



# ZGARD™ CCombo

## Controller

## Instruction Manual

### WARNING

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

The warranties made by Mine Safety Appliances Company with respect to these Products are voided if the products are not installed, used and serviced in accordance with the instructions in this user guide. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repair.

Instrument Division 1-800-MSA-INST or FAX (412) 776-9783

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MINE SAFETY APPLIANCES COMPANY  
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## MSA

### Permanent Instrument Warranty

**1. Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of eighteen (18) months from date of shipment or one (1) year from installation, whichever occurs first, provided it is maintained and used in accordance with Seller's instructions and/or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filament units, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF**

#### **MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

**2. Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.

**3. Exclusion of Consequential Damage-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non operation of the goods. This exclusion is applicable to claims for breach of warranty, tortuous conduct or any other cause of action against seller.

## General Warnings

### WARNING

1. The ZGARD COmbo Controller described in this manual must be installed, operated, and maintained in strict accordance with the labels, cautions, warnings, instructions, and within the limitations stated.
2. The ZGARD COmbo Controller must not be installed in outdoor areas or in locations where explosive concentrations of combustible gases or vapors might occur in the atmosphere: Class 1, Group A, B, C, and D areas as defined by the NEC. Because the controller is not explosion-proof, it must be located in non-hazardous areas.
3. Do not paint the ZGARD COmbo Controller.
4. The only absolute method to assure the proper overall operation of a gas detection instrument is to check it with a known concentration of the gas for which it has been calibrated. Consequently, a calibration check must be included as part of the installation and as a routine inspection of the system.
5. Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the ZGARD COmbo Controller, beyond the scope of these maintenance instructions or by anyone other than authorized MSA service personnel, could cause the product to fail to perform as designed, and persons who rely on this product for their safety could sustain serious personal injury or death.
6. The ZGARD COmbo Controller must be installed, located and operated in accordance to all applicable codes. These codes include, but are not limited to, the National Fire Prevention Code and National Electric Code.
7. Do not exceed the relay contact ratings listed in this manual otherwise, the relay operation may fail, which can result in personal injury or death.

**Failure to comply with the above warnings can result in serious personal injury or death.**

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**Section 1**  
**ZGARD COMbo Controller**  
**General Information**

The ZGARD COMbo controller employs an integrated Carbon Monoxide sensor. Generally, the controller is wall mounted in an area where the target gas is to be measured and features an onboard Solid-state (SS) Metal Oxide Semiconductor (MOS) sensing technology. The controller provides local audio/visual alarm status indication and optional 4-Digit LED readout. The standard 4-20mA analogue output can be integrated with PLC, DCS or Building Environmental Automation commercial systems. The ZGARD COMbo controller can also act as a master panel, managing up to seven additional remote gas sensors via RS485 serial data bus connections. The additional sensors may be selected to monitor a variety of toxic gases. Relay contact outputs can be employed to interface with air handling equipment to control the vehicle exhaust emissions and the general air quality inside buildings. Any of the MSA ZGARD S and DS gas sensors, operating as system with the ZGARD Combo are automatically recognized on a RS485 network.

<b>ZGARD COMbo Controller</b>	
<b>Power Requirements</b>	Standard 110Vac, 50/60 Hz ± 10% at 0.5 Amps
<b>(Optional)</b>	220Vac, 50/60 Hz ± 10% at 0.25 Amps; 24Vdc ± 10% at 1.5 Amps
<b>Sensor Operating Range</b>	Standard 0-100ppm <b>OR</b> 0-200ppm, Carbon Monoxide
<b>Principal of Operation</b>	SS, Semiconductor
<b>Accuracy</b>	+/- 5%, Full Scale (FS).
<b>Temperature</b>	Operating: 0° to 40°C (32° to 104°F), Storage: -10° to 50°C (14° to 122°F)
<b>Humidity</b>	0 to 95% RH
<b>Expected Sensor Life</b>	Typical 2 to 5 years
<b>Remote Sensor Inputs</b>	RS485, 4-wire serial bus network for remote sensor connections
<b>Remote Sensor Power</b>	24Vdc at 100mA / Input, maximum 7 remote sensors
<b>Warning &amp; Alarm Set points</b>	Factory set at 25% and 50% Full-Scale, unless otherwise specified (Field Adjustable)
<b>Sensor Fail Set point</b>	Non-adjustable
<b>Relay Outputs</b>	1-Warning Relay, 1- Alarm Relay and 1 -Sensor Fail Relay; Form C, SPDT
<b>Relay Contacts Rating</b>	10 Amps 1/8 H.P., 125Vac; 5 Amps, 30Vdc; 6 Amps 1/8 H.P., 277Vac
<b>Relay Action</b>	All relays Normally Energized or De-Energized, (Jumper selected) Alarm relay Latching or Non-Latching, (Jumper selected)
<b>Time Delay</b>	Factory set with a 5-minute ON delay for Alarm and a 5-minute OFF delay for Warning. Alternatively, selected with NO Delay action.
<b>Status Display</b>	Common LED's for Power, Warning, Alarm and Sensor Status
<b>(Optional) LED Readout</b>	1 + 3 Digital display exhibits the channel number and gas level
<b>4-20mA Output</b>	Yields the highest reading generated from the associated remote sensors and the ZGARD COMbo onboard sensor
<b>Audible Device</b>	93dB at 0.3 meters, standard continuous sound or Variable mode
<b>Pushbutton</b>	Used for alarm reset and Audible device silence
<b>Enclosure</b>	Metal NEMA 1; <b>(Optional)</b> Fiberglass NEMA 4X design
<b>Dimensions</b>	8.25" H (210 mm) x 8.25" W (210 mm) x 4.0" D (102 mm).
<b>Weight</b>	2.7 Kg (6 lbs.)
<b>Certification</b>	ENTECLA (to CSA Standards)

