

# AGM 500 Series

## Operation Manual



**GfG Instrumentation**

Worldwide Manufacturer of Gas Detection Solutions



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## **For your safety**

Like any piece of complex equipment, the GfG AGM 500 series will do the job it was designed to do, only if it is used and serviced in accordance with the manufacturer's instructions. All individuals who have or will have the responsibility of servicing the equipment must carefully read this manual.

The warranties made by GfG Instrumentation with regards to this instrument are voided, if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others who depend on this instrument by following these instructions. The above does not alter statements regarding GfG Instrumentation's warranties and conditions of sale and delivery.

## **Introduction to the AGM500 hazardous gas monitor**

The AGM 500 combines the best available gas sensors with the most advanced micro processing electronics to make the finest confined space instrument.

Gas detection instruments contain sensors which require periodic calibration. The AGM's AutoCal® feature greatly simplifies and reduces the time required for calibration. To aid you in tracking your calibration history the AGM displays the last successful calibration date and time when first switched on.

**Please check frequently for proper operation and treat the instrument with the respect due a device that can save your life.**

This instrument was designed and tested for intrinsic safety. This instrument was tested for intrinsic safety in explosive gas/air (21% O<sub>2</sub>) only. The unit is UL/ANSI 913 approved.

All AGM's have a PTO (power take-off) port to connect a PC for transferring data logging information and to power a mini-pump or HiLite for remote sampling. The program is resident in each AGM to operate these optional accessories and to accept other toxic sensors – consult the factory for complete information.

Note: The data logging function in the AGM 500 is shipped disabled and would require the optional PC program & cable (part number 4003-195) for set-up and use.

### **Operating the AGM500**

#### **ON/OFF key**

Turn the unit ON with the ON/OFF key and the unit will initiate a one minute warm up. During the warm up the last successful calibration date and time is displayed. At the end of the countdown the instrument will zero itself if the background air is fresh. If one of the sensors is detecting gas, its channel will fail to auto zero and will default back to the last successful zero. Following the warm up a warning message appears indicating that the previous setting is being used.

Note: See auto zero discussion (see AutoCal®).

After the countdown the standard gas exposure display will appear.

To turn the AGM Off, press and hold the ON/OFF key for three seconds. This feature is designed to prevent accidental shut off.

### **Function (GfG key)**

Pressing the "GfG" (FUNCTION) key will place the unit in TWA display mode showing the toxic TWA readings (see Appendix A for an explanation of TWA) and run time. Pressing it again will return the display to the standard gas exposure mode.

Holding the "GfG" key depressed for 4 beeps will move the toxic gas exposure display from CO to H<sub>2</sub>S or vice versa. Generally the unit should be set to the gas that is most likely to be encountered. Remember that both H<sub>2</sub>S and CO will be detected and shown on the one reading. When set to read CO, the alarm points are 200 PPM peak and 35 PPM TWA.

When reading H<sub>2</sub>S the peak alarm will be 15 PPM and 10 PPM TWA. If the AGM is being used in an environment where H<sub>2</sub>S gas is potentially present, it is recommended that the H<sub>2</sub>S display be selected. This gives an extra margin of protection if CO is present – alarming at 46 PPM peak and 31 PPM TWA on CO (see Appendix B).

Note: All alarm points are adjustable during set up. Factory settings are to OSHA standards (see set-up).

### **Accessory modes**

Because the PTO port is used to connect and power accessories, it is necessary to program the monitor for the accessory in use. Three different modes will be displayed while pressing and holding the "GfG" key. Release the "GfG"

key to enter or advance. The order in which these appear will depend upon the beginning mode.

The monitor is shipped from the factory in RA mode, for interface with computer and general use with no accessory attached.

### **Pump mode**

Holding the "GfG" key depressed for 8 beeps (until the beeps cease) will program the monitor for the pump. The display will read [PUMP MODE NOW]. Release the "GfG" key. Power is now directed continuously through the PTO connector for the pump.

Since a "Low Flow Alarm" occurs when in the pump mode if the pump isn't operating, it is advisable to set the unit to the RA mode when the mini-pump is not attached.

**Note:** If the Accessory Alarm and Light is attached in pump mode, it will begin to alarm and can only be stopped by removing it from the monitor or turning the monitor off. To correct, advance the mode setting to [EXT ALRM MODE NOW].

