MSA

CHEMGARD™

Infrared Gas Monitor

Instruction Manual

⚠ WARNING

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

The warranties made by Mine Safety Appliances Company with respect to this product are voided if the product is not installed, 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 repairs.

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

Manufactured by
MSA NORTH AMERICA
1000 Cranberry Woods Drive, Cranberry Township, PA 16066

(L) REV 4 **10031540**

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 nonoperation 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

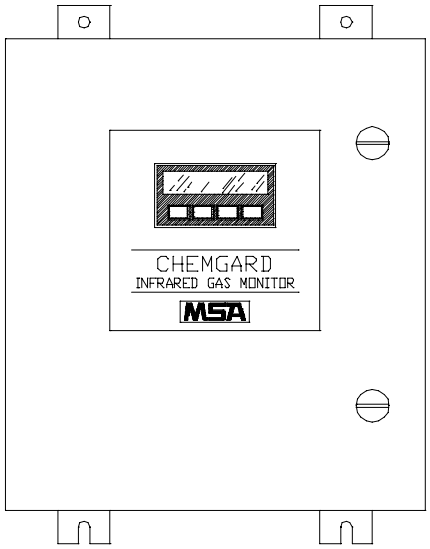
⚠ WARNING

1. The monitor and Relay Module 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 standard and rack mount monitor must not be installed in outdoor areas or in locations where explosive concentrations of combustible gases or vapors might occur in the atmosphere: Class I, Group A, B, C, and D areas as defined by the NEC. Because the monitor is not explosion-proof, it must be located in non-hazardous areas.
3. The explosion-proof (XP) Chemgard Monitor meets Class, I, Division 1, Groups B, C and D. To prevent ignition of a hazardous atmosphere, the cover of an XP monitor must be kept tightly closed when power is applied. Before removing the cover for maintenance or calibration, ensure the surrounding atmosphere is and remains free of toxic or combustible gases until the cover is closed.
4. The Chemgard Gas Monitor is designed to detect one particular gas or vapor at ambient atmospheric pressures. The unit will not detect gas at elevated temperatures.
5. High levels of or long exposure to certain compounds in the tested atmosphere may contaminate the sensor. In atmospheres where the system may be exposed to such materials, perform calibration frequently to ensure dependable system operation and accurate indications.
6. Do not paint the Chemgard System. Also, do not paint near any of the sample line inlets to ensure paint is not deposited on the sample inlet fitting of the units. Such paint deposits would interfere with the sampling process, whereby a sample of the atmosphere being monitored is drawn into the Chemgard System.
7. 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.
8. Perform periodic leak checks on all the sample lines and all flow system components and fittings of the Chemgard System.
9. 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 Chemgard System, beyond the scope of these maintenance instructions or by anyone other then 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.
10. Properly vent the exhaust of the Chemgard System to a safe area. Improper venting of the exhaust may cause serious personal injury or death.
11. Ensure the gas sample to the system is clean and non-condensing. Install end-of-line filters in all sample inlet lines.
12. Avoid any installation where condensation may form. Condensation may possibly clog or block the sampling line; this will prevent the instrument from receiving new or fresh gas samples from the area being monitored.
13. The Chemgard Gas Monitor 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.
14. The Chemgard Relay Module must be connected to proper main voltages. Connection of improper voltages will cause the unit to fail. The Chemgard Relay Module uses the same electrical ground as the Chemgard Monitor.
15. Protect the Chemgard Relay Module from vibration (which causes increased noise level on the instrument) and heating (which reduces the operating life of instrument); otherwise, improper operation may occur, which can result in personal injury or death.
16. Do not exceed the relay contact ratings listed in Appendix B, TABLE B-1 Otherwise, relay operation may fail, which can result in personal injury or death.

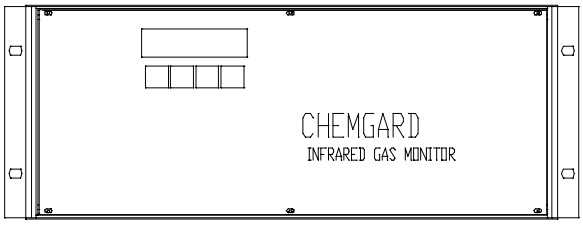
Failure to comply with the above warnings can result in serious personal injury or death.

⚠ CAUTION

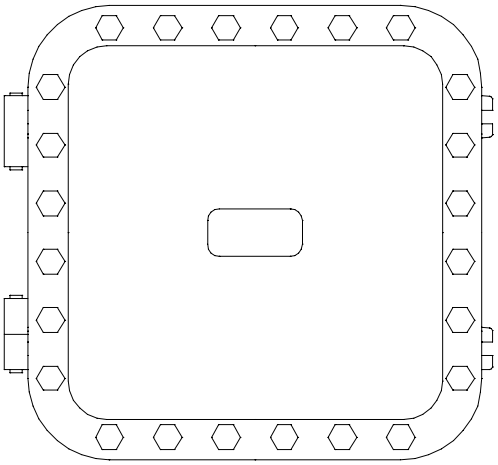
Do not attempt to modify or adjust the sensing element.



Standard Enclosure
Chemgard Infrared Gas Monitor



Rack Mount
Chemgard Infrared Gas Monitor



Explosion-proof (XP)
Chemgard Infrared Gas Monitor

NOTE: The rack mount has not been tested by UL and does not carry any UL approvals certification.

Table of Contents

Section 1
General Information 1-1

Section 2
Installation and Set-up 2-1

Section 3
Display Screens. 3-1

Section 4
Calibration 4-1

Section 1
General Information

Introduction

This manual provides instructions for the:

- Chemgard Monitor
- Chemgard unit with Multipoint Sequencer.

These instruments can provide continuous gas monitoring (see TABLE 1-1 for Operating Specifications).

NOTE: These units have not been evaluated for performance by UL.

Table 1-1. Chemgard System General Operating Specifications

TYPICAL PERFORMANCE SPECIFICATIONS		
STABILITY	0-5% full-scale (FS); ±0.2% FS	
	5%-100% FS; ±10% of reading	
SHORT TERM NOISE	±0.2% FS peak over a 10-minute period	
LINEARITY	0-5% FS; ±0.2% FS	
	5-100% FS, ±10% of reading	
WARM-UP TIME (READY)	24 hours maximum; typical, 20 minutes at 70°F ambient	
RESPONSE TIME	90% of a step-change in 70 seconds	
TRANSPORT TIME	500 FT (167 M) OF SAMPLING TUBING LENGTH	13 minutes for a 90% step change
	150 FT (50 M) OF SAMPLING TUBING LENGTH	105 seconds for a 90% step change
OPERATING TEMPERATURES	0°C to 50°C (32°F to 122°F)	
TEMPERATURE EFFECT	±0.3%/°C of reading, 0 to 35°C based on temperature at calibration	
	±0.6%/°C of reading, 0 to 35 to 50°C based on temperature at calibration	
RELATIVE HUMIDITY	0 to 95%, RH non-condensing	
SAMPLE FLOW RATE	.75 liter per minute - minimum with maximum tubing length; typically 1.2 to 1.5 liters per minute with no tubing	
MAXIMUM SAMPLE OR EXHAUST TUBING LENGTH	150 feet with 1/8" ID tubing, 1/4" OD (total of Inlet & Outlet); 500 feet with 0.18" ID tubing	

Table 1-1. Chemgard System General Operating Specifications

TYPICAL PERFORMANCE SPECIFICATIONS	
OPERATING PRESSURE	ambient atmospheric
OPERATING SPECIFICATIONS	
VOLTAGE RATING	100 to 240 VAC, 50-60 Hz
POWER REQUIREMENTS	.88 amps at 120 VAC; 80 W, max .54 amps at 240 VAC; 80 W, max
TROUBLE RELAY	Normally energized, Form C contact: 240 VAC, 8 amp resistive SPDT
WARNING RELAY	One relay, Form C contacts: 240 VAC, 8 amps resistive SPDT
CAUTION RELAY	One relay, Form C contacts: 240 VAC, 8 amps resistive SPDT
ALARM RELAY	One relay, Form C contacts: 240 VAC, 8 amps resistive SPDT
ANALOG OUTPUTS	4 to 20 mA sourcing, 1,000 ohm load, 0-10 V, 2 K ohm load
MAXIMUM OUTPUT SIGNAL LOAD FOR 4-20 MA OUTPUT	1000 ohms (includes wiring)
AUDIO ALARM DRIVE OUTPUT	10 VDC 20-ohm load maximum (available only with non-beacon models)
SAMPLE TUBING CONNECTIONS	1/4" OD
DIMENSIONS	18" high, 16" wide, 7" deep
	45.72 cm high, 14.64 cm wide, 17.78 cm deep
WEIGHT OF Chemgard WITH SEQUENCER	45 pounds (20 kilograms)
TRANSPORT AND STORAGE CONDITIONS	
TEMPERATURE	-55°C to +70°C (-67°F to 158°F)
HUMIDITY	99% RH non-condensing

For the Chemgard Remote Relay***** option, see Appendix B, "Relay Module."

*This unit has not been evaluated by Underwriters Laboratories, Inc.

The monitor uses infrared sensing technology, allowing accurate measurement of Gas vapors with minimum interference from other vapors. Your Chemgard unit is factory-calibrated for a specific Gas. It is extremely sensitive. The unit monitors the signal and can operate three alarm levels at a software-selectable gas concentration values. There is also a trouble indication to alert the operator when something is wrong with the unit.

Identifying Your Unit

Multipoint Sequencer

The Chemgard Gas Monitor is capable of monitoring different types of gases. However, each unit is factory-calibrated to detect one type of Gas. Check the label inside the front door to determine what gas your unit is designed to detect (FIGURE 1-1). For specific guidelines on using the RS232 function (serial communication port), see Appendix C.

The unit monitors only one zone or location, but your instrument may contain a Multipoint Sequencer capable of monitoring up to four or eight different zones or locations. To determine the number of sampling locations your particular unit is able to monitor, carefully tilt the unit and count the number of inlet ports at the bottom of the case (FIGURE 1-2, 1-3 or 1-4).

Beacon

The optional beacon is mounted on top of the unit (FIGURE 1-5). It is powered by the monitor's internal DC voltage.

End of Sample Line Filters

End of sample line filters are required for proper unit operation; they may be included in the shipping carton.

If the end of sample line filters are not included, they must be purchased.

