Controllers

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 (905) 238-4155

MINE SAFETY APPLIANCES COMPANY
PITTSBURGH, PENNSYLVANIA 15230

REV 1.2 August 2008 **10063483**

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 C controllers 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 C controllers 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 C controllers.

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 C controllers, 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 C controllers 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.

Table of Contents

The ZGARD C Controllers are microprocessor-based monitoring systems designed to interface with remote gas sensors and perform user configured control functions for surveillance, activate ventilation equipment, personnel alert or alarm indication. The controllers feature audible and visual status indicators with relay outputs. MSA ZGARD S or GS sensor-transmitters are available to detect a wide variety of gases including Carbon Monoxide, Carbon Dioxide, Nitrogen Dioxide and Refrigerants.

The table below provides the distinctive features of the ZGARD C Controllers. This is a quick guide for determining the functionally, capability and configuration of each controller.

ZGARD C CONTROLLER MODEL	1 CHANNEL	4 CHANNEL
Number of Remote Sensors	1	4
Power LED (Green)	Yes	None
Digital Readout	1 + 3 digits	1 + 3 digits
Audible Alarm	Solid ON / Variable, (Jumper H1-6)	Solid ON / Variable, (Jumper H1-6)
Relay Mode, Energized De-Energized	YES (Jumper H1-3)	YES (Jumper H1-3)
Time Delay	5 min. ON/OFF (Jumper H1-5 IN) **OR** 0-10 min., Pots (H1-5 OUT)	5 min. ON/OFF (Jumper H1-5 IN) **OR** 0-10 min., Pots (H1-5 OUT)
Warning Set Points	Pot (H1-7 IN) **OR** 35% FS (H1-7 OUT)	Pot (H1-7 IN) **OR** 35% FS (H1-7 OUT)
Alarm Set Points	Pot (H1-8 IN) **OR** 50% FS (H1-8 OUT)	Pot (H1-8 IN) **OR** 50% FS (H1-8 OUT)
Alarm Relay Latching	YES (Jumper H1-9)	YES (Jumper H1-9)
Optional Analogue Output	4-20mA (Hi-Select)	4-20mA (Hi-Select)

Section 2

ZGARD C Controllers
Installation Guidelines

The performance of ZGARD C Controllers is dependent on the appropriate 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 C 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 ZGARD C controllers Installation Outline drawings 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 sensor is given a unique address (Jumper selected), or the ZGARD C controller may not be able to communicate appropriately.
6. When connecting the remote sensors, make sure that all wiring is correct for the power and signal leads. Ensure the RS485 bus wiring is 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.

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

OPERATING SPECIFICATIONS	
Remote Sensor Input	1 only, 4-20mA analogue, 2 or 3wire **OR** RS485 digital data bus, 4-wire connection
Remote Sensor Power	24Vdc at 100mA / Input
Network Capacity	1 Remote Gas Sensor
Power Requirements	Standard 110Vac, 50/60 Hz ± 10% at 0.15 Amps
(Optional)	220Vac, 50/60 Hz ± 10% at 0.10 Amps; 24Vdc ± 10% at 0.5 Amps
Temperature	Operating: -10° to 40°C (14° to 104°F); Storage: -20° to 50°C (-4° to 122°F)
LED Readout	1 + 3 Digit LED display exhibits the channel number and gas level, at 2 second intervals
Status LED Indicators	Power, Warning, Alarm and Sensor OK
Audible Alarm	Electronic device, 93 dB @ 0.3 meters with variable sound selection
Pushbutton	Alarm reset and Silence function
Alarm & Warning Set points	Factory set at 35% and 50% Full-Scale, unless otherwise specified (Field Adjustable)
Sensor Fail Set point	Non-adjustable
Time Delays	Fixed 5 minutes ON delay for Alarm and 5 minutes OFF delay for Warning **or** manually adjusted from 0 to10 minutes
Relay Outputs	Warning Relay, Alarm Relay and Sensor Fail Relay: Form C - SPDT
Relay Action	Alarm Relay Latching or Non-Latching, jumper selected
Relay Contacts Rating	10 Amps 1/8 H.P., 125Vac, 5 Amps, 30Vdc, 6 Amps 1/8 H.P., 277Vac
(Optional) Signal Output	4-20mA analogue output
Enclosure	Metal NEMA 1
(Optional)	Fiberglass NEMA 4X design
Dimensions	11.5” H (292 mm) x 10” W (254 mm) x 3.75” D (95 mm)
Weight	4.5kg (10 lbs.)
Certification	ENTELA (to CSA Standards)

Sensor Input: The ZGARD C 1-Channel controller accepts 1 remote gas sensor. The MSA ZGARD S or GS, 4-20mA 2 or 3-wire analogue or RS485 type sensor. The RS485 serial communication sensors are automatically recognized by the controller and establish the sensor range and gas code type.

Readout: LED display exhibits the corresponding sensor gas concentration level.

Warning and Alarm Set Points: The Warning and Alarm threshold levels are independently adjustable on the controller and can be set to any value between 0 and 100% Full-Scale (FS).

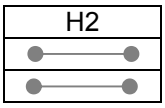
Delay Function: There are two user jumper selected methods for setting the ZGARD C 1-Channel controller warning and alarm delays. The first uses pre-programmed, fixed delays of 5 minutes OFF delay for warning and 5 minutes ON delay for alarm. The second allows adjusting of the delays from 0 to 10 minutes using potentiometers.

Warning and Alarm Scheme: During a Warning event, the Warning (Amber) LED will turn on and the warning relay will be activated. No audible alarm is set off at this time. Once a warning occurrence has been abated, the associated warning LED will turn off and the warning relay will be deactivated. If the 5 minute delay feature is selected, then this action takes place after a 5 minute delay period. During an Alarm event, the associated Alarm (Red) LED will turn on and the alarm relay will be activated. If the 5 minute delay feature is selected and the alarm event has prolonged for a period of 5 minutes, then the alarm relay will be activated and the audible device will sound. Pressing the reset button on the front panel will silence the audible device. Once the alarm occurrence has been abated, the audible device will silence (if not silenced already by reset button) and the alarm relay will be deactivated. If any other active channels reach the alarm state, the audible device will sound with every new alarm event. Once all of the active channels have been cleared of alarm events, the audible device will silence (if not silenced already by reset button) and the alarm relay will be deactivated.

Sensor Fail: If an analog sensor is used and the input is between 1mA and 3.5mA, the Sensor OK LED will turn off and the Sensor Fail Relay will be activated. Any analog input below 1.0mA causes the controller to ignore that analog input and treat that sensor as an RS485 type sensor. If there is a lose of communication between the controller and the remote gas sensor residing on the RS485 network, the Sensor Fail Relay will be activated and the Sensor OK LED will turn off.

