

MSA Chillgard® NH₃ Gas Monitor

Instruction Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this device will perform as designed only if it is 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 the product are voided if the product is not used and serviced in accordance with the instructions in this manual. 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 service.

In the U.S., to contact your nearest stocking location, dial toll-free 1-800-MSA-INST
To contact MSA International, dial 1-412-967-3354.

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Manufactured by

MSA INSTRUMENT DIVISION

P.O. Box 427, Pittsburgh, Pennsylvania 15230

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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, sensor elements, 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 goods sold under this contract. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass onto 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.**
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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 and Cautions

WARNING

1. The Chillgard NH₃ Gas Monitors described in this manual must be installed, operated and maintained in strict accordance with their labels, cautions, warnings, instructions, and within the limitations stated.
2. The Chillgard NH₃ Gas Monitor is designed to detect gases or vapors in air. It cannot measure the concentration of gases or vapors in steam or inert or oxygen-deficient atmospheres.
3. Electrochemical sensors are sealed units which contain a corrosive electrolyte. Should a sensor develop leakage, it must be immediately removed from service; then, remove it from the sensing head and discard it properly. Caution must be exercised so that the electrolyte does not contact skin, eyes, clothing or circuitry; otherwise, serious personal injury (burns) and/or equipment damage may result.
4. 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 Chillgard NH₃ Gas Monitor, beyond the scope of these maintenance instructions or by anyone other than an 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.
5. Do not locate the general-purpose enclosure models in an area which may contain a flammable mixture of gas and air; otherwise, an explosion may occur. The general-purpose Chillgard NH₃ Gas Monitors can be a source of ignition and must not be mounted in an area where a flammable mixture of combustible gas and air may become present; otherwise, an explosion may occur.

Failure to follow the above can result in serious personal injury or death.

⚠ CAUTION

1. As with all gas monitors of these types, high levels of, or long exposure to, certain compounds in the tested atmosphere could contaminate the sensors. This sensor is not intended for areas that have constant ammonia present. Constant exposure to ammonia may shorten the life of the internal sensor. In atmospheres where a Chillgard NH₃ Gas Monitor may be exposed to such materials, calibration must be performed frequently to ensure that operation is dependable and display indications are accurate.
2. The Chillgard NH₃ Gas Monitor must not be painted. If painting is done in an area where a Monitor is located, care must be exercised to ensure that paint is not deposited on the sintered, metal flashback arrestor in the inlet fitting of the Chillgard NH₃ Gas Monitor, if so equipped. Such paint deposits would interfere with the diffusion process, whereby a sample of the atmosphere being monitored diffuses into the Monitor.
3. The only absolute method to ensure proper overall operation of a Chillgard NH₃ Monitor is to check it with a known concentration of the gas for which it has been calibrated. Consequently, calibration checks must be included as part of the routine inspection of the system.
4. Protect the Chillgard NH₃ Gas Monitor from extreme vibration. Do not mount the sensing head in direct sunlight as this may cause overheating of the sensor.

Failure to follow the above can result in injury, product damage and/or an unsafe condition.

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Chapter 1, Installation

General Description

The Chillgard NH₃ Gas Monitor is designed to sample the environment where mounted and alert you to potentially dangerous levels of your target gas. The unit is factory-calibrated and shipped ready for installation.

Identifying Your Unit

- The Chillgard NH₃ Gas Monitor is housed in a rugged, plastic general-purpose enclosure (FIGURE 1-1).



Figure 1-1. General-Purpose Chillgard NH₃ Gas Monitor

To determine your sensor type and options, check the shipping carton. Checked items are included in the carton. Also check the sensor I D label located on the sensor module. The carton label identifies output (2 or 3 wire, 4 to 20 mA) and any options, such as internal relays and/or LEDs.

Installing Your Gas Monitor

NOTE: Reference installation outline drawings listed in Chapter 3, "Specifications".

Generally, the Chillgard NH₃ Gas Monitors or remote sensing module should be mounted close to the area where a leak is likely to occur or where the gas is expected. Install the Chillgard NH₃ Gas Monitors or the remote sensing module at a high level (ceiling) based upon the density of the gas most likely to be found. Install the unit so that the front display of the unit is not blocked or hidden from view.

⚠ CAUTION

Mount the Chillgard NH₃ Gas Monitor or remote sensing module with the sensor inlet fitting pointed downward; otherwise, the inlet may become clogged with particulate matter or liquids.

Do not paint the Chillgard NH₃ Gas Monitors. If painting is done in an area where a sensor is located, exercise CAUTION to ensure paint is not deposited on the sensor inlet fitting. Such paint deposits would interfere with the diffusion process, whereby a sample of the monitored atmosphere diffuses into the sensor. In addition, solvents in the paint may cause an alarm condition to occur.

Protect the Chillgard NH₃ Gas Monitors from extreme vibration. Do not mount sensing head in direct sunlight as this may cause overheating of the sensor.

⚠ WARNING

Do not locate the general-purpose enclosure models in an area which may contain a flammable mixture of gas and air; otherwise, an explosion may occur. The general-purpose Chillgard NH₃ Gas Monitors can be a source of ignition and must not be mounted in an area where a flammable mixture of combustible gas and air may become present; otherwise, an explosion may occur. If such a location must be monitored, use an explosion-proof gas monitor.

Installing the Chillgard NH₃ Gas Monitor

Remove lid and drill enclosure for power, signal and optional relay cable entry. Use one of the following methods to mount the general-purpose Chillgard NH₃ Gas Monitor/Less Sensor or the Chillgard NH₃ Gas Monitor.

- Using customer-installed wiring holes, install the Chillgard NH₃ Gas Monitor to the end of rigid conduit.
- Use mounting holes in the corners of the Chillgard NH₃ enclosure to mount directly to a wall.

NOTE: For Chillgard NH₃ units with internal relays, see Appendix A.

This assembly is marked to identify power, ground and signal connections.

- A two-wire connection is possible if your unit does not contain an internal heater.
- A three-wire connection is required for all other models.

Wiring for all Models

In these installations, twisted-pair, instrument quality cable is recommended. Shielded cable is recommended for cable runs where interferences from radio frequency interference (RFI), electromagnetic interference (EMI) or other noise sources exist (such as motors, welding equipment, heaters, etc.).

NOTE: See Installation Outline Drawings for wiring details as specified in Chapter 3, "Specifications".

