# *Operating Manual*

**Models A16-0001, A16-0002, A16-0004**
**Portable Blender for Gas Standards**

Model A16-0001: 90-264 VAC / 47-63 Hz
Model A16-0002: 90-264 VAC / 47-63 Hz
Model A16-0004: 90-264 VAC / 47-63 Hz

**December 2021**

Rev. 5

**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

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

1. The warranty period begins with the shipping date of the equipment to the original purchaser.

2. Certain parts such as batteries, fused, glass accessories, septa, columns, etc., are expendable in normal use, and their service life is unpredictable. Such items are not covered by this warranty.

3. Filaments of thermal conductivity detectors are not covered by this warranty.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

# Contents

## 1-0 Models A16-0001, A16-0002, and A16-0004 Portable Blenders for Gas Standards

1-1 The GOW-MAC Models A16-0001, A16-0002, and A16-0004 blenders are designed for generation of non-corrosive calibration standards for gas analyzers and chromatographs, including $N_2O$, atmospheric gases, and hydrocarbons. The highly repeatable mixing is accomplished by two mass flow controllers that allow a maximum dilution ratio of 2000:1. The blenders are portable and, with external 24 V power supply, can be used with an input voltage range of 90 to 264 VAC, 47-63 Hz.

1-2 Features of the A16-0001, A16-0002, and A16-0004 make them suitable for blending part per billion (ppb) standards for some of the most sensitive detectors on the market. They are built for precision and repeatability. The blenders have electro-polished wetted surfaces, face seal-type critical tubing connections, high purity diaphragm shut-off valves, and zero dead volume. Each mass flow controller has a panel-mounted display and control module.

1-3 On the A16-0001, control and monitoring of gas flows is manual using the panel-mounted displays. The A16-0002 adds monitoring and control capability from a remote computer. The A16-0004 uses a sample gas mass flow controller, 1 to 100 sccm instead of 1 to 50 sccm.

## 2-0 Specifications

| | |
|---|---|
| Flow Ranges | A16-0001 & A16-0002:<br>Sample Gas: 1 to 50 sccm<br>Dilution Gas: 40 to 2000 sccm<br><br>A16-0004:<br>Sample Gas: 1 to 100 sccm<br>Dilution Gas: 40 to 2000 sccm |
| Accuracy | |
| Concentration: | ± 2% of set point |
| Flow: | ± 1% of full scale of each mass flow controller |
| Sample channel: | ± 0.5 ccpm He |
| Dilution channel: | ± 20 ccpm He |
| Repeatability: | < 0.2% Rd |
| Warm Up Time: | 30 minutes for best accuracy |
| Gas Supply Pressure (Blender IN, $P_1$) | |
| Minimum: | 5 psig (0.4 barg) |
| Recommended: | 65 psig (4.5 barg) |
| Maximum: | 145 psig (10 barg) |
| Gas Delivery Pressure (Blender OUT, $P_2$) | |
| Minimum: | 0 psig (0 barg) |
| Maximum: | 80% of $P_1$ |
| Operating Temperature for Best Performance | 59 °F to 95 °F (15 °C to 35 °C) |

| | |
|---|---|
| Operating Temperature | 32 °F to 122 °F (0 °C to 50 °C) |
| Displays for Sample and Dilution Flow Control | 1.6” OLED display<br>4 push buttons for menu operation |
| Gas Connections:<br>Internal particle filter: | 1/4-inch VCR face seal<br>2 micron |
| Manual Shut-Off Valves: | diaphragm seal, round handle with open and closed indication, 3/4-turn |
| Wetted Materials: | 316L stainless steel<br>Nickel VCR gaskets<br>Viton mass flow controller seals and plunger |
| Power | 100 to 240 VAC @ 50 to 60 Hz |
| Dimensions | 11" W x 8" H x 11" D (28 cm x 21 cm x 28 cm) |
| Weight | 11.0 lb (5.0 kg) |

## 3-0 Instrument Operation

3-1 Cabinet. The blender cabinet has a bale so the front panel can be tilted up about 12 degrees for better access. With the bale extended, the mass flow controllers are also tilted 12 degrees which will not affect their accuracy. The cabinet should rest on a flat surface or tilted no more than the 12 degrees that the bale affords. Avoid placing items on top of the cabinet during operation. Below the cabinet handle is a slot which allows heat to vent from the cabinet.

3-2 Location. Avoid installation in close proximity to mechanical vibration or heat sources. The blenders are rated IP-40 meaning that the electronics housing and electrical connections offer no protection against moist environments or incidental water.