### **Alarm mode**

The high intensity light/horn accessory requires the mode setting be advanced by again pressing and holding the "GfG" key for eight (8) beeps. When the beeps cease the display will indicate [EXT ALRM MODE NOW]. Release the key and install the accessory light/horn.

## **RA mode**

To return to the RA Mode (normal setting) repeat the procedure by holding the "GfG" key until the beeps cease and the display reads [RA MODE NOW]. This setting permits the PTO connector to be operated as an output for transferring data to PC.

**Note:** The TWA Mode display is always accessed by holding the "GfG" key depressed for one beep regardless of the Accessory Mode selected.

## **Hold key**

When the HOLD key is depressed for up to three (3) beeps, the unit will retain (Latch) the peak readings. This feature is useful for taking readings prior to entering a confined space. When in the hold mode, an "H" will appear in the middle of the bottom line of the display. If the unit is lowered into a confined space and then removed, the peak values will be retained on the display. If a gas exposure reaches the alarm point, the alarm will sound until the HOLD key is again pressed, releasing both the display and the alarm.

If the HOLD key is depressed for more than three (3) beeps, the display reading [SAMPLE LOGGED] will indicate the unit is recording a data sample. This is only applicable when operating the instrument as a data logger where the recorded information will be downloaded to a PC.

## **Alarms and display**

The AGM is equipped to alarm at both peak and time weighted Average levels (see Appendix A for explanation of TWA). With the mini-pump attached, a low flow alarm and a



low flow message on the display will occur if the pump is not operating properly or the intake is blocked.

A gas reading at or above the alarm level will activate the alarm light and horn and cause the gas reading to flash. In the case of a TWA alarm, the standard exposure display alternates with the letters "TWA".

A "FLT" message indicates that the zero readings have fallen below zero. Turn the unit off and back on to initiate a new Auto Zero.

When the low battery alarm sounds, the letter "B" appears in the center of the bottom line. The unit will turn off automatically in approximately fifteen minutes after the low battery alarms.

### **Charging**

Always place the AGM on the charger when not in use. The unit will rapid charge until the battery pack is about 90% charged and then trickle charge thereafter. During charge the display will indicate which part of the charging cycle the instrument is in.

Eight hours of rapid charging are required to bring totally discharged batteries to 90% of their capacity. Another few hours of trickle charging will bring them to 100% of capacity.

## **Operating suggestions and help**

### **Battery gauge**

The battery gauge is a measure of the batteries voltage. The voltage decreases as the unit is used. However, the battery voltage drop is not linear throughout the discharge period. The batteries discharge quickly when initially removed from the charger and then hold their voltage fairly constant throughout the run time until discharging rapidly during final hours of runtime. The battery gauge will display this gradual decrease in the number of bars until the end of the discharge cycle when they disappear more rapidly. The battery gauge is to be used as an approximate indication of the run time remaining.

### **Back lighting display**

Backlighting of the display is automatic in a dim environment. Covering the clear light sensor (sentinel) will increase the backlighting. Backlight use will consume more battery power and reduce the run time.

### **Operating auxiliary equipment**

To power the mini-pump from the PTO port, the instrument needs to be set to the PUMP MODE. The unit can operate as a data logger with either a pump or external horn light. To off-load data, remove the pump or external horn light from the PTO and connect to the PC (using the optional interconnect cable, P/N 4003-192). Be sure the AGM is in the RA MODE. To use the mini-pump or the HiLite, follow the prompts displayed when the "GfG" key is pressed. The mini-pump and HiLite plug into the PTO port and fastens to the sensor bay with the captive screw. The PTO cap is stored in the opening formed by the pump and instrument. When the AGM is turned on and

the program set to PUMP MODE as described, the pump will also turn on. The AGM with pump attached will operate continuously for more than 12 hours from the instrument's batteries.

**CAUTION: Do not operate the AGM in pump mode without the hydrophobic filter or damage to monitor may result.**

When a blockage or low flow occurs in the inlet, the AGM will alarm and a "Low Flow" warning appears on the display. A hydrophobic filter on the pump's sample wand prohibits water from entering the pump.

### **Set-up mode**

To enter the set-up mode turn the unit off. Press and hold the HOLD key while turning the unit on, and then release each key when the SET-UP message appears.

