



ZGARD™ S & DS

(APOGEE P1) Gas Sensors

Instruction Manual

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.

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

MSA International (412) 967-3228 or FAX (412) 967-3373

In Canada 1-800-267-0672 or FAX (416) 620-4225

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MINE SAFETY APPLIANCES COMPANY
PITTSBURGH, PENNSYLVANIA 15230

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, tortious conduct or any other cause of action against seller.

General Warnings

WARNING

1. The ZGARD S & DS APOGEE P1 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 APOGEE P1 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.
3. Do not paint the ZGARD S & DS APOGEE P1 gas sensors.
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 APOGEE P1 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 APOGEE P1 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.

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Section 1
ZGARD S & DS APOGEE P1 Gas Sensors
General Information and Applications

The **ZGARD S APOGEE P1** sensors are designed to detect the presence of Carbon Monoxide or Nitrogen Dioxide in air. The EC type employs electrochemical plug-in cells. The solid-state (SS) type employs Metal Oxide Semiconductor (MOS) sensing technology. Each sensor generates a representative output signal proportional to the calibrated operating range.

The **ZGARD DS APOGEE P1** is a Dual Sensor in one enclosure and both sensors employ Electrochemical (EC) plug-in cells. The sensor is designed to detect the presence of Carbon Monoxide and Nitrogen Dioxide in air.

The **ZGARD S & DS APOGEE P1** sensors are specifically designed for the Siemens network communication protocol. These sensors are integrated with the Siemens equipment and the associated Building Environmental Automation Systems.

The table below provides the distinctive features of the ZGARD S APOGEE P1 Sensors. This is a quick guide for determining the operating features of each sensor.

ZGARD S & DS APOGEE P1 SENSORS	CARBON MONOXIDE (SS)	CARBON MONOXIDE (EC)	NITROGEN DIOXIDE (EC)
Principal of Operation	MOS, Metal Oxide Semiconductor	Electrochemical	Electrochemical
Operating Range	0-100, 0-200 or 0-500ppm	0-100 or 0-200ppm	0-10ppm
On-Board Test	50 & 100% Full Scale Output Test jumper	0 & 100% Full Scale Output Test jumper	0 & 100% Full Scale Output Test jumper
Digital Output	RS485 APOGEE P1 Network	RS485 APOGEE P1 Network	RS485 APOGEE P1 Network
Calibration	Zero and Span Potentiometers	Zero and Span Potentiometers	Zero and Span Potentiometers
Cut-Off Feature	17ppm	NONE	NONE
Periodic inspections and calibration: This unit requires calibration. The calibration frequency will be a function of the operating conditions, including operating under extreme temperatures, exposure to contaminants or gas concentrations greater than the lower explosive limits. A calibration inspection must be included as part of a routine maintenance to ensure proper operation of the gas detection unit. If unit span or zero cannot be adjusted, the sensor may be approaching its end-of-life or has been contaminated and must be replaced.			

The performance of any ZGARD S & DS APOGEE PI sensors are dependent on the appropriate and strategic placement within a guarded area.

Section 2

ZGARD S & DS APOGEE P1 Sensors Installation Guidelines

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 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 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 APOGEE P1 sensor into operation, determine the elevation and the number of gas sensors according to the required application. **Also refer to the ZGARD S & DS APOGEE P1 sensor Installation Outline drawings 107130 and 107139 located in the back of this manual, which provides important information regarding;**

- **Required conductors and wire size:** Connect an electrical cable between the devices.
- **Operating power:** The 24Vac operating power is connected on terminal TB1.
- **APOGEE P1 Network wiring connection:** The connection terminal labeled + and - are for communication. Install a ground shielded cable on terminal marked S.

CAUTION

1. When wiring the sensor, disconnect the main power to prevent bodily harm.
2. Do not use the sensor power when connecting any external devices.
3. 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.
4. When connecting the remote sensors, make sure that all wiring is correct for the power and signal leads. Make sure that all wiring is correct and the two connecting leads of the digital output are not interchanged or permanent damage to the sensor may result.
5. Perform all wiring and conduit installation in accordance to the National Electrical Code.

Failure to follow the above cautions can result in injury or property damage.

Section 3
ZGARD S & DS APOGEE P1 Sensors
Operating Specifications and Features

OPERATING SPECIFICATIONS	
Detection Range	(SS) CO - Carbon Monoxide, 0-100, 0-200 or 0-500ppm
Principal of Operation	MOS, Metal Oxide Semiconductor
Detection Range	(EC) CO - Carbon Monoxide, 0-100, or 0-200ppm
Principal of Operation	Electrochemical
Detection Range	(EC) NO2 – Nitrogen Dioxide, 0-10ppm
Principal of Operation	Electrochemical
Operating Power	24Vac, 100mA used with Siemens equipment only
Network Connection	RS485 APOGEE P1, 2-wire output connection
Status LED Indicator	Sensor OK
Temperature	Operating: 0° to 40°C (32° to 104°F) Storage: -10° to 50°C (14° to 122°F)
Accuracy	(SS) Solid-State Sensors +/- 5%, Full Scale (FS) (EC) Electrochemical Sensors +/- 10%, Full Scale (FS)
Humidity	0 to 95% RH
ZGard S	
Enclosure (Optional)	Standard, Plastic double-gang connection box with metal front cover Metal housing and cover or Nema 4x Fiberglass housing
Dimensions	5.5" H (140 mm) x 5.5" W (140 mm) x 2.2" D (56 mm)
Weight	0.45kg (1.00 lbs.)
ZGard DS	
Enclosure	Standard, NEMA 4X Fiberglass
Dimensions	7.0" H (178 mm) x 10.5" W (267 mm) x 4.5" D (114 mm)
Weight	1.1kg (2.45 lbs.)
Certification	ENTECLA (To CSA Standards)

Sensor Output: The ZGARD S & DS APOGEE P1 Sensors provide an identifiable digital signature recognized by the Siemens digital network equipment.

Sensing Technology: Toxic gasses are detected by way of electrochemical cells, for targeting the gas of interest and resolution. Moreover, second generations of semiconductor detectors offer a highly effective solution for a variety of different applications.

LED Status: The Sensor OK LED is OFF for 30 seconds upon power-up and will turn ON indicating that the device is operating properly.