Conduit may also be needed in areas where large amounts of electrical noise is expected.

Use caution when selecting a cable size. The following tables express the maximum cable length when only using the Chillgard NH₃ Gas Monitors. Chillgard NH₃ options may take additional power which requires a heavier cable or a short cable run.

When selecting cable size, consider future needs (i.e., addition of sensors and/or options available with the Chillgard NH₃ Monitors). See Chapter 3, "Specifications" for proper input voltage.

Ensure that water and dirt are not able to enter the unit via the wire or conduit. If the unit is installed in a location known to be wet or damp, it is good practice to loop or bend the entry into the unit that prevents water incursion.

For Milliamp Output

The Chillgard NH₃ Gas Monitors may be connected to any device capable of accepting 4 to 20 mA analog signals such as:

- Model 5000 unit (with 4 to 20 mA inputs)
- Quad Gas Controller

- Gasgard Monitors
- Programmable controllers
- DCS's, etc.

An external power supply is required. (For power requirements, see Chapter 3, "Specifications".) All connections should be made by following appropriate wire code procedures.

- See TABLE 1-1 for typical cable length and wire size for installation.

⚠ WARNING

When using any of the the Chillgard NH₃ accessories (such as relays) with the 4 to 20 mA output Chillgard NH₃ Gas Monitor, a three-wire connection must be used. Failure to use a three-wire connection could damage the electronics within the Chillgard NH₃ Gas Monitor which can result in serious personal injury or death.

Be sure to install your Chillgard NH₃ Gas Monitor according to National Electrical and local procedural codes. Failure to do so can result in an unsafe condition.

NOTE: TABLES 1-1 does not apply to Chillgard NH₃ Gas Monitors with Internal Relays. If Internal Relays exist, see Appendix A.

Typical Chillgard NH₃ Gas Monitor Wiring

- Two-wire, 4 to 20 mA Chillgard NH₃ Monitors operate in the current loop mode (see FIGURE 1-3 for general-purpose).
 - Three-wire Chillgard NH₃ Monitors operate in the current source mode (see FIGURE 1-5 for general-purpose).
1. Connect 7 to 30 VDC power lead to J8-1 (see FIGURE 1-2).
 2. Connect J8-2 to 4 to 20 mA input on remote system.
 3. For three-wire operation, connect the signal ground to J8-3 (for two-wire operation, there is no connection to J8-3).
 4. Connect the sensor module to labeled connector J-1 on the main pc board.
 5. Wire for optional relays (see Appendix A).
 6. Assemble lid on enclosure.

Table 1-1.
Chillgard NH₃ Maximum Cable Length and 4-20 mA Signal Load

POWER SUPPLY		24 VOLTS		
CONFIGURATION	NO RELAYS	RELAYS INSTALLED	NO RELAYS	RELAYS INSTALLED
22 AWG CABLE	1000 FEET	800 FEET	- - -	- - -
18 AWG CABLE	2500 FEET	2100 FEET	900 FEET	640 FEET
16 AWG CABLE	4200 FEET	3000 FEET	1400 FEET	900 FEET
12 AWG CABLE	10,000 FEET	7700 FEET	3600 FEET	2200 FEET
MAXIMUM LOAD ON 4 - 20 mA SIGNAL		600 OHMS	300 OHMS	