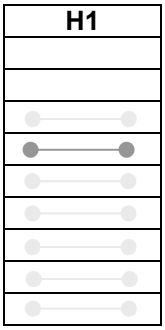
Optional 4-20mA Output: The analogue output continuously represents the signal generated by the remote sensor output.

ZGARD C 1-Channel Controller
Installation and Setup



RANGE A	H2-2	H2-1
999	OUT	OUT
250	OUT	IN
100	IN	OUT
10.0	IN	IN

RANGE B	H2-2	H2-1
500	OUT	OUT
200	OUT	IN
75	IN	OUT
50	IN	IN



PARAMETER SETUP
RELAY NORMALLY EN/DE (IN/ OUT)
DISPLAY RANGE B/A (IN/ OUT)
DELAY 5MIN. / POT (IN/ OUT)
HORN SOLID / VAR (IN / OUT)
WARNING POT / 35% (IN / OUT)
ALARM POT / 50% (IN / OUT)
ALARM LATCH (IN)

On the main circuit of every ZGARD C Controller is a series of user configurable components for setting, adjustment and selecting the required functionality and operation of the instrument. **Refer to the associated controller, Installation Outline Drawing, 106956 for further details.**

Display Mode:

The ZGARD C controller can accept a 4-20mA or RS485 input signal depending on the type of remote gas sensor employed. If the incoming signal is a 4-20mA analog type, then the controller must be configured to reflect the actual operating range of the incumbent remote gas sensors.

There are two display mode options, A and B and is selected by placing Jumper H2 in the required position. If jumper H1-4 is OUT, Range A is selected. If jumper H1-4 is IN, then Range B is selected. After the display mode is chosen the operating range must be selected. This option is chosen using Jumper H2 with various jumper positions for the different display operating ranges.

H1		PARAMETER SETUP
	1	
	2	
● — ●	3	RELAY NORMALLY EN/DE (IN/ OUT)
○ ○	4	DISPLAY RANGE B/A (IN/ OUT)
● — ●	5	DELAY 5MIN. / POT (IN/ OUT)
○ ○	6	HORN SOLID / VAR (IN / OUT)
○ ○	7	WARNING POT / 35% (IN / OUT)
○ ○	8	ALARM POT / 50% (IN / OUT)
○ ○	9	ALARM LATCH (IN)

Setting-up Relay Functions:

When jumper H1-3 is not inserted (OUT), all relays are normally de-energized when inactive and energized when activated. If jumper H1-3 is inserted (IN), then all relays are normally energized when inactive and de-energized when activated.

Setting-up the Warning & Alarm Delays:

There are two methods for setting the warning and alarm delays. The first uses pre-programmed, fixed delays of 5 minutes OFF delay for warning and 5 minutes ON delay for alarm. To select the fixed delay, jumper H1-5 must be inserted.

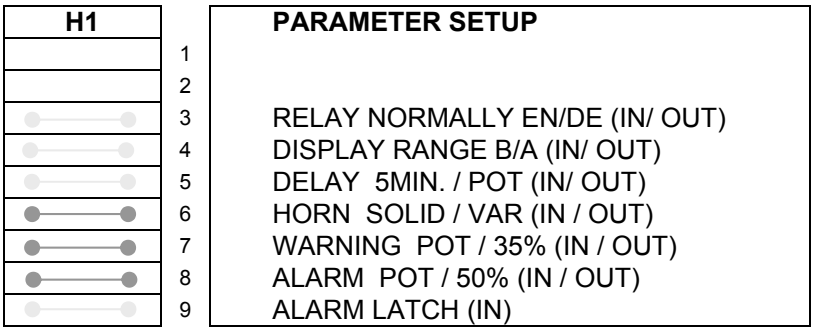
The second allows adjusting of the delays from 0 to 10 minutes via two potentiometers (labeled: Warning Delay, Alarm Delay). To select the adjustable delay, jumper H1-5 is NOT inserted. Removing the jumper activates the associated potentiometer and test points (TP3 for warning delay and TP4 for alarm delay). The test points show a voltage of 0-5Vdc for a delay of 0 - 10 minutes.

TP = Delay (minutes)/10 x 5Vdc

Example: To set up a Warning delay of 4 minutes and an Alarm delay of 6 minutes,

Warning Delay **TP3 and TPCOM should read:** Warning Delay (4/10) x 5 = **2.0Vdc**

Alarm delay **TP4 and TPCOM should read:** Alarm Delay (6/10) x 5 = **3.0Vdc**



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 C controller 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.

Warning and Alarm Set-Points:

There are two methods for setting the warning and alarm set points. The first uses pre-programmed, fixed set points of 35% for warning and 50% for alarm.

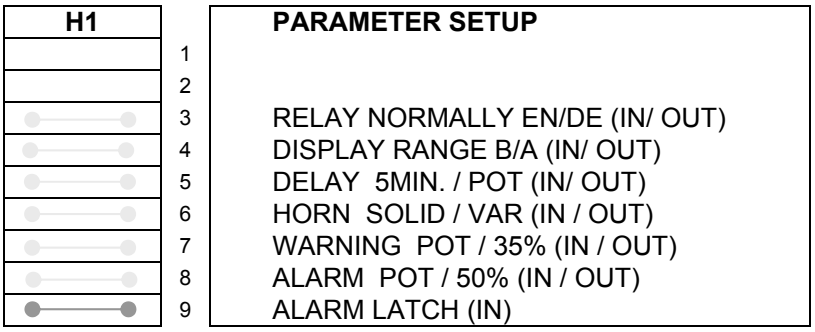
The second allows for adjusting the set points anywhere from 0% to 100% via two potentiometers (labeled: WARNING, ALARM). To select the fixed set points, jumpers H1-7 (warning) and/or H1-8 (alarm) must NOT be inserted. Inserting a jumper activates the associated potentiometer and test point (TP1 for warning and TP2 for alarm). The test points show a voltage of 0 - 5Vdc for a set point of 0 - 100%.

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

Example: To set up a Warning threshold of 25% FS and an Alarm threshold of 60% FS.

Warning Set-Point **TP1 and TPCOM should read:** Warning (25/100) x 5 = **1.25Vdc**

Alarm Set-Point **TP2 and TPCOM should read:** Alarm (60/100) x 5 = **3.0Vdc**



Alarm Relay Latch Set-up:

Normally all relays return to their inactive state once an Alarm event has cleared. The alarm relay can be made to latch in the activated position even after all alarms have cleared. Inserting jumper H1-9 (IN) will lock in the alarm relay so it will remain latched after all alarms clear until the reset button is pressed. Note that the Alarm LED on the front panel will not follow this action.

