appearing above the F1 key. This is when the operator has the ability of changing CURRENT INC.)
- Press “***5***” for CURRENT ON to turn the bridge current on. If this occurs immediately after instrument power up, the starting bridge current will be default of zero (0) and will need “4” key CURRENT INC to increase the bridge current. If the CURRENT ON occurs after the initial bridge setting without a power down, the last entered bridge current will resume.

- Press "***Shift***", then "***5***" for CURRENT OFF to turn bridge current off.
- Press "***6***" CURRENT DEC to decrease to desired setting. (Current can only be adjusted in the "RUN" mode. Once capturing begins, the current cannot be adjusted. "ESC" must be pressed to end "CAPTURE" process to return to the main menu This is indicated by "CAPTURE" appearing above the F1 key. This is when the operator has the ability of changing CURRENT DEC.)
- Press "***7***" to change Polarity to "1". This setting should be used if the thermal conductivity of the Sample (or Span) Gas is less than that of the Reference Gas (i.e. a "negative" concentration reading is displayed on the screen in Calibration Mode while analyzing the SPAN GAS.) This change can only be made in "RUN' mode.
- Press "***Shift***", then "***7***" to change Polarity to "0". This is the default setting which is used in most applications where the thermal conductivity of the Sample Gas is greater than that of the Reference Gas. (i.e. a "positive" concentration reading is displayed on the screen in Calibration Mode while analyzing the SPAN GAS.) This change can only be made in "RUN' mode.
- Press "***9***" to enter RUN MODE when calibration is completed and instrument is ready to collect sample data. This option can be activated only when the main menu is closed. Press "1" to close menu and "9" to activate run mode.
- Press "***Shift***", then "***9***" to enter CAL MODE. This is a diagnostic condition which will place the instrument into a "NOT READY" state to allow ZERO and SPAN calibrations while in capture mode. This option can be activated only when the main menu is closed. Press "1" to close menu and "Shift" then "9" to activate cal mode.
- Press "***1***" again to close MENU when finished.

2. In order to operate the Series 5100, the TCD must be turned on and bridge current set. Press "***5***" for CURRENT ON and use the keypad to adjust it to the appropriate setting. The MINIMUM current is set by default. See QCRecord for recommended setting for your application

   INCREASE the current by pressing/holding the "***4***" key to the desired setting.

   DECREASE the current by pressing/holding the "***6***" key to the desired setting.

NOTE

The initial warm up may take 3-4 hours for complete detector stability to be reached. More time may be required. For ppm-level analysis, OVERNIGHT warm up is recommended.

NOTE

THE DETECTOR CAN BE DAMAGED IF THE CURRENT IS SET IMPROPERLY. FOR MAXIMUM FILAMENT LIFE, THE LOWEST CURRENT SETTING THAT WILL ACHIEVE THE DESIRED SENSITIVITY SHOULD BE USED. FOR BEST RESULTS, START TESTING WITH THE SETTING INDICATED ON THE QC RECORD SUPPLIED FOR YOUR APPLICATION. INCREMENTAL ADJUSTMENTS FROM THIS SETTING CAN BE MADE IF NECESSARY. FOR MORE INFORMATION, REFER TO THE ENCLOSED GENERAL SERVICE BULLETIN INCLUDED WITH THIS MANUAL.

3. CAPTURE MODE

After instrument warm up, press 'CAPTURE" (F1) to enter CAPTURE MODE.

Screen displays: Please wait... Zeroing

- If AUTO CYCLE mode was selected, instrument will auto-zero for user-programmed interval.

- If CONTINUOUS SAMPLE mode was selected, "**CONT**" will appear at the bottom right of the screen. The sample will be continuously analyzed.

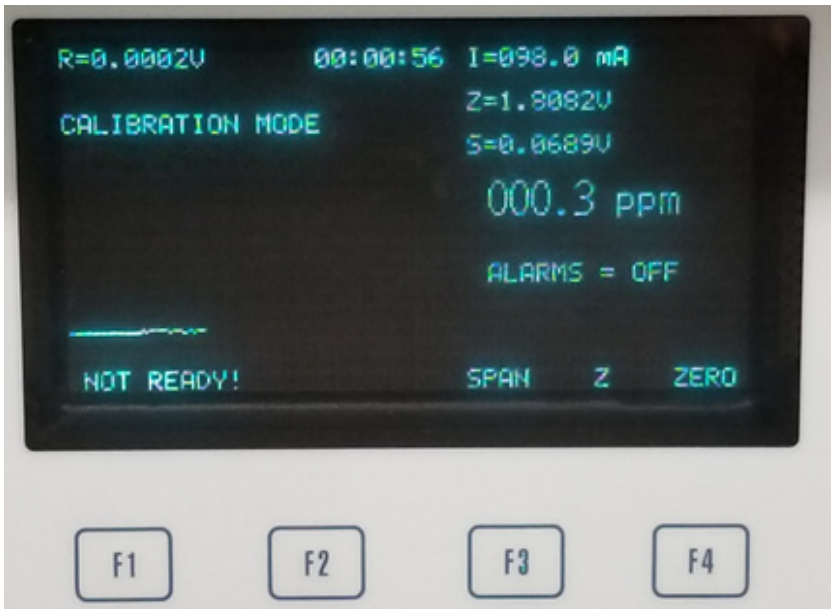
Pressing "***ESC***" will EXIT CAPTURE MODE when desired.