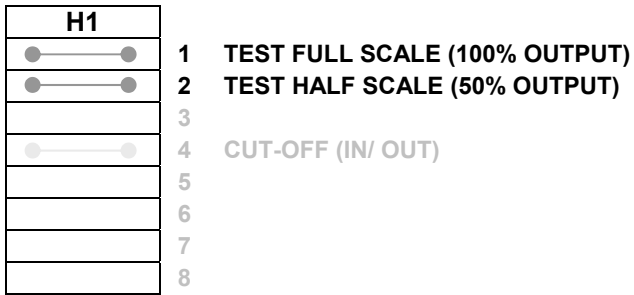
Onboard Communication Test: The ZGARD S & DS APOGEE P1 (SS) sensors provide a means of driving the output to 50% or 100% full-scale. The ZGARD S & DS

APOGEE P1 (EC) sensors provide a means of driving the output to 0% or 100% full-scale. When the onboard test jumpers are inserted, the sensor generates the selected output signal. This feature is useful for testing remote devices, which may be connected to the sensor output.

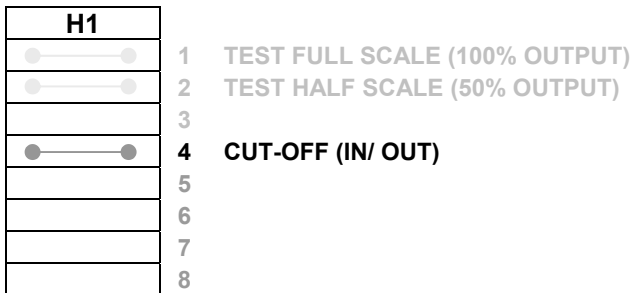
Enclosures: The standard ZGARD S APOGEE P1 sensor is housed in a surface mount tamper resistant plastic enclosure. There are two additional enclosure options, Metal housing and cover plate or Nema 4x Fiberglass housing. The standard ZGARD DS APOGEE P1 sensor is housed in a Nema 4x Fiberglass housing.

Cut-Off Feature: The (SS) Solid-State version provides a cut-off feature to eliminate possible high background interferants. This function is factory set to enable and is also jumper selectable.

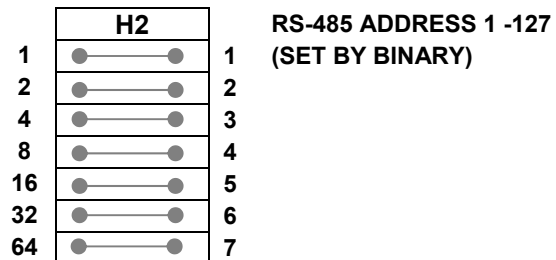
Section 4
ZGARD S APOGEE P1 Sensors
(SS) Sensor Operating Features and Setup



Solid-State (SS) Sensors, Output Test: Each sensor provides a means of driving the output to 50% or 100% full-scale. Respectively, when the onboard test jumpers are inserted the sensor generates the selected output signal. This feature is useful for testing remote devices, which may be connected to the sensor output.



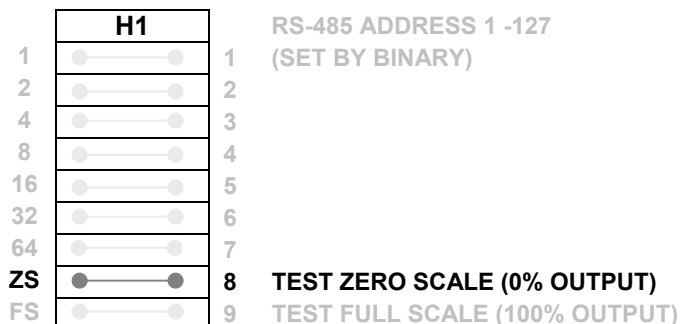
Solid-State (SS) Sensors, Cut-off Feature: Each sensor provides a cut-off option to eliminate possible high background interference of any unsuspected environmental or other airborne compounds. This function is jumper selectable. This function is factory set to enable (jumper in) and is also jumper selectable. The Carbon Monoxide can be set with a 17ppm cut-off.



Digital Address Binary Code Setup: Each sensor must be given a unique address code or it will not be able to communicate correctly. The binary address code is set by arranging the user selection jumpers **H2** as shown. Arrange jumpers H2-1, H2-2, H2-3, H2-4, H2-5, H2-6 and H2-7 according to the appropriate Binary Address Code required for each application. Refer to Table 1 on page 6 for further details.

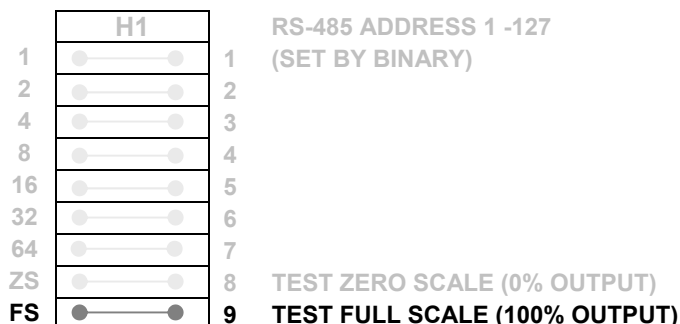
Refer to the APOGEE P1 sensor PCB Layout Drawing 107127 for further details.

**ZGARD S & DS APOGEE P1 Sensors
(EC) Sensor Operating Features and Setup**



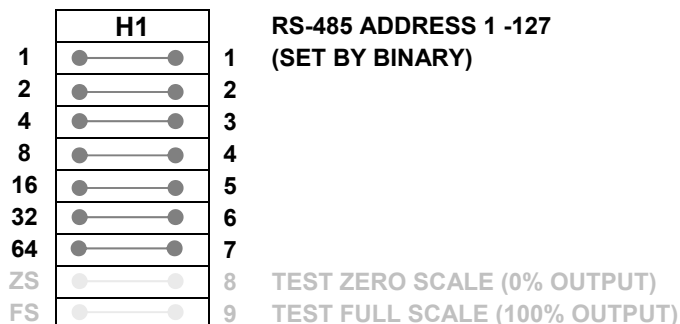
RS-485 ADDRESS 1 -127
(SET BY BINARY)

Electrochemical (EC) Sensors, 0% Output Test:
Each sensor provides a means of driving the output to 0% full-scale. Respectively, when the onboard test jumper H1-8 is inserted the sensor generates the selected output signal. This feature is useful for testing remote devices, which may be connected to the sensor output.