Analog Output Adjustment:

The analog output (4-20mA) is factory calibrated, and should not require adjustment. It does not drift because it is digitally controlled by the microprocessor. If adjustments are required, a ZERO and SPAN potentiometer can be used to perform these.

To adjust the output to 4-20mA for 0-100% input (factory setting) when using a 4-20mA type sensor, apply a 0% (4mA) signal to the input and adjust the ZERO potentiometer until the output reads 4mA. Then apply a 100% (20mA) signal to the input and adjust the SPAN potentiometer until the output reads 20mA.

To adjust the output to 4-20mA for 0-100% input (factory setting) when using RS485 type sensors, a 0% and 100% input can be obtained by making sure the sensor is not exposed to any gas or ideally by disconnecting the sensor (the Sensor Fail will then activate - ignore it) for a 0% signal, and by inserting the 100% jumper on the back of the sensor board for a 100% signal.

Section 4

ZGARD C 4-Channel Controller
General Information

OPERATING SPECIFICATIONS	
Remote Sensor Inputs	Up to 4, 4-20mA analogue, 2 or 3wire **OR** RS485 digital data bus, 4-wire connection
Remote Sensor Power	24Vdc at 100mA / Input
Network Capacity	4 Remote Gas Sensors
Power Requirements	Standard 110Vac, 50/60 Hz ± 10% at 0.5 Amps
(Optional)	220Vac, 50/60 Hz ± 10% at 0.25 Amps; 24Vdc ± 10% at 1.0 Amps
Temperature	Operating: -10° to 40°C (14° to 104°F); Storage: -20° to 50°C (-4° to 122°F)
LED Readout	1 + 3 Digit LED display exhibits the channel number and gas level, at 2 second intervals
Status LED Indicators	Discrete Warning, Alarm and Sensor OK for each channel
Audible Alarm	Electronic device, 93 dB @ 0.3 meters
Pushbutton	Alarm reset and Silence function
Alarm & Warning Set points	Factory set at 35% and 50% Full-Scale, unless otherwise specified (Field Adjustable)
Sensor Fail Set point	Non-adjustable
Time Delays	Fixed 5 minutes ON delay for Alarm and 5 minutes OFF delay for Warning **or** manually adjusted from 0 to10 minutes
Relay Outputs	4-Warning Relays and a common Alarm Relay and a Sensor Fail Relay: Form C - SPDT
Relay Action	Alarm Relay Latching or Non-Latching, jumper selected
Relay Contacts Rating	10 Amps 1/8 H.P., 125Vac, 5 Amps, 30Vdc, 6 Amps 1/8 H.P., 277Vac
(Optional) Signal Output	4-20mA, high select analogue output
Enclosure	Metal NEMA 1
(Optional)	Fiberglass NEMA 4X design
Dimensions	15” H (381 mm) x 12” W (305 mm) x 3.75” D (95 mm)
Weight	6.8kg (15 lbs.)
Certification	ENTELA (to CSA Standards)

Sensor Inputs: The ZGARD C 4-Channel controller accepts up to 4 remote gas sensors. The MSA ZGARD S or GS, 4-20mA 2 or 3-wire analogue or RS485 type sensors. The RS485 serial communication sensors are automatically recognized by the controller and establish the sensor range and gas code type.

Readout: LED display exhibits the active channel number and the corresponding sensor gas concentration level. The display scans through all of the active channels at 2-second intervals.

Warning and Alarm Set Points: The Warning and Alarm threshold levels are independently adjustable on the controller and can be set to any value between 0 and 100% Full-Scale (FS).

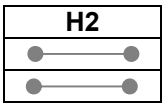
Delay Function: There are two user jumper selected methods for setting the ZGARD C 4-Channel controller warning and alarm delays. The first uses pre-programmed, fixed delays of 5 minutes OFF delay for warning and 5 minutes ON delay for alarm. The second allows adjusting of the delays from 0 to 10 minutes using potentiometers.

Warning and Alarm Scheme: During a Warning event, the associated Warning (Amber) LED will turn on and the warning relay will be activated. No audible alarm is set off at this time. Once a warning occurrence has been abated, the associated warning LED will turn off and the warning relay will be deactivated. If the 5 minute delay feature is selected, then this action takes place after a 5 minute delay period.

During an Alarm event, the associated Alarm (Red) LED will turn on and the alarm relay will be activated. If the 5 minute delay feature is selected and the alarm event has prolonged for a period of 5 minutes, then the alarm relay will be activated and the audible device will sound. Pressing the reset button on the front panel will silence the audible device. Once the alarm occurrence has been abated, the audible device will silence (if not silenced already by reset button) and the alarm relay will be deactivated. If any other active channels reach the alarm state, the audible device will sound with every new alarm event. Once all of the active channels have been cleared of alarm events, the audible device will silence (if not silenced already by reset button) and the alarm relay will be deactivated.

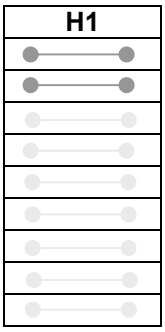
Sensor Fail: If an analog sensor is used and the input is between 1mA and 3.5mA, the Sensor OK LED will turn off and the Sensor Fail Relay will be activated. Any analog input below 1mA causes the controller to ignore that analog input and treat that sensor as an RS485 type sensor. If there is a lose of communication between the controller and the remote gas sensor residing on the RS485 network, the Sensor Fail Relay will be activated and the Sensor OK LED will turn off.

Optional 4-20mA Output: The analogue output continuously represents the highest signal generated by all of the active channel inputs.



RANGE A	H2-2	H2-1
999	OUT	OUT
100	OUT	IN
10.0	IN	OUT
* 10.0/100	IN	IN

RANGE B	H2-2	H2-1
500	OUT	OUT
200	OUT	IN
75	IN	OUT
50	IN	IN



	PARAMETER SETUP
1	Number of Active Points
2	1 + (0 -3)
	RELAY NORMALLY EN/DE (IN/ OUT)
	DISPLAY RANGE B/A (IN/ OUT)
	DELAY 5MIN. / POT (IN/ OUT)
	HORN SOLID / VAR (IN / OUT)
	WARNING POT / 35% (IN / OUT)
	ALARM POT / 50% (IN / OUT)
	ALARM LATCH (IN)

On the main circuit of every ZGARD C Controller is a series of user configurable components for setting, adjustment and selecting the required functionality and operation of the instrument. **Refer to the associated controller, Installation Outline Drawing, 106957 for further details.**

Display Mode:

The ZGARD C 4-Channel controller can accept up to 4, 4-20mA or RS485 input signals depending on the type of remote gas sensors employed. If the incoming signals are 4-20mA analog type, then the controller must be configured to reflect the actual operating range of the incumbent remote gas sensors.