The performance of any ZGARD COMbo is dependent on the appropriate and strategic placement within guarded area. The remote gas sensors should be strategically placed closest to the areas where the target gases or vapors might occur in the atmosphere. Follow the recommended guidelines listed below.

**Determination of number of sensors:** The number of sensor locations is determined by a unit's operational radius of surveillance. Using table below, the number of units required can be easily evaluated.

Gas Detected	Radius of Surveillance	Guarded Area
<b>CO Carbon Monoxide, NO2 Nitrogen Dioxide</b>	50 feet (15 meters)	7,854 square feet (707 square meters)

**Surface-mount installation:** Installation of the sensor simply requires the physical mounting of the enclosure and connection of the power and output lines.

Target Gas	Relative Density (air = 1)	Recommended Height
<b>CO</b> Carbon Monoxide	0.968	3 - 5 feet (1 - 1.5 m ) from floor
<b>* NO2</b> Nitrogen Dioxide	1.58 (cold)	1- 3 feet (30 cm to 1 m) from ceiling

\* May differ in certain applications. Hot NO2 from exhaust systems is lighter than ambient air.

## Section 1

### ZGARD COmbo Controller Operating Features

**Onboard Sensor:** Solid- State (SS) plug-in Carbon Monoxide sensing element with a standard operating range of 0-100ppm or 0-200ppm option.

**Sensor Inputs: Up to seven (7)** additional MSA ZGARD S and DS remote gas sensors may be connected to the ZGARD COmbo's RS485 network bus. The digital profile of a RS485 serial communication sensor is automatically recognized by the controller and establishes the sensor range and gas code type. Typically, the remote sensors are combinations of Carbon Monoxide and Nitrogen Dioxide.

**(Optional) Readout:** The readout will display the gas concentration level of the onboard sensor. If remote sensors are connected, then the readout acts as a sequential scanning display showing the gas concentration level and the channel number of the active remote sensors.

**Warning Event:** The ZGARD COmbo provides a common Warning (Amber) LED and relay contacts. If the gas level measured by the onboard sensor or by any of the active remote sensors exceed the Warning set point, the amber LED will turn ON and the Warning relay will activate. No alarm is sounded. Once the gas level measured by the onboard sensor or by any of the active remote sensors have dropped below the Warning set point, the Warning LED will turn off and after a 5-minute delay the Warning relay will deactivate.

**Alarm Event:** The ZGARD COmbo provides a common Alarm (Red) LED and relay contacts. If the gas level measured by the onboard sensor or by any of the remote active sensors exceed the Alarm set point, the Red LED will start to flash slowly. If the gas level persists for a period of 5 minutes then the Alarm relay activates and sounds an audible. Pressing the reset button will silence the audible device and changes the Alarm LED from slow flashing to continuously ON. Once the gas level measured by the onboard sensor and all of the active remote sensors has dropped below the alarm set point, the Alarm will silence (if not silenced already by reset button) and the Alarm relay will deactivate.

**Relay Outputs:** All relays are factory configured to be normally de-energized. All relays will return to their inactive state once their condition has cleared. The alarm relay can be made to latch-in the activated position even after the alarm has been cleared. The controller provides a common Warning, Alarm relay and Sensor Fail relay. The warning relay is non-latching and will return to inactive state once the condition has cleared. The alarm relay can be made

to act in a non-latching or latching mode, which will stay in the activated position even after an alarm condition has been cleared. Pressing the reset button after an alarm has been cleared will de-activate and unlatch the alarm relay. Each relay has an LED indicating the relay is energized.

**Warning Delay:** If the gas level measured by the onboard sensor or by any of the active remote sensors (up to seven) connected to the ZGARD COmbo exceed the Warning set point, the warning relay and the Warning LED will come ON. The Warning relay will automatically reset after a 5-minute delay, after the gas level measured by the onboard sensor and all of the active sensors have dropped below the Warning set point.