RS-485 ADDRESS 1 -127
(SET BY BINARY)

Electrochemical (EC) Sensors, 100% Output Test:
Each sensor provides a means of driving the output to 100% full-scale. Respectively, when the onboard test jumper H1-9 is inserted the sensor generates the selected output signal. This feature is useful for testing remote devices, which may be connected to the sensor output.



RS-485 ADDRESS 1 -127
(SET BY BINARY)

Digital Address Binary Code Setup: Each sensor must be given a unique address code or it will not be able to communicate correctly. The binary address code is set by arranging the user selection jumpers H1 as shown. Arrange jumpers H1-1, H1-2, H1-3, H1-4, H1-5, H1-6 and H1-7 according to the appropriate Binary Address Code required for each application. **Refer to Table 1 on page 6 for further details.**

Refer to the APOGEE P1 sensor PCB Layout Drawings 107128 and 107139 for further details.

Section 6
ZGARD S & DS APOGEE P1 Sensors
Digital Binary Address Codes

Table 1

Binary	1	2	4	8	16	32	64
Address	H2-1 (H1-1)	H2-2 (H1-2)	H2-3 (H1-3)	H2-4 (H1-4)	H2-5 (H1-5)	H2-6 (H1-6)	H2-7 (H1-7)
1	IN	OUT	OUT	OUT	OUT	OUT	OUT
2	OUT	IN	OUT	OUT	OUT	OUT	OUT
3	IN	IN	OUT	OUT	OUT	OUT	OUT
4	OUT	OUT	IN	OUT	OUT	OUT	OUT
5	IN	OUT	IN	OUT	OUT	OUT	OUT
6	OUT	IN	IN	OUT	OUT	OUT	OUT
7	IN	IN	IN	OUT	OUT	OUT	OUT
8	OUT	OUT	OUT	IN	OUT	OUT	OUT
9	IN	OUT	OUT	IN	OUT	OUT	OUT
10	OUT	IN	OUT	IN	OUT	OUT	OUT
11	IN	IN	OUT	IN	OUT	OUT	OUT
12	OUT	OUT	IN	IN	OUT	OUT	OUT
13	IN	OUT	IN	IN	OUT	OUT	OUT
14	OUT	IN	IN	IN	OUT	OUT	OUT
15	IN	IN	IN	IN	OUT	OUT	OUT
16	OUT	OUT	OUT	OUT	IN	OUT	OUT
17	IN	OUT	OUT	OUT	IN	OUT	OUT
18	OUT	IN	OUT	OUT	IN	OUT	OUT
19	IN	IN	OUT	OUT	IN	OUT	OUT
20	OUT	OUT	IN	OUT	IN	OUT	OUT
21	IN	OUT	IN	OUT	IN	OUT	OUT
22	OUT	IN	IN	OUT	IN	OUT	OUT
23	IN	IN	IN	OUT	IN	OUT	OUT
24	OUT	OUT	OUT	IN	IN	OUT	OUT
25	IN	OUT	OUT	IN	IN	OUT	OUT
26	OUT	IN	OUT	IN	IN	OUT	OUT
27	IN	IN	OUT	IN	IN	OUT	OUT
28	OUT	OUT	IN	IN	IN	OUT	OUT
29	IN	OUT	IN	IN	IN	OUT	OUT
30	OUT	IN	IN	IN	IN	OUT	OUT
31	IN	IN	IN	IN	IN	OUT	OUT
32	OUT	OUT	OUT	OUT	OUT	IN	OUT
33	IN	OUT	OUT	OUT	OUT	IN	OUT
34	OUT	IN	OUT	OUT	OUT	IN	OUT
35	IN	IN	OUT	OUT	OUT	IN	OUT
36	OUT	OUT	IN	OUT	OUT	IN	OUT
37	IN	OUT	IN	OUT	OUT	IN	OUT
38	OUT	IN	IN	OUT	OUT	IN	OUT
39	IN	IN	IN	OUT	OUT	IN	OUT
40	OUT	OUT	OUT	IN	OUT	IN	OUT
41	IN	OUT	OUT	IN	OUT	IN	OUT
42	OUT	IN	OUT	IN	OUT	IN	OUT
43	IN	IN	OUT	IN	OUT	IN	OUT
44	OUT	OUT	IN	IN	OUT	IN	OUT
45	IN	OUT	IN	IN	OUT	IN	OUT
46	OUT	IN	IN	IN	OUT	IN	OUT
47	IN	IN	IN	IN	OUT	IN	OUT
48	OUT	OUT	OUT	OUT	IN	IN	OUT

ZGARD S APOGEE P1 (SS) Carbon Monoxide Sensor Calibration

Calibration Procedure, Solid-State (SS) APOGEE P1 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 expiration date on the gas cylinders. The sensor is factory calibrated for 0-100, 0-200 or 500ppm Carbon Monoxide, which represents 0 to 100% full scale. The output voltage of 1 to 5Vdc between the test points TPCAL and TPCOM represents 0 to 100 % full-scale.

WARNING

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

Calibration Equipment

Flow controller 0.25 liters/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 the (SS) sensors Calibration Gas (Humidified) Setup Procedure Drawing 107129 for further details.

Calibration Procedure

1. Disconnect the sensor output from the associated monitoring device. Using a multi-meter insert test probes into test point terminals labelled TPCAL & TPCOM.
2. Insert Jumper H1-4 to disable the sensor cut-off feature.
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. 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.

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 output voltage is equal to 1Vdc.
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 output voltage is equal to the calculated value representing the gas concentration. See the example 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 TPCAL and TPCOM.
16. Reconnect the sensor output to the associated monitoring device.
17. Remove Jumper H1-4 to enable the sensor cut-off feature.