4. Press "***SHIFT***", then "***9***" to enter CAL mode to Calibrate. Be sure the screen displays CALIBRATION MODE.

(NOTE: In this mode, the instrument is "NOT READY"; 4-20 mA Output = 4 mA)

Screen now displays:

"R=" value	Located at **top left of screen**. Indicates the relative difference between the voltage recorded (as the "zero voltage") and the present voltage reading.	
Real-time Clock:	Located at **top center of screen**. 24 Hour Clock indicating Hours, Minutes, and Seconds.	
Detector Current Setting	Located at **top right of screen** as: I= XXX.X mA	
Zero voltage ("Z")	**Directly below** Current Reading (I):The voltage recorded as "ZERO VOLT-	
Span delta ("S")	**Directly below** Zero Voltage (Z):The voltage recorded as "SPAN VOLTAGE". Relative to the programmed concentration.	
Concentration Reading	Indicates current sample or standard concentration reading in Parts per Million (PPM) or Percent (%) <application specific>	
Alarms= OFF	Alarm Status will be On or Off	
Concentration-Level Graph	Located at bottom left of screen. A real-time plot of the ABSOLUTE VALUE of the current concentration as measured by the detector. Both Positive and Negative concentration values will be portrayed as POSITIVE increases in the baseline display. Negative is indicated by a "-" preceding the concentration display.	
Not Ready Status	Located at **bottom left of screen**. Will display if instrument is in Cal Mode and "Not Ready". Output are disabled	
BUTTONS>>>	SPAN (F3)	F3 key pressed to accept Span Voltage
	"Z" or "S"	Indicator of Zero or Span gas flowing
	ZERO (F4)	F4 key pressed to accept Zero Voltage



5. Zero Calibration

   Press "***3***" on keypad to flow ZERO GAS. A "z" will be displayed on the screen between F3 and F4 to indicate zero gas flow. Wait for stable ZERO reading on Concentration display.

   Press & hold "***ZERO***" (F4) button for TWO SECONDS to set "ZERO" value. The "Z Voltage" will be recorded on the display screen (Z=x.xxxx)

   You may "Re-ZERO" with the F4 button as many times as needed.

   ZERO VOLTAGE (Z) set in step C.1.f. **MUST be greater than 0.1** volts **AND** the "R=" value on the display **MUST be fluctuating.**
   If "Z" set in step C.1.f is **greater than** 0.1 V **AND** the **"R=" value IS** fluctuating, proceed to "C.2. Span Standard" below.
   If "Z" **is not greater than 0.1 V, AND/OR** the **"R=" value IS NOT** changing, press ESC (Escape) to exit CAPTURE MODE. Try LOWERING the current setting, and re-zero. (Press "1" to see Menu Options)
   If you are unable to achieve a ZERO (Z) value above 0.1V, with fluctuation of the "R" value, proceed to Section 9 - Troubleshooting.
   *NOTE: If this does not work call GOW-MAC. There is an internal adjustment needed.

   ---

6. Span Calibration

   Press "SHIFT", then "3" on the keypad to flow SPAN GAS. An "s" will be displayed on the screen between F3 and F4 to indicate span gas flow. Wait for stable SPAN reading on Concentration display. Press & hold "SPAN" (F3) button for TWO SECONDS to set "SPAN" value. The "S Voltage" will be recorded on the display screen (S=x.xxxx) You may "Re-SPAN" with the F3 button as many times as needed.

   If the "S=" value displayed on the screen seems to be locked at "0.0" with no fluctuation of the "R" value, and/or the Concentration display says "OVERRANGE" or "00000", the current (mA) setting may be TOO HIGH. Exit CAPTURE MODE (ESC), lower current setting, and re-calibrate. (See Section 6C "Calibration and Sample Analysis")

   If the Concentration display indicates a negative value, the thermal conductivity of the SPAN (or Sample) Gas may be lower than that of the Reference Gas or the instrument was zeroed with an elevated impurity "Leak or Span Gas" i.e. lines not purged.

See menu options in Zero Calibration Section (Section 6.C.1) to change Polarity.

For more information, see Section 9 - Troubleshooting.

7. Verify CALIBRATION STANDARD SETTINGS

Press “3” on the keypad to flow ZERO GAS. A “z” will be displayed on the screen between F3 and F4 to indicate zero gas flow. Wait for stable ZERO reading on Concentration display, and compare to ZERO SET CONCENTRATION VALUE to confirm reproducibility. Concentration display should read very close to “000.0”. Re-ZERO if outside the precision required for your application, if so desired. (See Section 6 C.1f.).

Press “***SHIFT***”, then “***3***” to flow SPAN GAS. An “s” will be displayed on the screen between F3 and F4 to indicate span gas flow. Wait for stable SPAN reading on Concentration display and compare to SPAN SET VALUE to confirm reproducibility. Re-set SPAN if outside the precision required for your application, if so desired. (See 6.2.a.i above).

Repeat calibration procedure until readings replicate within desired tolerance without having to Re-ZERO or Re-SPAN instrument.