3-3 Front Panel

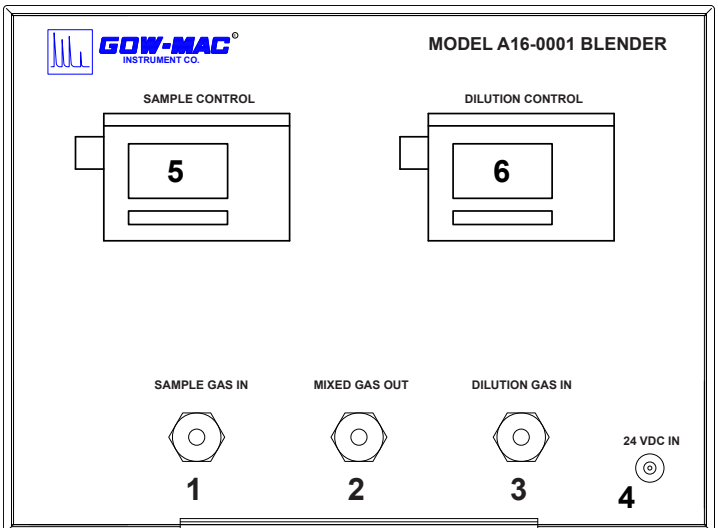


Figure 3.1 Front Panel, A16-0001 and A16-0004

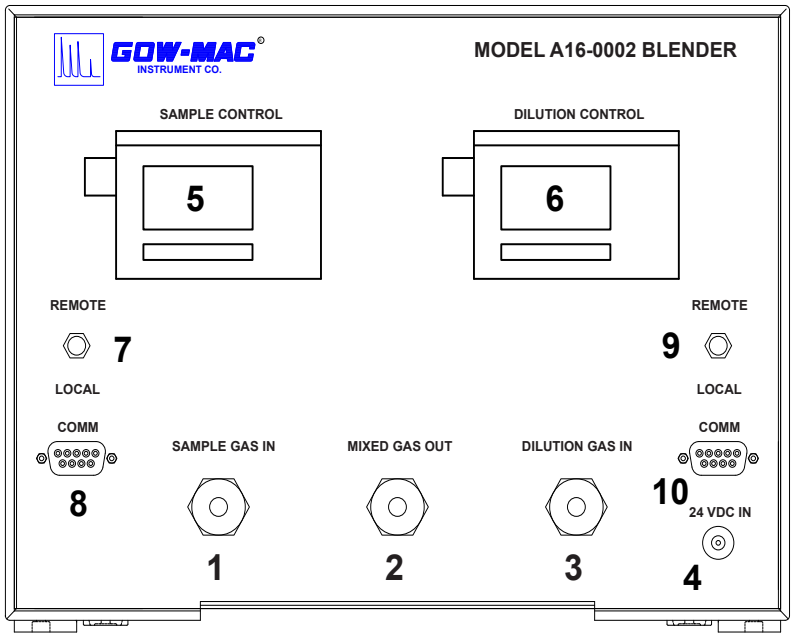


Figure 3.2 Front Panel, A16-0002

1 through 10 refer to the numbers on Figures 3.1 and 3.2. Numbers 1 - 6 are on all Models A16-0001, A16-0002, and A16-0004. Numbers 7 - 10 are only on Model A16-0002.

1 ***SAMPLE GAS IN*** connection. Connect the sample gas to the SAMPLE GAS IN fitting on the blender front panel. The fitting size is 1/4-inch VCR male. A VCR gasket **MUST** be inserted in all VCR fitting connections (GOW-MAC part number 175-171). Supplied gas pressure should be set to 65 psig (4.5 barg) if possible. $P_1$ can be in the range of 5 psig (0.4 barg) to 145 psig (10 barg).

2 ***MIXED GAS OUT*** connection. Connect the MIXED GAS OUT fitting on the blender front panel to the Calibration In connection on the instrument. The fitting size is 1/4-inch VCR male. Use VCR gasket in the connection. The back pressure on the blender, $P_2$, can be in the range of 0 psig (0 barg) to 80% of the inlet pressure, $P_1$.

3 ***DILUTION GAS IN*** connection. Connect the dilution gas to the DILUTION GAS IN fitting on the blender front panel. The fitting size is 1/4-inch VCR male. Use VCR gasket in the connection. Supplied gas pressure should be set to 65 psig (4.5 barg) if possible. $P_1$ can be in the range of 5 psig (0.4 barg) to 145 psig (10 barg).

4 ***POWER CONNECTION.*** The blenders are shipped with an external power supply that converts 90 to 264 VAC, 47 to 63 Hz to 24 VDC. They also include a line cord with plug specific to the country of the end user of the original order. The line cord part number is 127-407-“Country Code”, for example 127-407-CHINA. Contact GOW-MAC for different line cords that you may need in various countries. (alternate – refer to the list of line cords in the Replacement Parts Section). Plug the power supply output into the jack labeled 24 VDC IN on the blender front panel.