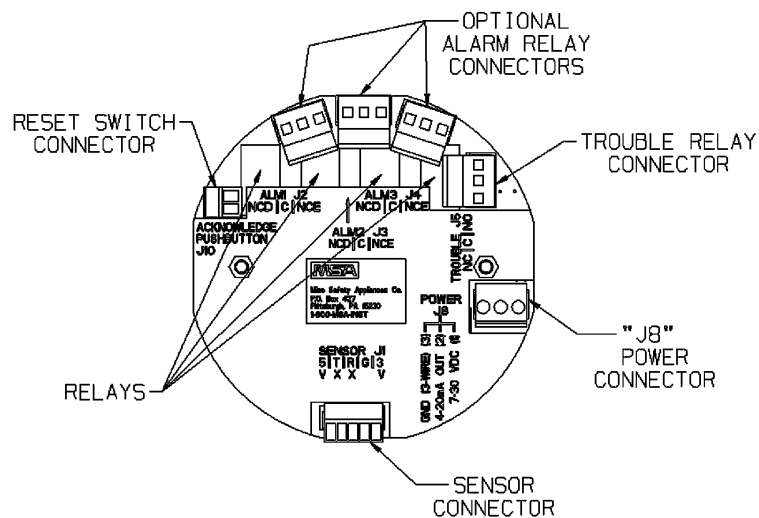


Figure 1-2. Circuit Board

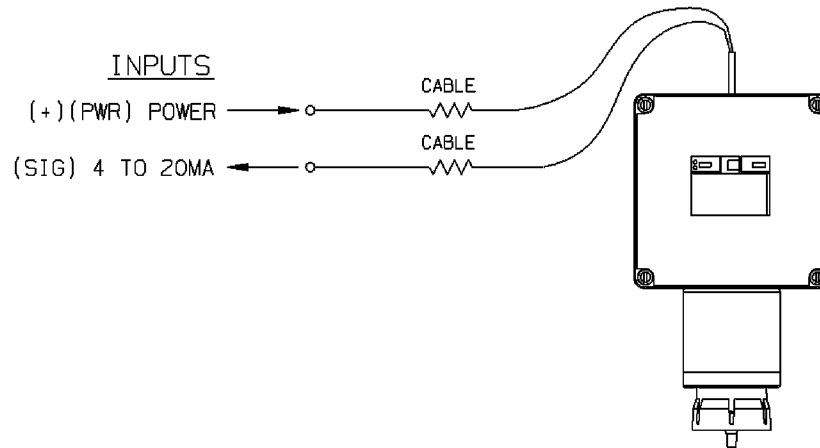


Figure 1-3. General-Purpose Two Wire Operation

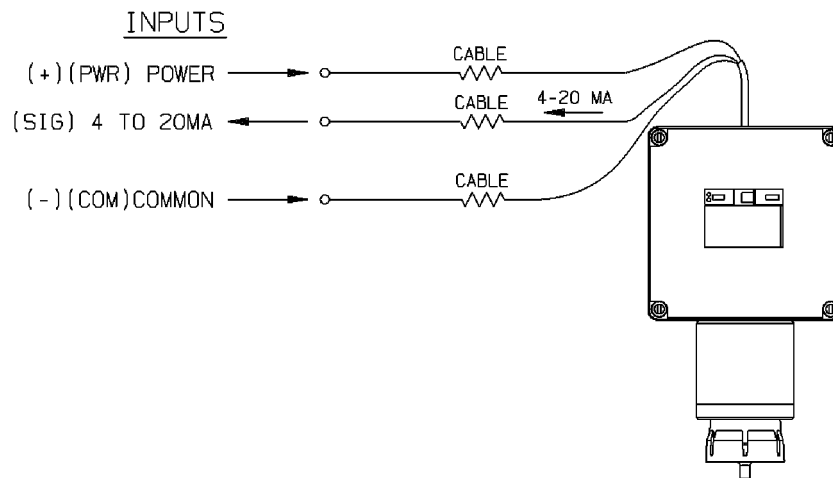


Figure 1-4. General-Purpose Three-Wire 4 to 20 mA Operation

Chapter 2, Start-up and Calibration

Initial Start-up

- The Chillgard NH₃ Gas Monitors are factory-calibrated and ready for immediate use.
- Once power is applied to the unit, the LCD shows a test of all display words. The software version number displays; then, a 30-second (self-check) countdown for sensor stability begins.
- During the 30-second countdown, the output signal is the same as the calibration signal when enabled during a normal calibration. This is described later in this chapter under "Chillgard NH₃ Gas Monitor Calibration Output Signal".
- For units with LEDs, the Alert red LED will be solid ON during the 30-second countdown.
- After the 30-second countdown, observe that the gas type and gas concentration (ppm) alternately flash (FIGURE 2-1).
- For units with LEDs, the Normal green LED will be solid ON after the 30-second countdown.
- A complete listing of instrument operation features can be found in TABLE 2-1.

During normal operation, the Chillgard NH₃ Monitor displays the gas concentration of the surrounding environment. The corresponding output signal can be transmitted to a controller. At temperatures less than 0°C, viewing of the display may be difficult due to low temperature and condensation. Therefore, at temperatures less than 0°C, it is recommended that the 4-20 mA output is used in conjunction with the display.

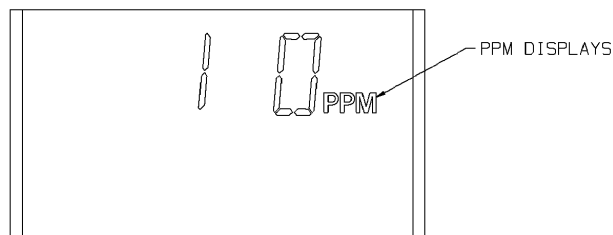


Figure 2-1. LCD Gas Concentration Display

Table 2-1. Instrument Operation

OPERATION	LEDs		4 to 20 mA	FAULT RELAY
	GREEN	RED		
NORMAL NO ALARMS	ON steady	OFF	Gas value	Energized
ALARMING	OFF	Flashing	Gas value	Energized
FAULT	OFF	ON steady	3.0 mA	De-energized
POWER UPI/ COUNTDOWN	OFF	ON steady	ALERT option ¹ disabled; 21.0 mA for O ₂ ; 3.75 mA for others	Energized if ALERT option disabled
			ALERT option ¹ enabled; 3.75 mA for all	De-energized if ALERT option enabled ¹
SENSOR MISSING/ COUNTDOWN	OFF	ON steady	3.0 mA if SWAP delay timeout ² expired, SWAP Delay ³ disabled or FAULT	De-energized if SWAP delay timeout ² expired, SWAP delay ³ disabled or FAULT
			Previous gas value if SWAP delay ³ enabled and SWAP delay timeout ² not expired	Energized if SWAP delay ³ enabled and SWAP delay timeout ² not expired
SENSOR CAL	OFF	ON steady	3.75 mA if cal signal enabled and ALERT option ¹ enabled; gas value if cal signal disabled	Energized if ALERT option disabled
			21.0 mA for O ₂ if cal signal enabled & ALERT option ¹ disabled	De-energized if ALERT option enabled ¹
CAL 4-20	OFF	ON steady	4 mA if 4 mA calibration selected	Energized if ALERT option disabled
			20 mA if 20 mA calibration selected	De-energized if ALERT option enabled ¹
CAL FAULT	OFF	ON steady	Gas value	De-energized two seconds every minute
UNDERRANGE	OFF	ON steady	3.0 mA if gas value 0 or less; gas value otherwise	De-energized

NOTES:

¹ See Controller/Calibrator manual for ALERT option

² Swap Delay timeout is 60 seconds if enabled; 0 seconds otherwise

³ See Controller/Calibrator manual for SWAP Delay option

⁴ Alarming operation will be followed if the alarms are enabled

Calibration Basics

While the Chillgard NH₃ Gas Monitor is factory-calibrated, it is good practice to calibrate the unit once it is installed in its final environmental destination.

As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor. The frequency of the calibration gas tests depends on the operating time and chemical exposures of the sensors. New sensors should be calibrated more often until the calibration records prove sensor stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager. Before calibrating, the Chillgard NH₃ Gas Monitor must be powered for a minimum of one hour to allow the sensor to settle into its new environment.

CAUTION

Before attempting a calibration, power the unit at least one full hour.

To ensure a fully functional sensor, perform a calibration check and adjustments at initial start-up and at regular intervals.

When it is determined that calibration adjustments are required, the Chillgard NH₃ Gas Monitor provides a one-man, non-intrusive method of adjustment at the unit.

To calibrate the unit, one of the following accessories is necessary:

- Ultima Calibrator P/N 809997 (FIGURE 2-2)
- Ultima Controller P/N 809086 (FIGURE 2-3)

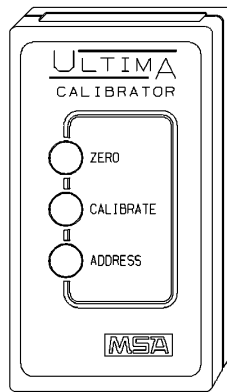


Figure 2-2. Ultima Calibrator

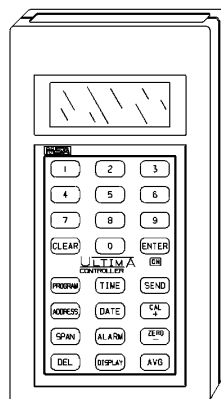


Figure 2-3. Ultima Controller

Ultima Calibrator

The Ultima Calibrator allows the following functions:

- Zero
- Calibration (zero and span)
- Changing address for some models.