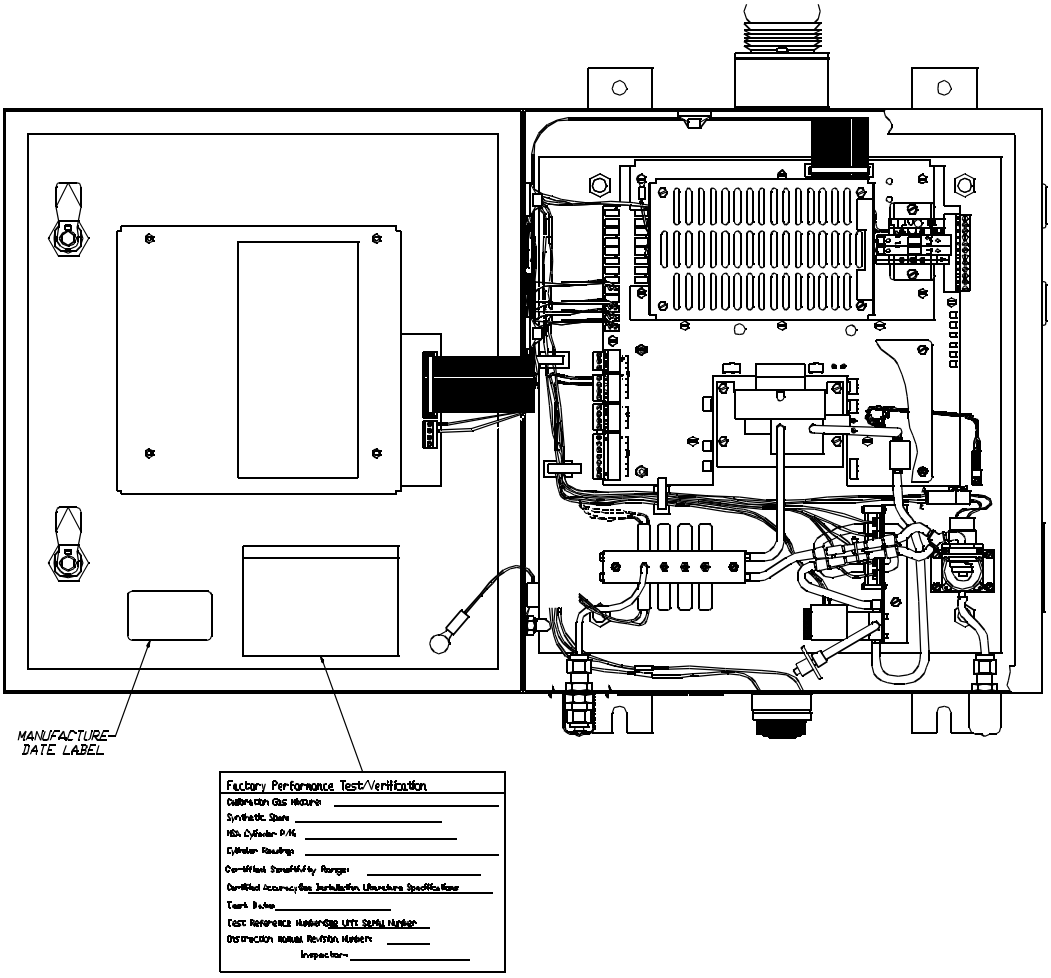


Figure 1-1. Identifying Your Unit

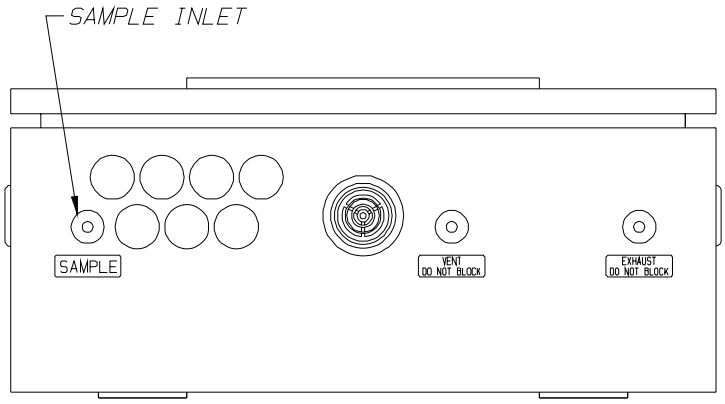


Figure 1-2. Single Point Sequencer Unit

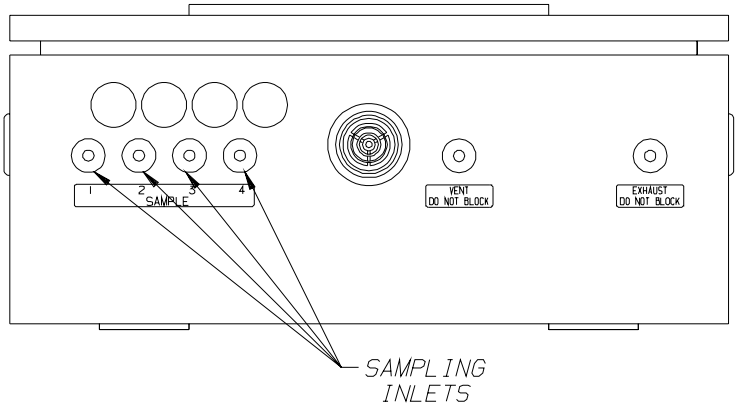


Figure 1-3. Four Point Sequencer Unit

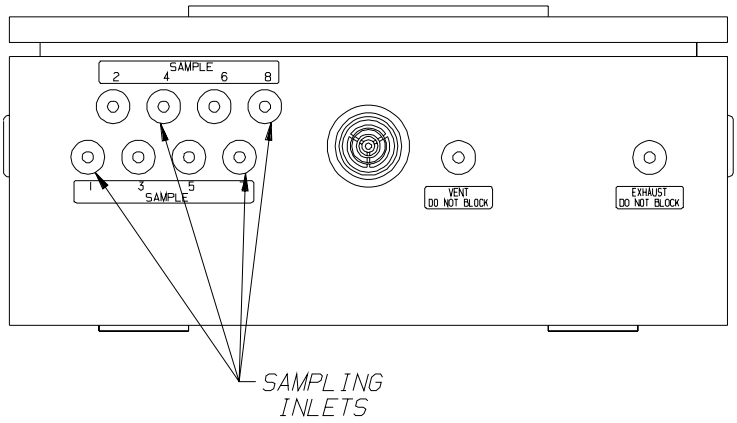


Figure 1-4. Eight Point Sequencer Unit

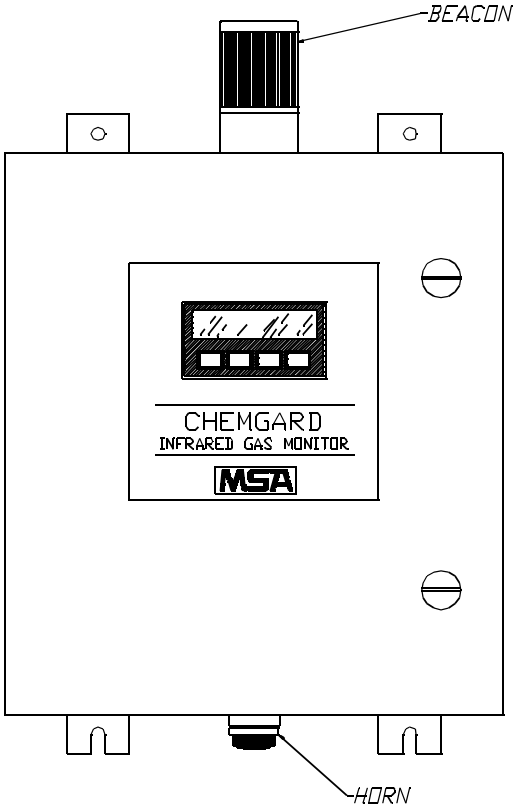


Figure 1-5. Chemgard Gas Monitor with Optional Beacon

General Description

The Chemgard Unit:

- Monitors gases from parts-per-billion (ppb) to % level
- Operates on the photo-acoustic principle, allowing gas concentration measurement in a complex mixture of background gases
- Allows gas detection in applications where contaminants or interferants preclude use of other techniques
- Provides a digital display; if it is a multi-point monitor, it also shows the point number currently being sampled by the unit
- Is also used for applications requiring long-term stability and low maintenance
- Is factory-calibrated to the full scale value of gas
- Is compensated for the relative humidity of the gas to give excellent zero stability.
- Operates over a wide temperature range
- Has front-panel windows for viewing:
  - Gas concentration
  - Diagnostics
  - Alarm Conditions
- Is highly selective to enable operation in:
  - Areas with varying humidity
  - Areas containing other contaminants.
- Comes standard with:
  - Four sets of relay contacts
  - Two completely independent outputs:
    0-10 V
    4-20 mA
- One input: 4-20 mA, assignable to the ALARM relay.
- RS 232 output (see Appendix C for more information).

The Internal Multipoint Sequencer Unit:

- Allows a single Chemgard unit to monitor up to four or eight areas or locations, if equipped

- Each point is capable of sampling from remote areas up to 500 feet from the Chemgard unit
- Contains all necessary flow components (excluding end-of-line filter and sampling line) to properly sample four or eight areas and indicate the gas or vapor concentrations.

Terminology

Become familiar with the following terminology.

ZERO- A zero (0) indication on the meter display usually indicates fresh air (no gas present).

ZEROING- The process of placing a zero gas on the unit during calibration.

SPAN- Full-scale or up-scale reading on meter display.

SPANNING- The process of placing a full-scale or span gas on the unit during calibration.

SPAN GAS VALUE- The gas concentration that gives the instrument a full-scale or up-scale value. This value is printed on the calibration gas cylinder containing the gas.

FLOW RATE- Volume of gas drawn through the sample line per minute.

EXHAUST GAS- Sample gas after it passes through the sensor.

PUMP- The electric motor driven device that moves the gas sample to the Chemgard Monitor.

ALARMS- The Chemgard System has three alarms to alert the user at specific, user-adjustable gas concentrations. (Level 1 = Caution, Level 2 = Warning and Level 3 = Alarm.)

RELATIVE HUMIDITY- The percent of water vapor saturation in air at a given temperature.

POINT NUMBER- The location or area from which a gas sample is drawn. Up to four or eight areas, sequentially numbered from 1 to 8, can be sampled.

BYPASS- The Sequencer is a look-ahead system; bypass gas flow is drawn from the next area to be sampled. This feature reduces the monitor response time when long sampling lines are used.

FRESH AIR- Air that has no possibility of containing gas.

TEMPERATURE EFFECT- The gas response displayed by the instrument (PPM) can change ±0.3% for each degree (C) that the instrument is operating above/below the temperature at which the instrument was last calibrated.

Applications

The Chemgard Monitor is factory-calibrated for a particular gas. When calibrated, the Chemgard System is used in a wide variety of industrial applications, such as:

- detection of gases leaking into the atmosphere
- ambient air monitoring for health and safety purposes

Sensor Selectivity*

The Chemgard Gas Monitor is factory-calibrated for your particular gas (TABLE 1-3). The system is highly selective to gases in air; however, the system also responds to other gases (interferants). See TABLES 1-2 through 1-22* for typical cross-sensitivities. Actual cross-sensitivities vary from instrument to instrument.

If it is not known whether the gas to be detected is an interferant gas, contact MSA at:

1-800-MSA-INST.