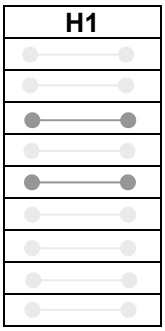
There are two display mode options, A and B and is selected by placing Jumper H2 in the required position. If jumper H1-4 is OUT, Range A is selected. If jumper H1-4 is IN, then Range B is selected. After the display mode is chosen the operating range must be selected. This option is chosen using Jumper H2 with various jumper positions for the different display operating ranges.

***** Range A 10.0/100 is a special Display Range that displays the first two channels (1 & 2) as 0-10.0ppm and the second two channels (3 & 4) as 0-100ppm. This is useful for Carbon Monoxide (CO) / Nitrogen Dioxide (NO2) applications.

Remote RS485 Digital Sensor Inputs:

The number of active remote sensors is set by arranging the user selection jumpers shown on H1-1 and H1-2. Care must be taken to represent the number of remote sensors connected for each application. Insert the jumpers such that the decimal equivalent of the binary code on H1-1 and H1-2 plus one equals the number of active sensors to be scanned.

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 C controller. **Refer to the associated controller, Installation Outline Drawing 106957 for further details.**



	PARAMETER SETUP
1	Number of Active Points
2	1 + (0 -3)
	RELAY NORMALLY EN/DE (IN/ OUT)
	DISPLAY RANGE B/A (IN/ OUT)
	DELAY 5MIN. / POT (IN/ OUT)
	HORN SOLID / VAR (IN / OUT)
	WARNING POT / 35% (IN / OUT)
	ALARM POT / 50% (IN / OUT)
	ALARM LATCH (IN)

Setting-up Relay Functions:

When jumper H1-3 is not inserted (OUT), all relays are normally de-energized when inactive and energized when activated. If jumper H1-3 is inserted (IN), then all relays are normally energized when inactive and de-energized when activated.

Setting-up the Warning & Alarm Delays:

There are two methods for setting the warning and alarm delays. The first uses pre-programmed, fixed delays of 5 minutes OFF delay for warning and 5 minutes ON delay for alarm. To select the fixed delay, jumper H1-5 must be inserted.

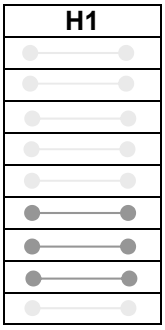
The second allows adjusting of the delays from 0 to 10 minutes via two potentiometers (labeled: Warning Delay, Alarm Delay). To select the adjustable delay, jumper H1-5 is NOT inserted. Removing the jumper activates the associated potentiometer and test points (TP3 for warning delay and TP4 for alarm delay). The test points show a voltage of 0-5Vdc for a delay of 0 - 10 minutes.

TP = Delay (minutes)/10 x 5Vdc

Example: To set up a Warning delay of 4 minutes and an Alarm delay of 6 minutes,

Warning Delay **TP3 and TPCOM should read:** Warning Delay (4/10) x 5 = **2.0Vdc**

Alarm delay **TP4 and TPCOM should read:** Alarm Delay (6/10) x 5 = **3.0Vdc**



	PARAMETER SETUP
1	Number of Active Points
2	1 + (0 -3)
	RELAY NORMALLY EN/DE (IN/ OUT)
	DISPLAY RANGE B/A (IN/ OUT)
	DELAY 5MIN. / POT (IN/ OUT)
	HORN SOLID / VAR (IN / OUT)
	WARNING POT / 35% (IN / OUT)
	ALARM POT / 50% (IN / OUT)
	ALARM LATCH (IN)

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 C controller 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.

Warning and Alarm Set-Points:

There are two methods for setting the warning and alarm set points. The first uses pre-programmed, fixed set points of 35% for warning and 50% for alarm.

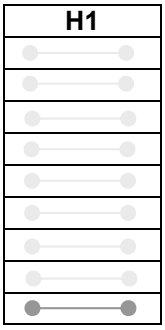
The second allows for adjusting the set points anywhere from 0% to 100% via two potentiometers (labeled: WARNING, ALARM). To select the fixed set points, jumpers H1-7 (warning) and/or H1-8 (alarm) must NOT be inserted. Inserting a jumper activates the associated potentiometer and test point (TP1 for warning and TP2 for alarm). The test points show a voltage of 0 - 5Vdc for a set point of 0 - 100%.

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

Example: To set up a Warning threshold of 25% FS and an Alarm threshold of 60% FS.

Warning Set-Point **TP1 and TPCOM should read:** Warning (25/100) x 5 = **1.25Vdc**

Alarm Set-Point **TP2 and TPCOM should read:** Alarm (60/100) x 5 = **3.0Vdc**



	PARAMETER SETUP
1	Number of Active Points
2	1 + (0 -3)
	RELAY NORMALLY EN/DE (IN/ OUT)
	DISPLAY RANGE B/A (IN/ OUT)
	DELAY 5MIN. / POT (IN/ OUT)
	HORN SOLID / VAR (IN / OUT)
	WARNING POT / 35% (IN / OUT)
	ALARM POT / 50% (IN / OUT)
	ALARM LATCH (IN)

Alarm Relay Latch Set-up:

Normally all relays return to their inactive state once an Alarm event has cleared. The alarm relay can be made to latch in the activated position even after all alarms have cleared. Inserting jumper H1-9 (IN) will lock in the alarm relay so it will remain latched after all alarms clear until the reset button is pressed. Note that the Alarm LED on the front panel will not follow this action.

Analog Output Adjustment:

The analog output (4-20mA) is factory calibrated, and should not require adjustment. It does not drift because it is digitally controlled by the microprocessor. If adjustments are required, a ZERO and SPAN potentiometer can be used to perform these.

To adjust the output to 4-20mA for 0-100% input (factory setting) when using a 4-20mA type sensor, apply a 0% (4mA) signal to one of the input and adjust the ZERO potentiometer until the output reads 4mA. Then apply a 100% (20mA) signal to input and adjust the SPAN potentiometer until the output reads 20mA.

To adjust the output to 4-20mA for 0-100% input (factory setting) when using RS485 type sensors, a 0% and 100% input can be obtained by making sure the sensor is not exposed to any gas or ideally by disconnecting the sensor (the Sensor Fail will then activate - ignore it) for a 0% signal, and by inserting the 100% jumper on the back of the sensor board for a 100% signal.

When wiring, checking or working within a ZGARD C Controller, 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 code for the number of remote sensors associated with the corresponding controller.
5. Confirm that each controller's active 4-20mA remote sensor(s) are appropriately wired to the appropriate analog input terminals. **OR** 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 manual for further details.**
6. Power up the controller and observe the behavior of the following indicators;

   Green LED (POWER) Indicator on front panel should be ON. **(On the 1-Channel Controllers only)**

   Green LED (Sensor OK) Indicator(s) on front panel should be ON.

