ZGARD S & DS Gas Sensors

(with Magnetic Calibration)

Instruction Manual for RS-485-MPO Sensors

(Multi-Protocol: BACnet, MODBUS, ZGard, Apogee)

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR INSTALLING, USING 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.

Manual d'instructions

⚠ AVERTISSEMENT

Veuillez lire attentivement les instructions qui suivent. Tous ceux qui sont responsables, ou qui aurons la responsabilité pour l'installation, la fonctionnalité ou l'usage de ce produit doivent se familiariser complètement avec ses instructions. Comme tout appareil complexifié, ce produit peut vous donner les résultats anticipés seulement s'il est installé, usagé et que le service d'entretien sont effectués d'après les instructions du fabricant (ou manufacturier). Sous peine de ne pas suivre les instructions ci-incluses, il est possible que cet appareil vous donne des résultats insuffisant. En conséquence, les personnes qui dépendront sur ce produit pour leur sécurité peuvent être blessés ou mourir.

Les garanties de 'Mine Safety Appliances Company' par rapport à ces produits sont annulés si les produits ne sont pas installés, usagés et le service maintenus conformément aux instructions ci-incluses. Veuillez vous protéger ainsi que les autres, en suivant les instructions d'installations. S'il vous plaît, entrez en communications avec nous au sujet de ce produit avant l'utilisation de ce produit ou pour plus amples renseignements, sois pour l'usage ou les réparations.

In North America., to contact your nearest stocking location, dial toll-free 1-800-MSA-INST
To contact MSA International, dial (724) 776-8626

This manual is available on the internet at www.MSAsafety.com

Manufactured by

MSA NORTH AMERICA

1000 Cranberry Woods Drive, Cranberry Township, PA 16066

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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 S & DS gas sensors 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 S & DS gas sensors 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 gas sensors are not explosion-proof, they must be located in non-hazardous areas. The ZGARD S & DS gas sensor must not be subject to direct sunlight or equivalent.

3. Do not paint the ZGARD S & DS gas sensors. Cleaning must be with warm water only (no cleaning solutions).

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 S & DS gas sensors, 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 S & DS gas sensors 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.

⚠ AVERTISSEMENT

1. Le détecteur d'émanations ZGARD S & DS tel que représenté dans ce manuel doit être installé, opéré et maintenu conformément aux étiquettes, les cautions, avertissements, ainsi que les instructions et les restrictions spécifiées.

2. Le détecteur d'émanations ZGARD S & DS ne doit pas être fixé en plein air ou dans une région où des concentrations explosives de gaz ou de vapeur sont présentes dans l'atmosphère; Classe 1, Groupes A, B, C, et D comme définis pas le NEC. Étant donné que les détecteurs d'émanations ne sont pas protégés contre les explosions, ils devraient être localisé dans un endroit non-dangereux. Le détecteur d'émanation ZGARD S & DS ne doit pas être exposé au soleil.

3. Veuillez ne pas peinturer le ZGARD S & DS. Nettoyer uniquement avec de l'eau tiède, sans savon ou produits de nettoyage.

4. Pour vérifier que l'appareil fonctionne bien, il s'agit de l'exposer à une concentration d'émanation pour laquelle l'appareil a été calibré. Conséquemment, une vérification du calibre doit être incluse comme partie de l'installation ainsi qu'à l'inspection régulière du système.

5. Un mot de caution lors de l'entretien de cet appareil; il est nécessaire d'utiliser que les pièces MSA lors d'effectuer l'entretien de cet appareil. Sinon, l'appareil peut faillir. Toutes réparations ou modifications du détecteur d'émanations au dessus des instructions ciincluses, ou par autre personne non-autorisée par le MSA peut causer une faillite mettant en danger les personnes qui dépendent sur cet appareil pour leur bien-être contre les blessures et la mortalité.

6. Le détecteur d'émanations ZGARD S & DS doit être fixé, localisé, et opéré conformément aux codes applicable. Ces codes sont inclus, mais pas limités au 'National Fire Prevention Code' et le 'National Electric Code.'

7. Ne pas dépasser l'indique du relais tel que spécifié dans ce manuel d'instructions. Autrement, l'opération du relais peut faire faillite qui, par la suite peut causer des blessures physiques ou même la mortalité.

SI VOUS N'ADHÉRÉ PAS AUX AVERTISSEMENTS CI-HAUT SPÉCIF BLESSURES CORPORELLES GRAVES OU MORTELLES PEUVENT RESULTER

Table of Contents

Section 1,
General Information and Applications

The ZGARD S Sensors are designed to detect the presence of Carbon Monoxide, Nitrogen Dioxide and Combustibles in air.

The ZGARD DS is a Dual Sensor in one enclosure designed to detect the presence of Carbon Monoxide and Nitrogen Dioxide in air.

Depending on the type of sensor used, electrochemical or catalytic bead technology is employed. Each generates a representative output signal proportional to the calibrated operating range.

The ZGARD S & DS sensors offer a number of built-in communications protocols that connect via an RS-485 multi-drop trunk to a master controller. The ZGARD S & DS RS-485 version is specifically designed to operate with any MSA ZGARD C 485 or CXII Controller, operating as a system.