***Typical cross-sensitivities not verified or investigated by UL.**

Table 1-2.
Cross-Sensitivity Data for Carbon Monoxide

Cylinder P/N 806734, 100 ppm CO in nitrogen, available as a span gas; see Calibration procedure for details

GAS	CONCENTRATION	CO READING
CARBON DIOXIDE	1%	15
METHANE	2.5%	0
PENTANE	0.75%	90
PROPANE	2.0%	110
AMMONIA	880 ppm	0
HYDROGEN SULFIDE	40 ppm	0
METHANOL	1000 ppm	10
Acetone	1000 ppm	40
TOLUENE	1000 ppm	0
R123	100 ppm	0
R11	100 ppm	6

TEST CONDITIONS:
Calibrated 0-1000 PPM CO in N_2
Temperature: 25°C

Table 1-3.
Cross-Sensitivity Data for Ethylene Oxide

Cylinder P/N 804870, 100 ppm R-113 in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	ETO READING
METHANE	2.5%	18
R12	100 ppm	59
R22	100 ppm	54
R123	100 ppm	267
R124	100 ppm	38
R134a	100 ppm	42
PENTANE	0.75%	198
BUTANE	8%	109
ISO-BUTYLENE	100 ppm	18

TEST CONDITIONS:
Calibrated 0-1000 PPM Ethylene Oxide in N_2
Temperature - 25°C

Table 1-4.
Cross-Sensitivity Data for Ethyl Alcohol

Cylinder P/N 804532, 0.75% Pentane in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	ETHYL ALCOHOL READING
R11	100 ppm	337
R22	100 ppm	33
R113	100 ppm	150
R12	100 ppm	407
R123	100 ppm	21
AMMONIA	50 ppm	10
METHANE	1%	0
PROPANE	2%	185
METHANOL	1060 ppm	487
ACETONE	954 ppm	41

TEST CONDITIONS:
Calibrated 0-1000 PPM Ethyl Alcohol in N_2
Temperature: 25°C

Table 1-5.
Cross-Sensitivity Data for Hexane

Cylinder P/N 10014894, 1000 ppm Pentane in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	HEXANE READING
METHANE	1000 ppm	211
CARBON DIOXIDE	2500 ppm	0
CARBON MONOXIDE	500 ppm	0
ETHANOL	100 ppm	28
ISO-BUTYLENE	100 ppm	46
NITROUS OXIDE	100 ppm	0
R11	100 ppm	0
R22	100 ppm	5
R123	1000 ppm	20
R134a	100 ppm	17
ACETONE	944 ppm	174
METHANOL	1059 ppm	332

TEST CONDITIONS:
Calibrated 0-1000 PPM Hexane in N_2
Temperature: 25°C

Table 1-6.
Cross-Sensitivity Data for Cyclo-Pentane

Cylinder P/N 494450, 100 ppm Isobutylene in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	CYCLO-PENTANE READING
METHANE	1000 ppm	250
CARBON DIOXIDE	2500 ppm	0
CARBON MONOXIDE	500 ppm	0
ETHANOL	100 ppm	33
NITROUS OXIDE	100 ppm	0
R11	100 ppm	0
R22	100 ppm	6
R123	1000 ppm	24
R134a	100 ppm	20
ACETONE	944 ppm	206
METHANOL	1059 ppm	394

TEST CONDITIONS:
Calibrated 0-1000 PPM Cyclo-Pentane in N_2
Temperature: 25°C

Table 1-7.
Cross-Sensitivity Data for Toluene

Cylinder P/N 10014894, 1000 ppm Pentane in air, is available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	TOLUENE READING
R11	100 ppm	4
R12	100 ppm	4
R22	100 ppm	14
R113	100 ppm	4
R134a	100 ppm	22
CARBON MONOXIDE	5000 ppm	5
NITROUS OXIDE	100 ppm	3
ETHANOL	50 ppm	52
AMMONIA	50 ppm	3

TEST CONDITIONS:
Calibrated 0-1000 PPM Toluene in N_2
Temperature: 25°C

Table 1-8.
Cross-Sensitivity Data for Methylene Chloride

Cylinder P/N 804532, 0.75% Pentane in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	METHYLENE CHLORIDE READING
R11	100 ppm	3
R12	100 ppm	2
R22	100 ppm	10
R113	100 ppm	5
R134a	100 ppm	2
ISO-BUTYLENE	100 ppm	0
ETHANOL	100 ppm	0
AMMONIA	100 ppm	0
R123	100 ppm	10
METHANE	1.25%	0

TEST CONDITIONS:
Calibrated 0-1000 PPM Methylene Chloride in N_2
Temperature: 25°C

Table 1-9.
Cross-Sensitivity Data for Trichloroethylene

Cylinder P/N 804532, 0.75% Pentane in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	TRICHLORO-ETHYLENE READING
R11	100 ppm	17
R12	100 ppm	285
R22	100 ppm	0
R113	100 ppm	80
R123	100 ppm	1
NITROUS OXIDE	100 ppm	0
ISO-BUTYLENE	100 ppm	5
AMMONIA	50 ppm	20
METHANE	1.25%	0

TEST CONDITIONS:
Calibrated 0-1000 PPM Trichloroethylene in N_2
Temperature: 25°C

Table 1-10.
Cross-Sensitivity Data for Xylenes

Cylinder P/N 494450, 100 ppm Iso-butylene in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	XYLENES READING
R12	100 ppm	0
R22	100 ppm	5
R113	100 ppm	0
R123	100 ppm	1
R134a	100 ppm	10
AMMONIA	100 ppm	0
METHANE	5000 ppm	750
NITROUS OXIDE	100 ppm	0
CARBON MONOXIDE	60 ppm	1

TEST CONDITIONS:
Calibrated 0-1000 PPM Xylenes in N_2
Temperature: 25°C

Table 1-11.
Cross-Sensitivity Data for Methanol

Cylinder P/N 804868, 100 ppm R-22 in nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	METHANOL READING
METHANE	1.25%	0
PROPANE	.6%	94
PENTANE	1000 ppm	15
ISO-BUTYLENE	100 ppm	3
NITROUS OXIDE	100 ppm	0
R11	100 ppm	280
R12	100 ppm	185
R123	100 ppm	28
R134a	100 ppm	86

TEST CONDITIONS:
Calibrated 0-1000 PPM Methanol in N_2
Temperature: 25°C

Table 1-12. Cross-Sensitivity Data for Ethane

Cylinder P/N 494450, 100 ppm Iso-butylene in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	ETHANE READING
R12	100 ppm	0
R22	100 ppm	6
R123	100 ppm	0
CARBON MONOXIDE	60 ppm	3
HYDROGEN	.6%	0
NITROUS OXIDE	100 ppm	0
R113	100 ppm	0
R134a	100 ppm	11
R11	100 ppm	0

TEST CONDITIONS:
Calibrated 0-1000 PPM Ethane in N_2
Temperature: 25°C

Table 1-13. Cross-Sensitivity Data for Nitrous Oxide
Cylinder P/N 806736, 100 ppm Nitrous Oxide in Nitrogen, is available as a span gas; see Calibration procedure for details

GAS	CONCENTRATION	NITROUS OXIDE READING
R134a	100 ppm	0
R113	100 ppm	0
ISO-BUTYLENE	100 ppm	0
PROPANE	.6%	9
R22	100 ppm	0
CARBON DIOXIDE	2.5%	115
PENTANE	1000 ppm	2
METHANE	1.25%	0
CARBON MONOXIDE	60 ppm	10
BUTANE	8%	450

TEST CONDITIONS:
Calibrated 0-1000 PPM Nitrous Oxide in N_2
Temperature: 25°C

Table 1-14. Cross-Sensitivity Data for Acetone

Cylinder P/N 803499, 100 ppm R11 in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	ACETONE READING
R12	100 ppm	615
R22	100 ppm	420
R123	100 ppm	465
ISO-BUTYLENE	100 ppm	15
CARBON MONOXIDE	300 ppm	0
HYDROGEN	.6%	0
NITROUS OXIDE	100 ppm	20
AMMONIA	50 ppm	35
METHYL ETHYL KETONE	140 ppm	85

TEST CONDITIONS:
Calibrated 0-1000 PPM Acetone in N_2
Temperature: 25°C

Table 1-15. Cross-Sensitivity Data for Perchloroethylene
Cylinder P/N 804532, 0.75% Pentane in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	PERCHLORO-ETHYLENE READING
METHANE	1.25%	0
R11	100 ppm	15
R22	100 ppm	0
R113	100 ppm	75
NITROUS OXIDE	100 ppm	0
R134a	100 ppm	2
ACETONE	100 ppm	5

TEST CONDITIONS:
Calibrated 0-1000 PPM Perchloroethylene in N_2
Temperature: 25°C

Table 1-16. Cross-Sensitivity Data for Perfluoromethylvinyl Ether
Cylinder P/N 803500, 100 ppm R134a in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	PERFLUOROMETHYL-VINYL ETHER READING
R142B	100 ppm	30
ISO-BUTYLENE	100 ppm	0
PROPANE	.6%	3
R23	100 PPM	4
ETHYL ACETATE	1000 PPM	185
PENTANE	1000 PPM	0
METHANE	2.5%	42
R218	100 PPM	35
BUTANE	8%	15

TEST CONDITIONS:
Calibrated 0-1000 PPM Perfluoromethylvinyl Ether in N_2
Temperature: 25°C

Table 1-17. Cross-Sensitivity Data for Propylene Oxide
Cylinder P/N 494450, 100 ppm Iso-butylene in air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	PROPYLENE OXIDE READING
R12	100 ppm	820
R113	100 ppm	775
PROPANE	.6%	290
R22	100 ppm	245
NITROUS OXIDE	100 ppm	0
PENTANE	1000 ppm	95
METHANE	1.25%	0
HYDROGEN	0.8%	0
PROPYLENE OXIDE	100 ppm	100

TEST CONDITIONS:
Calibrated 0-1000 PPM Propylene Oxide in N_2
Temperature: 25°C

Table 1-18. Cross-Sensitivity Data for N-Pentane

Cylinder P/N 10014894 1000 ppm Pentane in Air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	N-PENTANE READING
R134a	100 ppm	15
R123	1000 ppm	20
ISO-BUTYLENE	100 ppm	40
NITROUS OXIDE	100 ppm	0
R22	100 ppm	5
ETHANOL	100 ppm	25
PENTANE	1000 ppm	1000
METHANE	1000 ppm	200
R11	100 ppm	0
CARBON DIOXIDE	2500 ppm	0
CARBON MONOXIDE	500 ppm	0

TEST CONDITIONS:
Calibrated 0-1000 PPM N-Pentane in N_2
Temperature: 25°C

Table 1-19. Cross-Sensitivity Data for Ethyl Ether

Cylinder P/N 804868, 100 ppm R-22 in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	ETHYL ETHER READING
METHANE	2.5%	46
R11	100 ppm	0
R12	100 ppm	141
R123	100 ppm	184
R134a	100 ppm	166
R113	100 ppm	121
ISO-BUTYLENE	100 ppm	0

TEST CONDITIONS:
Calibrated 0-1000 PPM Ethyl Ether in N_2
Temperature: 25°C

Table 1-20. Cross-Sensitivity Data for Dimethylamine

Cylinder P/N 804868, 100 ppm R-22 in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION (PPM)	DIMETHYLAMINE READING
METHANE	2.5%	87
R11	100 ppm	2
R12	100 ppm	534
R123	100 ppm	590
R134a	100 ppm	701
R113	100 ppm	457
ISO-BUTYLENE	100 ppm	0