   Amber LED (WARNING) Indicator(s) on front panel should be OFF.

   Red LED (ALARM) Indicator(s) 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.

7. Allow the associated remote gas sensors to stabilize. **Refer to the appropriate gas sensor manual 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 C Controller.

8. Confirm the functionality of the controller and that is operating according to the designed or pre-set configuration settings.
9. 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 manual 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.

10. Remove any test equipment from the sensor and controller.
11. Secure the locking screws on the front door of the ZGARD C Controller.
12. Secure the locking screws on cover or front door of the associated remote gas sensors.

    ✓ The initial function test of the ZGARD C Controller is now completed.

ZGARD C Controllers
Parts List

Item	Part Number
1-Channel Controller	10097989
1-Channel Display	10090652
1-Channel Ribbon Cable Assembly	10090653

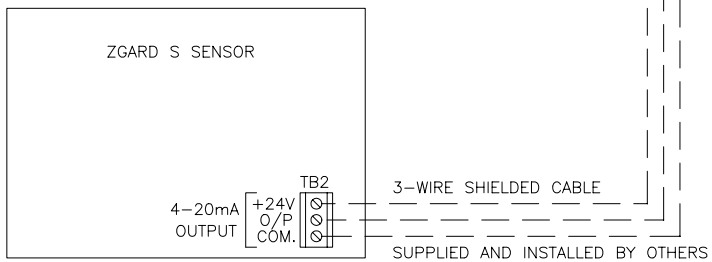
Item	Part Number
4-Channel Controller	10097990
4-Channel Display	10097928
4-Channel Ribbon Cable Assembly	10097988

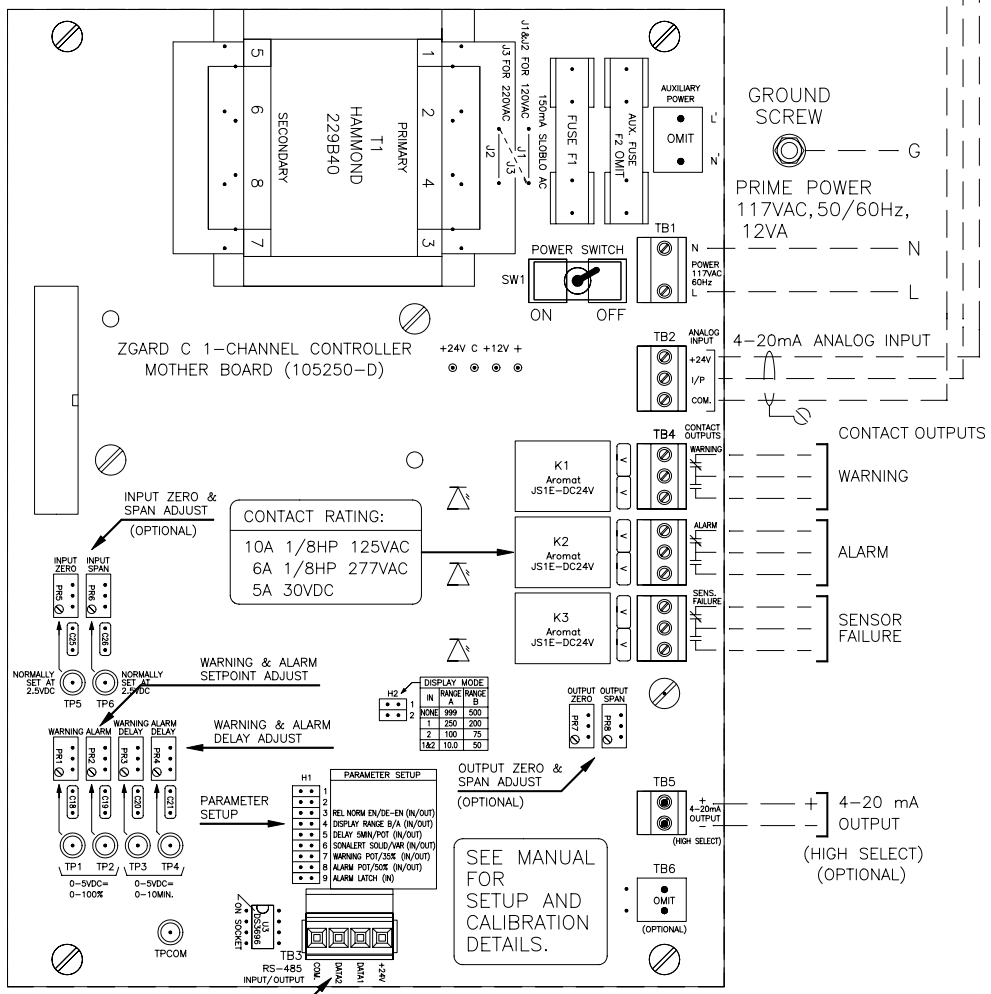
*** When ordering replacement parts, please state the MSA P/N and S/N of unit.**

⚠ WARNING

Use only genuine MSA replacement parts when performing any maintenance on the ZGARD C Controllers. Failure to do so may seriously impair instrument performance. Repair or alteration of the ZGARD C controllers, 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.

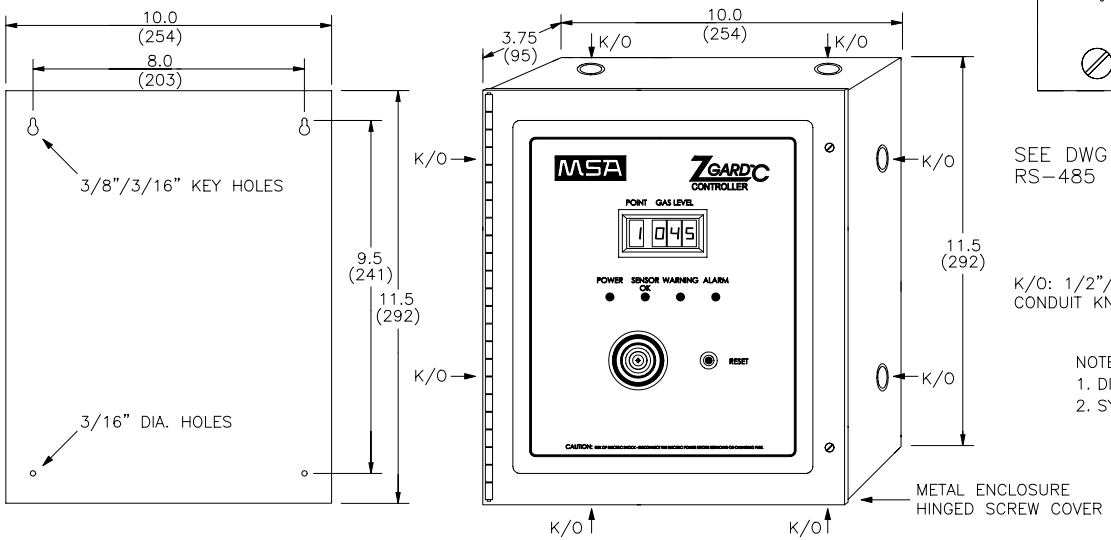
Disconnect all power source(s) to the ZGARD C Controllers before removing or changing any components.