It is VERY important to wait for stable readings before zero or span calibration or verifying calibrations.

---

8. Analyze Sample

Press “9” to turn RUN MODE ON when calibration is completed. The instrument is now analyzing sample.

(READY output is now in “CLOSED” state, Alarms are active and 4-20 mA output reflected recorded concentration on the screen.)

Begin collecting data.

9. Clear Screen

Holding in keypad keys too long could create extraneous characters on the display screen. If this occurs, pressing “SHIFT”, then F4 will refresh the display. (Use in CAPTURE Mode only).

D. Escape Option

1. Press ***ESCAPE (ESC)*** to if you wish to exit CAPTURE Mode, change run parameters, or change settings.

   a. Press ***END RUN*** (F2) to return to HOMESCREEN (See Section 6.B.3.)

   b. Press ***CAPTURE*** (F1) to return to CAPTURE MODE (See Section 6.C.1.c)

E. Alarm Condition (if applicable)

1. If an ALARM CONDITION is indicated on screen during CAPTURE:

   a. Press “***1***” to view MENU if you would like to see available options.

   b. Press “***1***” again to exit MENU.

Make all setting changes AFTER exiting MENU.

Menu Options

Press "***9***" to turn RUN MODE ON, and switch instrument to "Ready" state.

Press "***SHIFT***", then "***2***" to turn ALARMS OFF in order to correct alarm condition.

Press "***SHIFT***", then "***8***" to REACTIVATE ALARMS. (Alarms ON)

Press "***SHIFT***", then "***9***" to turn CAL MODE ON.

Press "***3***" to turn ZERO GAS on.

Press "***SHIFT***", then "***3***" to turn SPAN GAS on.

Press "***ESC***" to exit.

F. Outputs

1. READY — Output indicates the instrument's "ready" status. (CLOSED = READY; OPEN = NOT READY)

2. SIGNAL — Output indicates voltage level changes relative to signal change.

3. 4-20mA — Output indicates current changes relative to concentration. (0 ppm = 4 mA; 100 ppm = 20 mA.) ***Application Dependent*** Usually set as dictated by the customer at the time of manufacture.

   NOTE: Ranges can change according to ordered specifications.

4. RS-232 — Records continuously in CAPTURE Mode. Marks OVER-RANGE readings, Day Count*, Time, ZERO, SPAN, and alarms on recorded concentration readings. Refer to Section 7C.

   *not functional

G. Inputs

There are three (3) input options for this instrument. Presently, only one can be selected. The inputs are:

1. REMOTEZERO — Refer to Section 6, B, 10.

2. FILAMENTFAILSAFE — Refer to Section 6, B, 11.

3. REMOTECALIBRATION — Refer to Section 6, B, 12.

H. Calibration Frequency

Calibrate the 5100 Series Continuous Analyzer:

1. After initial start-up

2. After prolonged shutdown.

3. Weekly or as experience and application requirements dictate.

I. Shut Down Procedure

When the analysis is completed or the instrument needs to be shut down for a period of time, proceed as follows:

1. Using the keypad, press "***ESC***" if in a run. Then press "***SHIFT***" then "***5***" while in the run mode to turn off the current.

2. Switch power "OFF".

3. Shut "OFF" SAMPLE GAS flow.

4. Allow ZERO GAS to flow through the detector for 3-4 hours. When the detector is completely cooled to ambient temperature, shut "OFF" ZERO GAS flow.

FAILURE TO ALLOW SUFFICIENT TIME FOR THE DETECTOR TO COOL MAY RESULT IN FILAMENT DAMAGE.

FOR CERTAIN SAMPLE COMPOSITIONS THAT INTERACT WITH ATMOSPHERICS (OXYGEN, MOISTURE, ETC.) IT IS NECESSARY TO THOROUGHLY PURGE THE ENTIRE INSTRUMENT OF SAMPLE GAS BEFORE SHUTDOWN USING AN INERT GAS - INCLUDING THE SAMPLE INLET. THIS IS REQUIRED FOR SAMPLES WITH HIGH CONCENTRATIONS OF COMPOUNDS THAT FORM ACIDS (HF, HCL, HBR, ETC.) OR REACT VIOLENTLY AND/OR CORROSIVELY WITH ATMOSPHERIC ELEMENTS.

A. Voltage to Current Converter, 4-20 mA

The Voltage to Current Converter has been specifically designed for high accuracy applications in process control and monitoring systems. It offers complete galvanic isolation and protection against damage from transients and fault voltages in transmitting information between sub-systems or separate system elements.

Option 600 is a high performance, compact voltage to current converter offering 15 volt dc input to output isolation in interfacing standard process signals. The isolated output current range is 4 to 20 mA which is capable of delivering rated current to an external 0-750 ohm load.

In the industrial environment, option 600 can serve as a transmission link between such systems elements as transmitters, indicators, controllers, recorders, computers, actuators and signal conditioners.

B. Filament Fail-Safe (optional)

This circuit provides protection for your thermal conductivity detector. It monitors the pressure of the reference and sample gas by way of pressure switches, as a means of assuring that gas is available for the detector. If the circuit detects the absence of pressure, the detector power supply will be shut down. Once the circuit has been restored, the instrument must be reset by turning OFF the power, waiting 30 seconds, and then turning the instrument power back ON.