The display will read combustible gas in %LEL (standard) or % CH<sub>4</sub> (mining). The ON/OFF key or "GfG" key will change the setting.

Pushing the HOLD key again will index the display to the combustible sensor's alarm point. Pushing the ON/OFF key will lower the alarm point. Pushing the "GfG" key will raise the alarm point. Pushing the HOLD key again will index the display to the next sensor's alarm point setting.

The standard alarm value for combustible is 10% LEL or .5% V on methane (natural) gas depending which scale you select.

The standard percentage of oxygen in air throughout the world is 20.9% V. The oxygen low alarm is set at 19.5% V and enrichment alarm at 23.5% V.

The peak alarm for CO is the ceiling/STEL value of 200 PPM (factory set to 35 PPM) and the TWA value of 35 PPM when the instrument's readout is set for CO.

The peak alarm for H<sub>2</sub>S is the ceiling/STEL value of 15 PPM (factory set to 10 PPM) and the TWA value of 10 PPM when the instrument readout is set for H<sub>2</sub>S.

Note: When changing the display from CO to H<sub>2</sub>S or vice versa with the "GfC" key, the alarm levels will also be switched to the appropriate values indicated above.

After setting the alarm points, the date and time may be changed using the ON/OFF and "GfG" keys.

After indexing through all the set-up displays, the unit will go into its 60 second warm up followed by the standard gas exposure display. To re-enter the set-up mode turn the unit off by holding the OFF key for three seconds and again depressing the HOLD key while pressing the ON/OFF key.

Note: If the battery is unplugged or the power is interrupted, the date and time must be reset.

**Introduction to error protected auto zero and AutoCal®**  
AGM instruments incorporate the very helpful AutoCal® function. AutoCal® greatly simplifies the operation of gas monitors. Thanks to AutoCal® the AGM is easy to operate, easy

to maintain and accurate. An easy to use, accurate monitor increases worker safety. To insure AutoCal® is dependable, protection is included to prevent false calibration. This could occur if the wrong test gas is used, a worn out sensor is present, or the unit warms up in an atmosphere where gas is present.

The AGM uses "error protection" to prevent these calibration errors. There are three safety checks which the computer uses to avoid calibration errors.

- First – to accept auto zero, a minimum variation from a base zero value is required. This prevents zeroing in a toxic or combustible background.
- Second – to AutoCal®, a minimum response to calibration gas is required. This prevents calibration on weak or faulty sensors nearing the end of their useable life.
- Third – the change to the calibration gain settings for all sensors must not exceed an allowable percentage of the previous calibration gain settings. Error protection will allow auto-calibration only when all these requirements are met.

When a unit is new, the sensors require some burn-in (settling or seasoning) time. They are exposed to varying conditions in shipping, including high heat and freezing. It is not unusual under these conditions for new units or those that have not been used recently, to require the error protection be temporarily disengaged. The error protection must temporarily be disengaged to allow gain adjustments that would otherwise exceed the acceptable parameters for AutoCal®. We will refer to this procedure as "manual

calibration". The error protection for minimum sensor response cannot be disengaged.

Under normal operating conditions the AGM will AutoCal® and no user intervention will be required.

### **Error protected auto zero**

In the event the AGM does not auto zero following the normal one minute warm up, the instrument will continue to use the values established by the last successful auto zero. The error protection for auto zero can be disengaged by turning the monitor OFF, then ON to repeat the warm up. Press and hold the HOLD key for the final five seconds of the countdown.

**CAUTION: Alcohols, esters and certain other gases as well as CO can interfere with the auto zero. It is highly advisable to remove the instrument to a fresh air environment before repeating the auto zero.**

Exercise extreme caution when deciding to disengage the zero protection. The most common reason for an unsuccessful auto zero is the presence of toxic or combustible gas in the atmosphere when the instrument is turned on. Overriding the error protection in the presence of gas will cause the instrument to read incorrectly and can be potentially dangerous.

**CAUTION: Do not disengage the auto zero error protection unless you are in clean, fresh air. Never turn the monitor OFF and ON in an alarm situation. Always**

**leave the area first when an alarm sounds and follow your company's safety policies.**

**Error protect AutoCal®**

A sensor can fail to AutoCal® under two conditions:

- 1) When the sensor response to gas is too low, or
- 2) A large gain adjustment is required based on the setting from the last calibration.