CABLE LENGTH VS. SIZE (AWG#)	
CABLE LENGTH FEET	GAUGE (AWG#)
1 TO 5,000	18

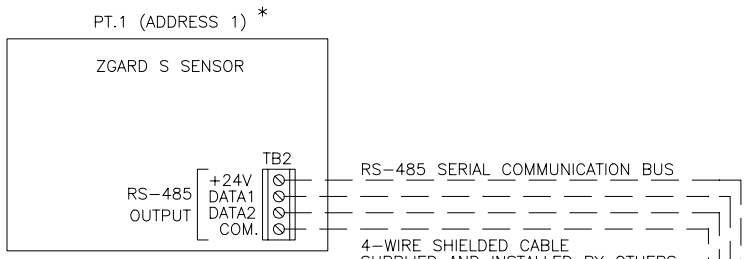
SUGGESTED CABLE	
GAUGE (AWG#)	3–WIRE SHIELDED CABLE
18	ALPHA WIRE 5523



K/O: 1/2"/3/4"
CONDUIT KNOCK OUT

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

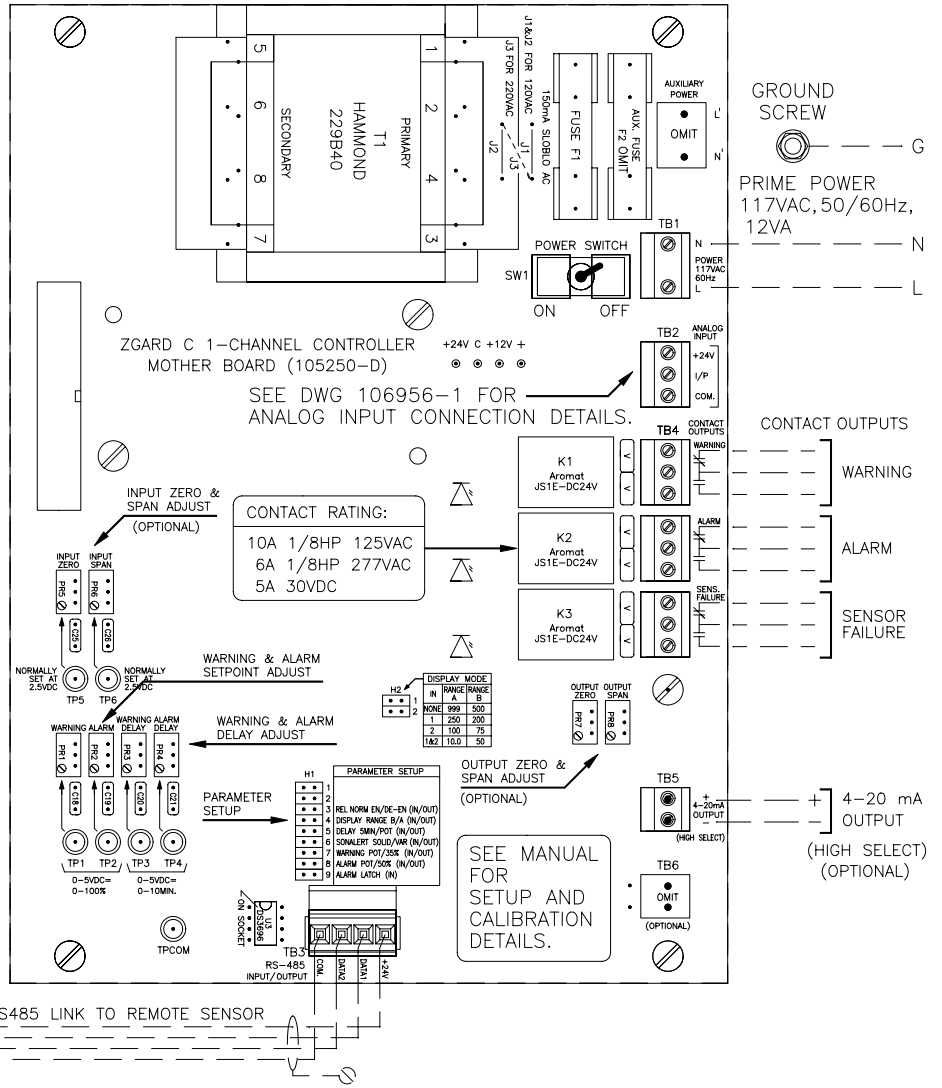
MSA		
CHKD:	DATE: Jan. 26/05	DRN: KS
ZGARD C 1-Channel Controller Installation Outline for 4-20mA Analog Signal Type Sensor		
DWG. NO.: 106956-1		REV. A

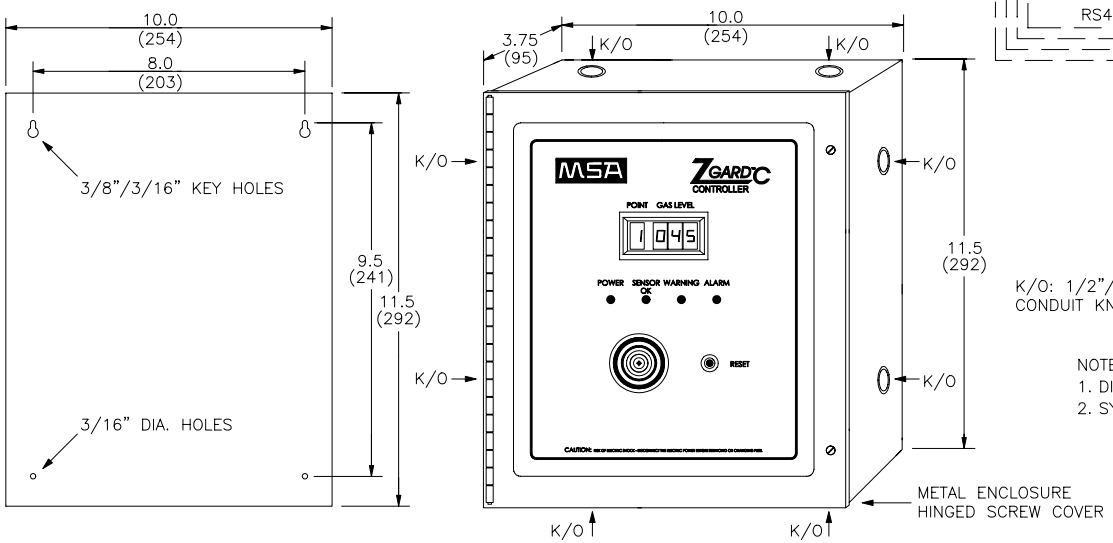


* MAKE SURE THAT THE ZGARD S SENSOR IS GIVEN ADDRESS 1 ON ITS ADDRESS JUMPERS OR THE ZGARD C CONTROLLER WILL NOT BE ABLE TO COMMUNICATE TO IT.