TABLE 1-1 shows distinctive features of the ZGARD S & DS Sensors and is a quick guide for determining the operating features of each sensor. The performance of any ZGARD S & DS Sensor depends on the appropriate and strategic placement within a guarded area. Gas sensors should be strategically placed closest to the areas where the target gases or vapors might occur in the atmosphere.

Table 1-1. ZGARD S & DS Sensors

	Carbon Monoxide (EC)	**Nitrogen Dioxide (EC)**	**Combustible (LEL)**
Principal of Operation	Electrochemical	Electrochemical	Catalytic Bead
Accuracy at STP	+/- 5% Full Scale	+/- 10% Full Scale	+/- 5% Full Scale
Operating Range	0-100 ppm OR 0-200 ppm	0-10 ppm	0-100% LEL
Zero Deadband	1 ppm	0.1 ppm	1% LEL
Operating Temperature	-20° to 40°C	0° to 40°C	-20° to 40°C
Storage Temperature	-20° to 50°C	-10° to 50°C	-20° to 50°C
Humidity	0 to 95% RH	0 to 95% RH	0 to 95% RH
Altitude	0-6526ft / 0-2000m		

Sensor Enclosure	
ZGARD Enclosure	Powder-coated metal double-gang connection box
Dimensions	5.5” H (140mm) x 5.5” W (140mm) x 2.2 D (56mm)
Weight	0.45kg (1.00 lbs.)
ZGARD DS Enclosure	Polycarbonate
Dimensions	7.0” H (178mm) x 10.5” W (267mm) x 4.5” D (114mm)
Weight	1.1kg (2.45 lbs.)

Section 2, Installation Guidelines

NOTE: Reference the Installation Outline Drawings in this manual, Appendix A.

Mounting

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

Wiring Connections

Before putting a ZGARD S & DS Sensor into operation, determine the elevation and the number of gas sensors according to the required application. Also refer to the ZGARD S & DS sensor(s) Installation Outline drawings for important information regarding:

- Operating power
- Required conductors and wire size
- RS485 Network wiring

⚠ WARNING

When wiring the sensor, disconnect the main power to prevent bodily harm.

⚠ AVERTISSEMENT

Lors de l'installation électrique du détecteur, couper le courant d'électricité du détecteur en entier pour éviter toutes possibilités de chocs qui peut causer des blessures corporelles.

⚠ CAUTION

Do not use the sensor power when connecting any external devices.

Use shielded cable for wiring installation. Do not install low voltage signal cable in the same conduit as the other devices such as sensors operating power and or relay wiring.

Make sure that each RS485 sensor is given a unique address (Switch selected) to enable the MSA ZGARD C series controller to communicate properly.

When connecting sensors, make sure all wiring is correct for the power and signal leads. Ensure the RS485 bus wiring is not interchanged; otherwise, permanent sensor damage may result.

Perform all wiring and conduit installation in accordance with the National Electrical Code.

Failure to follow the above Warning and Cautions can result in injury or property damage.

⚠ CAUTION

Utilisez pas le pouvoir électrique du détecteur pour brancher autres appareils.

Se servir uniquement le fil conducteur électrique ayant un écran de protection. Soyez avisé qu'il faut isoler un conduit uniquement pour l'électricité (pouvoir) du détecteur ainsi que le relais.

Assurez-vous que chaque détecteur a son propre bouton de contrôle pour assurer que le contrôleur du MSA ZGARD S & DS communique directement tel que branché.

Lorsque vous branchez le détecteur isolé, assurez-vous que le branchage de fils électriques sont convenable au pouvoir (électricité). Veuillez noter que le fil RS 485 ne doit pas être échangé pour un autre fil électrique, il est unique à cet appareil. Autrement, vus courez le risque d'endommager, en permanence, le détecteur.

Exécuter tout branchement et installation de conduit conformément au "National Electric Code". A coup sûr, si les cautions ci-haut mentionnés ne sont pas suivis, il y a possibilité de blessures corporelles et vous courez chance d'endommager votre propriété.

Section 3, Start-Up

- The ZGARD S and DS Sensors are factory-calibrated and ready for immediate use.
- Once power is applied to the unit and a 30-second delay occurs, the normal green LED is solid ON to indicate the sensor is operating properly.

Table 3-1. ZGARD S & DS Sensor Specifications

Operating Power	24VDC or 24VAC 50/60Hz Class 2 Source	250 mA max Comb 100 mA max EC
Signal	RS-485	2-wire (plus shield) network connection

Network Features and Configuration

- All network communication uses 8N1 serial framing (8 data bits, no parity, 1 stop bit) regardless of protocol or BAUD rate. The serial framing cannot be changed.

Table 3-2. Configuration Switches

	SWx No.	Binary Value	Function
SW1	1	1	BACnet MAC (Range = 1-127) or BACnet Device ID (Range = 291000-291999) or MODBUS Address (Range = 1-127)
	2	2	
	3	4	
	4	8	
	5	16	
	6	32	
	7	64	
	8	128	
SW2	1	256	
	2	512	
	3		MAC or Device ID (BACnet only)
	4		Baud Rate
	5		
	6		Protocol
	7		
	8		

SW1-1 through **SW2-2** are used to represent a value using the binary number system. This value is used as an address or ID numbers. Any switch that is in the ON position adds its Binary Value to the sum of all switches. Switches in the OFF position add '0'.