**Alarm Delay:** If the gas level measured by the onboard sensor or by any of the active remote sensors (up to seven) connected to the ZGARD COmbo exceed the Alarm set point for a successive period of 5 minutes, the Alarm relay will activate and the alarm will sound. Pressing the reset button will silence the audible device. Should other sensors reach the alarm state; the audible device will sound after every new alarm occurs. Pressing the reset button after every new alarm event will concurrently silence the audible device. Once the gas level measured by the onboard sensor or by any of the active remote sensors has dropped below the Alarm set point, the Audible alarm will be silenced (if not silenced already by reset button) and the Alarm relay will deactivate.

**Sensor Failure:** If the onboard sensor fails to operate properly, the Sensor Fail LED on the ZGARD COmbo will turn ON and the Sensor Fail relay will be activated. Consequently, if any of the active remote sensors should lose communication with the controller, the Sensor Fail LED and the Fail relay on the controller will be activated.

**4-20mA Output:** The analogue output continuously represents the highest signal generated by onboard and any active remote gas sensors.

**Cut-Off Feature:** The onboard CO sensor provides a cut-off feature to eliminate possible high background interferences. The cut off is factory set at 17ppm.

Section 2  
**ZGARD COmbo Controller  
Installation Guidelines**

The performance of ZGARD COmbo is dependent on the appropriate location and employment of the associated remote gas sensors. The remote gas sensors should be strategically placed closest to the areas where the target gases or vapors might occur in the atmosphere. Follow the recommended guidelines listed below.

**Mounting:**

- Do not mount the controller to structures subject to vibration and shock, such as piping and piping supports.
- Do not locate the controller near excessive heat source or in wet and damp locations.
- For proper cooling, allow at least five inches of clearance around all surfaces except for the mounting surface. Also consider mounting the controller so it can be easily accessed for service and routine testing.
- Make sure the controller is not blocked; otherwise front panel lights and controls will be obscured from view.
- The controller has four mounting lugs; securely mount the instrument to a wall or support using appropriate hardware.

**Wiring Connections:**

Before putting a ZGARD COmbo controller into operation, determine the capacity, designation and number of remote gas sensors, and configure the controller according to the required application. Also refer to the Installation Outline drawing located in the back of this manual, which provides important information regarding;

- Operating power.
- Number and type of remote sensors.
- Required conductors and wire size.
- Relay wiring connection.
- 4-20mA Output wiring connection.

 **CAUTION**

1. When wiring the controller, disconnect the main power to prevent bodily harm.
2. Do not use the controller power when connecting any external devices to the relay contacts.
3. Use shielded cable for wiring installation. Do not install low voltage signal cable in the same conduit as the controller's operating power and or relay wiring.
4. Do not exceed the contact ratings marked on the relays.
5. Make sure that each remote sensor is given a unique address (Jumper selected), or the ZGARD COmbo controller may not be able to communicate appropriately.
6. When connecting the remote sensors, make sure that all wiring is correct and the four leads of the RS485 bus are not interchanged, or permanent damage to the sensor may result.
7. Perform all wiring and conduit installation in accordance to the National Electrical Code.
8. The fuse at the input is a SloBlo type fuse and REPLACE FUSE ONLY WITH A FUSE WITH THE SAME RATING.

### Section 3

## ZGARD COmbo Controller Installation and Setup

H1		ZGARD COmbo MODE *	
1		<b>1</b>	NUMBER OF REMOTE SENSORS
2		<b>2</b>	1 – 7 (OUT=0, IN=1)
3		<b>4</b>	(SET BY BINARY)
4			REL NORM ENG. / DE-ENG. (IN/OUT)
5			NO DELAY / 5MIN DELAY (IN/OUT)
6			AUDIBLE SOLID / VAR (IN / OUT)
7			ALARM LATCH / NO LATCH (IN/OUT)

On the inside of the front door of every ZGARD COmbo controller is a circuit board with a series of user configurable components for setting, adjustment and selecting the required functionality and operation of the instrument. **Refer to the associated ZGARD COmbo controller, Installation Outline Drawing, 106966A for further details.**

### Binary chart for the number of Remote Sensors

Binary	1	2	4
Number of Remote Sensors	H1-1	H1-2	H1-3
NONE	OUT	OUT	OUT
1	IN	OUT	OUT
2	OUT	IN	OUT
3	IN	IN	OUT
4	OUT	OUT	IN
5	IN	OUT	IN
6	OUT	IN	IN
7	IN	IN	IN

**Number of Remote Sensor Inputs:** When a MSA ZGARD COmbo masters a series of RS485 sensors, they are automatically recognized. Each RS485 digital gas sensor reports a digital message to the controller and is used to establish the operating range and gas type. A signal and power connection board located inside each sensor enclosure is used to connect the host controller.

Up to 7 additional remote RS485 sensors can be connected to the data bus terminal. Jumpers H1-1, H1-2 & H1-3 must be carefully inserted on the ZGARD COmbo to represent the number of external sensors connected for each system.