Ultima Controller

The Ultima Controller also provides the above functions plus access to the following features:

- Three levels of alarm and relays
- Date of last successful calibration
- Maximum gas readings over selected time periods
- Average gas readings over selected time periods
- Changing span gas value from factory-set value
- Access to real-time clock for time and date
- Changing of full scale value.

NOTE: See Ultima/Chillgard NH₃ Controller/Calibrator manual (P/N 813379) for full functionality.

Note on Resetting Latched Alarms with Controller or Calibrator

When an Chillgard NH₃ Gas Monitor has an active latched alarm (indicated by a flashing alarm display):

- An infrared (IR) remote device (such as the Ultima Calibrator or Controller) may be used to reset this alarm.
- The next IR command it receives from a calibration device will reset the latched alarm (if it is not beyond the alarm threshold). The intended IR command will be ignored and interpreted as an 'alarm reset.' When the latching alarm function is inactive, other valid IR commands may be used.

Chillgard NH₃ Gas Monitor Calibration Output Signal

The Chillgard NH₃ Gas Monitor is shipped with the calibration output signal disabled so the output signal will track the gas concentration value during the calibration process. In some applications, it may be desirable to disable or lock the output to a pre-determined output value to prevent activation of alarm devices. The calibration signal can be enabled using the Ultima Controller. When the calibration signal is enabled, the output signal is 3.75 milliamps for the 4 to 20 milliamp output models.

Calibration Kit

Calibration Kit #40 is available for the Chillgard NH₃ Gas Monitors.

Chillgard NH₃ Gas Monitor Calibration Procedure

Read all calibration instructions before attempting an actual calibration. Also, identify and become familiar with all of the calibration components. During the calibration, it is necessary to quickly apply the span gas to the unit. Prior connection of the calibration components will aid in the ease of unit calibration.

The only true check of any gas monitor's performance is to apply gas directly to the sensor. The calibration procedure must be performed regularly.

INITIAL Calibration

When the unit is powered up for the first time, or when a new sensor module is placed in the unit, an INITIAL Calibration is recommended. This procedure enables the unit to gather data about the sensor to make accurate decisions for the CHANGE SENSOR function and the CAL FAULT function to work properly. During normal use, INITIAL calibration should only be used when a regular calibration will not clear a fault condition due to use of incorrect calibration gas or another similar situation.

The INITIAL calibration is accomplished by:

- simultaneously pressing the ZERO and CALIBRATE buttons of the Ultima Calibrator or
- pressing and holding SPAN button on the Ultima Controller:
 - The display should show "APPLY ZERO GAS"
 - The word "ICAL" on the display distinguishes an INITIAL Calibration from a regular calibration. If "ICAL" does not appear, abort the calibration; then, retry the above procedure.

NOTE: The zero or calibration process can be aborted at any time simply by pressing any button during the 30-second countdown on the Calibrator while aiming at the unit or by pressing and releasing the push-button if push-button calibration is available.

- The remainder of the procedure is now the same as that for a regular calibration, as described in the following procedure.

Regular Calibration

A regular calibration includes a "zero" and "span" procedure as described in the following procedures. If the user chooses to only perform a "zero" procedure, they may do so by pressing the

ZERO button on the Calibrator or Controller instead of the CALIBRATE button as described as follows, or by using the optional push-button calibration as outlined in Appendix A, "Optional Push-button Calibration".

Zeroing

1. Using zero gas cylinder:

- a. Locate the zero gas cylinder and the Calibration Kit Flow Controller.
- b. Screw the Flow Controller onto the top of the zero gas cylinder.
- c. Locate the Tube Assembly from the cal kit.
- d. Push the smaller end of the Tube Assembly over the Flow Controller gas outlet and ensure tubing completely covers the gas outlet.
- e. When using Cal Kit 40, connect the other end of the tubing over the SensorGard inlet.
- f. Turn on the zero gas flow by turning the knob on the flow controller.

2. Point the Calibrator or Controller at the Chillgard NH₃ Monitor display; press the CALIBRATE button.

NOTE: The zero or calibration process can be aborted at any time during the 30-second countdown interval; simply press any button on the Calibrator or Controller while aiming it at the unit or by pressing and releasing the push-button if push-button calibration is available.

NOTE: The 30-second countdown interval is omitted for oxygen units; it is electronically zeroed.

The display shows:

- A countdown from 30 to 0 seconds
- APPLY ZERO GAS (FIGURE 2-4)

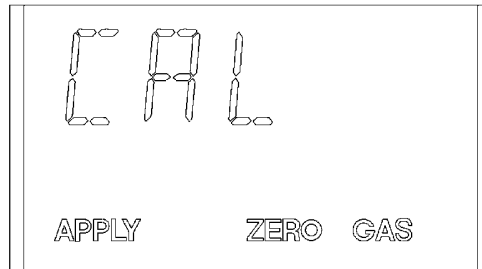


Figure 2-4. Apply Zero Gas Flag

3. After the 30 second countdown:
 - The display alternates between "CAL" and a value. This value is the actual reading of the gas concentration the sensor is detecting.
 - Once the gas value on the display is stable, the alternating display stops. If the calibration is successful, the display will show END.
 - a. If using the zero cap: remove it.
 - b. If using a zero gas cylinder:
 - 1) Turn OFF the gas flow by turning the flow controller knob.
 - 2) Remove the tubing from the SensorGard.
 - If the calibration output signal is enabled during calibration, it will be held at the lockout value for an additional two minutes or until after the span routine if performing a full calibration.
 - c. If CAL FAULT appears on the display, this indicates:
 - An unsuccessful attempt to zero or calibrate the Chillgard NH₃ Monitor
 - The Chillgard NH₃ Monitor is operating with the calibration parameters defined before the calibration was attempted.
 - See Troubleshooting Guidelines found in Chapter 4.

To extinguish the CAL FAULT, a complete, successful calibration procedure must be performed.

- The Chillgard NH₃ Monitor allows automatic zero adjustment only within a pre-defined range. It cannot make corrections outside this range, such as when an empty or wrong cylinder of gas is applied or failure to begin gas flow within the allotted 30-second countdown occurs.
- If only a ZERO was performed, the procedure is complete and the user should return the calibration equipment to the cal kit. If a CAL was performed, the gas monitor will continue to the "span" sequence as described in the following section.