Example:

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

1 - 5Vdc is 0-100% F.S., the voltage that is generated is $4 + 1 = 5\text{Vdc}$.

$$\mathbf{60ppm} = ((\text{Span Gas Value} \times 4) / \text{Full Scale}) + 1 = ((60 \times 4) / 100) + 1 = \mathbf{3.4Vdc}$$

Section 8

ZGARD S & DS APOGEE P1 (EC) Carbon Monoxide Sensor Calibration

Calibration Procedure, Electrochemical (EC) APOGEE P1 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 expiration date on the gas cylinders. The sensor is factory calibrated for 0-100 or 0-200ppm Carbon Monoxide, which represents 0 to 100% full scale. The output voltage of 1 to 5Vdc between the test points TPCAL and TPCOM represents 0 to 100 % full-scale.

WARNING

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

Calibration Equipment

Flow controller 0.25 liters/minute and tubing
Purified air as zero gas
60ppm CO in air span gas
Magnetic Strips
Electronic Multi-meter

Calibration Procedure

1. Disconnect the sensor output from the associated monitoring device. Using a multi-meter insert two test probes into the test point terminals labelled TPCAL & TPCOM.
2. 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 it could fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

ZERO Calibration

3. Attach 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.
4. Connect ¼" Tygon tubing to the outlet of the flow controller, and then slip the open end on the calibration adapter.
5. Turn ON the flow controller valve and allow the ZERO grade air to quench the sensor for at least 2 minutes.
6. Adjust the ZERO potentiometer until the output voltage is equal to 1Vdc.
7. Turn OFF the valve and remove the flow controller from the Zero gas cylinder.

SPAN Calibration

8. Attach the flow controller onto a SPAN gas cylinder. The SPAN gas should be at least 50% of the sensor's operating range.
9. Turn ON the flow controller valve and allow the SPAN gas to quench the sensor for at least 2 minutes.
10. Adjust the SPAN potentiometer until the output voltage is equal to the calculated value representing the gas concentration. **See the example equation below.**
11. Turn OFF the valve and remove the flow controller from the SPAN gas cylinder.
12. Remove the test hose from the calibration adapter.
13. Remove the multi-meter test probes from terminals labelled TPCAL and TPCOM.
14. Reconnect the sensor output to the associated monitoring device.

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

1-5Vdc is 0-100% F.S., the voltage that is generated is $4 + 1 = 5\text{Vdc}$.

$$\mathbf{60ppm} = ((\text{Span Gas Value} \times 4) / \text{Full Scale}) + 1 = ((60 \times 4) / 100) + 1 = \mathbf{3.4Vdc}$$

ZGARD S & DS APOGEE P1 (EC) Nitrogen Dioxide Sensor Calibration

Calibration Procedure, Electrochemical (EC) APOGEE P1 Nitrogen Dioxide Sensor: Perform calibration checks regularly as part of a routine inspection and maintenance procedure. Use calibration gases of known and certified concentrations. Check the expiration date on the gas cylinders. The sensor is factory calibrated for 0-10ppm Nitrogen Dioxide, which represents 0 to 100% full scale. The output voltage of 1 to 5Vdc between the test points TPCAL and TPCOM represents 0 to 100 % full-scale.

WARNING

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

Calibration Equipment

Flow controller 0.25 liters/minute and tubing
Purified air as zero gas
10ppm NO₂ in air span gas
Magnetic Strips
Electronic Multi-meter

Calibration Procedure

1. Disconnect the sensor output from the associated monitoring device. Using a multi-meter, insert two test probes into the test point terminals labelled TPCAL & TPCOM.
2. 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 it could fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

ZERO Calibration

3. Attach 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.
4. Connect ¼" Tygon tubing to the outlet of the flow controller, and then slip the open end on the calibration adapter.
5. Turn ON the flow controller valve and allow the ZERO grade air to quench the sensor for at least 2 minutes.
6. Adjust the ZERO potentiometer until the output voltage is equal to 1Vdc.
7. Turn OFF the valve and remove the flow controller from the Zero gas cylinder.

SPAN Calibration

8. Attach the flow controller onto a SPAN gas cylinder. The SPAN gas should be at least 50% of the sensor's operating range.
9. Turn ON the flow controller valve and allow the SPAN gas to quench the sensor for at least 2 minutes.
10. Adjust the SPAN potentiometer until the output voltage is equal to the calculated value representing the gas concentration. **See the example equation below.**
11. Turn OFF the valve and remove the flow controller from the SPAN gas cylinder.
12. Remove the test hose from the calibration adapter.
13. Remove the multi-meter test probes from terminals labelled TPCAL and TPCOM.
14. Reconnect the sensor output to the associated monitoring device.

Example:

The SPAN gas concentration is **10ppm** Nitrogen Dioxide in air.

1-5Vdc is 0-100% F.S., the voltage that is generated is $4 + 1 = 5\text{Vdc}$.

$$10\text{ppm} = ((\text{Span Gas Value} \times 4) / \text{Full Scale}) + 1 = ((10 \times 4) / 10) + 1 = 5.0\text{Vdc}$$

Section 10

ZGARD S & DS APOGEE P1 Sensors

Start-Up Procedure

- ✓ Apply the appropriate operating power to the sensor.
- ✓ The green Sensor OK LED Indicator on front of the sensor should be ON after a 30 second delay. This will also indicate that the device is operating properly.
- ✓ Allow a few minutes for the sensor to stabilize.
- ✓ Insert Test Jumper H1-Full Scale (FS) into the test position. This should drive the sensor output to 100% full-scale. If the sensor is connected to a gas monitoring instrument, check that the readings correspond with that device.
- ✓ Remove Test Jumper H1-Full Scale (FS) from the test position.

Note! Check the binary code jumper H1 on EC and H2 on SS version. They must be correctly positioned to reflect the unique address number of each remote sensor connected to the host Siemens controller. **Refer to Table 1 on page 6 for further details.**

BUMP TEST: Apply a representative sample gas to each sensor and simply check if the sensor responds to the target gas and has reached the appropriate value.

Note! Any remote equipment, which may be connected to a remote device, may be activated.

The initial function test of the ZGARD S & DS APOGEE P1 sensor is now completed.