Connect a 4-conductor serial bus electrical cable between the devices. The connection terminal labeled Data 1 and Data 2 are for communication while the +24Vdc and COM are for power, supplied by the ZGARD COmbo. Make sure that all wiring is correct and the four connecting leads of the RS485 bus are not interchanged or permanent damage to the sensor may result. **Refer to the associated ZGARD COmbo, Installation Outline drawing for further details.**



Section 3  
**ZGARD COMbo Controller  
 Installation and Setup**

H1				<b>ZGARD COMbo MODE *</b>	
○ — ○	1	<b>1</b>	NUMBER OF REMOTE SENSORS		
○ — ○	2	<b>2</b>	1 – 7 (OUT=0, IN=1)		
○ — ○	3	<b>4</b>	(SET BY BINARY)		
● — ●	4		REL NORM ENG. / DE-ENG. (IN/OUT)		
● — ●	5		NO DELAY / 5MIN DELAY (IN/OUT)		
● — ●	6		AUDIBLE SOLID / VAR (IN / OUT)		
● — ●	7		ALARM LATCH / NO LATCH (IN/OUT)		

**Relay Mode:**

If jumper H1-4 is NOT inserted, then all relays are normally de-energized when inactive and energized when activated. If jumper H1-4 is inserted, then all relays are normally energized when inactive and de-energized when activated.

**Warning and Alarm Delays:**

If the delay bypass jumper H1-5 is NOT inserted, then there is a 5-minute ON delay for the alarm relay and audible device. The warning relay will have a 5-minute OFF delay. The jumper may be inserted if no delays are desired.

**Audible Alarm Device Setting:**

There are two audible alarm modes. The first is a Solid-ON mode that sounds the audible alarm continuously while the ZGARD COMbo is in an alarm state. The second is a Variable-ON mode that sounds the audible alarm in an eight second interval pulsed fashion. The time between pulses is fixed, but the on-time of the audible alarm is determined by the amount that the alarming sensor is exceeding the alarm set point. For example, if the set point is at 50% and an alarm comes in at 55%, the audible alarm would give short beeps every eight seconds. As the alarm level increases from 55% to 100%, the beeps become longer in duration until a solid tone appears at 100%.

To select the Solid-ON audible alarm mode, jumper H1-6 must be inserted. To select the variable-ON audible alarm mode, jumper H1-6 must be removed. In both modes, pressing the reset button will silence the audible alarm, but will not have any effect on the alarm LED on the front panel or the alarm relay.

**Alarm Relay Action:**

If jumper H1-7 is NOT inserted, then the alarm relay is in non-latching mode. If jumper H1-7 is inserted, then the alarm relay will remain latched. Pressing the reset button during the alarm condition does not affect the latching. The reset button must be pressed after the alarm condition has cleared in order to deactivate the alarm relay.

### Section 3

## ZGARD COmbo Controller Installation and Setup

### Warning and Alarm Set-Points:

The alarm set points are factory preset at 25ppm for warning and 50ppm for alarm. Alternatively, the set points can be adjusted by using the ALARM and WARNING potentiometers located on the main circuit board.







A voltage between 0 to 5Vdc represents the alarm set point of 0 to 100% of full scale. The voltage is present on test points TP-AL with respect to TP-COM for the Alarm setting. Similarly, the voltage on the test points TP-WA with respect to TP-COM for the warning set point.

**TP = Set point (% full-scale)/100 x 5Vdc.**

**Example:** To set up a Warning threshold of 25% FS and an Alarm threshold of 50% FS.

**Warning Set-Point**      **TP-WA and TPCOM should read:**      Warning (25/100) x 5 = **1.25Vdc**

**Alarm Set-Point**      **TP-AL and TPCOM should read:**      Alarm (50/100) x 5 = **2.5Vdc**

H2	
	1 ZGARD COmbo MODE *
	2 ZGARD COmbo Mode (IN) / TGS Mode (OUT)
	3 100ppm (OUT) / 200ppm (IN) OPERATING RANGE
	4 NOT USED
	5 NOT USED
	6 100% TEST (IN)

On the inside of the front door of every ZGARD COmbo controller is a circuit board with a series of user configurable components for setting, adjustment and selecting the required functionality and operation of the instrument. **Refer to the associated ZGARD Combo controller, Installation Outline Drawing, 106966A for further details.**

### ZGARD COmbo Mode:

\* This is the normal operating mode. In this mode, the unit operates as a controller. Jumper H2-1 must be inserted to enable this mode.

### Operating Range:

Normally jumper H2-2 is not inserted, and the operating range of the ZGARD COmbo is 0-100ppm Carbon Monoxide (CO). If jumper H2-2 is inserted, the operating range of the controller will be 0-200ppm.

### 100% Full Scale Test:

When jumper H2-5 (100% Test) is into position the audible device will sound (Press the reset button to silence), the Amber LED (WARNING), and the Red LED (ALARM) should come on. The Warning and Alarm Relays should also be activated. **Warning!** Any remote equipment that may be connected to the relay contacts may be activated.