SW2-3 is used to select whether the above value is used as a **MAC** address or **Device ID*** (for BACnet protocol only). The **Device ID*** has an offset of 291000*. The above value is then added to the **Device ID*** offset for the final value. For MODBUS protocol this switch has no meaning.

SW2-4 & SW2-5 are used to select the **BAUD Rate** for MODBUS and BACnet. See Table 3-3.

SW2-6 through **SW2-8** are used to select the communications **Protocol** for the sensor. See Table 3-4

***** If **Device ID** is set via SW1 & SW2. See 4.

Table 3-3. BAUD Rate

SW2-4	SW2-5	BAUD Rate
OFF	OFF	9600
ON	OFF	19200
OFF	**ON**	38400
ON	**ON**	57600

Table 3-4. Network Protocol

SW2-6	SW2-7	SW2-8	Protocol
OFF	OFF	OFF	BACnet
ON	OFF	OFF	MODBUS RTU
OFF	**ON**	OFF	MODBUS ASCII
ON	**ON**	OFF	ZGard Proprietary
OFF	OFF	**ON**	Apogee P1 (Siemens)

ZGARD S & DS Sensors
Binary Value Switch Settings

Table 3-5. A representation of switch settings for values 0 through 48

Value	SW1-1 1	SW1-2 2	SW1-3 4	SW1-4 8	SW1-5 16	SW1-6 32	SW1-7 64
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	**ON**	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	**ON**	OFF	OFF	OFF	OFF	OFF
3	**ON**	**ON**	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	**ON**	OFF	OFF	OFF	OFF
5	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF
6	OFF	**ON**	**ON**	OFF	OFF	OFF	OFF
7	**ON**	**ON**	**ON**	OFF	OFF	OFF	OFF
8	OFF	OFF	OFF	**ON**	OFF	OFF	OFF
9	**ON**	OFF	OFF	**ON**	OFF	OFF	OFF
10	OFF	**ON**	OFF	**ON**	OFF	OFF	OFF
11	**ON**	**ON**	OFF	**ON**	OFF	OFF	OFF
12	OFF	OFF	**ON**	**ON**	OFF	OFF	OFF
13	**ON**	OFF	**ON**	**ON**	OFF	OFF	OFF
14	OFF	**ON**	**ON**	**ON**	OFF	OFF	OFF
15	**ON**	**ON**	**ON**	**ON**	OFF	OFF	OFF
16	OFF	OFF	OFF	OFF	**ON**	OFF	OFF
17	**ON**	OFF	OFF	OFF	**ON**	OFF	OFF
18	OFF	**ON**	OFF	OFF	**ON**	OFF	OFF
19	**ON**	**ON**	OFF	OFF	**ON**	OFF	OFF
20	OFF	OFF	**ON**	OFF	**ON**	OFF	OFF
21	**ON**	OFF	**ON**	OFF	**ON**	OFF	OFF
22	OFF	**ON**	**ON**	OFF	**ON**	OFF	OFF
23	**ON**	**ON**	**ON**	OFF	**ON**	OFF	OFF
24	OFF	OFF	OFF	**ON**	**ON**	OFF	OFF
25	**ON**	OFF	OFF	**ON**	**ON**	OFF	OFF
26	OFF	**ON**	OFF	**ON**	**ON**	OFF	OFF
27	**ON**	**ON**	OFF	**ON**	**ON**	OFF	OFF
28	OFF	OFF	**ON**	**ON**	**ON**	OFF	OFF
29	**ON**	OFF	**ON**	**ON**	**ON**	OFF	OFF
30	OFF	**ON**	**ON**	**ON**	**ON**	OFF	OFF
31	**ON**	**ON**	**ON**	**ON**	**ON**	OFF	OFF
32	OFF	OFF	OFF	OFF	OFF	**ON**	OFF
33	**ON**	OFF	OFF	OFF	OFF	**ON**	OFF
34	OFF	**ON**	OFF	OFF	OFF	**ON**	OFF
35	**ON**	**ON**	OFF	OFF	OFF	**ON**	OFF
36	OFF	OFF	**ON**	OFF	OFF	**ON**	OFF
37	**ON**	OFF	**ON**	OFF	OFF	**ON**	OFF
38	OFF	**ON**	**ON**	OFF	OFF	**ON**	OFF
39	**ON**	**ON**	**ON**	OFF	OFF	**ON**	OFF
40	OFF	OFF	OFF	**ON**	OFF	**ON**	OFF
41	**ON**	OFF	OFF	**ON**	OFF	**ON**	OFF
42	OFF	**ON**	OFF	**ON**	OFF	**ON**	OFF
43	**ON**	**ON**	OFF	**ON**	OFF	**ON**	OFF
44	OFF	OFF	**ON**	**ON**	OFF	**ON**	OFF
45	**ON**	OFF	**ON**	**ON**	OFF	**ON**	OFF
46	OFF	**ON**	**ON**	**ON**	OFF	**ON**	OFF
47	**ON**	**ON**	**ON**	**ON**	OFF	**ON**	OFF
48	OFF	OFF	OFF	OFF	**ON**	**ON**	OFF