Spanning

4. During a regular calibration, the Chillgard NH₃ Monitor automatically begins the span countdown after a successful zeroing of the unit. The span countdown is 30 seconds (FIGURE 2-5).

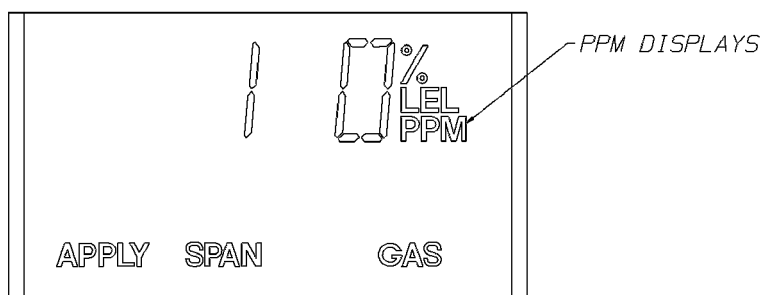


Figure 2-5. Apply SPAN Gas Flag

NOTE: The span process can be aborted at any time during the countdown by simply pressing any button on the Calibrator while aiming it at the unit.

5. Locate the span gas cylinder and the Calibration Kit Flow Controller.
6. Screw the Flow Controller onto the top of the span gas cylinder.
7. Locate the Tube Assembly from the cal kit.

8. Push the smaller end of the Tube Assembly over the gas outlet of the Flow Controller and ensure that the tubing completely covers the gas outlet.
9. When using Cal Kit 40, connect the other end of the tubing over the SensorGard inlet.
10. Turn ON the gas flow by turning the flow controller knob.
 - It is good practice to have all calibration components previously assembled.
 - Ensure that any calibration gases are applied during the 30-second count down period.
 - If a CAL FAULT indication is on the Chillgard NH₃ Monitor display before the user is able to apply the gas, a steady state gas condition was reached, causing the unit to use a wrong reading as a span indication.
 - It is necessary to restart the calibration process to clear this condition.
11. After the 30 second countdown:
 - The display alternates between "CAL" and a value. This value is the actual reading of the gas concentration the sensor is detecting.
 - Once the gas value on the display is stable, the alternating display stops. If the calibration is successful, the display will show END for approximately two seconds. (FIGURE 2-6).
 - No user adjustments are necessary.
 - The display will show the span gas value while the span gas is flowing to the unit.

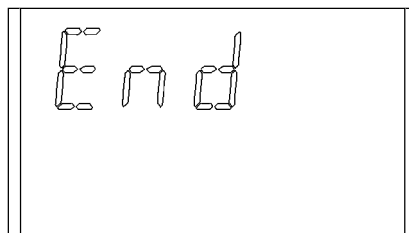


Figure 2-6. Calibration End Display

12. Turn OFF the gas flow by turning the knob on the flow controller.
- If the calibration output signal is enabled during calibration, it will be held at the lockout value for two additional minutes after END is displayed.
 - When the span gas is removed from the sensor, the sensor reading should change to show an ambient condition.
 - If a CAL FAULT appears on the display, this indicates:
 - An unsuccessful attempt to calibrate the Chillgard NH₃ Monitor
 - The Chillgard NH₃ Monitor is operating with the calibration parameters defined before the calibration was attempted.

To extinguish the CAL FAULT flag, a complete calibration procedure must be performed.

The Chillgard NH₃ Monitor allows automatic zero and span adjustments within a pre-defined range. It cannot make corrections outside this range, such as when an empty or wrong cylinder of gas is applied or failure to begin gas flow within the allotted 30-second countdown occurs.

13. After a successful calibration, remove the tubing from the Flow Controller and remove the Flow Controller from the cylinder; return all items to their appropriate location in the Calibration Kit.

Calibration Documentation

The Chillgard NH₃ Monitor records the date of the last successful calibration. This date can then be displayed on the front-panel LCD (with the use of the Controller).

Chapter 3, Specifications

Table 3-1 . Performance Specifications

TEMPERATURE RANGE	OPERATING RANGE	0 to +30°C (32 to +86°F) -40 to 30°C with heater option Calibrate within Operating Range
	*EXTENDED RANGE	0 to +40°C (32 to +104°F) without optional heater -40 to 40°C (-40 to +104°F) with optional heater
DRIFT	ZERO DRIFT	Less than 5% per year, typically
	SPAN DRIFT	Less than 10% per year, typically
NOISE		Less than 1% FS
ACCURACY	AMMONIA	LINEARITY: ±10% FS REPEATABILITY: ±5% FS
STEP CHANGE RESPONSE	TIME TO REACH 20% OF SCALE	Less than 12 seconds (typically 6 seconds)
	TIME TO REACH 50% OF SCALE	Less than 30 seconds (typically 12 seconds)
HUMIDITY		15 to 95% RH, non-condensing, 24 hours or less
		35 to 95% RH, long term
SENSOR LIFE		Two years typically
	FULL REPLACEMENT WARRANTY	One year (see "MSA Instrument Warranty")
WIRING REQUIREMENTS	mA OUTPUT	Two-wire (no heater or relays) Three-wire (all other models)
POWER INPUT		7-30 VDC @ 340 mA max.
SIGNAL OUTPUT	4-20 mA	Two-wire current sink (no heater or relays) Three-wire current source
PHYSICAL	SIZE	9.432" H x 5.125" x 3" D (239.34 mm x 130 mm x 76 mm)
	WEIGHT	1.5 lbs. (0.7 Kg.)
*Extended Range: The sensor may not meet all of the accuracy parameters listed.		

Table 3-2. Sensor Response to Interferants

If your readings are higher or lower than expected, it could be due to the presence of an interferant gas. The gas listed in column 1 is presented to the sensor. Column 2 indicates the concentration of that gas presented to the sensor. The remaining columns indicate the respective responses by the sensors to each particular gas. For Example: Scan column 1 until you locate "hydrogen". Column 2 shows that 500 ppm of hydrogen was presented to the sensor. Column 3 shows that a CO (filtered) sensor gave an equivalent response of 200 ppm. Column 4 shows that an H₂S sensor gave an equivalent response of 0.5 ppm, etc.