TEST CONDITIONS:
Calibrated 0-1000 PPM Dimethylamine in N_2
Temperature: 25°C

Table 1-21. Cross-Sensitivity Data for Nitrogen Trifluoride

Cylinder P/N 804532 0.75% Pentane in Air, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	NITROGEN TRIFLUORIDE READING
CARBON DIOXIDE	300 ppm	0
R123	100 ppm	1
R134a	100 ppm	2
R11	100 ppm	6
R22	100 ppm	1
PROPANE	0.6% ppm	25
METHANE	2.5% ppm	1
PENTANE	0.75% ppm	65
ISO-BUTYLENE	100 ppm	4
C5F8	50 ppm	2
METHYL FLUORIDE	50 ppm	0
C4F6	50 ppm	4
SF6	50 ppm	120
C4F8	50 ppm	9

TEST CONDITIONS:
Calibrated 0-1000 PPM Nitrogen Trifluoride in N_2
Temperature: 25°C ppm

Table 1-22. Cross-Sensitivity Data for C4F6

Cylinder P/N 812784 30 ppm R123 in Nitrogen, available as a simulant span gas; see Calibration procedure for details

GAS	CONCENTRATION	C4F6 READING
C4F8	50 ppm	40
C5F8	50 ppm	98
CARBON MONOXIDE	50 ppm	0
R22	50 ppm	3
METHYLENE CHLORIDE	50 ppm	0
AMMONIA	50 ppm	0
ETHANOL	50 ppm	3
IPA	50 ppm	5
METHYL FLUORIDE	50 ppm	0
NITROUS OXIDE	50 ppm	0
SF6	50 ppm	0
NITROGEN TRIFLUORIDE	50 ppm	0
R32	50 ppm	3

TEST CONDITIONS:
Calibrated 0-1000 PPM C4F6 in N_2
Temperature: 25°C

Section 2
Installation and Set-up

Receiving

Upon receipt of the unit, inspect the shipping carton for signs of visible damage. Report any damage to the carrier and note it on the delivery receipt. The unit must be stored in a dry, secure place prior to its installation and use. Store unit in the original shipping carton.

Unpacking the System

To unpack the equipment:

1. Carefully remove the Chemgard Monitor from its shipping container(s) in order to prevent damage to sensitive electrical components. If any damage is found, report it to the shipper immediately.

⚠ WARNING

Do not install or operate a damaged unit. It may not function properly and may not alert you to any gas conditions.

2. Search through all packing material and containers to avoid inadvertently discarding usable or valuable parts. Report any shortages immediately to MSA.

   The contents of the shipping carton are:

   - instrument
   - manual
   - end-of-line filters (may be purchased separately).

   Retain original packing form for re-use in the event the unit must be returned for service.

3. Using a screwdriver, loosen the two latches on the Chemgard door (FIGURE 2-1) by turning 1/4 turn counterclockwise.

4. Open the front door.

Initial Inspection

With the front door open, carefully inspect components and assemblies inside the enclosure. If damage or shortage is evident, advise and promptly file the proper claim with the carrier.

Location of the Monitor

⚠ WARNING

This unit must not be located in areas that may contain a flammable mixture of gas and air; otherwise, an explosion may occur.

The monitor performance is dependent on its location and sensing pick-up location(s). Follow the guidelines listed below before mounting the monitor.

Instrument Location Guidelines

1. Select a location where personnel will see the front panel or the optional beacon before they enter the equipment room or the area where the monitoring point is located.
2. Mount the unit vertically; do not mount the unit to structures subject to vibration and shock, such as piping and piping supports.
3. Do not locate the unit near an excessive heat source or in wet and damp locations.

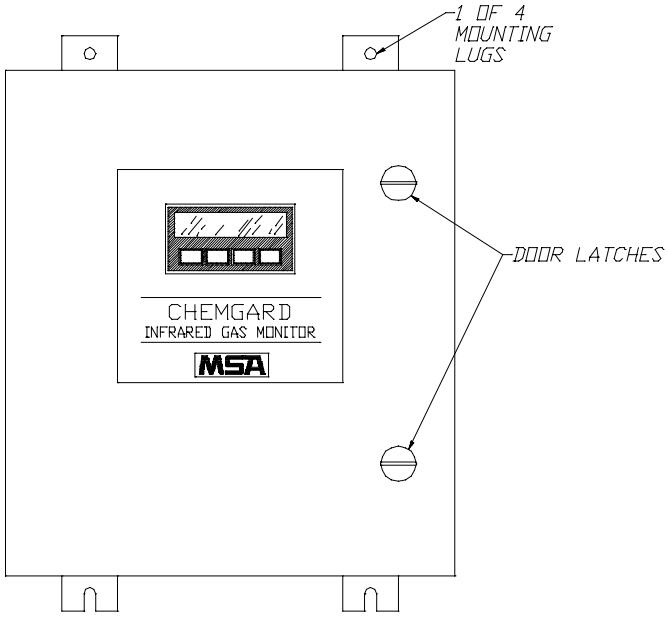


Figure 2-1. Front Door Latches

4. Do not mount the unit where it will be exposed to direct solar heating.
5. For proper cooling, allow at least three inches clearance around all surfaces except for the mounting surface.
6. Mount unit so the front panel is easily seen and accessed for service and calibration.

Guidelines for Locating the Sampling Point(s)

Due to the wide variation in equipment room layouts, each situation must be analyzed individually. A sampling point may be remotely located up to 150 feet from the monitor (500 feet if 0.180" I.D. tubing is used) in an area where gas vapors are most likely to leak or accumulate.

NOTE: The 150 and 500 feet allowances refer to the total sample and exhaust line length for each sample point.

Activity in the Room

The expected activities in the room must also be considered when determining the sensing point.

NOTE: Select sampling locations which result in the shortest possible line length in order to reduce transport time.

Consider the following guidelines when selecting the location for the sampling point(s).

1. Place the end of the sampling line in an area that provides the instrument with a representative sample; ventilation Smoke Tubes (P/N 458480) are useful in determining air flow patterns in ambient sampling areas.
2. Properly exhaust the instrument to a safe area or to outside atmosphere.
3. Ensure the sampling area is free of particulate matter and condensing moisture; ensure sample lines will not draw moisture up into the line.

   NOTE: The sample gas must be adequately filtered before entering the instrument. End-of-sample-line filters must be used with the unit. These filters must be installed at the end of all sample lines.
4. Ensure the end of the sampling line is unobstructed to allow the sample to flow freely to the instrument.
5. Keep sample lines as short as possible to reduce transport time.

⚠ CAUTION

Ensure that tubing radii are wide enough to prevent kinking or bending. Otherwise, an obstruction may occur, preventing the instrument from sampling the intended area.

6. DO NOT:
   - back-pressure the exhaust line or
   - connect it to a vacuum source or
   - install a flow meter in the exhaust line.

   ALWAYS :
   connect an exhaust line
   that is vented to a safe area or an
   outside atmosphere.

Mounting the Standard Enclosure Unit

The instrument has four mounting lugs (FIGURE 2-1). Securely mount the unit to a wall or support, using appropriate hardware.

⚠ WARNING

Do not mount the unit directly to a source which may affect the operation of the monitor, resulting in incorrect readings.

Sample System Installation

1. Remove all caps on the sample inlets and exhaust of the Chemgard Monitor (FIGURE 2-2).

⚠ WARNING

Failure to remove any caps from the unit gas inlet or exhaust fittings prevents gas sampling and may cause an undetected toxic and hazardous gas build-up and a flow trouble indication.

2. Route the 1/4" OD tubing into the areas to be monitored.
3. After the line(s) are installed and BEFORE they are connected to the monitor:
   a. Clean lines with compressed air or nitrogen to remove any debris.
   b. Perform a leak-check to assure they are free of leaks.
   c. Connect the line(s) to the sample port(s) on the monitor.
   d. Install the end-of-line filters.

   NOTE: All unused sample inlet(s) must be plugged or have an end-of-line filter installed to avoid debris entering the unit. To disable these unused lines, refer to the setup screen shown in FIGURE 3-11.