ZGARD S & DS Sensors
Network Setup

BACnet

Sensors connected to a **BACnet** network must have the following parameters set properly in order to communicate with the BACnet controller:

- Protocol selection set to BACnet (see Table 3-4)
- BAUD Rate (see Table 3-3)
- MAC Address (1-127)
- Device ID (291000 to 291999 if set by SW1 & SW2, unrestricted if set by BACnet)

1. Select **BACnet protocol** on protocol selection switches SW2-6 through SW2-8 as indicated in Table 3-4.

2. Select **BAUD Rate** of ZGARD sensor to match that of the port on the BACnet controller that the sensor is connected to using SW2-4 & SW2-5 as indicated in Table 3-3.

3. Slide SW2-3 to the ON position. This allows the **MAC address** of the sensor to be selected. Choose a **MAC address** for this sensor that is not yet used by another device on the RS-485 bus of this sensor. Set switches SW1-1 through SW2-2 to reflect the value for the **MAC address**.

4. **Device ID** may be set via SW1 & SW2 or via BACnet.

   a. By factory default, **Device ID** is settable via SW1 & SW2. Slide SW2-3 to the OFF position. Now **Device ID** may be set using switches SW1-1 through SW2-2. Choose a **Device ID** for this sensor that is not yet used by another device on the BACnet controller. Set switches SW1-1 through SW2-2 to reflect the value for the **Device ID**. Leave SW2-3 in the OFF position. **Device ID** is limited to be within the range of 291000 to 291999.
   b. **Device ID** may also be set via BACnet using any BACnet object browser or the BACnet controller itself. ***Once* Device ID *is changed using BACnet, SW1 & SW2 become disabled for setting* Device ID *regardless of SW2-3 setting. To re-enable SW1 & SW2* Device ID *setting, follow 4.a. to set* Device ID *to 291999. Now* Device ID *may be set using SW1 & SW2 again.***

5. The sensor is now ready to be discovered using the discover function on a BACnet controller.

6. Repeat steps 1. through 5. for all sensors making sure that each sensor is assigned a unique MAC address on each RS-485 bus and that each sensor is assigned a unique Device ID system-wide.

Sensors configured for and connected to a **BACnet Network** have the following **BACnet Objects** available for exchange with the BACnet controller.

Object Name	Object Type	Description
Sensor-BAC	Device ID	
Sensor CO[1)]	Analog Input	Gas value (Actual)
Sensor Range	Analog Value	Full Scale Sensor Range
Caution Level	Analog Value	Caution Level (Typical)[2)]
Warning Level	Analog Value	Warning Level (Typical)[2)]
Alarm Level	Analog Value	Alarm Level (Typical)[2)]
Alarm State	multiStateValue	Sensor Status 0-OK 1-Caution 2-Warning 3-Alarm 4-Fail
GasID	multiStateValue	1-99

[1)] Actual **Object Name** is dependent on sensor type

[2)] Typical (suggested) setpoint levels for sensor, not actual setpoint levels, may be different than the setpoint(s) a controller uses

MODBUS RTU & ASCII

Sensors connected to a **MODBUS** network must have the following parameters set properly in order to communicate with the MODBUS controller:

- Protocol selection set to **MODBUS RTU or MODBUS ASCII** (see Table 3-4)
- BAUD Rate (see Table 3-3)
- MODBUS Address (1-127)

1. Select **MODBUS RTU** or **MODBUS ASCII** on protocol selection switches SW2-6 through SW2-8 as indicated in Table 3-4. The type of MODBUS selected depends on the MODBUS controller.

2. Select **BAUD Rate** of ZGARD sensor to match that of the port on the MODBUS controller that the sensor is connected to using SW2-4 & SW2-5 as indicated in Table 3-3.

3. Set switches SW1-1 through SW2-2 to reflect the value for the **MODBUS address**.

4. The sensor is now ready to be addressed from a MODBUS controller.

5. Repeat steps 1. through 4. for all sensors making sure that each sensor is assigned a unique address on each RS-485 bus that sensors are connected to.

Sensors configured for and connected to a **MODBUS Network** have the following **Registers** available for exchange with the MODBUS controller.

Register	Description	Value Range
40000	Sensor Address	1-99
40001	Status	0-OK 1-Caution 2-Warning 3-Alarm 4-Fail
40002	Reserved	
40003	Reserved	
40004	Full Scale Sensor Range	0-65535[1)]
40005	Gas value (Actual)	0-65535[1)]
40006	Caution Level (Typical)[2)]	0-65535[1)]
40007	Warning Level (Typical)[2)]	0-65535[1)]
40008	Alarm Level (Typical)[2)]	0-65535[1)]
40009	Reserved	

[1)] Actual **Value Range** is dependent on sensor type
[2)] Typical (suggested) setpoint levels for sensor, not actual setpoint levels, may be different than the setpoint(s) a controller uses

Section 4, Calibration

Calibration Procedure

While the ZGARD S & DS sensors are factory calibrated, the user must perform regular calibration checks as part of a routine inspection and maintenance schedule. Use calibration gases of known and certified concentrations, and check the expiration date on the gas cylinders.