Section 11
**ZGARD S & DS APOGEE P1 Sensors
Parts List**

Item	Part Number
Replacement Electrochemical (EC) CO Cell Assembly	10064004
Replacement Electrochemical (EC) NO2 Cell Assembly	10064003
Replacement Solid-State (SS) CO Cell Assembly	10063828

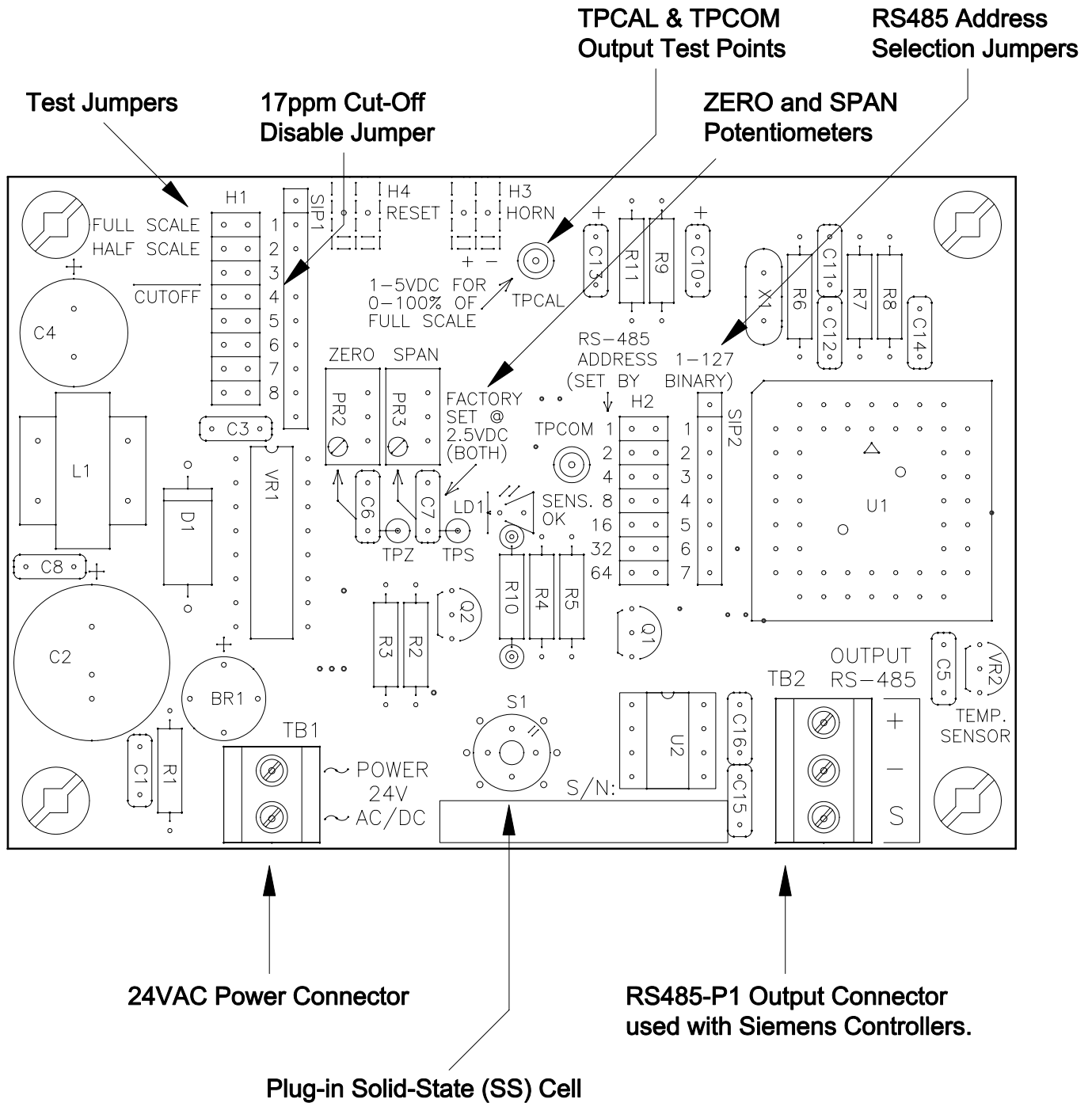
*** When ordering replacement parts, please state the MSA P/N and S/N of unit.**

 WARNING

Use only genuine MSA replacement parts when performing any maintenance on the ZGARD S & DS APOGEE P1 gas sensors. Failure to do so may seriously impair instrument performance. Repair or alteration of the ZGARD S & DS APOGEE P1 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 APOGEE P1 Sensors before removing or changing any components.

Carbon Monoxide (CO), SS, RS485-P1 Output Sensor Board (107022)



Refer to Drawing 107130 for Installation Outline.