INTERFERANT	CONCENTRATION	NH ₃
Acetone	1000	No Data
Acetylene	12000	No Data
Ammonia	25	25
Arsine	1	No Data
Benzene	20	No Data
Bromine	2	No Data
Carbon Dioxide	5000	0
Carbon Disulfide	15	No Data
Carbon Monoxide	100	0
Chlorine	5	0
Diborane	20	No Data
Ethylene	50	0
Ethyl Alcohol	100	No Data
Ethylene Oxide	10	No Data
Ether	400	No Data
Fluorine	5	No Data
Freon 12	1000	0
Germane	1	No Data
Hexane	500	No Data
Hydrogen	500	No Data
Hydrogen Chloride	50	0
Hydrogen Cyanide	10	0
Hydrogen Fluoride	10	No Data
Hydrogen Sulfide	10	0.5
MEK	200	0
Mercaptan (Methyl)	5	No Data
Methane	5000	No Data
Nitric Oxide	100	0
Nitrogen Dioxide	5	No Data
Phosphine	0.5	0
Silane	5	No Data
Sulfur Dioxide	10	0
Tichloroethylene	1000	No Data

Chapter 4, Maintenance

General

The Chillgard NH₃ Gas Monitor is constantly performing a self-check.

- When a critical error is detected in the unit, the 4 to 20 mA output signal goes to the 3.0 mA fault condition.

NOTE: TABLES 4-1 and 4-2 describe the messages users may see.

Replacing a Sensor

The only routine maintenance item is the sensing element itself, which has a limited lifetime. When the Chillgard NH₃ Gas Monitor's read-out indicates that the sensor must be changed, there is very little sensor lifetime remaining. It is good practice to obtain a replacement sensing element before the sensing element within your unit becomes inoperative. Typically, the Chillgard NH₃ Monitor LCD display shows a maintenance message when the sensor is due for replacement (FIGURE 4-1).

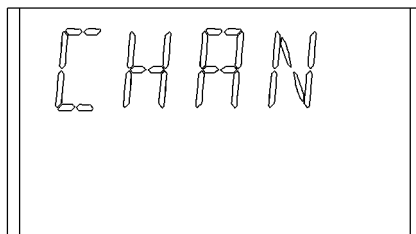


Figure 4-1. "Change Sensor" Scrolls Across the Display

⚠ WARNING

Handle the sensor carefully; the electrochemical version is a sealed unit which contains a corrosive electrolyte. If electrolyte is leaking from the sensor, exercise CAUTION to ensure the electrolyte does not contact skin, eyes or clothing, thus avoiding burns. If contact occurs, rinse the area immediately with a large quantity of water. In case of contact with eyes, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

⚠ CAUTION

Do not install a leaking sensor in the sensing head assembly. The leaking sensor must be disposed of in accordance with local, state and federal laws. To obtain a replacement sensor, contact MSA at the address given under "Obtaining Replacement Parts."

1. There is no need to open the main enclosure; simply unscrew the sensor assembly located on the bottom of the Chillgard NH₃ Gas Monitor main assembly (FIGURE4-2).

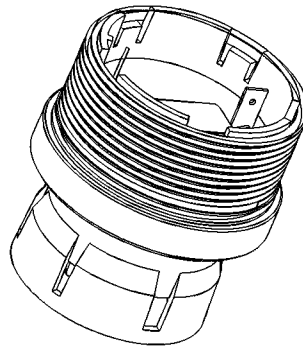


Figure 4-2. Sensor Assembly and Sensor Guard for General-Purpose Model

2. Identify the sensor assembly needed and obtain the appropriate sensor assembly; replace sensor assembly.

NOTE: Alarm setpoints and relay functions (energized/de-energized, latching/unlatching, and upscale/downscale) will not change when changing a sensor module from its current gas type to the same gas type (e.g., carbon monoxide to carbon monoxide). Alarm setpoints and the upscale/downscale relay function will change to the new sensor's default settings when changing a sensor module from its current gas type to a different gas type (e.g., carbon monoxide to oxygen).

3. The Chillgard NH₃ Gas Monitor is shipped with the Sensor Swap Delay enabled. This means that the 4-20 mA output signal and the FAULT relay will hold off a fault indication for 60 seconds after the sensor missing indication is displayed on the instrument. This setting allows the operator to exchange sensor modules without a FAULT indication.
4. Refer to Chapter 2, "Calibration".

It is recommended that all other maintenance be performed at an MSA factory-authorized service center.

Table 4-1. Operational Display Messages

MESSAGE	INDICATES
MM/DD/YY	Format for date scrolling
VER	Software version level will display next
TIME	Time will display next
DATE	Date will display next
MIN	MIN value for this interval will display next
MAX	MAX value for this interval will display next
AVG	AVG value for this interval will display next
Adr	Instrument's address will display next
End	End of calibration cycle
Err	An Error code will display next
HR	Special case indicates hours (two characters or less)
OVER	Gas value is greater than the set range

Table 4-2. Configuration Display Messages

MESSAGE	INDICATES
CAL SIG ON	Instrument will output the calibration signal during calibration
CAL SIG OFF	Instrument will output gas value during calibration
LTCH/	Latching relay operations
UNLTCH/	Non-latching relay operations
INCR/	Increasing Alarm relay operations
DECR/	Decreasing Alarm relay operations
ENER	Energized relay operations
DENER	De-energized relay operations
CAL	Normal calibration or 4-20 calibration cycle
iCAL	Initial calibration cycle
OFF	Alarm is OFF
ON	Alarm is ON
RNGE	Instrument's operational full-scale will display next
PCAL	Instrument's previous calibration date will display next
TBLE	Instrument gas table selection (if applicable)
ALERT OP ON	Instrument output will follow ALERT mode
ALERT OP OFF	Instrument output will not follow ALERT mode
SWAP DELAY ON	60-second delay after sensor missing before fault
SWAP DELAY OFF	Fault occurs at sensor missing condition

Table 4-3. Troubleshooting Guidelines

MESSAGE	INDICATES	ACTION
CHANGE SENSOR	Sensor is at its end of life	Replace sensor
CAL FAULT	Unit did not calibrate successfully	Repeat calibration; check for proper calibration gas; check for blockage in the flow system
SENSOR MISSING	Instrument has lost communication with the sensor module	Connect or replace sensor
CHECK CAL	Calibration should be verified	Perform bump test or calibration
SENSOR WARNING	Sensor approaching end of life	Prepare to replace sensor module
SNSR FLASH FAULT	Sensor module program memory is invalid	Replace sensor module
SNSR RAM FAULT	Sensor module has a defective RAM location	Replace sensor module
SNSR DATA FAULT	Sensor module datasheet invalid	Send reset data sheet command from the controller; if error persists, replace sensor