⚠ WARNING

The calibration procedure must be completed after the replacement of sensing cells; 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.

⚠ ATTENTION

Le procès de calibration doit être complete lors du remplacement de cellules du détecteur. Sinon, l'appareil peut faire faillite qui augmente la possibilité de causer des blessures corporels ou la mortalité.

Calibration Equipment

- Flow Controller 0.25 liters/minute and tubing
- Zero Gas and Span Gas

Table 4-1. Calibration Equipment

SENSOR TYPE	SPAN VALUE	MSA GAS CYLINDER PART NO.
Carbon Monoxide	60 ppm CO	710882
Nitrogen Dioxide	5 ppm NO_2	710332
Combustible	2.5% CH_4	100280032
Zero Air	20.8% O_2 in Nitrogen	10028042

- Calibration Magnet (MSA p/n 30060-2)
- Calibration Cover for S Sensor (MSA p/n 10128624)
- Calibration Cover for DS Sensor (MSA p/n 10149017)

⚠ WARNING

Remove the Calibration Cover after calibration is complete; 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.

⚠ ATTENTION

Enlever le couvercle du calibre seulement une fois le procès de calibration est terminé. Autrement, vous courez chance de faillite de l'appareil et les gens qui se fient sur cet appareil pour leurs sécurité cours une chance de blessures corporelles ou même la mortalité.

Calibration of ZGARD S & DS Sensors

NOTE: Slow Flash = 1 Flash per second
Fast Flash = 8 Flashes per second

Zero Calibration

1. Apply Zero Air to sensor using calibration cover.
2. Apply magnet to calibration target until the Green LED slow flashes; then, **remove** magnet.
3. Remove Zero Air when green LED is SOLID ON (stops flashing)

   NOTE: If the previous Span Calibration failed, the red LED SLOW FLASH appears instead of the green SOLID ON LED. Proceed to Span Calibration.

4. Zero calibration is now complete (time required is two minutes); proceed to Span Calibration.

Span Calibration

1. Apply Span Gas to sensor using calibration cover.
2. Apply magnet to calibration target until the Green LED fast flashes; then, **remove** magnet.

   NOTE: Green LED slow flashes first.

3. Remove the Span Gas when the Green LED is Solid ON.
4. Span calibration is now complete (time required is two minutes).

   - There is a two-minute delay when the Green LED stays ON.

5. Remove calibration cover.

   NOTE: Upon completion of span calibration, there is a two-minute delay before sensor output returns. This time allows for the span gas to dissipate, preventing false indications from the controller.

   - If magnet is left on for more than 16 seconds, calibration aborts and normal operation resumes (with no change to calibration).

Sensor Out of Range or Inoperative After Calibration

- If Sensor is out of range or inoperative after calibration, the Red LED slow flashes.

- Perform a new Zero and Span calibration to resolve the problem.

Sensor Fail Indication

- If a sensor fails or is not present, the Red LED turns ON and the sensor is not seen by the controller. (SENSOR FAIL)

Section 5, Parts List

Table 5-1. Parts List

ITEM	PART NUMBER
Replacement Electrochemical (EC) CO Cell Assembly	10064004
Replacement Electrochemical (EC) NO_2 Cell Assembly	10064003
Replacement LEL Cell Assembly	10143928
Calibration Cover for S Sensor	10148624
Calibration Cover for DS Sensor	10149017
Calibration Magnet	30060-2

NOTE: When ordering replacements parts, please state the unit's MSA Part Number and Serial Number

⚠ WARNING

Use only genuine MSA replacement parts when performing any maintenance on the ZGARD S & DS Sensors. Failure to do so may seriously impair instrument performance. Repair or alteration of the ZGARD S & DS gas sensors, 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.

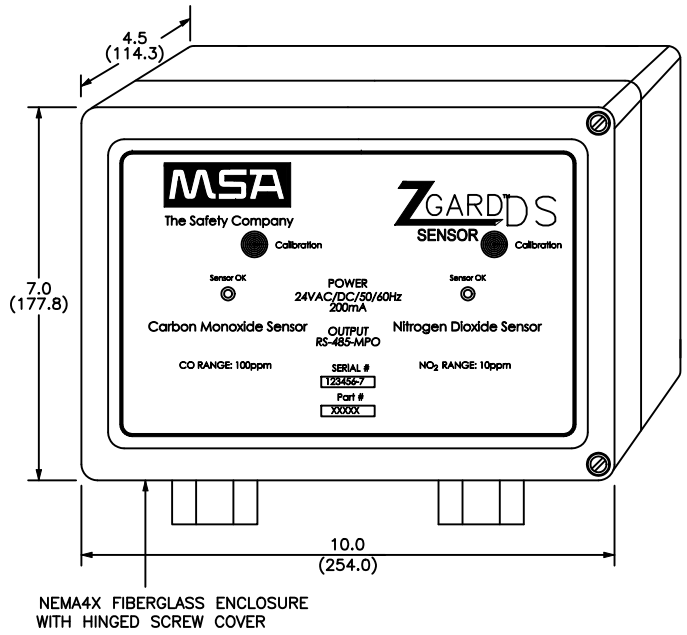
Disconnect all power source(s) to the ZGARD S & DS Sensors before removing or changing components.