Section 4  
**ZGARD COmbo Controller  
Calibration Procedure**

**Calibration Procedure, Solid-State (SS) Carbon Monoxide Sensor:** Perform calibration checks regularly as part of a routine inspection and maintenance procedure. Use calibration gases of known and certified concentrations. Check the expiry date on the gas cylinders. The ZGARD COmbo onboard sensor is factory calibrated for 100 or 200ppm Carbon Monoxide, which represents 0 to 100% full scale. The 4-20mA output current between the output terminals + and - represents 0 to 100 % full-scale. **Caution!** The calibration procedure must be completed after the replacement of the sensing cell.

**Calibration Equipment**

Flow controller 0.25 litres/minute and tubing

Purified air as zero gas and 60ppm CO in air span gas

Magnetic Strips

Electronic Multi-meter

Container of Distilled water with inlet and outlet tubing, required for humidifying the calibration gas. **REFER: to Drawing 106965A.**

**Calibration Procedure**

1. Disconnect the 4-20mA output from any associated remote monitoring device. Using a multi-meter, insert two test probes into the output terminals labelled + and -.
  2. Remove Jumper H2-1 to enable TGS Mode (Calibration mode). Once removed, any remote sensors associated with the ZGARD COmbo RS485 network will be disabled. The 4-20mA output and Digital Readout display (if present) will be dedicated to the onboard ZGARD COmbo Carbon Monoxide sensor during the calibration mode.
  3. Place the magnetic strips on the top and bottom of the sensor cover plate, ensure the vent holes are fully covered.
- WARNING!** Remove the magnetic strips after the calibration has been completed.

**ZERO Calibration**

4. Join a 0.25 l/m., flow controller onto a ZERO gas cylinder. Insert a calibration adapter into thread port provided on the protective cover located on the front plate.
5. Connect the ¼" Tygon tubing between the inlet of the gas humidification assembly and the calibration cylinder flow controller outlet port.
6. Connect the outlet tubing of the gas humidification assembly to the sensor calibration adapter.
7. Turn ON the flow controller valve and allow the ZERO grade air to quench the sensor for at least 15 minutes.
8. Adjust the ZERO potentiometer until the current reading is equal to 4mA.
9. Turn OFF the valve and remove the flow controller from the Zero gas cylinder.

**SPAN Calibration**

10. Join the flow controller onto a SPAN gas cylinder. The SPAN gas should be at least 50% of the sensor's operating range.
  11. Turn ON the flow controller valve and allow the SPAN gas to quench the sensor for at least 15 minutes.
  12. Adjust the SPAN potentiometer until the current reading is equal to the calculated value representing the gas concentration.
- SEE: The equation below.**
13. Turn OFF the valve and remove the flow controller from the SPAN gas cylinder.
  14. Remove the test hose from the calibration adapter.
  15. Remove the multi-meter test probes from terminals labelled + and -.
  16. Reconnect the 4-20mA output to the associated monitoring device.
  17. Insert Jumper H2-1 to enable the ZGARD COmbo mode (Normal operating mode).

**Example:**

The SPAN gas concentration is **60ppm** Carbon Monoxide in air.

4 - 20mA is 0-100% F.S., the current that is generated is  $16 + 4 = 20\text{mA}$ .

**60ppm** =  $((\text{Span Gas Value} \times 16) / \text{Full Scale}) + 4$

=  $((60 \times 16) / 100) + 4 = \mathbf{13.6\text{mA}}$

## Section 5

### ZGARD COmbo Controller Start-Up Procedure

**When wiring, checking or working within a ZGARD COmbo, always disconnect the main power to prevent bodily harm.**

1. Loosen the locking screws on front of the controller and open the door.
2. Locate the power switch on main circuit board inside controller enclosure.
3. Check all wiring connections are correct and secure.
4. Confirm that the selection jumpers are appropriately inserted to reflect binary coded for the number of remote sensors associated with the controller.
5. Confirm that each controller's active RS485 digital remote sensor(s) are appropriately assigned a unique binary address code. **Refer to the appropriate gas sensor user guide for further details.**
6. Insert the delay bypass jumper into H1-5, which will allow the monitor to obtain instantaneous relay activation during this dynamic test.
7. Power up the controller and observe the behavior of the following indicators;
  - Green LED (POWER) Indicator on front panel should be ON.
  - Red LED (SENSOR FAIL) Indicator on front panel should be ON for 60 seconds during the initial start-up.
  - Amber LED (WARNING) Indicator on front panel should be OFF.
  - Red LED (ALARM) Indicator on front panel should be OFF.