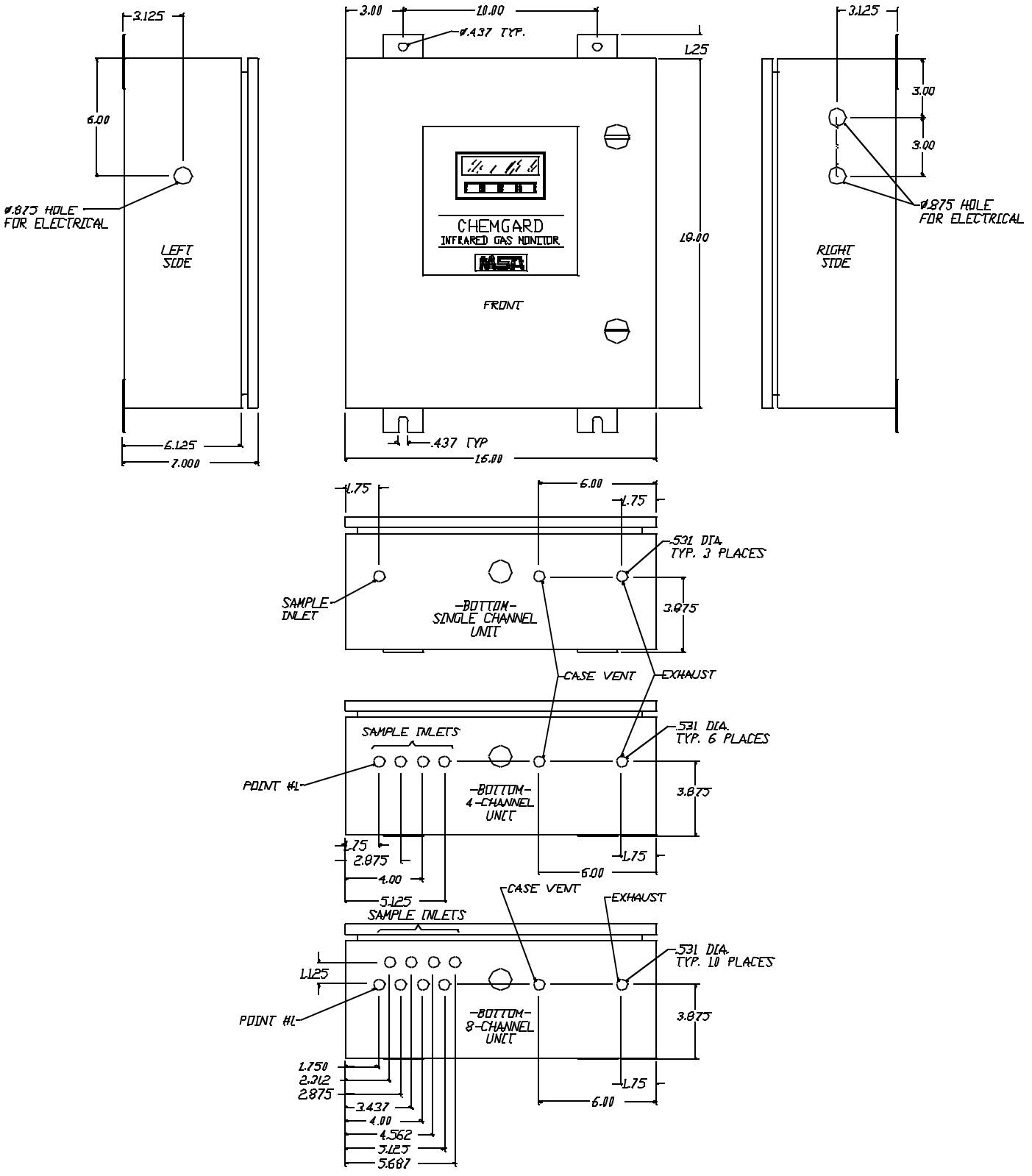
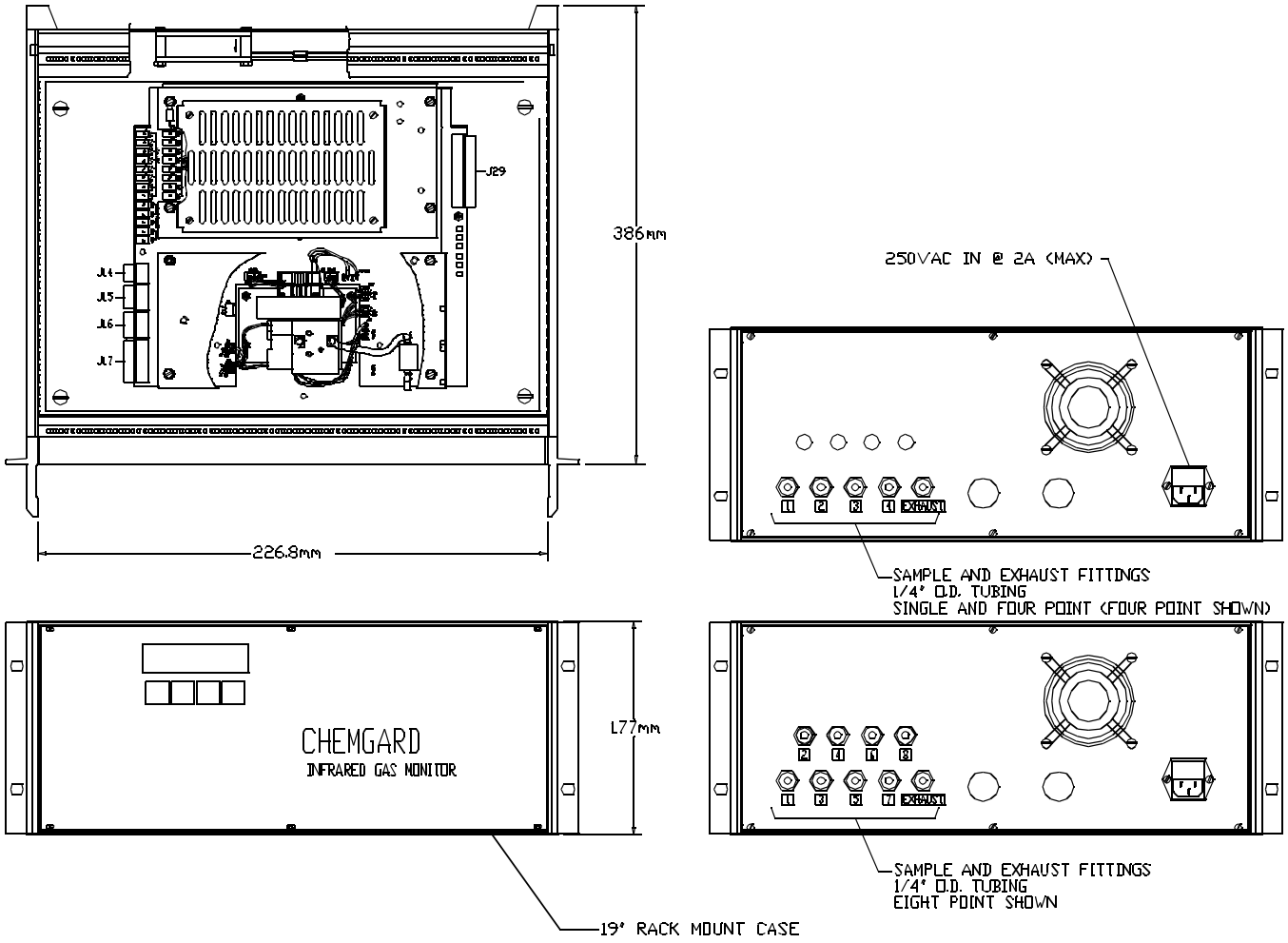


Figure 2-2. Mounting Dimensions



NOTE: The Rack Mount version has not been tested by UL for performance and does not carry any approvals certification

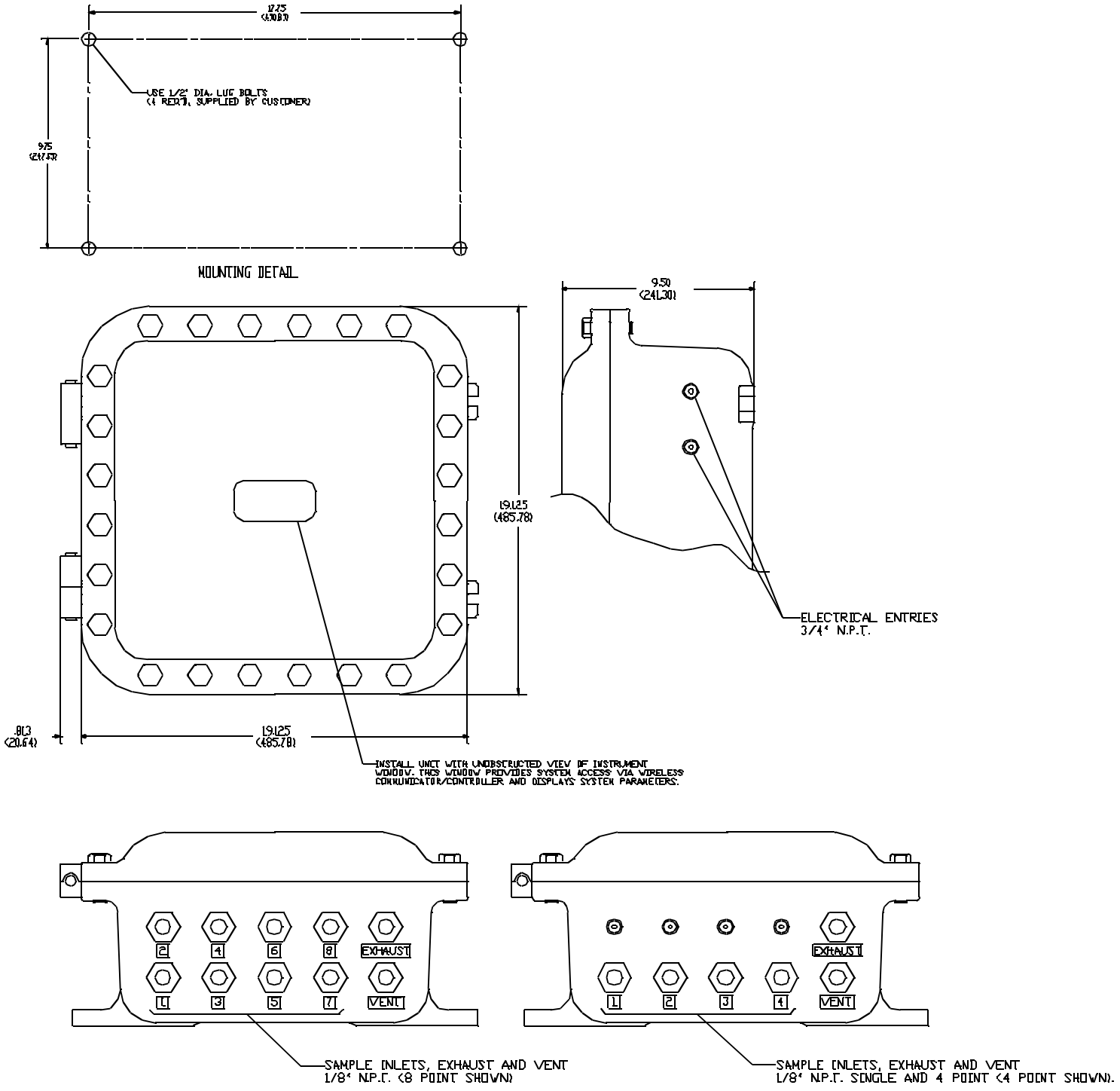
Figure 2-3. Rack Mount Unit Mounting Dimensions

4. Install all tubing ends to the inlet fittings of the unit. Mark the location identity of each individual tubing on the tubing or on the inside of the instrument itself (FIGURE 2-2).

5. Connect the exhaust fitting to tubing which is routed to an area where gases may be safely dispersed.

⚠ CAUTION

Ensure that each and every sample tubing has an end-of-line filter on it; otherwise, damage to the internal components may result.



NOTE: The XP version has not been tested by UL for performance.

Internal grounding terminal shall be used as the equipment grounding means and the external ground terminal is only a supplemental bonding connection where local authorities permit or require such a connection.

Figure 2-4. XP Unit Mounting Dimensions

Wiring Connections

Opening the Unit

All wiring to the Chemgard unit is made via the side entries. Open the unit to provide complete access to all wiring connections.

Ensure that all wiring codes are followed. These codes include, but are not limited to, the National Electrical Code.

⚠ CAUTION

Do not open the Chemgard door unless equipment is protected from splashing, spraying, or dripping water; otherwise, damage to internal components may result.

Unit Power Wiring

A separate, dedicated power source is recommended for the Infrared Gas Monitor to ensure that the unit remains powered when other circuits are shut down for servicing, routine maintenance or shift changes.

The monitor uses a wide range power supply which can accept AC power from 100 to 240 volts, 50 or 60 Hz. The power wiring should enter the unit through one of the openings on the right side of the enclosure. Connections are made to the screw terminals labeled L1, L2, ACN and GND, located in the upper right side of the unit (FIGURE 2-5). The maximum wire size that these connectors can accept is #12 AWG.

The incoming power provided to the monitor determines the configuration of the fuse(s) and wiring to the main power terminal block. FIGURE 2-5 shows the fuse and wire connections for various voltages.

Power Supply Wiring

1. Using a screwdriver, loosen the two latches on the enclosure door (FIGURE 2-1).
2. Open the front door.
3. Determine the power requirements for your Chemgard unit, ensuring the power is clean and reliable. (Refer to TABLE 1-1 for current capacity specifications.)

⚠ CAUTION

If unsure of your power available, contact your facility engineer or safety officer. If incorrect power is applied, damage may occur to the instrument.

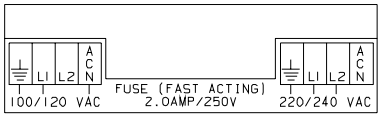


Figure 2-5. Primary Power Wiring

Wiring the Chemgard Unit

4. Route power wiring through one of the entries in the side of the unit.

   NOTE: Power wiring should be separated from relay wiring.

5. For single fuse 100/120 Volts AC power connection, connect the:
   - power wire to L1
   - neutral wire to ACN
   - ground wire to ⏚ terminal
6. For double fuse 220/240 Volts AC power connection, connect power wires to L1 and L2 and ground wire to ⏚ terminal.