CABLE LENGTH VS. SIZE (AWG#)	
CABLE LENGTH FEET	GAUGE (AWG#)
1 TO 500	22
501 TO 1,000	22
1,001 TO 1,500	20
1,501 TO 2000	18

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

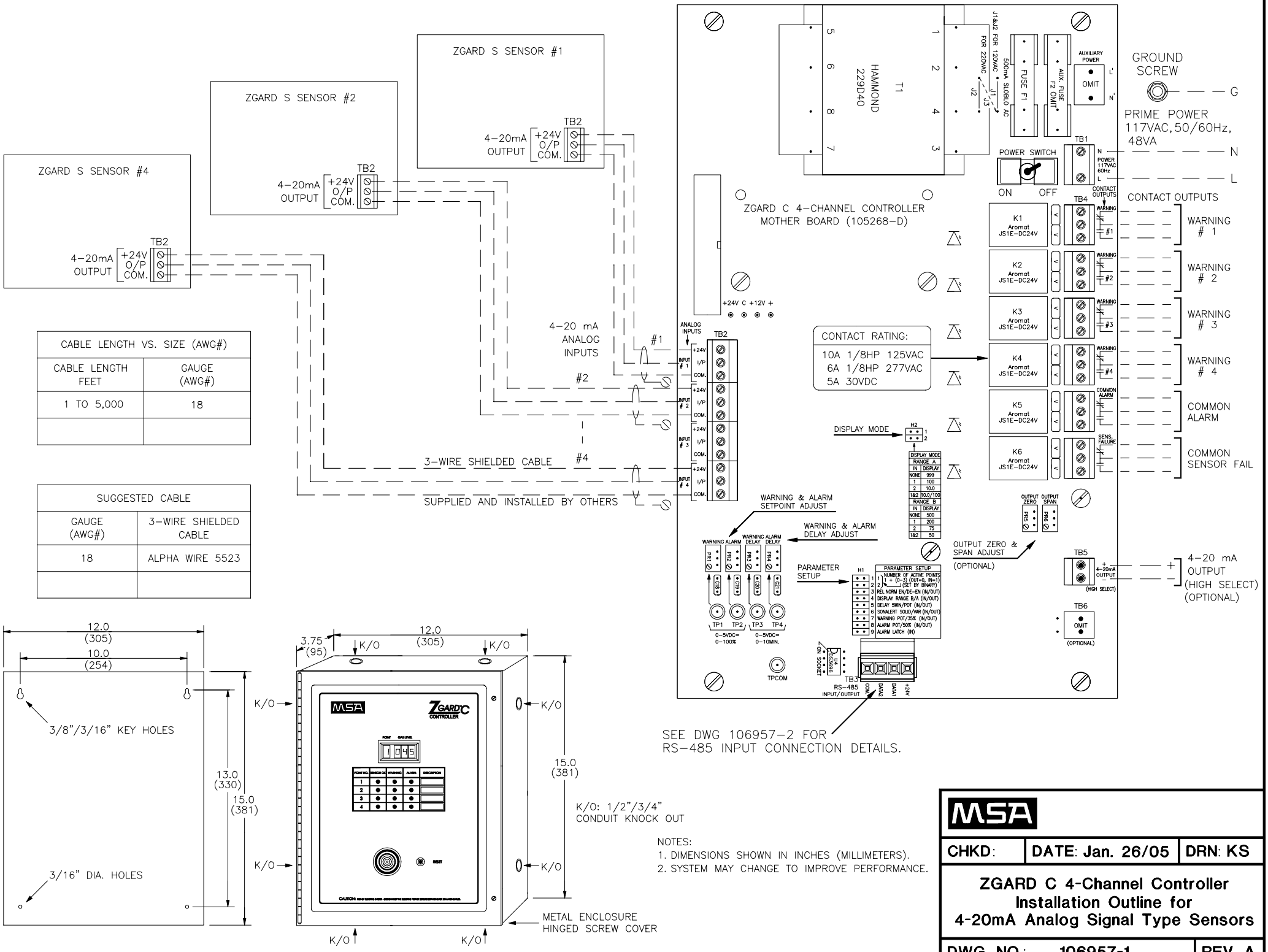




K/O: 1/2"/3/4" CONDUIT KNOCK OUT

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

MSA		
CHKD:	DATE: Jan. 26/05	DRN: KS
ZGARD C 1-Channel Controller Installation Outline for RS-485 Digital Signal Type Sensor		
DWG. NO.: 106956-2		REV. A