**During initial power up of the controller, the local audible alarm may be activated, press RESET button to silence.**

8. Allow the associated remote gas sensors to stabilize. **Refer to the appropriate gas sensor user guide for further details.**

**Depending on the controller's warning, alarm and delay settings, the display status and the relay action of the controller may vary. Refer to the installation sections of the associated ZGARD COmbo controller.**

9. Place jumper H2-5 (100% Test) into position. After a few seconds, the audible device will sound (Press RESET BUTTON to silence), the Amber LED (WARNING), and the Red LED (ALARM) should come on. The Warning and Alarm Relays should also be activated.
  10. Remove Test Jumper from 100% test position. The controller should now be in normal state with the power LED ON without any other status conditions.
  11. Remove jumper H1-5 from position, this will re-instate the alarm delay function.
  12. Confirm the functionality of the controller and that is operating according the designed or pre-set configuration settings.
  13. Apply a representative sample (at least 60% of the operating range) of the target gas to each of the associated remote gas sensors. This simple test should drive the gas sensors upscale and simulate a warning and or an alarm condition on the controller. **Refer to the appropriate gas sensor user guide for further details.**
    - During this procedure, the audible device may be activated, press RESET button to silence.
    - The warning and alarm indicators and the corresponding relays may be activated.
    - Depending on the controller's warning and alarm set-points and delay feature settings, the Warning and Alarm Relays may be activated.
    - Any remote equipment which may be connected to the controller relay contacts should now be activated.
  14. Remove any test equipment from the sensors and controller.
  15. Secure the locking screws on the front door of the ZGARD COmbo controller.
  16. Secure the locking screws on cover or front door of the associated remote gas sensors.
- ✓ The initial function test of the ZGARD COmbo controller is now completed.

Section 6  
**ZGARD COmbo Controller  
Parts List**

<b>Item</b>	<b>Part Number</b>
ZGARD COmbo Sensor Circuit Board (without Readout)	
ZGARD COmbo Sensor Circuit Board (with Readout)	
ZGARD COmbo Main Circuit Board	
Replacement Carbon Monoxide Sensing Element	

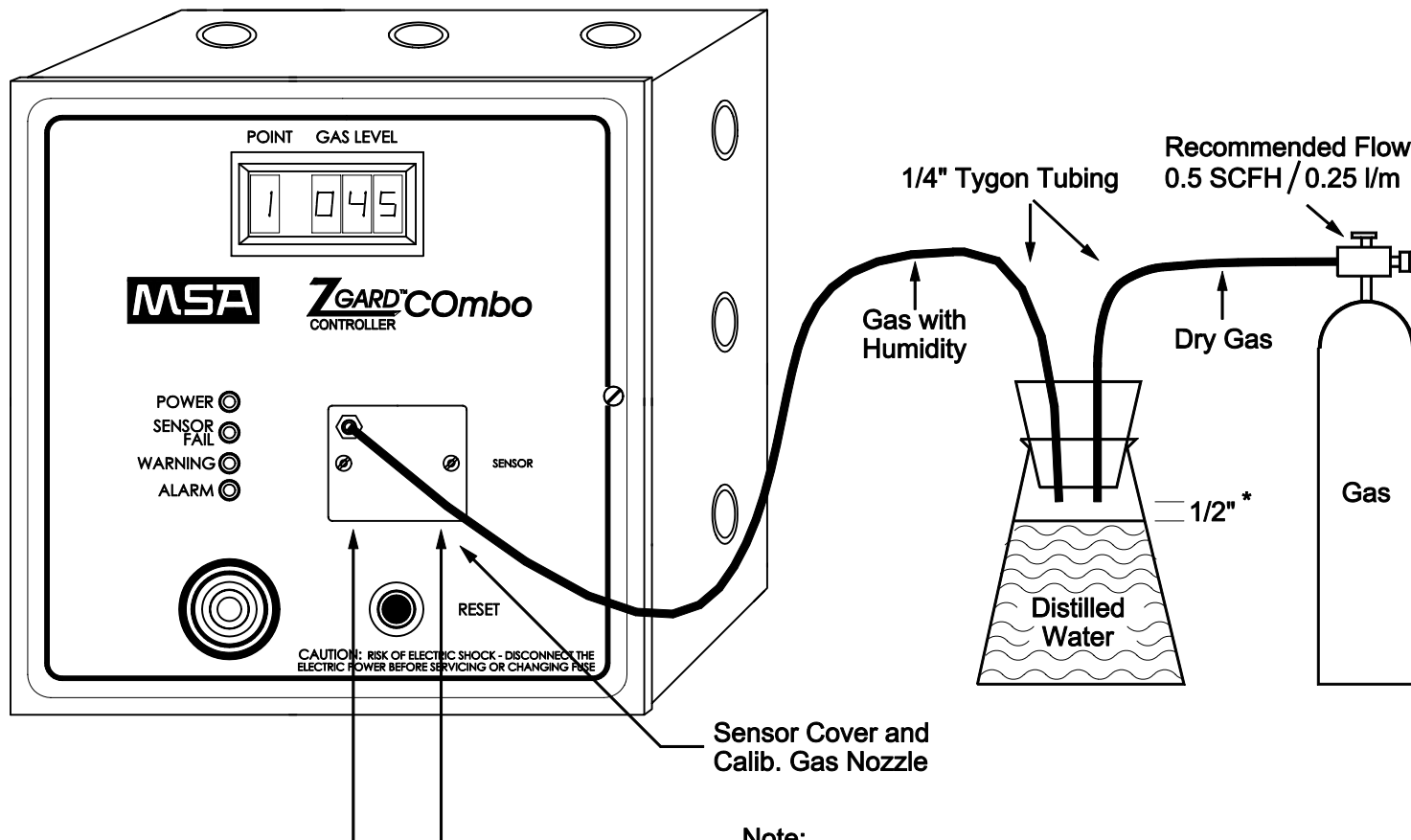
**\* When ordering replacement parts, please state the MSA P/N and S/N of unit.**