MESSAGE	INDICATES	ACTION
MN SUPPLY FAULT	Power supply on main PCBA is out of range	Check sensor wiring or replace main pc board
MN EEPROM FAULT	EEPROM on the main PCBA is invalid	Replace main pc board
MN FLASH FAULT	Program memory on the main PCBA is invalid	Replace main pc board
MN RAM FAULT	Defective RAM memory location was found on the main PCBA	Replace main pc board
INVALID SENSOR	Attached sensor module is not compatible with main instrument	Replace with correct sensor type
CONFIG RESET	Main EEPROM memory was reset	Use Controller to reset all configurations (e.g., alarm levels, calibration signals ON or OFF, etc)
RELAY FAULT	Error with the internal relays has occurred	Cycle power to unit or replace main pc board
SNSR POWER FAULT	Power at the sensor module is out of range	Correct wiring error, replace main pc board, or replace sensor module
und	Under-range condition - quick	Recalibrate or replace sensor
Und	Under-range condition - slow	Recalibrate or replace sensor
+LOC	Instrument is locked in over-range condition	Recalibrate or reset sensor
- SUPPLY FAULT	The negative supply sensor module is out of range	Check wiring or replace sensor module
PARAM FAULT	An operational parameter is out of range or sensor failed internal check	Restart; replace, if necessary

Obtaining Replacement Parts

See Table 4-4 for replacement sensor kits. To obtain a replacement sensor, address the order or inquiry to:

- **Mine Safety Appliances Company**
Instrument Division
P.O. Box 427, Pittsburgh, PA 15230-0427
- **or call, toll-free:**
1-800-MSA-INST.

WARNING

Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair sensor performance. Repair or alteration of the Chillgard NH₃ Gas Monitor, 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.

Table 4-1. Replacement Parts List

PART	PART NO.
AMMONIA, 1000 ppm, no heater	10066134
AMMONIA, 1000 ppm, with heater	10066135
SENSOR GUARD	10065487

Appendix A, Internal Relay Option

General Information

The internal relays are designed to enable Chillgard NH₃ Gas Monitors to control other equipment. There are four relays within the Chillgard NH₃ Gas Monitor's module:

- three alarm relays
- one fault relay.

Once configured, the relays activate when the Chillgard NH₃ Gas Monitor detects an alarm condition. Similarly, the fault relay de-energizes when a fault condition is detected.

- The internal relays will be within the read-out module.

The alarm relays are enabled in the non-latching, de-energized mode at the factory.

- To disable or configure the alarms, you need the Ultima Controller (P/N 809086).
- The fault relay is normally-energized so the relay de-activates into a fail-safe condition if a fault or power outage occurs. See "Fault Relay" later in this Appendix.

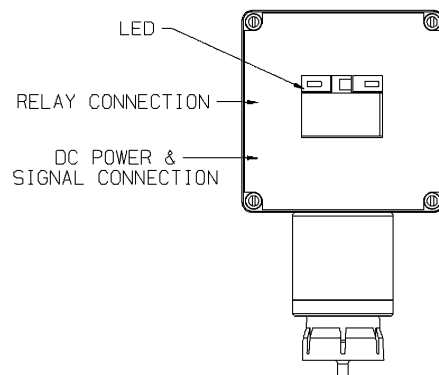
CAUTION

To prevent false alarms in the following instances, alarms/relays are temporarily disabled: 1) During the first minute from power-up 2) During calibration 3) For two minutes after calibration.

Unpacking, Mounting and Wiring the Chillgard NH₃ Gas Monitor with Internal Relays

Unpack, mount and wire the Chillgard NH₃ Gas Monitor according to Chapter 1, "Set-up." All electrical connections to the Chillgard NH₃ Gas Monitor can be made via the clearly marked board-mounted connections.

- See FIGURE A-1 for Single module general-purpose Chillgard NH₃ Gas Monitors, respectively.



**Figure A-1. Sensor Module
General-Purpose Chillgard NH₃ Wiring**

- See Ultima Controller and Calibrator Manual (P/N 813379) for complete configuration information.

NOTE: To avoid electrical noise problems, do not run AC lines from relays in the same conduit or cable tray as the DC Signal lines.

- In all installations, twisted instrument-quality cable is recommended.
- Shielded cable is recommended in situations where radio frequency interference (RFI), electro-magnetic interference (EMI) or other electrical noise sources exist or are anticipated.

Chillgard NH₃ Gas Monitor Internal Relays

Relay Specifications

Table A-1. Relay Specifications

TEMPERATURE RANGE		-40 to +60°C (-40 to +140°F)
HUMIDITY		15 to 95% RH, non-condensing
RELAYS	3 ALARMS	SPDT (Single pole, double throw)
	FAULT (normally-energized)	SPDT (Single pole, double throw)
RELAY RATINGS	AT 125 or 250 VOLTS AC, NON-INDUCTIVE	5.0 Amps or 5 Amps @ 1/10 Hp
	AT 30 VOLTS DC, NON-INDUCTIVE	5.0 Amps or 5 Amps @ 1/10 Hp
POWER CONSUMPTION (TOTAL UNIT WITH RELAYS)		7 VDC (610 mA max) 12 VDC (300 mA max) 24 VDC (200 mA max)

Alarm Relays

There are three alarm relays and one fault relay in the Chillgard NH₃ Gas Monitors. The three alarm relays:

- Activate when the Monitor detects a gas concentration level that exceeds setpoints
 - Alarms 1, 2 and 3 generally default to 10%, 20% and 30% of the full-scale reading and are set when the gas reading is above these values.
 - These default setpoints can be changed or verified via the Chillgard NH₃ Controller.
 - See Ultima/Chillgard NH₃ Controller and Calibrator manual (P/N813379).
 - The Controller can also enable the latching alarm function.
- Are factory-set to a de-energized position.

- All relay connections have a normally-open set of contacts and a normally-closed set of contacts. These contacts are labeled as NCD (normally-closed, de-energized) or NCE (normally-closed, energized).
- The units are shipped with alarm relays factory-set to the de-energized (non-alarm) position and the trouble relay set to the energized (non-fault) position.
- Upon activation, the relay contacts change state and remain changed for as long as:
 - The alarm condition exists within the Chillgard NH₃ Gas Monitor or
 - The latching mode is selected (see "Note on Resetting Latched alarms with Controller or Calibrator" in Chapter 2).
- These defaults can be changed or verified via the Ultima Controller.