C. RS232 Output

RS232 OUT- Records continuously in CAPTURE Mode. Marks OVER-RANGE readings, DayCount*, Time, ZERO, SPAN and alarms on recorded concentration readings. Each field is separated by a comma, i.e., comma delimited.

*not functional

This section provides information concerning the proper maintenance for the 5100 Series Gas Analyzer. Schematics and drawings are provided for easy reference. If a problem arises which cannot be resolved by this manual, contact GOW-MAC for assistance: (610) 954-9000.

A. The Detector and Filaments

Filaments available from GOW-MAC for your analyzer are either made of tungsten (W2) or rhenium-tungsten (WX). The filaments in your particular detector depend upon the detector option you ordered. When ordering new filaments, check *Section 3 - Specifications* to locate the part number to reorder. If you need to order a new detector, reference should also be made to this section.

GOW-MAC will clean, repair and re-filament your TCD to the specifications of a new detector if it is returned to the factory. (Note: Additional charges will be incurred if complete oven assemblies are returned to us. To minimize costs, remove detector from oven and ship only the TC block to us).

If you desire, the detector can be serviced in the field by the instructions set down in the following paragraphs.

ALWAYS USE MATCHED PAIRS OF FILAMENTS. REPLACEMENT OF SINGLE FILAMENTS IS IMPRACTICAL. OPEN INDIVIDUAL CONTAINERS WITH CARE. DO NOT TOUCH HELIX WITH FINGERS

1. Filament Removal & Replacement for TC Cells

BEFORE ATTEMPTING TO REMOVE FILAMENTS OR DETECTOR, ALL POWER TO THE INSTRUMENT MUST BE TURNED "OFF" BY REMOVING THE POWER CORD FROM THE OUTLET.

To remove and replace hot wire filaments, use the supplied drawings and proceed as follows:

a. Remove power cord from wall outlet.

b. Disconnect recorder cable at recorder.

c. Remove the five (5) screws on back of case (see Figure 4-3).

d. Remove the three (3) screws on front panel of instrument (see Figure 4-4).

e. CAREFULLY, slide chassis out of case.

f. Locate detector housing. Remove two (2) black hex screws found on the top sides of the detector housing (there is no need to unscrew the black temperature controller that sits on top of detector housing lid).

g. Let detector cover dangle off to one side.

h. Remove insulation.

INSULATION CONTAINS FIBERGLASS. USE OF GLOVES AND FACE PROTECTION IS STRONGLY RECOMMENDED.

i. Disconnect filament wires from the terminal strip (Pins 7, 8, 9, & 10).

j. Using a 1/2-inch open end wrench, carefully unscrew the filament hex nuts from the detector. Physical removal of the detector may be necessary.

k. Remove filaments. Inspect detector and filaments for cleanliness or damage. Clean or replace detector and/or filaments if necessary. Tighten replacement filaments per instructions found in the accompanying GENERAL SERVICE BULLETIN.

l. Thread filament wires through hole in detector housing and reattach to terminal strip.

m. Replace insulation and detector housing lid.

n. Leak check system.

o. Replace chassis in case.

3. TC Detector Replacement

a. Follow Steps A.1.a-i above.

b. Locate and unscrew the thermocouple wire found on top of the detector block.

c. Disconnect detector tubing from inlet and outlet tubing (fittings located outside of detector housing) by using 7/16-inch and 5/16-inch open end wrenches.

d. Completely unscrew the four (4) screws located at the base of the detector block (Figure 8-1, Screws 1, 2, 3, & 4).

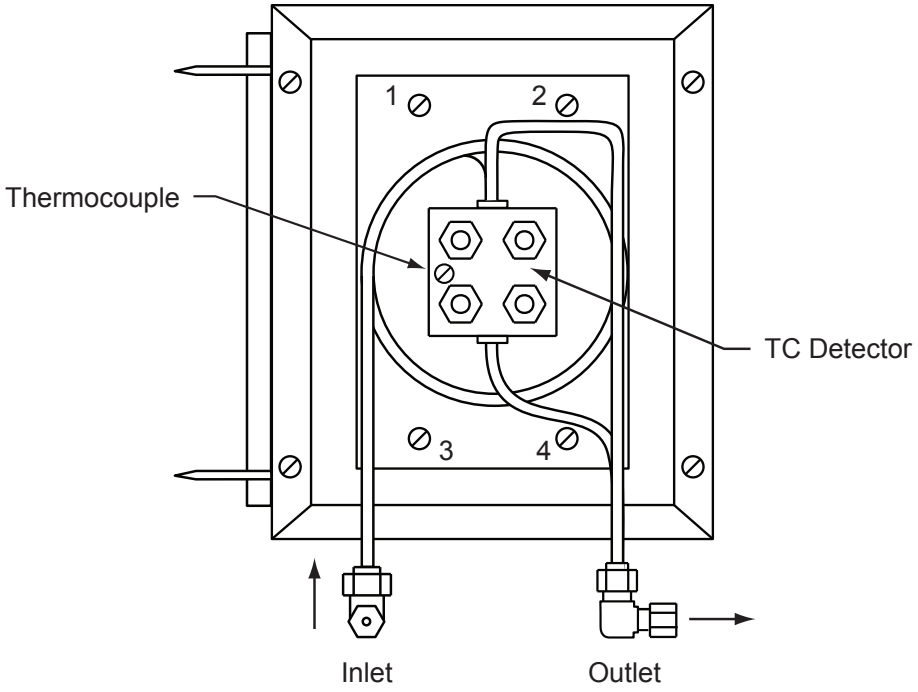


Figure 8-1: TC Detector in Cell Housing

e. Gently pull detector out of cell housing.

f. Unscrew insulation block from detector.

g. To replace detector, go in reverse order of above steps. **Leak check system**.