Analog Signal Output Wiring (FIGURE 2-6)

The Chemgard unit has two available analog outputs. Each analog output is software-selectable between 10or 100% of full scale:

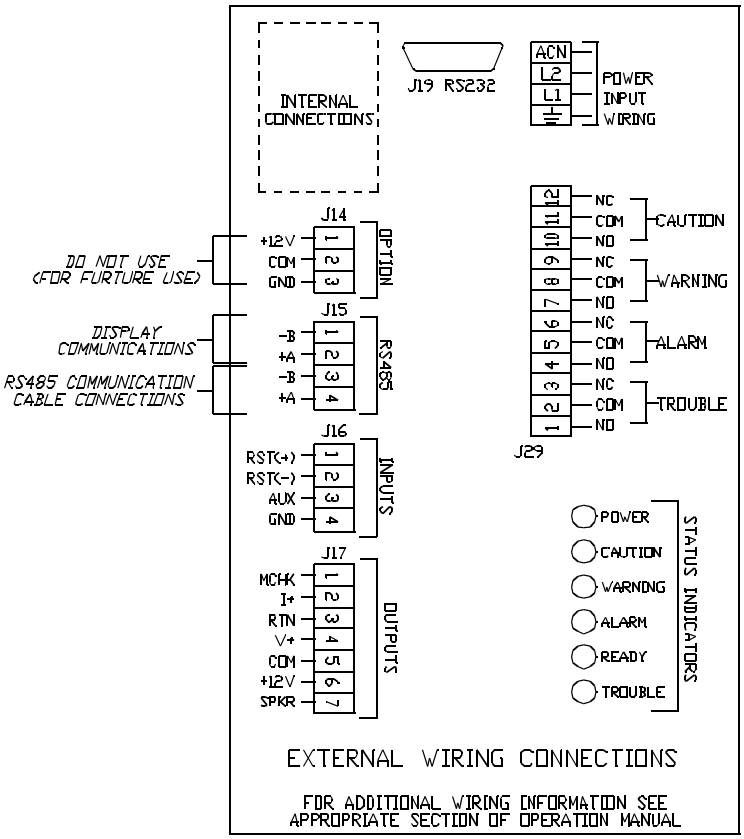


Figure 2-6. Wiring Connections

- 4-20 mA, isolated, current sourcing
- 0-10 VDC

These voltage and current outputs are proportional to the displayed gas concentration. Connections are made to terminal strip J17 located on the lower left side of the main circuit board (FIGURE 2-6). Analog output wiring should enter the unit through the hole provided on the left side of the unit. The terminal portion of the connector can be removed from the circuit board for easier connection. The maximum wire size that these connectors can accept is Listed #12 AWG; the maximum cable length is 500 feet (166 meters).

It is suggested that Listed #18 AWG, twisted-pair wire be used. If shielded wire is necessary, ground the shields of all cables at the receiving end of the signal. Do not ground or connect the shields at the Chemgard Monitor.

4-20 mA

The 4-20 mA output sources current to a separate return. Connections are made to terminals 2 (I+) and 3 (RTN) on terminal strip J17.

0-10 VDC

The 0-10 VDC output sources voltage to 2 K ohms maximum load. Connections are made to terminals 4 (V+) and 5 (COM) on terminal strip J17.

The voltage output can be programmed to correspond to the channel presently being sampled. The front-panel screen shows:

1V/PT IF OUT = 1-10V

(indicating one volt per point if output equals one to 8 volts).

When enabled, and the unit is monitoring from:

- channel 1:
  voltage output is one volt
- channel 2:
  voltage output changes to two volts.

RS 232 Output

- See Appendix C for wiring information.

Ferrite Bead Installation

Some models are shipped with ferrite beads. Follow the instructions below for proper installation.

- Input and output signals must be connected by using twisted, shielded wire pairs.
- The shield or its drain wire (FIGURE 2-7) must be connected to the grounding terminal on the power supply plate.
- Each unit is supplied with Thora-Electronik #16-28-9 or equivalent ferrite (P/N 10017468).
- The shield must also be connected to ground at the receiving equipment.
- The RS 485 communications lines to a relay module must be wired in a similar manner. See Appendix B for more information on the relay module.

⚠ CAUTION

Bundle low voltage wiring together (lower than 30 volts), separate from high voltage wiring (higher than 30 volts); otherwise, incorrect readings could occur.

Optional Alarm Beacon

Your unit may have an optional alarm kit installed. This kit is made up of a beacon on the top of the unit. It is factory-wired so no additional wiring is necessary; it lights when any alarm indication is given by the instrument. This function parallels the audible alarm output (when the horn sounds, the beacon lights).

Relay Outputs

Alarm Relays

There are three alarm relay outputs:

- Caution (factory-set to trip at 9 ppm)
- Warning (factory-set to trip at 29 ppm)
- Alarm (factory-set to trip at 700 ppm)

Each relay can be set up as latching/non-latching and/or normally-energized/normally de-energized. Contacts are Form C at 240 Volts AC 8 amps resistive. Connect wiring to Terminal Strip J29. User can adjust alarm trip points via the front panel (see Section 3, FIGURE 3-13).

Alarm Relay Connections Wiring

Three gas level alarm relay outputs are provided. All alarm relays are Form C, SPDT relays which can be wired to either closed or opened contacts in an alarm condition.

Each relay has contacts for:

- NORMALLY OPEN (NO)
- COMMON (COM)
- NORMALLY CLOSED (NC)

The function of each relay connector terminal is indicated on FIGURE 2-6. Relay wiring should enter the unit through one of the openings on the right side of the unit. Connections are made at the internal terminal strip labeled J29, located on the right side of the circuit board (FIGURE 2-6). The terminal portion of the connector can be unplugged from the circuit board for easier wire connections.

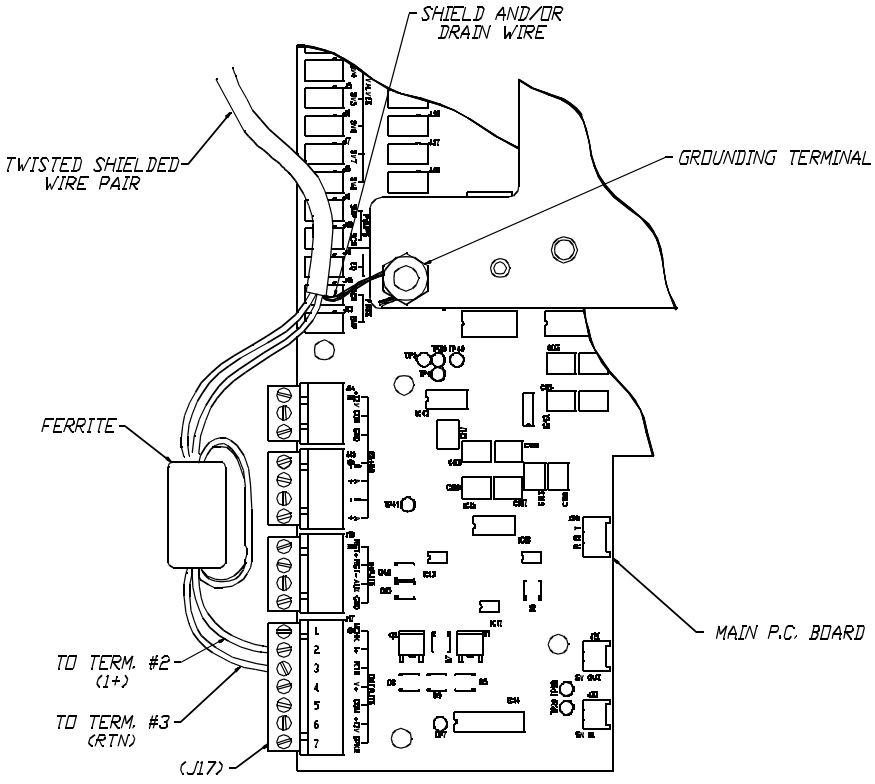


Figure 2-7.
Ferrite Bead Installation

NOTE: The maximum wire size that these connectors can accept is #12 AWG.

Trouble Relay

There is one relay (the Trouble relay) within the unit that indicates that a trouble or start-up condition exists. This relay is configured from the factory and operates differently than the alarm relays. It operates in a normally-energized mode.

This relay is energized when the instrument is:

- normally operating,
- in the calibration mode, or
- in the setup condition.

The relay is de-energized when:

- a fault is detected,
- the unit is in the start-up state, or
- the main power is lost.

This means that power is no longer provided to the relay coil. It is not possible to change the configuration of the Trouble relay.

The relay connector function or identification:

- NORMALLY OPEN (NO),
- COMMON (COM),
- NORMALLY CLOSED (NC)

as marked in FIGURE 2-6 refers to the relay contacts as if the relay is de-energized or in the trouble condition. A relay contact is provided between the Normally Closed (NC) and Common (COM) position. This contact will be made in the event that main power to the unit is lost or any other trouble condition exists.

Trouble Relay Connection Wiring

The Trouble relay wiring should enter the unit through one of the entries on the right side of the unit. Connections are made at the internal terminal strip labeled J29, positions 1, 2 and 3 (located on the right side of the circuit board - FIGURE 2-6). The terminal portion of the connector can be unplugged from the circuit board for easier wire connections. The maximum wire size that these connectors can accept is #12 AWG.

Remote Reset

The audible alarm and latched gas level alarms can be remotely reset through a switch that has a momentary contact opening (normally closed set of contacts). Connections are made to terminal strip J16, terminals 1 and 2 with the wiring entering the enclosure through the hole on the left side of the instrument. The switch must have signal-level contacts, typically gold plated. The maximum distance from the reset switch to the monitor, using 18 AWG wire, is 250 feet. The maximum wire size that these connectors can accept is #12 AWG.

Audible Alarm Output

An output is provided to drive the piezo-electric horn on the bottom of the unit (FIGURE 1-5). This output is available for customer use, provided that the beacon is not installed.

Auxiliary Input - Use UL Listed Devices

A 4-20 mA analog input can be made to the monitor from another device such as another Infrared Gas Monitor or an oxygen monitor. The input wiring should be brought into the enclosure through the hole on the left side of the instrument and connected to terminals 3 (AUX) and 4 (GND) on terminal strip J16. It is recommended that Listed #18 AWG, twisted pair wire be used; maximum wire length is 250 feet. The maximum wire size that these connectors can accept is Listed #12 AWG. Shielded wire is necessary. Ground the shields of all cables at the transmitting end of the signal. Do not ground or connect the shield at the Chemgard Monitor.

⚠ CAUTION

All field wiring must be done in accordance with national and local electrical codes.

Initial Calibration

⚠ WARNING

Calibrate after installation; otherwise, false or erroneous readings can result.

The initial calibration is the same as the routine calibration. Refer to Section 4 for this procedure.

Multipoint Sequencer Operation

In the sequencer setup screens, unneeded points can be de-activated by using the RIGHT ARROW key and selecting the point to be de-activated.

- When the change key is pressed, the number in the display goes blank.
- After pressing OK, the display shows a dark diamond to indicate which points are de-activated (see FIGURE 3-11).

In the sequencer setup screens, the monitor can be locked on a single point by pressing CHANGE before the RIGHT ARROW key.

- After pressing the RIGHT ARROW key and OK, only the selected point is indicated.
- After an hour (if no buttons are pushed), the monitor returns to normal sequencer operation (see FIGURE 3-12).