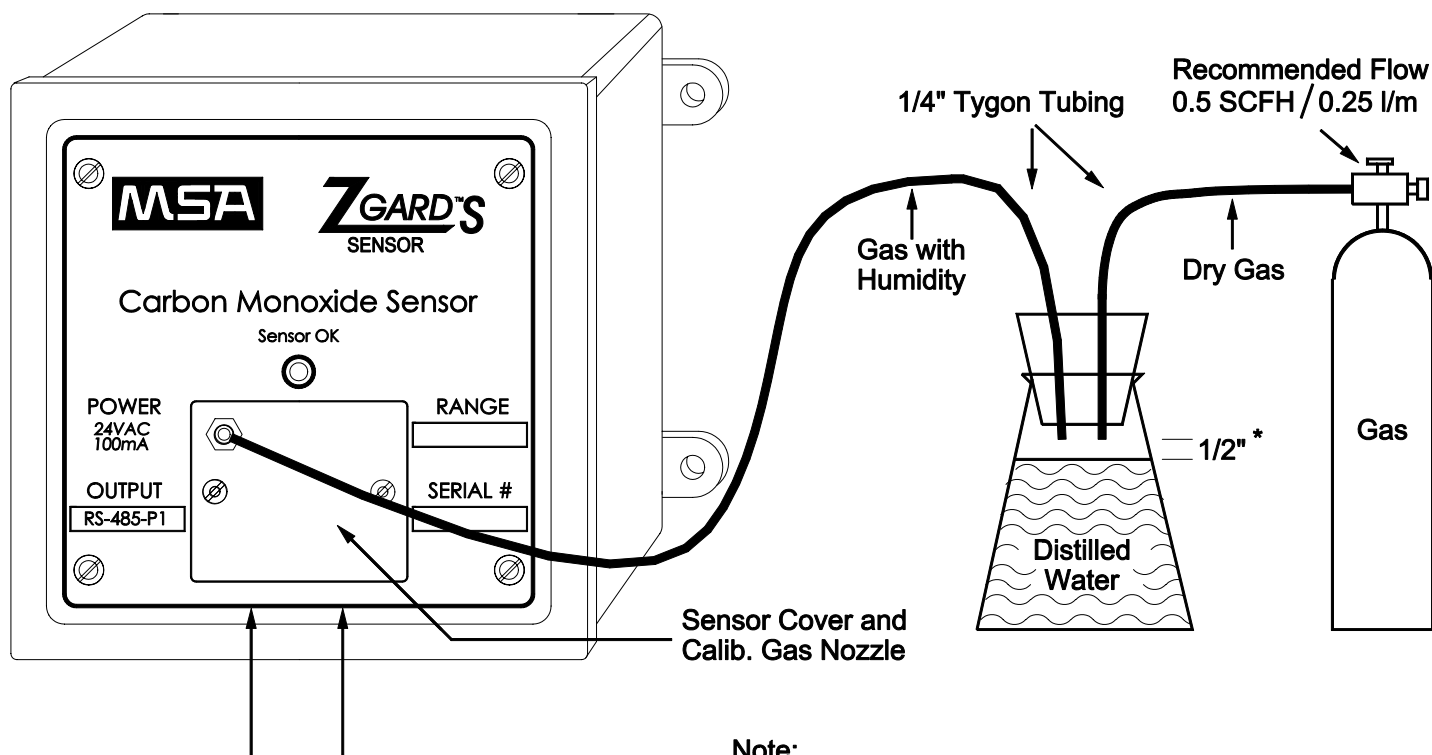


CHKD:	DATE: Dec. 19/05	DRN: KS
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**ZGARD S APOGEE P1,
CO, SS, RS485-P1 Output Sensor
Circuit Board Layout**

DWG. NO.:	107127	REV. A
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➔ The Apparatus is only used for Solid-State (SS) Carbon Monoxide (CO) Sensors.



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

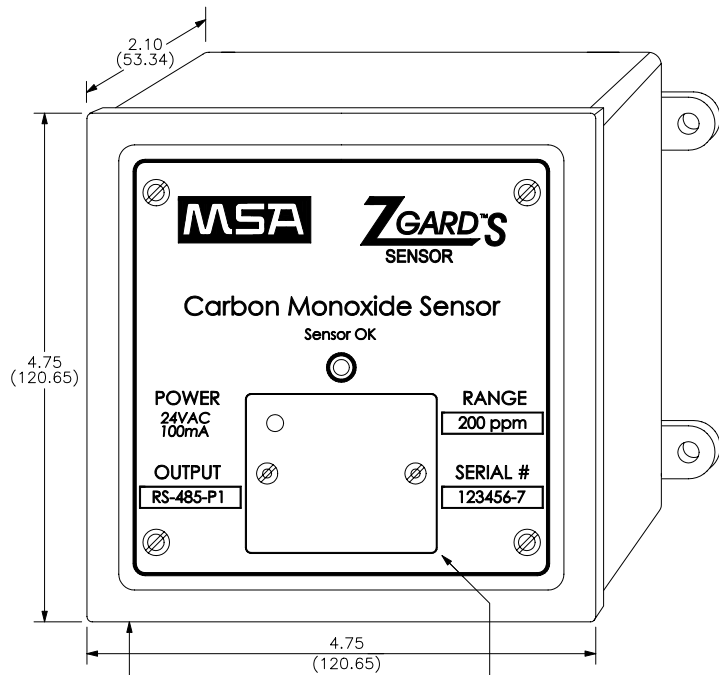
Note:

- * 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.)

⚠ WARNING

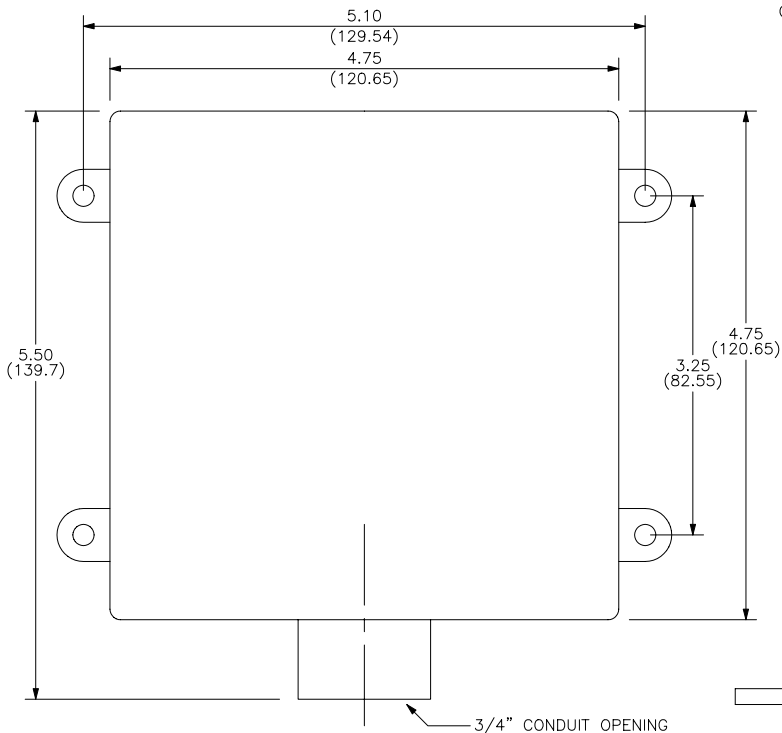
Remove the magnetic strips after the calibration has been completed. Otherwise, the unit could fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

MSA		
CHKD:	DATE: Dec. 19/05	DRN: KS
ZGARD S APOGEE P1, Solid-State (SS) Sensor Calibration Gas (Humidified) Setup		
DWG. NO.:	107129	REV. B