B. Maintenance

1. Check zero.

2. Check flow rates.

3. Observe whether heater indicator is at set temperature.

A. Troubleshooting the TC Detector

1. Make all daily service checks.
2. Check terminal hold-down screws.
3. Check flow for pulsations or wide variations.
4. If the above checks are made and erratic operation still exists, replace TC Detector.

B. Troubleshooting the Analyzer

SYMPTOM	POSSIBLE CAUSE	REMEDY
No bridge current	a. Fuse on power supply open	Replace fuse
	b. Filaments open	Replace filaments
	c. Defective power supply	Replace power supply
	d. Current not on	Turn on current and then increase current
TCD housing hotter than normal	a. Sensor probe shorted	Check for bare wires & tape over; Replace probe
	b. Set point on pot. incorrectly set	Call GOW-MAC Eng.
	c. Controller defective	Replace controller
Unable to Zero TCD	a. Filaments oxidized	Replace filaments
Baseline unstable	a. Leaks in flow system	Leak check system
	b. Power supply not regulating	Replace power supply
	c. Temp. controller not holding	Replace temp. controller temperature
	d. Defective filaments	Replace filaments

C. Troubleshooting Calibration Issues

SYMPTOM	POSSIBLE CAUSE	REMEDY
ZERO VOLTAGE (Z) setting acquired in zero calibration step is not greater than 0.1 VDC and/or the “R=” value does not consistently fluctuate after pressing ZERO (F4).	a. Current setting too high	Lower Current Setting and re-zero.(Section 6.C.1)
SPAN VOLTAGE (S) setting acquired in span calibration step is locked at “0000” or indicates an OVERRANGE condition.	a. Current setting too high	Lower Current Setting, re-zero, then re-span. (Section 6.C.1)
Concentration Display indicates a negative value after SPAN	a. Thermal conductivity of SPAN gas may be lower than Reference Gas	Change POLARITY (Section 6.C.1 Menu Options)
ZERO or SPAN readings not stable	a. Instrument not stable	Allow more time for instrument to stabilize. Be sure flow rates, current, and temperature are all properly set. (See QC Record or General Service Bulletin)
	b. Leak in system	Leak check all gas lines and fittings

Phone GOW-MAC for technical support or service @ (610) 954-9000.

PART NO.	DESCRIPTION
120-162	Filament Failsafe, Pressure Switch, set at 2 psig
120-173	Main Power Switch/5 amp Circuit Breaker
120-239-24	Switch, purge pressure, 24 VDC
122-114	Relay, solid state, 25 A
123-124	Power Supply, quad
123-159-3	Signal Amplifier PCB
123-188-5100	TTL to Relay Driver Interface (115 V)
123-188-5100-230	TTL to Relay Driver Interface (230 V)
123-191-2	Power Supply, constant current, 115 VAC
123-191-2-230	Power Supply, constant current, 230 VAC
123-278-1	PCB Controller
123-287-1	PCB, personality
123-298-1	PCB, 4-20 mA backplane
124-175	Temperature Probe
124-181	Heater, 100 Watt, 120 VAC
124-182	Heater, 100 Watt, 240 VAC
124-262-20-50	Detector Temperature Controller, programmed
127-406	Filter, RFI power line, 10 A, 250 VAC
128-260	Display, vacuum fluorescent
128-269	Gauge, pressure, 0.5 inch water
180-432-3	Solenoid Valve, 2-way, NC, 3-stacked
180-469	Mini Pressure Regulator, 60 psi
*180-889-1	Electronic Pressure Regulator, light gases (He & H_2 only)
*180-889-2	Electronic Pressure Regulator, heavy gases (all other gases)
**180-250	Neon rotameter, aluminum
**180-338	Air rotameter, aluminum
**180-376	Hydrogen rotameter, stainless steel