5 ***SAMPLE CONTROL***. The right hand edge of the display has an elastic boot covering four switches. The SAMPLE CONTROL display is dedicated to the sample gas mass flow controller. Refer to the detailed operating instructions for this control device in the Bronkhorst Bright Instruction Manual located at the end of this manual.

6 ***DILUTION CONTROL***. The right hand edge of the display has an elastic boot covering four switches. The DILUTION CONTROL display is dedicated to the dilution gas mass flow controller. Refer to the detailed operating instructions for this control device in the Bronkhorst Bright Instruction Manual located at the end of this manual.

7 ***REMOTE/LOCAL SWITCH FOR SAMPLE DISPLAY***. This switch controls where the display is shown. Local is for display on the A16 blender. Remote is for display to be shown on a computer.

8 ***COMM DB9 CONNECTION FOR SAMPLE DISPLAY***. Connect cable from this connection to DB9 connection on computer.

9 ***REMOTE/LOCAL SWITCH FOR DILUTION DISPLAY***. This switch controls where the display is shown. Local is for display on the A16 blender. Remote is for display to be shown on a computer.

10 ***COMM DB9 CONNECTION FOR DILUTION DISPLAY***. Connect cable from this connection to DB9 connection on computer.

## 3-4 Back Panel

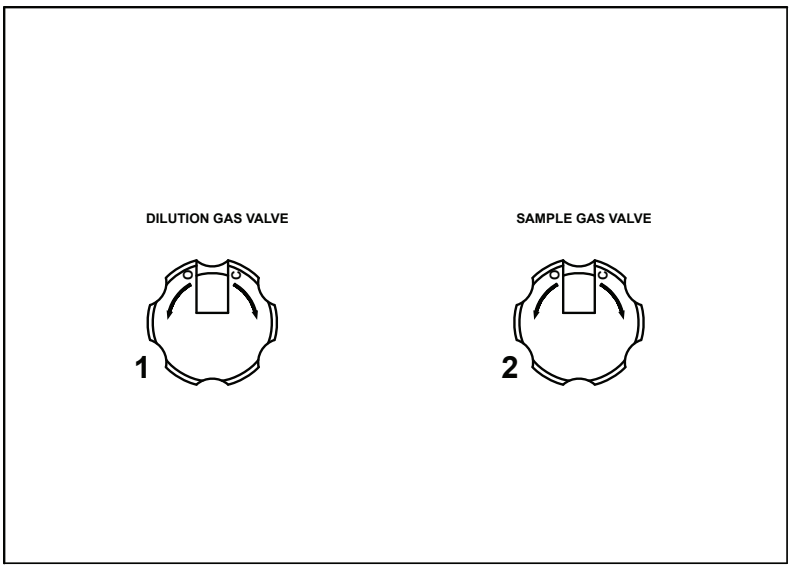


Figure 3.3 Back Panel

1 and 2 refer to the numbers on Figure 3.3 and are on all Models A16-0001, A16-0002, and A16-0004.

1 ***DILUTION GAS VALVE***. The DILUTION GAS VALVE is a 3-port diaphragm shut-off valve that should be in either the full open or full closed position. In the closed position, it provides positive dilution gas flow shut-off and a fully swept mixing manifold (no dead leg). In the open position, flow through the dilution gas mass flow controller is unimpeded (refer to the blender flow diagram).

2 ***SAMPLE GAS VALVE***. The SAMPLE GAS VALVE is a 3-port diaphragm shut-off valve that should be in either the full open or full closed position. In the closed position, it provides positive sample flow shut-off and a fully swept mixing manifold (no dead leg). In the open position, flow through the sample mass flow controller is unimpeded (refer to the blender flow diagram).

The greatest accuracy for the mass flow controllers occurs between 10% and 90% of their operating full scale. Choosing flow rates set-points that fall within this range will provide more accurate results.

## 4-0 Gas Blending Calculation and Example

The blended concentration can be calculated by the equation:

$$C_i = \left( \frac{Q_s}{Q_s + Q_d} \right) \text{ x } C_I$$

Equation 1

$C_I$ = Concentration of component I in the original sample

$C_i$ = Concentration of component I in the diluted sample

$Q_s$ = Sample flow rate

$Q_d$ = Dilution flow rate

*Example:*

10.1 ppmv $CH_4$ in helium needs to be diluted. The sample flow rate is 20 standard cubic centimeters per minute (sccm). The dilution helium flow is 980 sccm. The final blended $CH_4$ concentrations will be:

$$\left( \frac{20 \ sccm}{20 \ sccm + 980 \ sccm} \right) \text{ x } 10.1 \ ppm = 0.202 \ ppmv = 202 \ ppbv$$

Equation 2

## 5-0 Troubleshooting

The following section is used with the permission of Bronkhorst USA.