When calibrating:

- the gas inlet point can be selected.
- an inactive point can be selected.

After leaving calibration:

- the monitor returns to the previous sequencer setup (see FIGURE 3-4).

Chemgard operation with a sequencer has a normal dwell time of 30 seconds per sample line, or three measurement cycles.

To improve monitor performance in noisy environments and eliminate false alarms due to high noise, a user-selectable parameter "threshold" was established.

- The factory value for this threshold is 30%.
  - The threshold value is used with the Caution Alarm setpoint to determine when additional readings must be made on the current sample line to confirm actual concentration at the sample point.
  - The allowable adjustment range for the threshold value is 30% to 70%.
- If this value is greater or equal to the product of the threshold and the Caution Alarm value, the monitor dwells for an additional 70 seconds or seven more measurement cycles.

Section 3
Display Screens

Before applying power to the Chemgard Infrared Gas Monitor, follow the Appendix A check list. This will help ensure that the instrument is properly configured for operation.

All instrument operation is performed via the front panel which consists of four keys and a two-line by 20-character vacuum fluorescent display. There is no reason to open the unit for set-up, calibration or diagnostic testing of the instrument. The most commonly used, self-explanatory screens appear on the following pages. Simply follow the on-screen menus. The step-by step approach guides you through each operation.

- The Display Screen Flow Overview (FIGURE 3-1) shows a general system function flow. See the following FIGURES for specific Display Screen details:
  - Start-up and Normal Operation Screens (FIGURE 3-2)
  - Calibration Screens (FIGURES 3-4 through 3-6)
  - Information Screens (FIGURES 3-7 through 3-10 and FIGURES 3-23 and 3-24)
  - Set-up Screens (FIGURES 3-3 and 3-11 through 3-22).