**180-377 ..... Argon rotameter, aluminum

**180-470 ..... Hydrogen rotameter, aluminum

**180-472 ..... Air rotameter, stainless steel

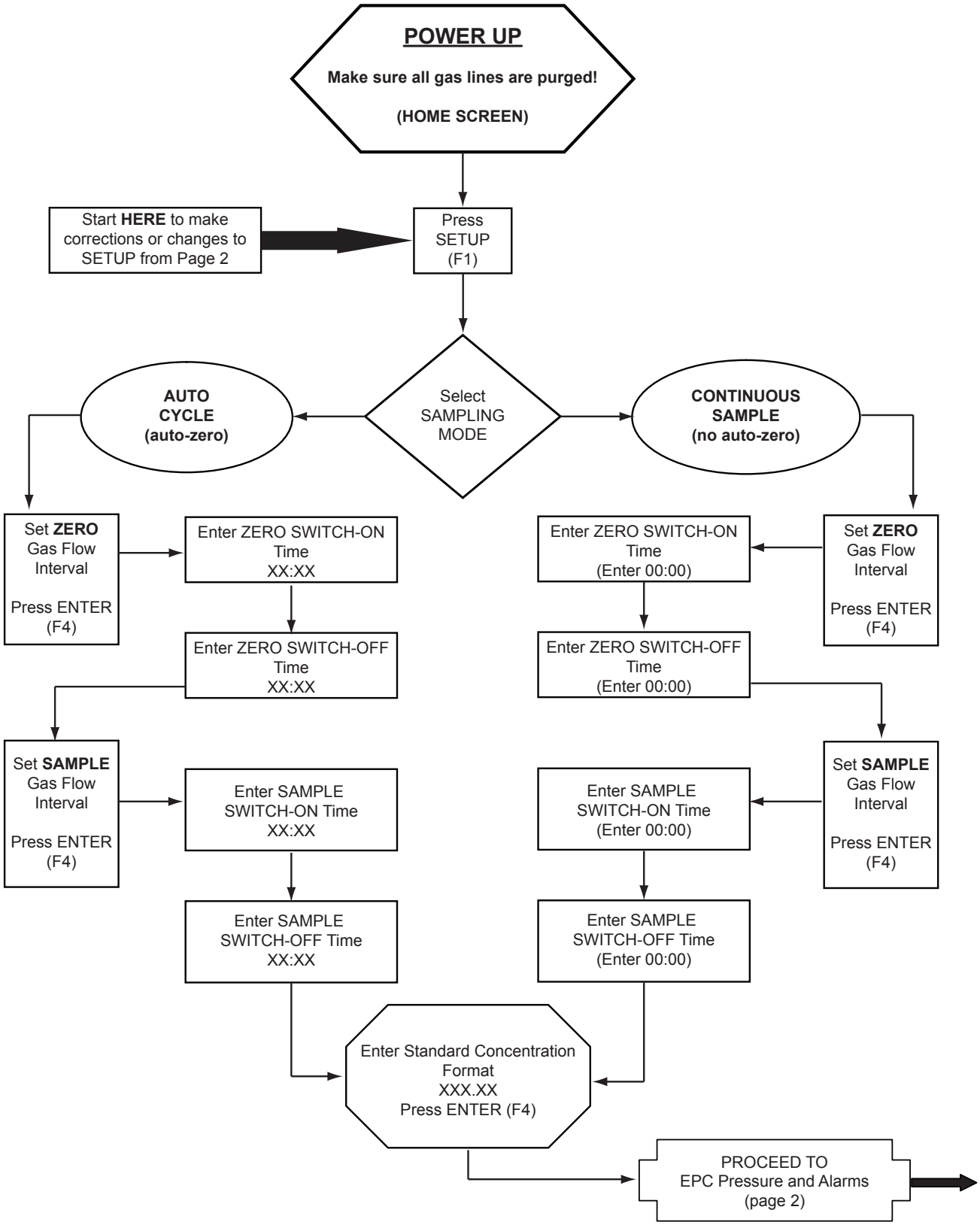
**180-928 ..... Carbon monoxide (CO) rotameter, aluminum

*Note: Electronic pressure regulator depends on the major component of the gas mixture of the specified analysis at time of ordering.