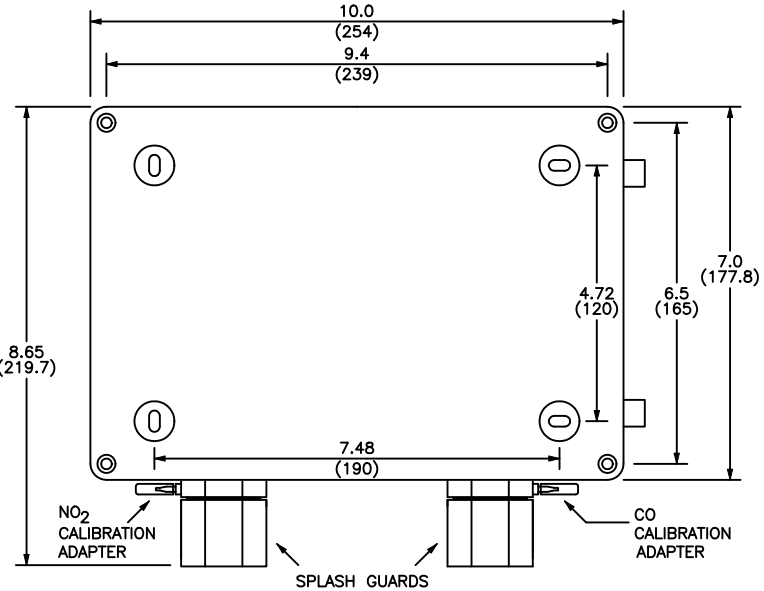
ATTENTION!

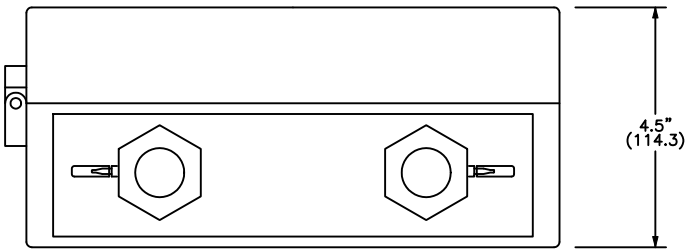
Un mot de caution lors de l'entretien du détecteur ZGARD S & DS. Il est nécessaire d'utiliser que les pieces MSA lors d'effectuer l'entretien. Sinon, vous pouvez causer l'appareil de ne pas fonctionner proprement. Toutes réparations ou modifications du détecteur ZGARD S & DS au dessus des instructions ci-incluses ou par autre personne non-autorisée par le MSA peut causer une faillite de l'appareil mettant en danger les personnes qui dépendent sur cet appareil pour leur bien-être contre les blessures et la mortalité.

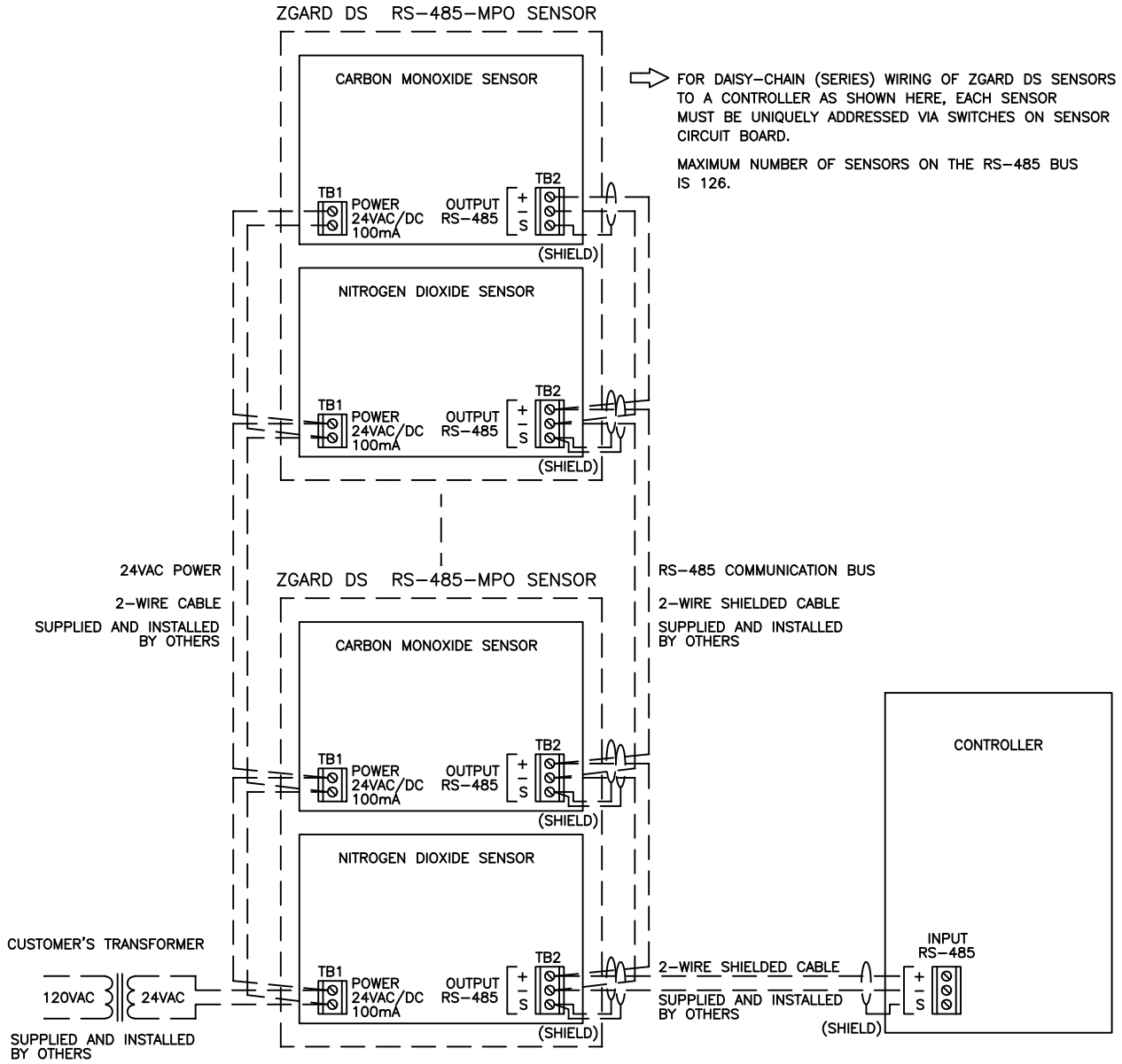
Coupez tout pouvoir (électricité) au détecteur ZGARD S & DS avant d'effectuer des changements, modifications ou réparations.