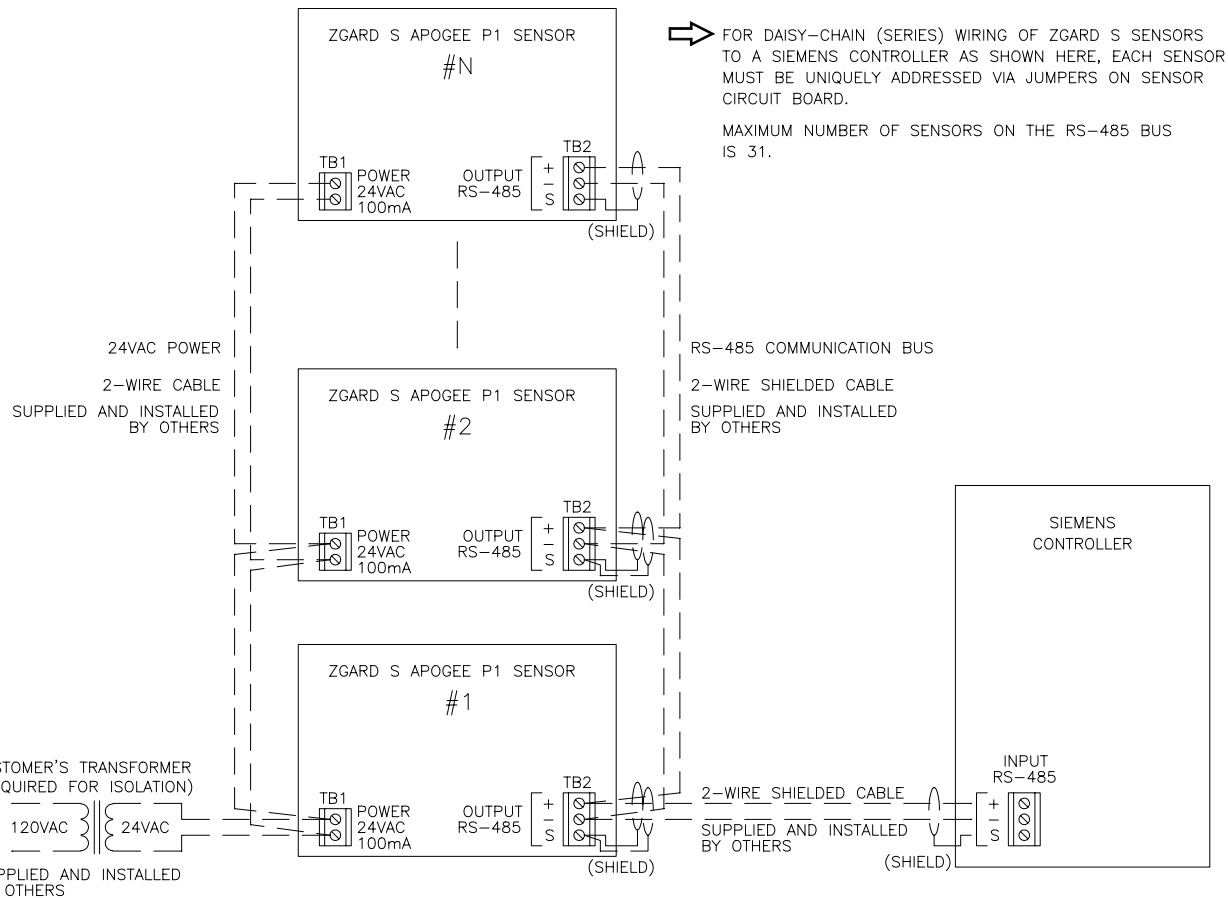


PLASTIC DOUBLE-GANG CONNECTION BOX WITH METAL FRONT PLATE FOR THE SENSOR AND PCB

TAMPER PROOF SENSOR COVER



3/4" CONDUIT OPENING



➔ FOR DAISY-CHAIN (SERIES) WIRING OF ZGARD S SENSORS TO A SIEMENS CONTROLLER AS SHOWN HERE, EACH SENSOR MUST BE UNIQUELY ADDRESSED VIA JUMPERS ON SENSOR CIRCUIT BOARD.

MAXIMUM NUMBER OF SENSORS ON THE RS-485 BUS IS 31.