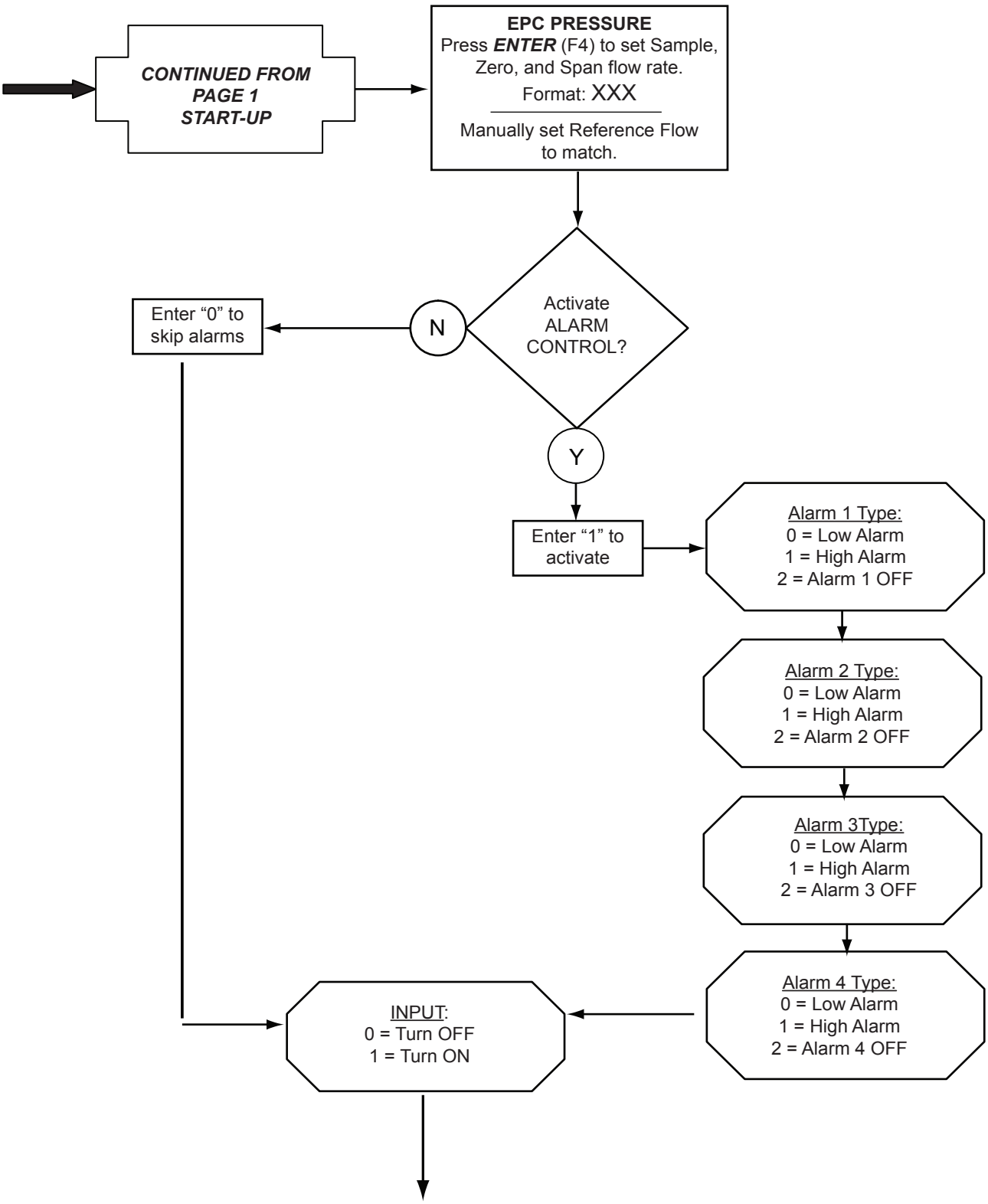
**Note: Rotameter depends on zero gas of the specified analysis at time of ordering.

Appendix A: 5100 Series Quick Start Reference Flow Chart

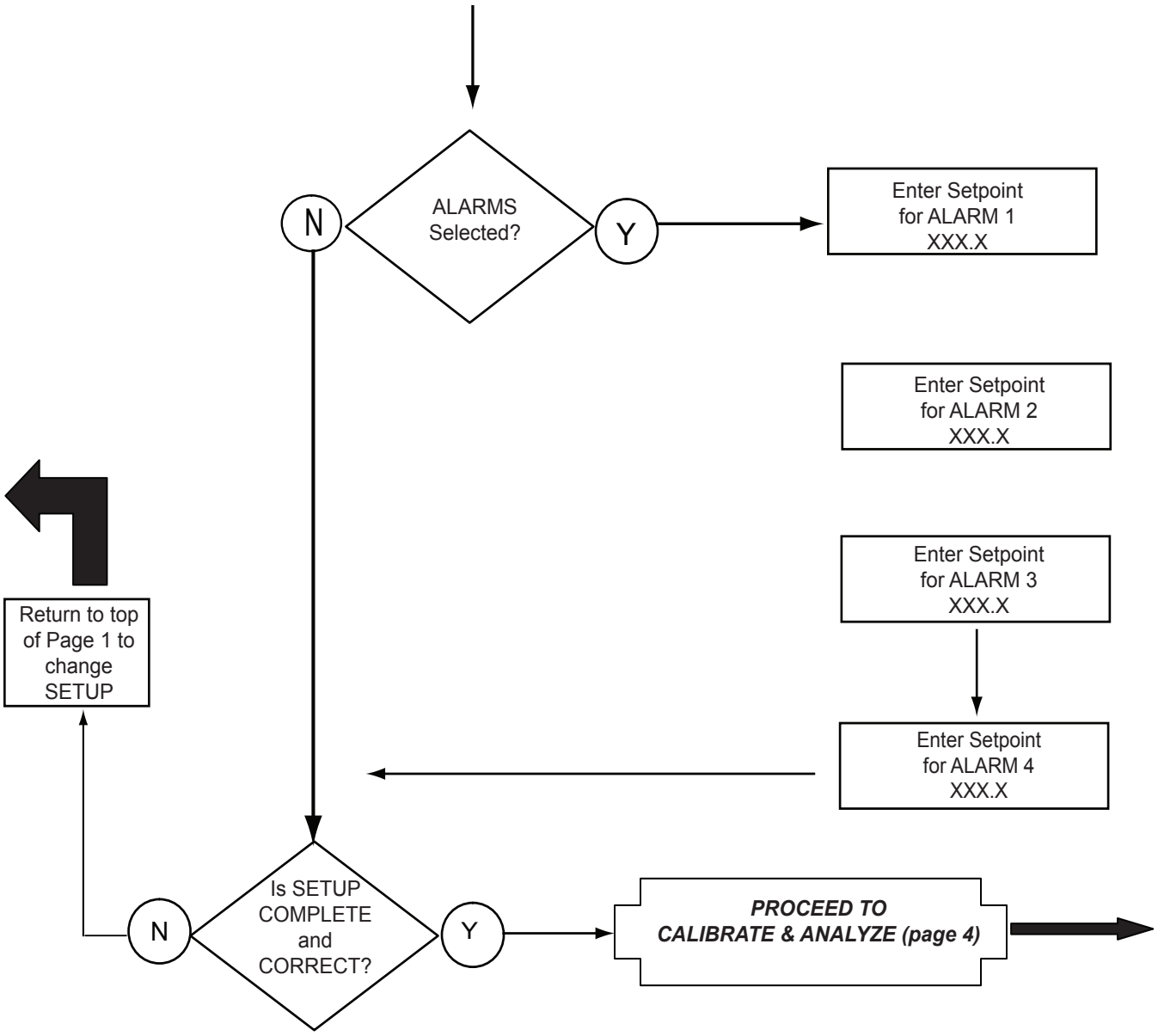
5100 Series Quick Start Reference Flow Chart
START-UP (page 1)
(Refer to Operating Manual for Detailed Instructions)