Fault Relay or Trouble

- It is a normally-energized, single-pole, double-throw (SPDT) relay.
- During normal operation, the relay contacts are normally closed (NC) and normally open (NO) as shown in FIGURE A-2.
- When a fault is detected or power is cut or turned OFF, these contacts change as follows:
 - normally closed contacts open
 - normally open contacts close.
- Provides an electrical path for fail-safe relay operation. In the event of any failure, including power loss, the relay will change to a fault condition

The Fault Relay can remain STEADY ON or PULSED. These two different modes can communicate different information to any PLC or DCS connected to the fault relay:

- **Fault Relay STEADY ON indicates:**
 - Chillgard NH₃ sensor is not connected properly or
 - Chillgard NH₃ Gas Monitor internal fault or
 - An inoperative relay.

- **Fault Relay PULSED (once per minute) indicates:**
 - Improper calibration of the Chillgard NH₃ Gas Monitor or
 - Chillgard NH₃ Gas Monitor CHECK CAL or CAL FAULT displayed.

Relay Connections

All electrical connections to internal relays can be made directly on the pc board (see FIGURE A-2).

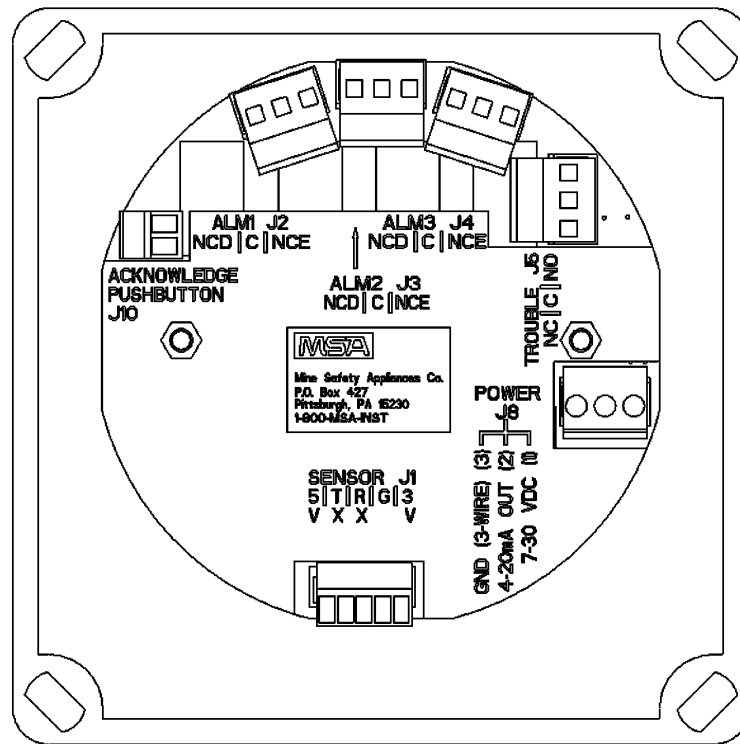


Figure A-2. Relay Contacts

If you are connecting the relays to motors, fluorescent lighting or other inductive loads, it is necessary to suppress any sparks or inductive feedback that may occur at the relay contact. These effects may render the unit inoperative. One way to reduce these effects is to install a *Quencharc® across the load being switched. This device is available from MSA as P/N 630413.

⚠ WARNING

Before wiring the Chillgard NH₃ Gas Monitors, disconnect power source supplying the monitor; otherwise, electrical shock could occur.

- The Chillgard NH₃ Gas Monitor must be disassembled for relay wiring
- The following procedure must be performed:
 1. Remove the Chillgard NH₃ Gas Monitor cover.
 2. Pull on the wiring plugs to disconnect the connectors on the exposed board.

NOTE: Observe connector locations for later re-insertion.

3. Route customer-supplied cable into the enclosure and connect to the appropriate wiring plugs.
4. Identify each conductor of the cable to enable proper connection at the control equipment.
5. If installing a RESET push-button:
 - a. Route a two-conductor cable to terminal block J10 (FIGURE A-3).
 - Route this cable with DC power to avoid noise interference from relay wiring.

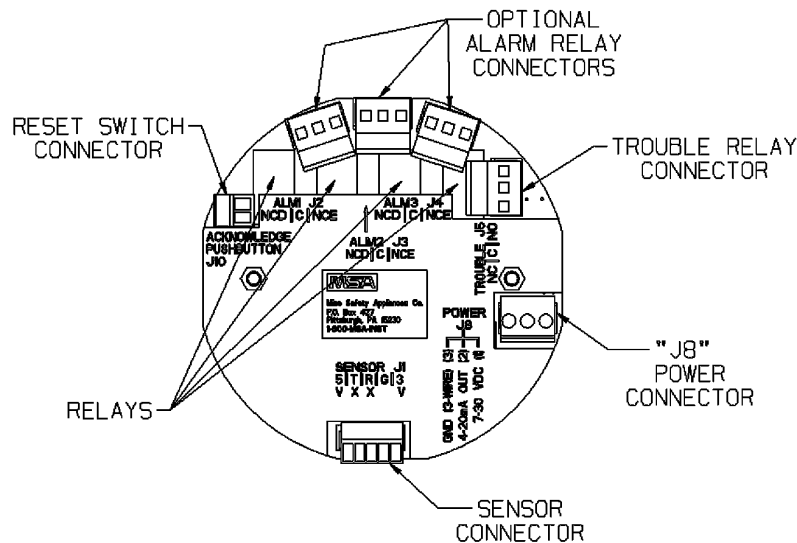


Figure A-3. Relay Printed Circuit Board

- b. Connect the two-conductor cable to the two positions of terminal block J10.
 - c. Identify the cable to enable proper connection at the button.
 - d. Route cable to the push-button location; wire the button.
6. Re-install the wiring plugs.
 - Ensure that wiring plugs are firmly seated into their mates.
7. Pull the cable away from the unit to relieve any excess slack.
 - It is important not to have excess wire or cable within the module to avoid unwanted AC noise.
8. Re-install the cover of the Chillgard NH₃ Gas Monitor.