Appendix A,
Installation Outline Drawings









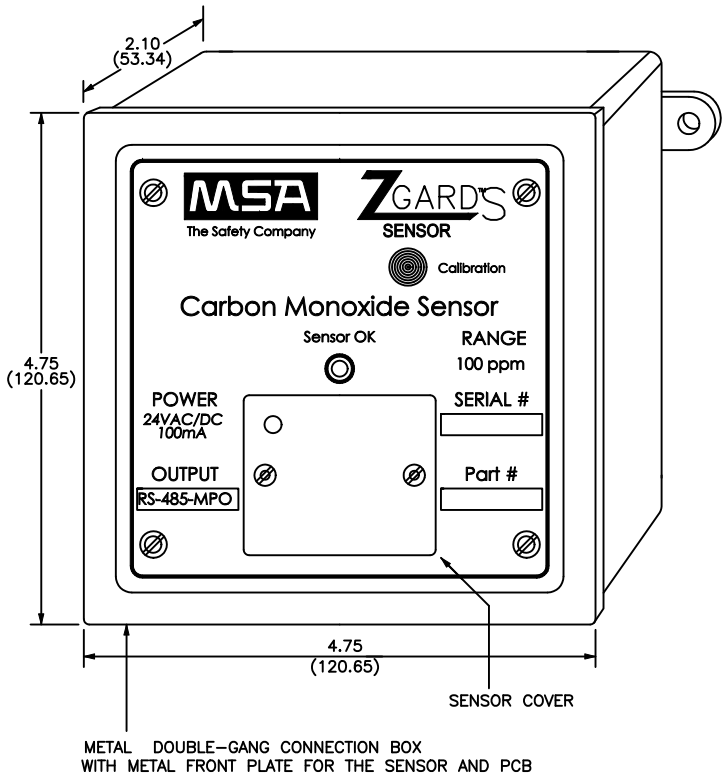
NOTES:
1. DIMENSIONS SHOWN IN INCHES (MILLIMETERS).