A weak sensor response (condition 1) will cause the following error messages to appear sequentially on the display following countdown: [CO (or other sensor) NOT CALED] [SERVICE SENSOR] [PUSH HOLD] [TO ACKNOWLEDGE].

**WARNING: The user will not be protected by this sensor!**

A sensor gain adjustment that is too large to be acceptable for AutoCal® (condition 2) will cause the following messages to be displayed following the calibration countdown: [CO (or other sensor) NOT CALED] [PUSH HOLD TO] [MANUALLY CAL]. Press HOLD when instructed to complete the calibration of the sensor.

Follow the additional prompt messages to complete the calibration.

**CAUTION: Be sure you are using the correct calibration gas, and flow rate when error protection is disengaged.**

If the unit is calibrated frequently, calibration will usually be automatic. If the unit goes for extended periods without

calibration, however, it may be necessary to override the error protection because large changes in sensor output have occurred since the last calibration.

The override will not allow a manual calibration when a sensor's output is too low or when the combustible sensor's zero moves above 20 counts. If the combustible sensor is unable to zero at the end of the warm-up countdown and the instrument is in clean air, the combustible counts must be reset. This five minute procedure is described under combustible sensor (see combustible sensor). The unit will probably not need to be adjusted again during the life of the combustible sensor.

### **Auto zero / AutoCal® trouble shooting**

#### **Failure to auto zero**

May be caused by the following conditions:

1. Gas or vapors are present in the atmosphere and the error protection is alerting you to unclean air. Solution: Go to a fresh air environment or use calibration air (zero gas) during the warm-up countdown following turn on.

**NOTE:** Never attempt to auto zero with calibration gas supplied to the monitor.

2. Sensor response has changed due to settling or aging of the sensor. Solution: Press and hold the HOLD key during final seconds of warm-up countdown in a fresh air environment.

3. Combustible sensor "counts" exceed the upper limit. Solution: Adjust combustible zero potentiometer (see changing a combustible sensor).



**Failure to AutoCal®**

May be caused by the following conditions:

1. Unacceptable calibration gas (type or concentration) or empty gas cylinder. Solution: Use the correct gas type, concentration and flow rate (see calibration).
2. Sensor response has changed due to settling or aging of the sensor. Solution: Press and hold the HOLD key when instructed by the display for a manual calibration.
3. Sensor failure – sensor output is too low for AutoCal® or manual calibration to be successful. Solution: Sensor must be replaced by competent technician or factory.

**Calibration**

GfC's calibration kit part number 7773-001 is required to calibrate the unit. The kit includes a gas valve, tubing, calibration connector, and part number 7802-016 test gas which contains 50% LEL methane and 200 PPM carbon monoxide. The calibration connector has a sliding switch that activates the calibration switch inside the instrument. The purpose of the sliding switch is to allow a test of the unit to confirm the gas levels without initiating a calibration. When the switch is in the "cal" position and placed over the sensor area, it will initiate AutoCal®. Using the captive screw, secure the calibration connector to the sensor bay. Be sure the calibration connector edges are fitted over the grill area and are firmly resting on the top of the case. Correct orientation places the switch in the lower right corner.

**Note:** The monitor must be warmed up for at least 60 minutes before attempting calibration.

To calibrate, slide the switch to the "cal" position (far right). With the calibration connector in place and the message reading [FLOW GAS], open the gas valve. The messages [AUTOCAL® FINISHED], [REMOVE GAS] will follow the countdown if calibration is successful.

Failure to calibrate will cause one of two messages:

1. [(Sensor) NOT CAL] [SERVICE SENSOR] [PUSH HOLD] [TO ACKNOWLEDGE]. If this message appears, it indicates that the sensor is not responding adequately to gas (be sure the proper gas is flowing over the sensor). It is not possible to manually calibrate this sensor. It must be serviced. If you choose to continue with the calibration of the other sensors, press the HOLD key as instructed.

**WARNING: The user will not be protected by this sensor!**

2. [(Sensor) NOT CAL] [PUSH HOLD TO] [MANUALLY CAL]. If this message appears, it indicates the gain setting for this sensor will be adjusted beyond the error protected limit acceptable for an AutoCal®. (See error protected AutoCal®.) Pressing the HOLD key when instructed will allow the necessary adjustment to occur. This sensor will now be calibrated. Proceed with any additional instruction displayed by the monitor.