## 6-0 Maintenance

6-1 The only scheduled maintenance for the A16 blenders is replacement of the filter VCR gaskets at the inside ends of the two supply gas bulkhead VCR fittings. Frequency of replacement will depend on the particle contamination of the supply gases. ***The 2 micron filters are required to keep clear the small orifices and moving parts in the mass flow controllers. Operation of the blender without the filter gaskets is not recommended and will void the warranty of the A16 Blenders.***

To access inside the blender cabinet, first the back panel must be removed. The following tools will be needed:

#2 Philips screwdriver
3/32-inch Allen wrench
5/64-inch Allen wrench
1-1/8-inch Crescent or open-ended wrench

6-2 The shut-off valves are panel-mounted on the back panel so their handles must first be removed.

6-2-1 To remove the valve handles, turn the handle to access two (2) set screws.

6-2-2 Remove the set screws with the 3/32-inch Allen wrench.

6-2-3 Remove the handle.

6-2-4 On the display part of the handle, remove two set screws with the 5/64-inch Allen wrench.

6-2-5 Remove the display part.

6-2-6 Remove the panel mount nut with the 1-1/8-inch wrench.

6-2-7 Remove the four Philips screws attaching the back panel.

6-2-8 Remove the back panel. The valves will be supported by the tubing. To remove the cabinet cover, slide it away from the front panel and pull up and out of the cabinet chassis.

6-3 To replace the filter gasket, back off the VCR nut with a 3/4-inch open-ended wrench. Gently pull the VCR connection apart until the filter gasket falls out or can be pushed out. Insert a new filter gasket and center between the face seals. Tighten the VCR nut by hand. Using the wrench, tighten the nut a further 1/8 of a turn, or through 45 degrees. Reassemble the back panel in the opposite order of disassembly. Although the filter part of the gasket could be cleaned ultrasonically, re-use of a used filter gasket is not recommended due to uncertainty aligning the crimps, thus risking a leak.

## 7-0 Replacement Parts

| Part No. | Description |
|---|---|
| 120-119 | Toggle switch |
| 123-312 | Power Supply, external, 100 to 240 VAC @ 50 to 60 Hz |
| 128-275 | Display/Control Panel |
| 175-125 | FIlter, 2 micron on VCR gasket |
| 175-171 | Gasket, Ni, unplated, 1/4" VCR |
| 180-900 | Mass Flow Controller, 50 sccm |
| 180-1008 | Mass Flow Controller, 100 sccm |
| 180-901 | Mass Flow Controller, 2000 sccm |
| 180-902 | Valve, low pressure diaphragm |
| 127-407 | Power cordset (USA) |
| 127-407-Argentina | Power cordset (Argentina) |
| 127-407-Australia | Power cordset (Australia) |
| 127-407-China | Power cordset (China) |
| 127-407-Denmark | Power cordset (Denmark) |
| 127-407-Europe | Power cordset (Europe) |
| 127-407-Hong Kong | Power cordset (Hong Kong) |
| 127-407-India | Power cordset (India) |
| 127-407-Israel | Power cordset (Israel) |
| 127-407-Italy | Power cordset (Italy) |
| 127-407-Japan | Power cordset (Japan) |
| 127-407-Switzerland | Power cordset (Switzerland) |

## 8-0 Drawings

## 8-1 A16-0001

| | |
|---|---|
| Drawing A-21358 | Flow Diagram |
| Drawing A-21359 | Wiring Schematic |

## 8-2 A16-0002

| | |
|---|---|
| Drawing A-21358 | Flow Diagram |
| Drawing B-21406 | Wiring Schematic |

## 8-3 A16-0004

| | |
|---|---|
| Drawing A-22701 | Flow Diagram |
| Drawing B-21359 | Wiring Schematic |

## 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/device/part being returned **will not** be accepted into GOW-MAC's facility until we receive this completed document. Once the product has been approved for return by our Chemical Safety Officer, an acknowledgement will be promptly issued to you with notification of your **Return Materials Authorization (RMA) number** and the procedure to follow for returning the product. *All applicable regulations should be followed when returning instrumentation, devices, 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/device/part WILL NOT be permitted into our facility for servicing!***

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

_____

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

❑ Yes – see below ❑ No – proceed to C.

*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/device/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._____

   _____

C] 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:**

❑ **Passed** Safety Inspection. **OK** to proceed to Repair Dept.

❑ **Failed Safety Inspection. DO NOT** proceed to Repair Dept.

Signed: _____

Chem. Safety Off.

**RMA No:** _____

Date ____/____/____

Comments: ( ) None

( ) On Back >>>>

GOW-MAC® INSTRUMENT CO.

277 Brodhead Road, Bethlehem, PA 18017 U.S.A. Tel: (610) 954-9000 Fax: (610) 954-0599 E-mail: sales@gow-mac.com URL: www.gow-mac.com