**⚠ WARNING**

Use only genuine MSA replacement parts when performing any maintenance on the ZGARD COmbo. Failure to do so may seriously impair instrument performance. Repair or alteration of the ZGARD COmbo is beyond the scope of this user guide and could cause the product to fail or perform as designed.

**Disconnect all power source(s) to the ZGARD COmbo before removing or changing any components.**

⇒ The Apparatus is only used for Solid-State (SS) Carbon Monoxide (CO) Sensor.



Place the magnetic strips on the top and bottom of the sensor cover plate, ensure the vent holes are fully covered.

**WARNING!** Remove the magnetic strips after the calibration has been completed. Otherwise, the unit could fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

**Note:**

- \* The calibration gas should be humidified to about 50% RH when flowing through air space of the container. (No bubbling. Keep a 1/2" space between the tubes and the water surface.)

**MSA**

CHKD:

DATE: Jan. 28/05

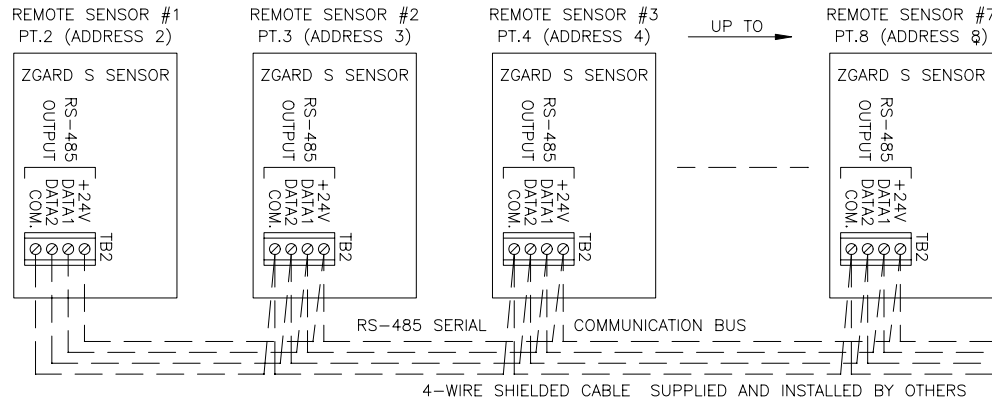
DRN: KS

ZGARD COMbo Controller  
Integral Solid-State (SS) CO Sensor  
Calibration Gas (Humidified) Setup

DWG. NO. : 106965

REV. A

➔ SEE NOTES BELOW FOR RS-485 ADDRESS ASSIGNMENT.