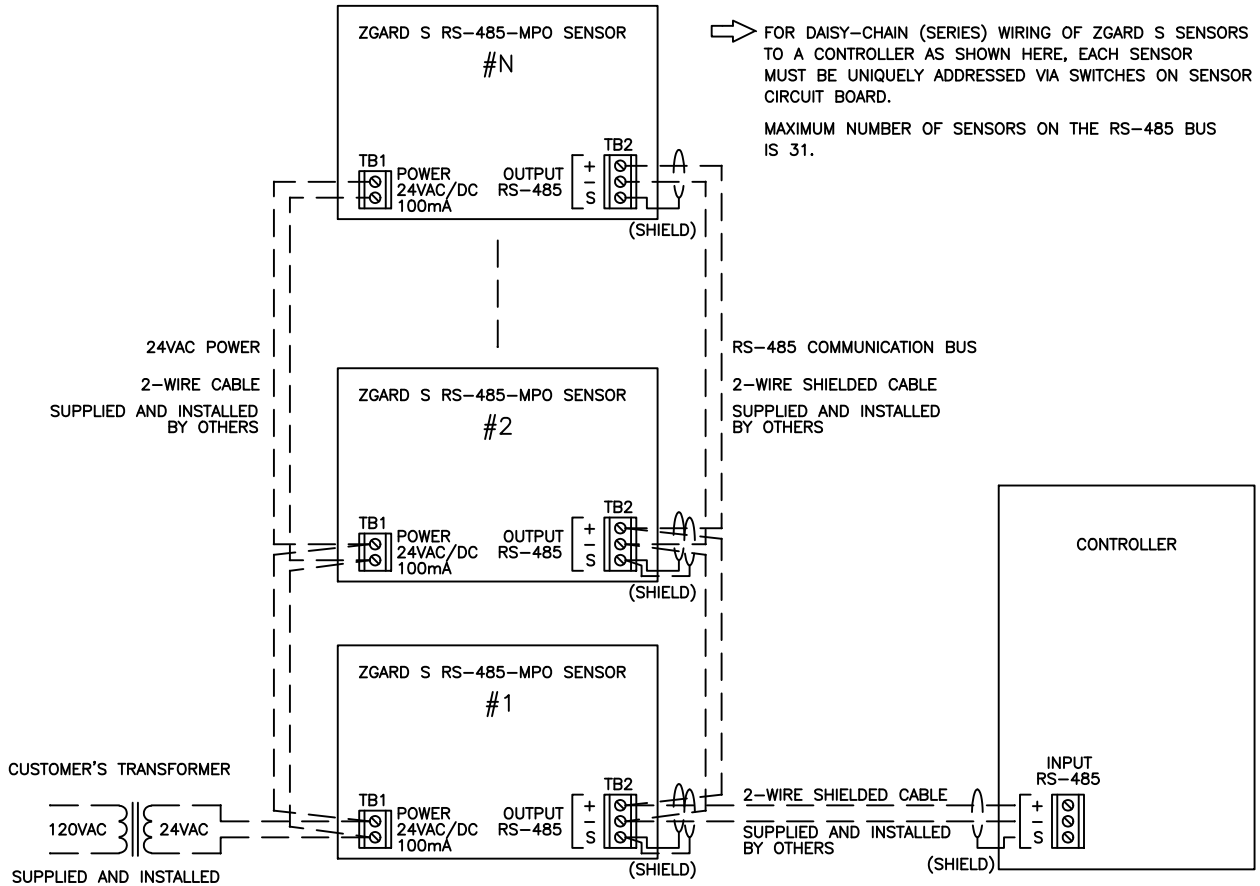
MSA

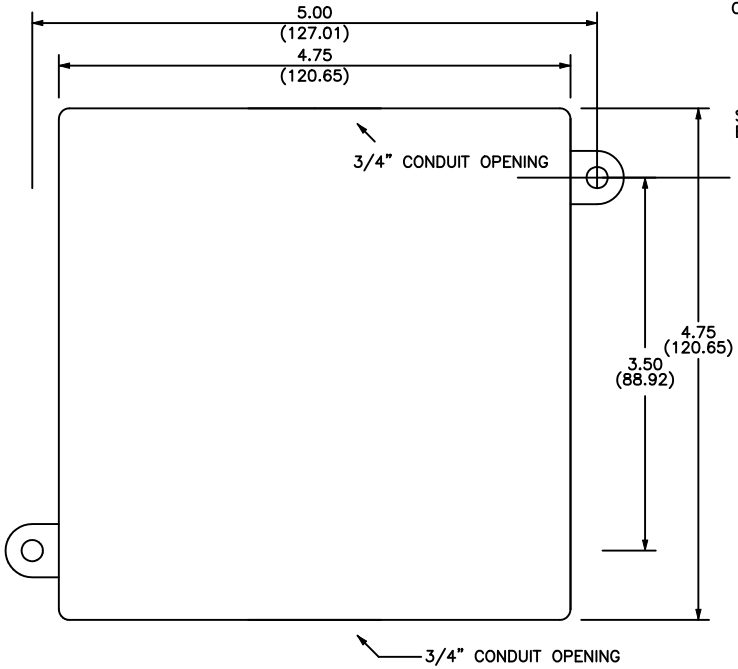
CHKD:V.B	DATE:Dec.21/15	DRN: D.P

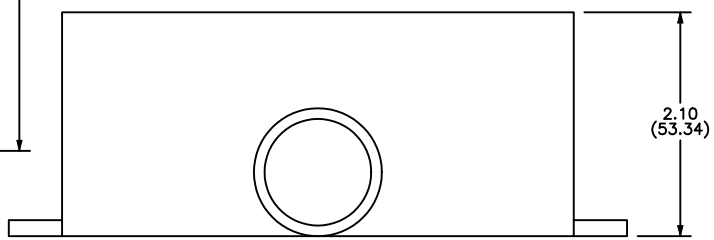
Installation Outline, ZGARD DS Multiple Protocol Output RS-485-MPO Output Sensors

DWG. NO.: 109129	REV. A









NOTES:
1. DIMENSIONS SHOWN IN INCHES (MILLIMETERS).

MSA

CHKD:	DATE:Dec. 21/15	DRN: KS

Installation Outline,
ZGARD S Multiple Protocol Output
RS-485-MPO Output Sensors

DWG. NO.: 109130	REV. A