**CAUTION: Be sure you are using the correct calibration gas at 1.0 SCFH before disengaging the error protection with the HOLD key for a manual calibration.**

The AGM 502's toxic sensor is calibrated with relatively inexpensive carbon monoxide for both CO and H<sub>2</sub>S readings. The sensor detects both gases and has a fixed response ratio that allows the microprocessor to convert the CO readings into calibrated hydrogen sulfide readings. (See Appendix B: DualTox response table.)

Five minutes after calibration the AGM will initiate new TWA readings. The delay is to enable the calibration gas readings to return to zero.

GfG standard combustible calibration is for methane (CH<sub>4</sub>). If you are measuring a known combustible other than CH<sub>4</sub>, use a known % LEL concentration of that gas for calibration.

### **Bump/test**

Slide the switch to the left (bump/test). While gas is flowing, note the gas readings; acceptable readings will be within a few percentage points of the calibration gas. If a sensor's response is too weak, the unit will not calibrate.

No response or low response when gas is applied in the bump/test mode probably indicates a new sensor is required. See maintenance section.

**Note:** The displayed readings for gases other than the calibration gas may or may not correspond one to one with the meter reading.

### **Start-up following a sensor change**

After replacing a sensor, the AutoCal® may not calibrate the unit because of the error protection programming. The error

protection setting is based on a calibration value from the previous sensor and needs to be disabled when a new sensor is being installed.

To temporarily disengage the error protection to calibrate a new oxygen sensor and to zero new toxic or combustible sensors, push and hold the HOLD key when the warm-up countdown shows five seconds and hold until the auto zeroing message appears. Release the HOLD key. The unit will zero and display a standard 20.9% volume oxygen gas reading.

**Note:** DO NOT APPLY CALIBRATION GAS UNTIL A SUCCESSFUL AUTOZERO HAS OCCURRED.

To temporarily disengage the error protection and manually calibrate a new combustible or toxic sensor, push and hold the HOLD key when prompted by the display and hold until the [AUTOCAL® FINISHED] [REMOVE GAS] message appears. Release the HOLD key and the unit will be calibrated.

Error protection will automatically reengage.

## **Maintenance**

### **Opening case for battery replacement**

Turn the AGM Off prior to opening the case. Place on a solid surface and remove the screws from both ends and the sensor cover. Gently lift top slightly and tilt it towards the bottom (switch) end.

Holding the cover 90 degrees to the base allows access to the sensors. After sensors have been changed, reverse the

process. Position the rubber gasket on the base. Insert the top screw, then compress the bottom of the cover and insert the remaining screw.

### **Battery replacement**

The battery plugs into the bottom circuit board and is replaced by unplugging and plugging in a new one.

Note: Date and time must be reset, see set-up mode.

### **Sensor replacement**

To change sensors, remove the two screws that secure the sensor access cover.

### **Oxygen sensor**

Unplug the oxygen sensor from the circuit board and plug in the new one. The sensor's pins are aligned so only one orientation is possible. Warm up the unit for one hour to stabilize the sensor. Then follow the procedure for disengaging the oxygen error protection by pressing the HOLD key for the last five seconds of the warm-up. The unit will be calibrated at 20.9% volume when the unit comes out of warm up.

### **Carbon monoxide / hydrogen sulfide sensor**

Unplug the sensor by pulling up on it. Be sure to remove the new sensor's shorting wire between its contacts. Plug in the new sensor and warm up for one hour. To auto zero the new sensor, turn the unit off and then back on. If the sensor fails to auto zero repeat the warm up, pressing and holding the HOLD button for the last five seconds. It will now require gas calibration.

When calibrating a new toxic sensor, manual calibration is required. Follow the calibration directions (see calibration) until prompted by the display at the end of the countdown to press the HOLD button, hold until the [AUTOCAL® FINISHED] [REMOVE GAS] message appears.

**Note:** Do not open the packaging of new sensors until you are ready to install them. Exposure to oxygen decreases shelf life.

**Note:** Do not press on the center portion of toxic or oxygen sensors. Damage may result.

### **Combustible sensor**

Replace the old sensor by unplugging and replacing with the correct new sensor. Leave the case open and turn the AGM on.