RS-485 ADDRESS ASSIGNMENT OF REMOTE SENSORS

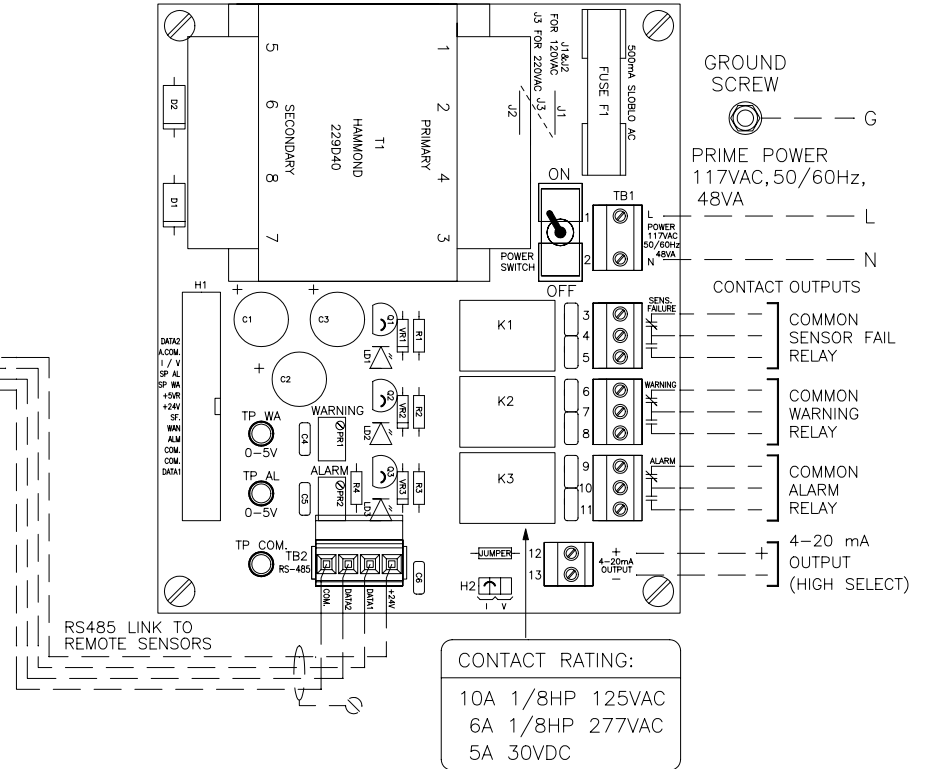
POINT NO.	SENSOR	RS-485 ADDRESS
1	INTEGRAL SENSOR	→ 1 (IN SOFTWARE)
2	REMOTE SENSOR #1	→ 2
3	REMOTE SENSOR #2	→ 3
4	REMOTE SENSOR #3	→ 4
5	REMOTE SENSOR #4	→ 5
6	REMOTE SENSOR #5	→ 6
7	REMOTE SENSOR #6	→ 7
8	REMOTE SENSOR #7	→ 8

**NOTE:**

MAKE SURE THAT EACH REMOTE SENSOR IS GIVEN A UNIQUE ADDRESS ON ITS ADDRESS JUMPERS OR THE ZGARD CCombo WILL NOT BE ABLE TO COMMUNICATE TO IT.

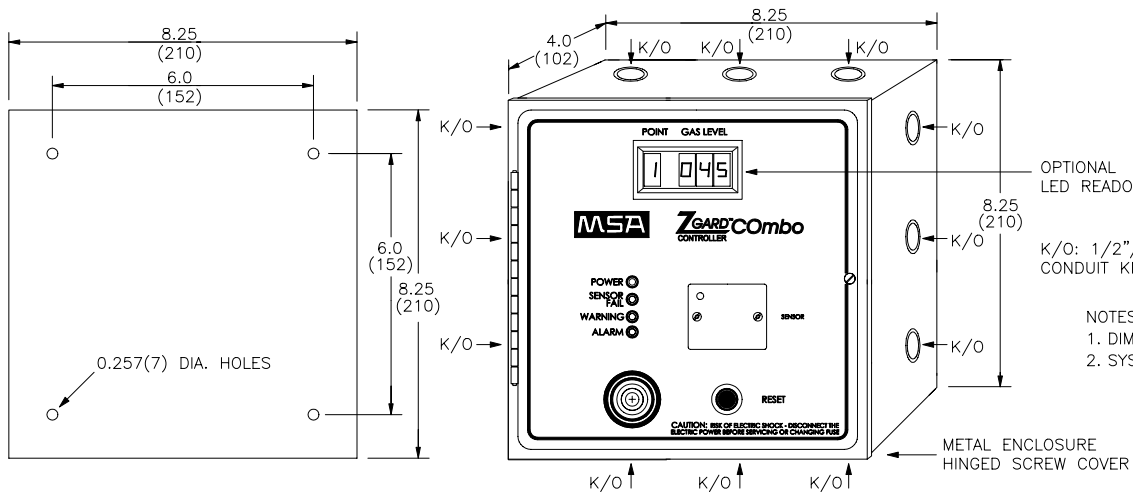
ADDRESS 1 CAN NOT BE USED BY ANY OF THE REMOTE SENSORS, SINCE IT IS ASSIGNED FOR THE INTEGRAL SENSOR IN SOFTWARE.

ZGARD CCombo MAIN CIRCUIT BOARD



CABLE LENGTH FEET	No. OF SENSORS	4	6	7
1 TO 500	AWG #	22	22	22
501 TO 1,000	AWG #	22	20	20
1,001 TO 1,500	AWG #	20	18	18
1,501 TO 2000	AWG #	18	16	16

GAUGE (AWG#)	4-WIRE SHIELDED CABLE
22	ALPHA WIRE 5504
20	ALPHA WIRE 5514
18	ALPHA WIRE 5524
16	ALPHA WIRE 5534



**NOTES:**

1. DIMENSIONS SHOWN IN INCHES (MILLIMETERS).
2. SYSTEM MAY CHANGE TO IMPROVE PERFORMANCE.

<b>CHKD:</b>	<b>DATE: Jan. 28/05</b>	<b>DRN: KS</b>
<b>ZGARD CCombo Controller (1-7 optional remote sensors) Installation Outline</b>		
<b>DWG. NO.:</b>	<b>106966</b>	<b>REV. A</b>