24VAC POWER
2-WIRE CABLE
SUPPLIED AND INSTALLED
BY OTHERS

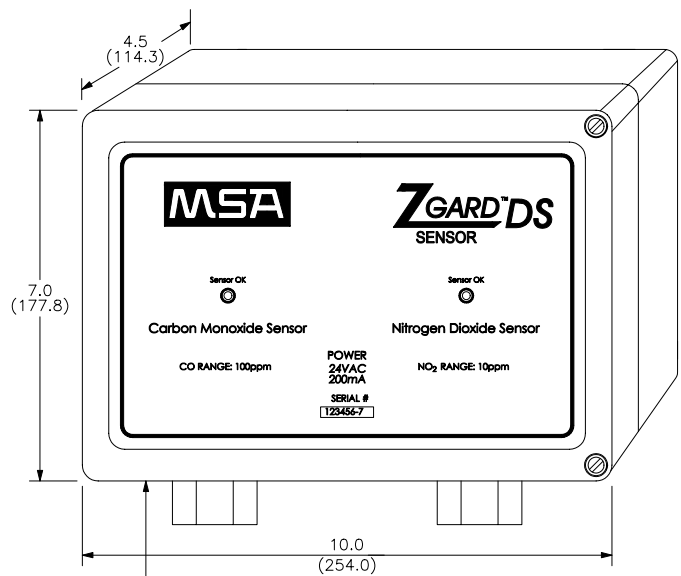
RS-485 COMMUNICATION BUS
2-WIRE SHIELDED CABLE
SUPPLIED AND INSTALLED
BY OTHERS

CUSTOMER'S TRANSFORMER
(REQUIRED FOR ISOLATION)
120VAC 24VAC
SUPPLIED AND INSTALLED
BY OTHERS

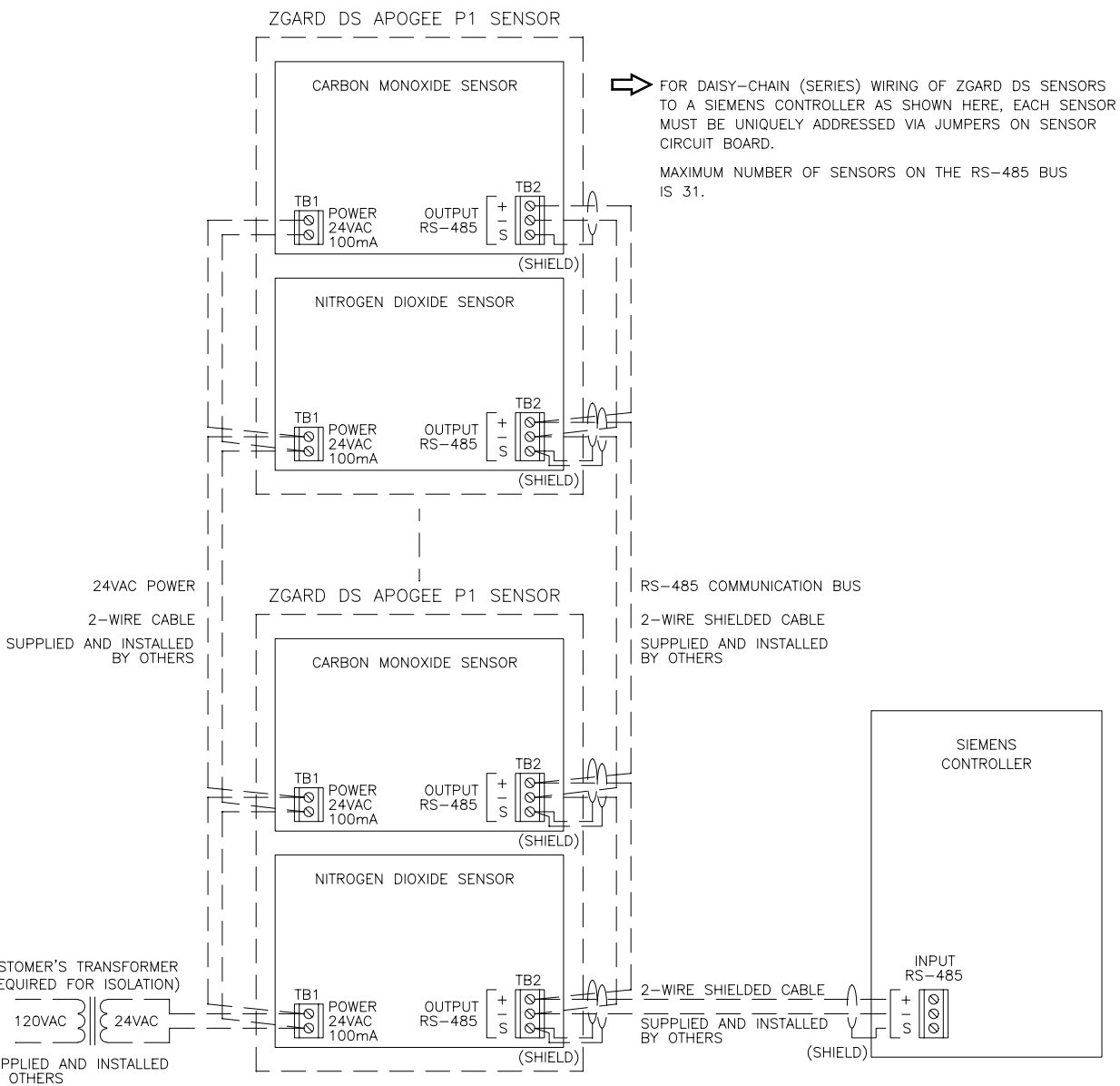
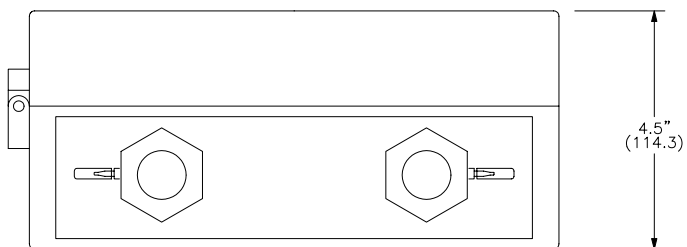
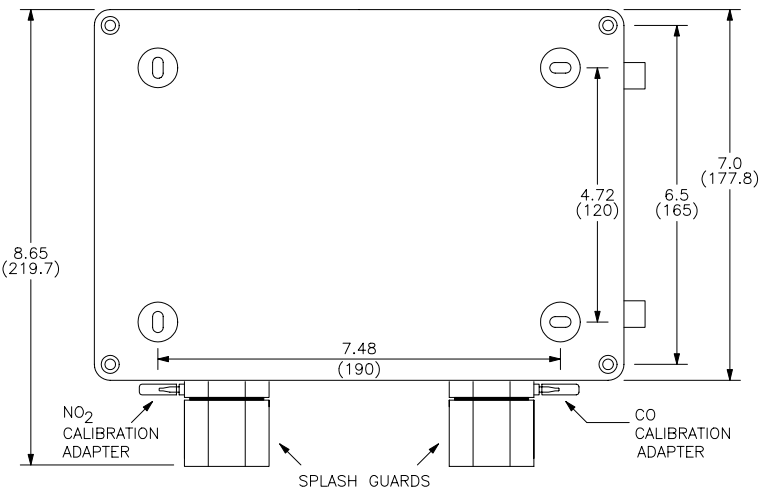
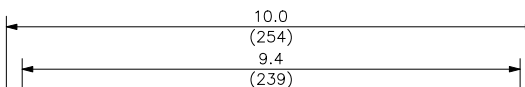
2-WIRE SHIELDED CABLE
SUPPLIED AND INSTALLED
BY OTHERS

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

MSA		
CHKD:	DATE: Dec. 19/05	DRN: KS
Installation Outline, ZGARD S APOGEE P1, RS485-P1 Output Sensors		
DWG. NO.:	107130	REV. A



NEMA4X FIBERGLASS ENCLOSURE WITH HINGED SCREW COVER



➔ FOR DAISY-CHAIN (SERIES) WIRING OF ZGARD DS SENSORS TO A SIEMENS CONTROLLER AS SHOWN HERE, EACH SENSOR MUST BE UNIQUELY ADDRESSED VIA JUMPERS ON SENSOR CIRCUIT BOARD.

MAXIMUM NUMBER OF SENSORS ON THE RS-485 BUS IS 31.

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

MSA		
CHKD:	DATE: Jan. 13/06	DRN: KS
Installation Outline, ZGARD DS APOGEE P1, RS485-P1 Output Sensors		
DWG. NO.:	107139	REV. A