Allow the sensors to warm up for 15 minutes. Switch the unit off and while holding the "GfG" key depressed, turn the unit back on. The display will read [COMB SET] and show a number. This number should be adjusted to about ten (10) to balance the new sensor's twin elements. Any number between 5 and 20 will allow auto zero of the combustible sensor. A small screwdriver control is located between toxic sensor B and the oxygen sensor. With a screwdriver or "pot tweaker" rotate the control until the number ten appears on the display. After setting to about 10 in the display, push the HOLD key which will advance the unit into the standard set-up mode; then index (using the HOLD key) through the set-up mode

until the warm-up countdown begins. The unit will auto zero and display the standard gas reading.

**Note:** DO NOT APPLY CALIBRATION GAS UNTIL A SUCCESSFUL AUTOZERO HAS OCCURRED.

Follow the calibration instructions (see calibration), except push the HOLD key when prompted by the display at the end of the calibration countdown. This temporarily disengages the calibration error protection and allows manual calibration of the new sensors.

When replacing the top cover, be sure that the sensors fit and the compartment is sealed. Replace the screws and turn the unit on.

**Note:** Following the installation of a new combustible sensor a readjustment of the combustible counts control may need to be made in two to three weeks.

### **Sensor missing alarm**

AGM-B models with serial numbers of 3000 and above are equipped to detect a missing toxic sensor. For this reason, monitors purchased from the factory without one or both of the toxic sensors installed will be equipped with an insert to bypass the sensor missing alarm.

To install a toxic sensor in this socket, simply remove the sensor cover and discard the black rubber insert. Note that Appendix C of the user's manual will guide you in the correct placement of the various toxic sensor combinations.

For instructions in setting the software to accommodate different sensors contact GfG Instrumentation customer service.

## **Glossary**

- % CH<sub>4</sub>:** The percentage by volume of combustible methane gas in an area. At 5% by volume the mixture of methane is at 100% LEL and will explode.
- % LEL:** A percentage of the lower explosion limit of a combustible gas (i.e., 20% LEL is 1/5 of the level of gas to have an explosion – also referred to as LFL)
- % VOLUME:** Percent volume (i.e., 20.9% V of oxygen is the standard percentage of oxygen by volume in air).
- CLEAN AIR:** An atmosphere which contains 0% LEL combustible, 20.9% volume oxygen, 0 PPM hydrogen sulfide, chlorine and sulfur dioxide, and less than 3 PPM carbon monoxide and 2 PPM total hydrocarbon.
- COMBUSTIBLE GAS:** Any gas that will ignite or explode – measured in %LEL or %V CH<sub>4</sub>.
- OXYGEN:** Percent of oxygen in the air – measured in % volume. Normal is 20.9% volume
- PPM:** Parts per million (i.e., 10 PPM H<sub>2</sub>S is 10 parts in a million parts of air).
- TOXIC GAS:** Any gas defined by the government as harmful to breathe – measured in PPM.
- TWA:** Time weighted average or threshold limit value of a gas. The government has set levels of toxic gas workers can be exposed to over a period of time (i.e., a worker may be exposed to 200 PPM carbon monoxide peak for a short time, but can not exceed 35 PPM average over eight hours). 35 PPM is the TWA for carbon monoxide.



## Replacement parts and accessories

For assistance contact your distributor or GfG Instrumentation at 1 (800) 959-0329 or 1 (734) 769-0573.

### Replacement parts

<b>Part number</b>	<b>Description</b>
1401-123	Shoulder strap
4001-027	Battery charger
4002-260	Nickel metal hydride battery pack
4003-188	PC interconnect cable
5701-014	Oxygen sensor
5704-014	Carbon monoxide / hydrogen sulfide sensor
5705-014	Combustible sensor
7802-016	Test gas - 50% LEL methane and 200 PPM carbon monoxide

## Accessories

Part number	Description
1401-122	Soft case with belt loop
4001-028	12 VDC vehicle charger
4003-195	PC program and connector for downloading data
7773-001	Calibration kit with case
7771-003	Hand aspirator attachment
7771-004	Mini-pump with wand, tubing and filter
9000-518	Hard carrying case includes space for calibration accessories

## Appendix A

### Calculation of TWA (time weighted average)

Note: OSHA uses an 8 hour work shift of a 40 hour work week to calculate TWA permissible exposure limits (PELS). NIOSH on the other hand uses a 10 hour workday of a 40 hour work week. Several organizations and other official bodies publish recommended PELs. The GfG AGM is factory set to OSHA published PEL's and uses the OSHA recommended formula for calculating the TWA.