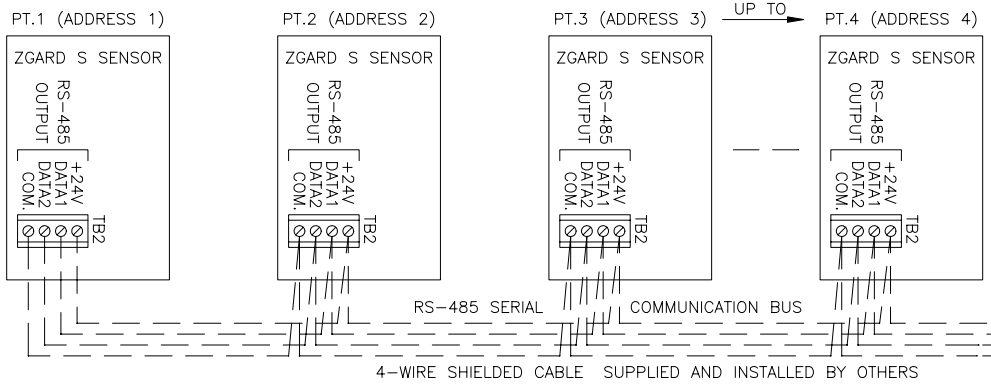


CABLE LENGTH VS. SIZE (AWG#)	
CABLE LENGTH FEET	GAUGE (AWG#)
1 TO 5,000	18

SUGGESTED CABLE	
GAUGE (AWG#)	3–WIRE SHIELDED CABLE
18	ALPHA WIRE 5523

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

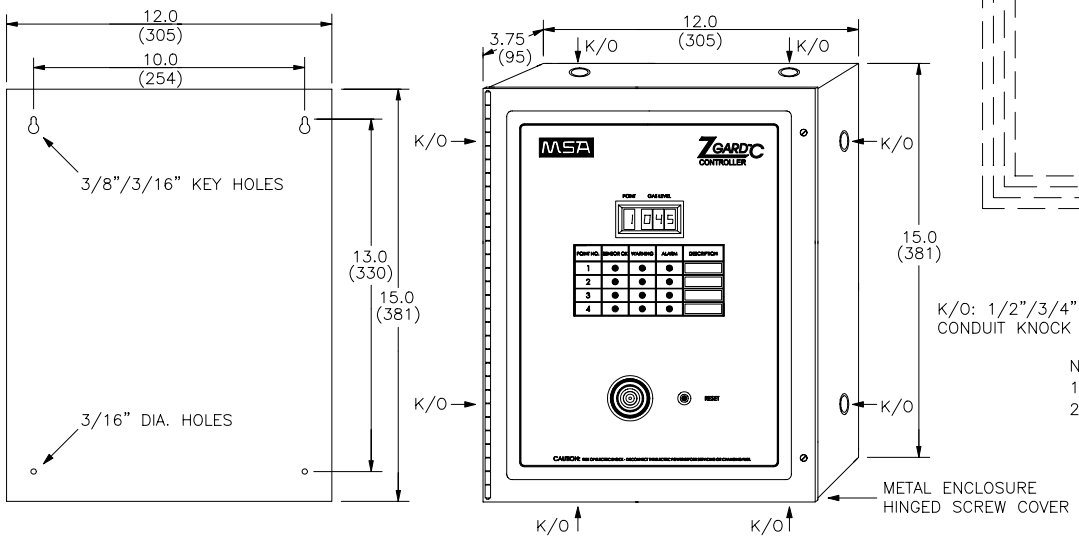
MSA		
CHKD:	DATE: Jan. 26/05	DRN: KS
ZGARD C 4-Channel Controller Installation Outline for 4-20mA Analog Signal Type Sensors		
DWG. NO.: 106957-1		REV. A

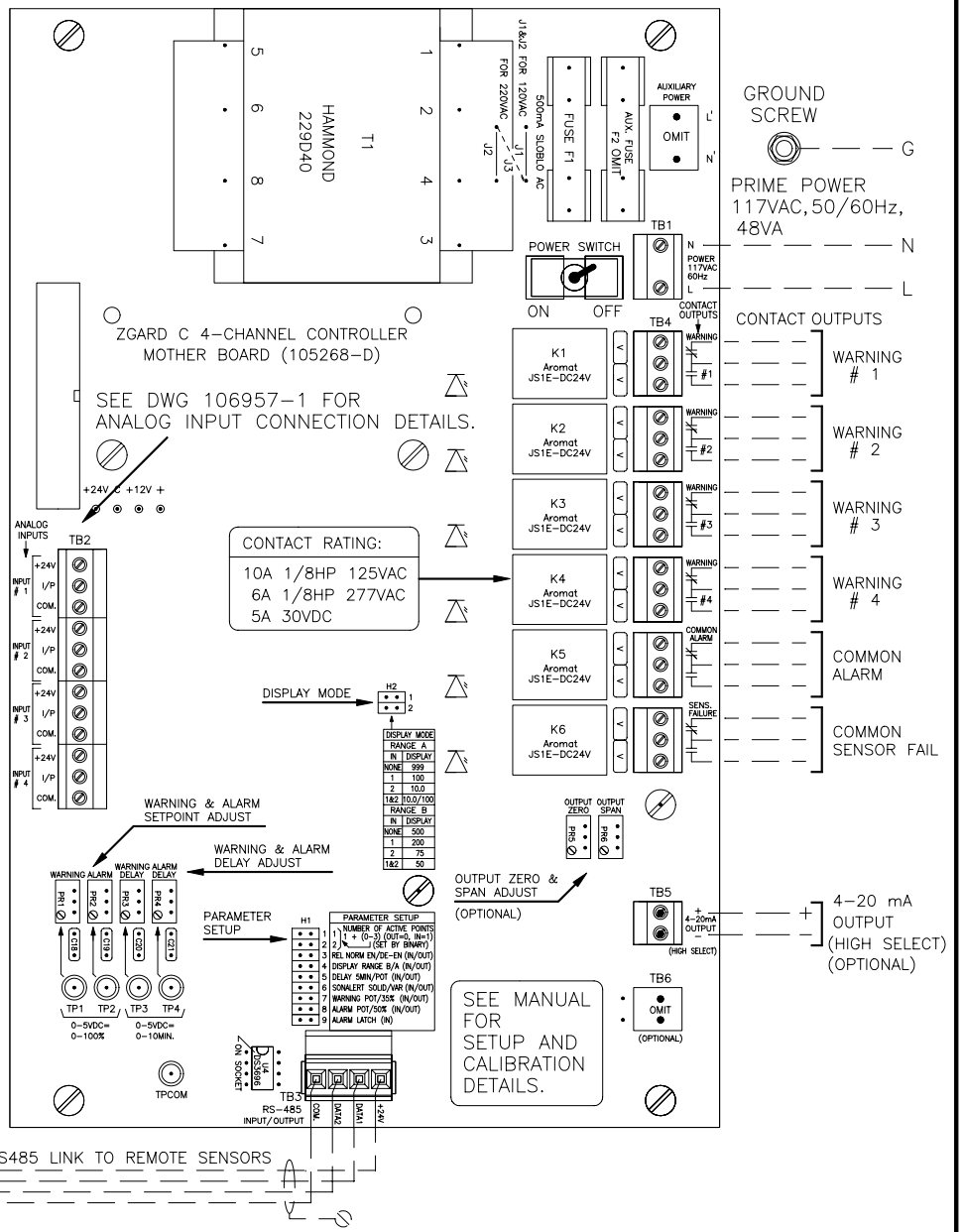


FOR DAISY-CHAIN (SERIES) WIRING OF ZGARD S SENSORS TO THE ZGARD C CONTROLLER AS SHOWN HERE, EACH SENSOR MUST BE UNIQUELY ADDRESSED VIA JUMPERS ON SENSOR CIRCUIT BOARD.

CABLE LENGTH VS. SIZE (AWG#)				
CABLE LENGTH FEET	No. OF SENSORS	2	3	4
1 TO 500	AWG #	22	22	22
501 TO 1,000	AWG #	22	22	22
1,001 TO 1,500	AWG #	20	20	20
1,501 TO 2000	AWG #	18	18	18

SUGGESTED CABLE	
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.

MSA		
CHKD:	DATE: Jan. 26/05	DRN: KS
ZGARD C 4-Channel Controller Installation Outline for RS-485 Digital Signal Type Sensors		
DWG. NO.: 106957-2		REV. A