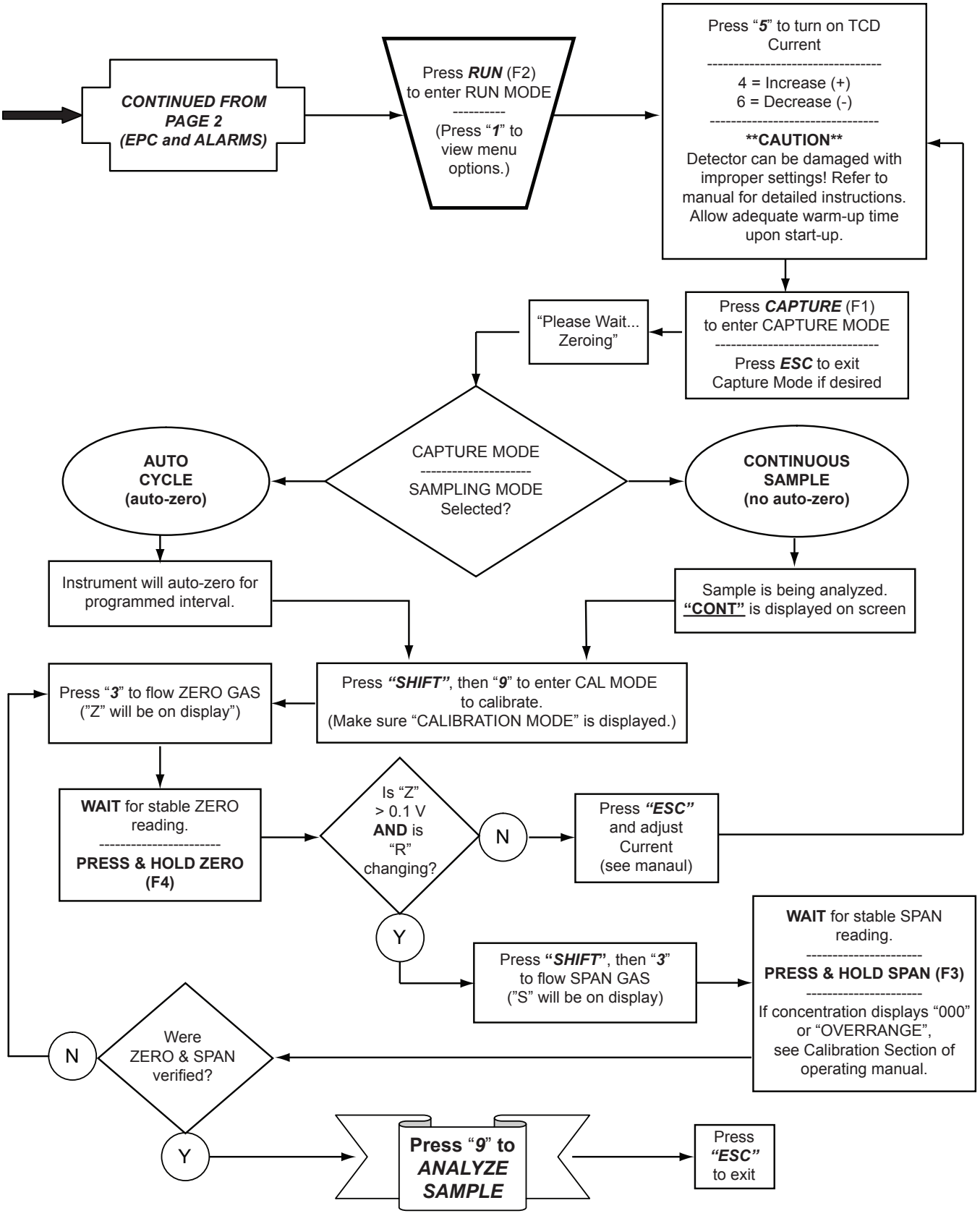
5100 Series Quick Start Reference Flow Chart
EPC and ALARMS (page 2)
5100 Series Quick Start Reference Flow Chart



5100 Series Quick Start Reference Flow Chart
EPC and ALARMS (page 3)



5100 Series Quick Start Reference Flow Chart
CALIBRATE and ANALYZE (page 4)
(Refer to Operating Manual for Detailed Instructions)



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.