The following information is taken from the OSHA standard 1910.1000 "Air Contaminants":

(3) (d) Computation formulae

(1) (i) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = (C_a T_a + C_b T_b + \dots C_n T_n) \div 8$$

Where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the 8-hour time weighted average limit in table Z-1, Z-2, or Z-3 for the material involved.

(ii) To illustrate the formula prescribed in paragraph (d)(1)(i) of this section, note that isoamyl acetate has a 8-hour time weighted average limit of 100 ppm. (table Z-1). Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm

Two hours exposure at 75 ppm

Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$(2 \times 150 + 2 \times 75 + 4 \times 50) \div 8 = 81.25 \text{ ppm.}$$

Since 81.25 ppm. is less than 100 ppm., the 8-hour time weighted average limit, the exposure is acceptable.

## **Appendix B**

### **DualTox CO / H<sub>2</sub>S response table**

Microvolts interpreted as parts per million gas Indicates OSHA standard alarm point.

The presence of either gas causes a chemical reaction increasing electrical conductance. H<sub>2</sub>S produces a response 2.5 X greater than CO.

The display will indicate the readings on the left when programmed for H<sub>2</sub>S. Setting the monitor for CO will cause the readings on the right.

## Appendix C

The AGM includes two toxic sensor sockets (toxic A, toxic B). Locate your monitor from the following list and note which socket is used for a specific sensor.

<b>Model</b>	<b>Toxic A</b>	<b>Toxic B</b>
500	0	0
502	0	CO / H <sub>2</sub> S
503	H <sub>2</sub> S	0
504	0	CO Filter
506	NO <sub>2</sub>	0
507	SO <sub>2</sub>	0
508	CL <sub>2</sub>	0
534	H <sub>2</sub> S	CO
536	NO <sub>2</sub>	H <sub>2</sub> S
537	SO <sub>2</sub>	H <sub>2</sub> S
538	CL <sub>2</sub>	H <sub>2</sub> S
546	NO <sub>2</sub>	CO
547	SO <sub>2</sub>	CO
548	CL <sub>2</sub>	CO

## **LIMITED LIFETIME WARRANTY**

GfG Instrumentation, Inc. warrants each new AGM 500 product manufactured by it to be free from defective material and workmanship and that all such product is warranted as to its merchantability and fitness for the purpose intended, for life to the original purchaser, except as noted below, and agrees to remedy any such defect or to furnish a new part (at the Company's option) in exchange for any part of any product of its manufacture which under normal use, and service disclosed such defect; provided the product is delivered by the purchaser to GfG Instrumentation's factory, intact, for our examination, with all transportation prepaid to our factory, provided that such examination discloses, in our judgment, that it is defective.

Chemical toxic cells and chargers have a warranty for two (2) years. Oxygen cells have a warranty for twelve (12) months. Rechargeable batteries, electric pumps, key pads and combustible sensors have a one (1) year warranty. Consumable components such as filter screens are not warranted.

This warranty does not extend to any products which have been subjected to misuse, neglect, accident, unauthorized modifications, or to use in violation of instructions furnished by us, nor does it extend to products which have been repaired or altered outside of our factory. This warranty is in lieu of all warranties express or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products. All implied warranties are limited to the duration of this written warranty. In no event is CfG Instrumentation, Inc. liable for special, incidental or consequential damages arising from any breach of warranty of product.

## **CAUTION**

Silicone compound vapors and lead compound vapors will cause desensitization of the combustible sensor resulting in low readings and measurements. Sensors should not be exposed to aerosol sprays, polishes, waxes and lubricants containing lead or silicones. If a combustible sensor has been exposed to these environments, the operation of the sensor should be verified by calibrating the instrument. If the combustible sensor cannot be calibrated the combustible sensor should be replaced. In environments where poisons cannot be eliminated, frequent bump testing is essential to ensure safe and accurate operation of the unit.





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