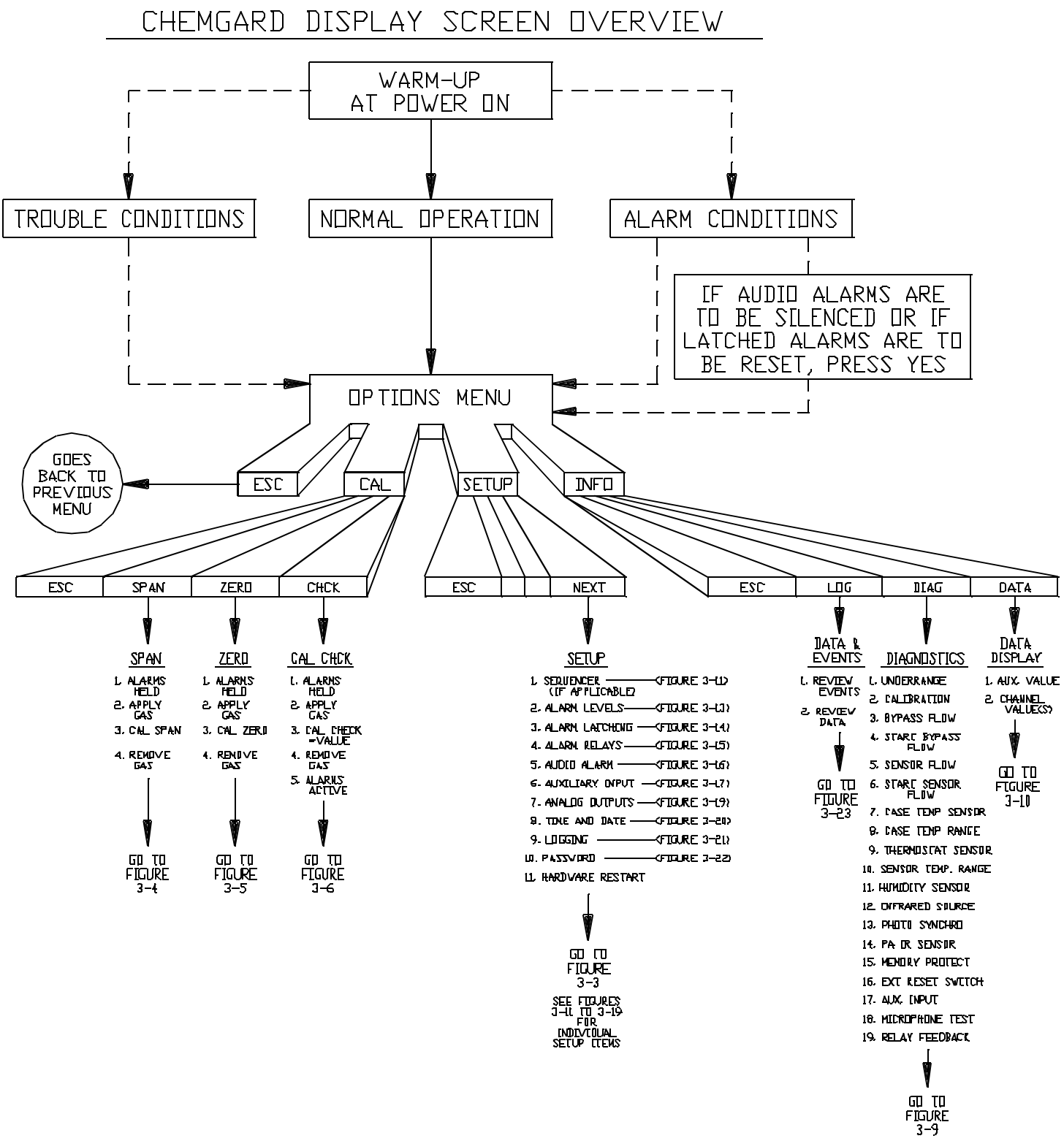


Figure 3-1. Display Screen Overview

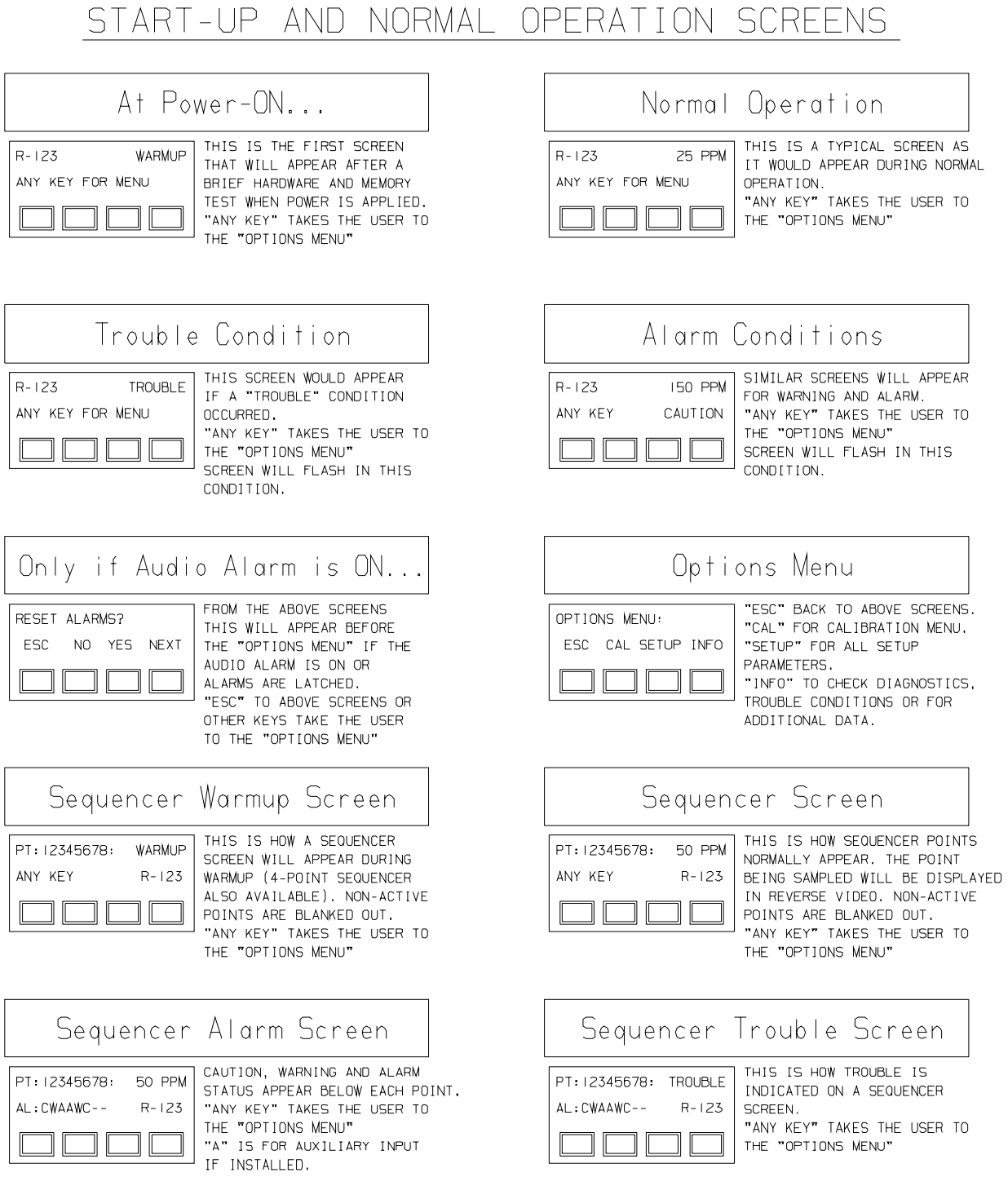


Figure 3-2.
Start-up and Normal Operation Screens

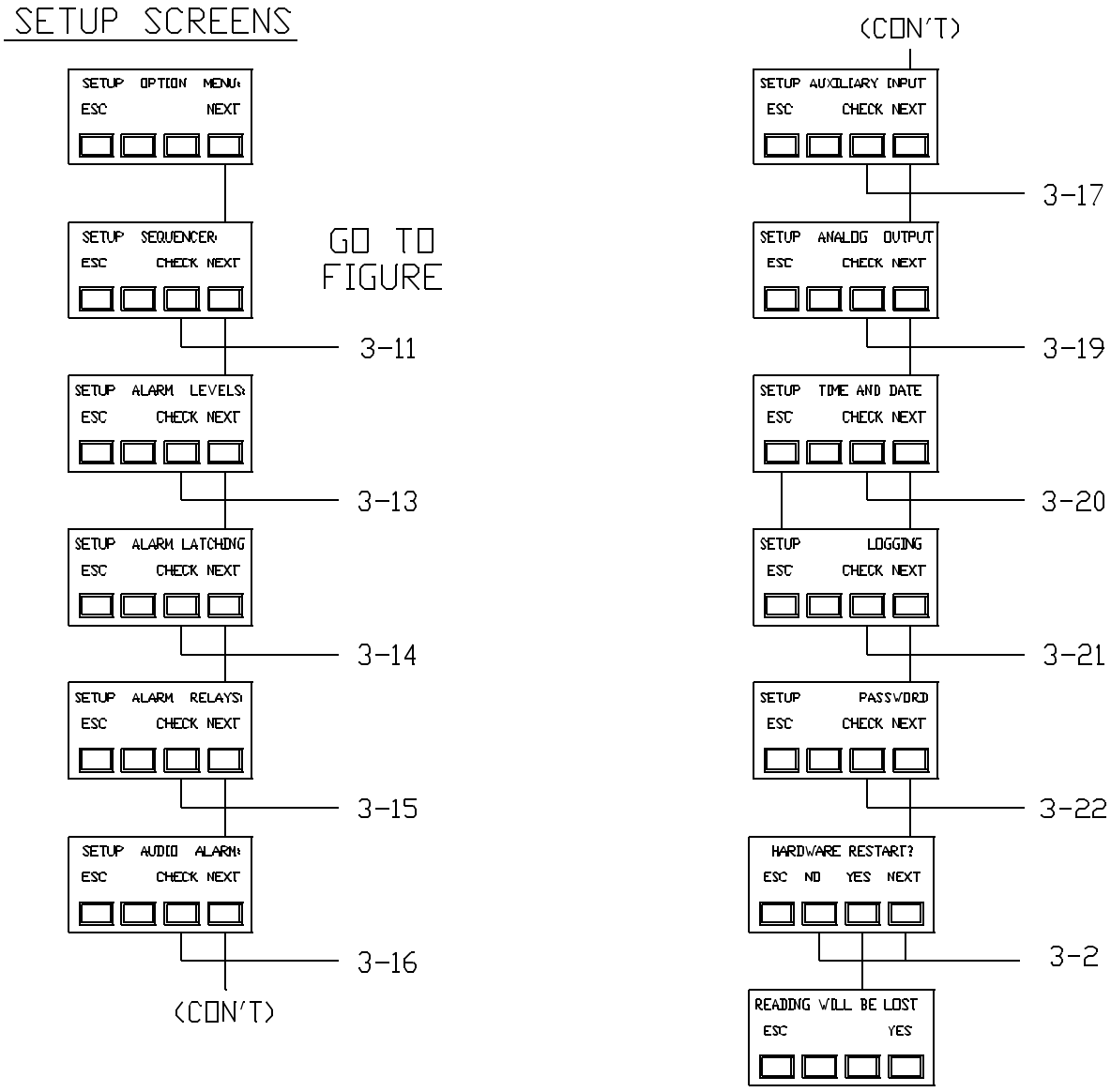


Figure 3-3
Set-up Screens

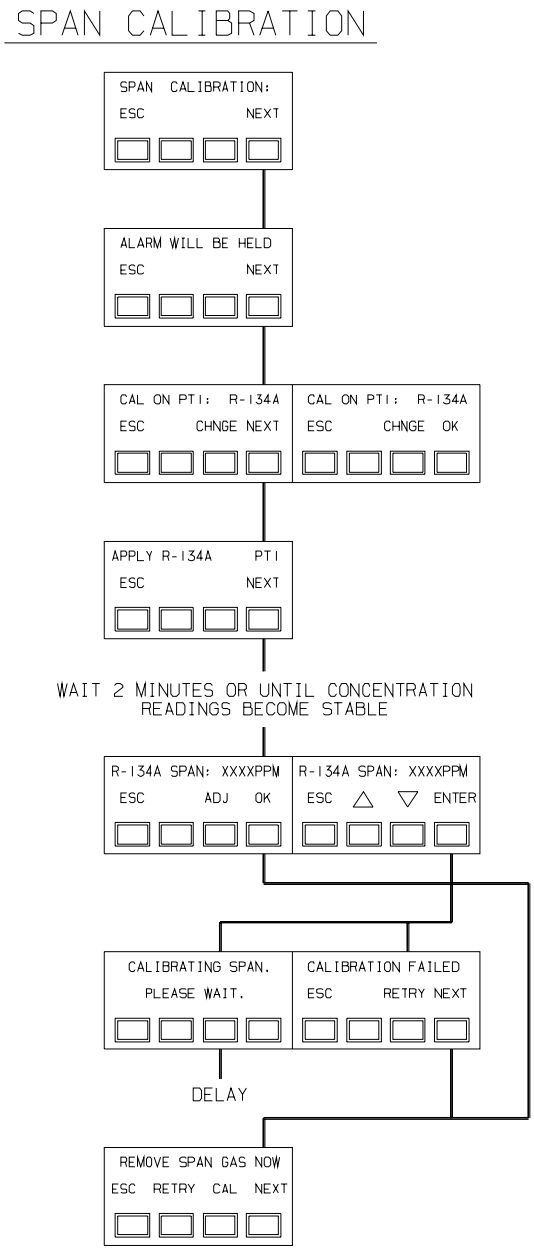


Figure 3-4
Span Calibration

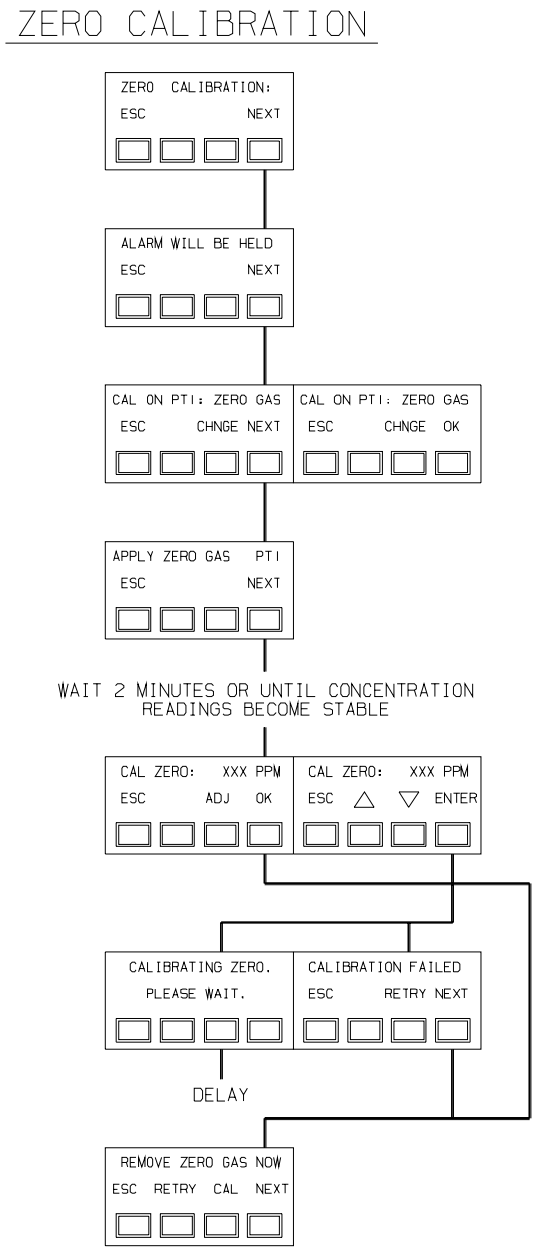


Figure 3-5
Zero Calibration

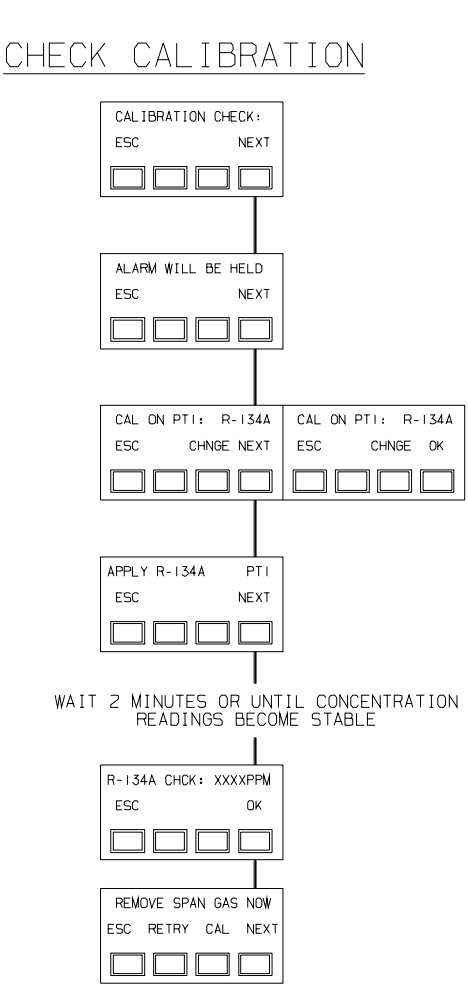


Figure 3-6
Check Calibration

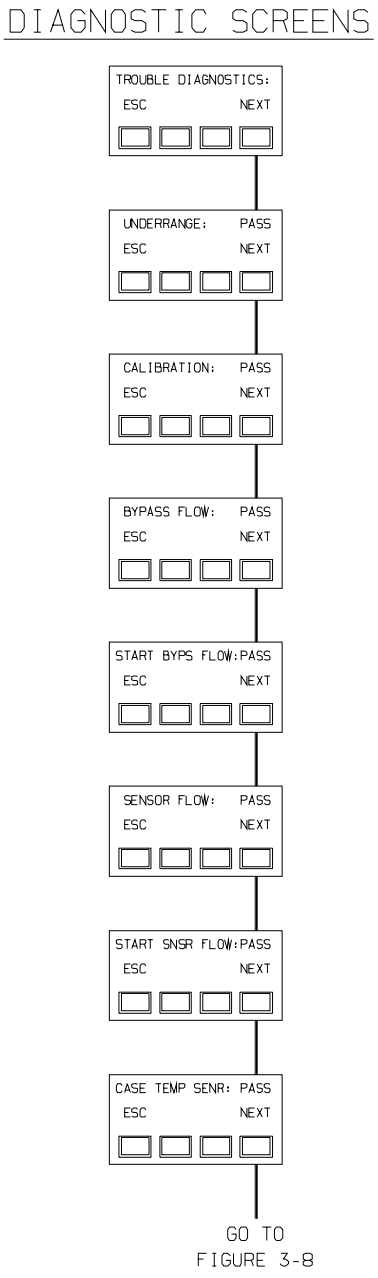


Figure 3-7
Diagnostic Screens

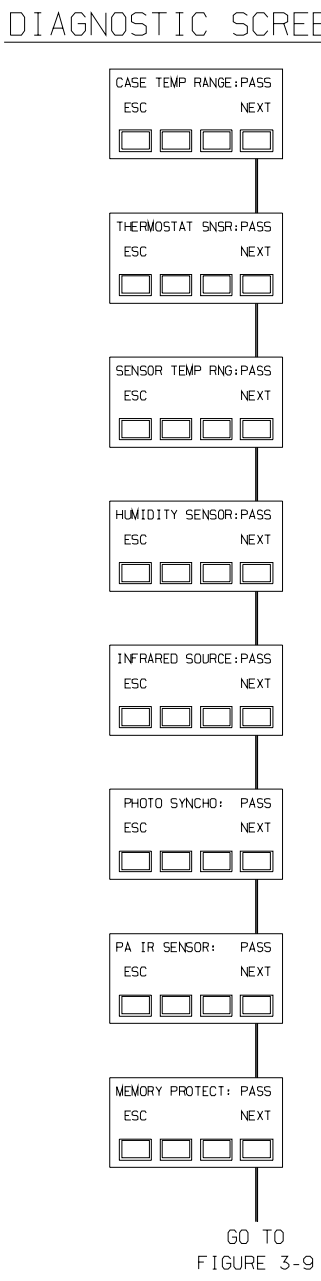


Figure 3-8
Diagnostic Screens

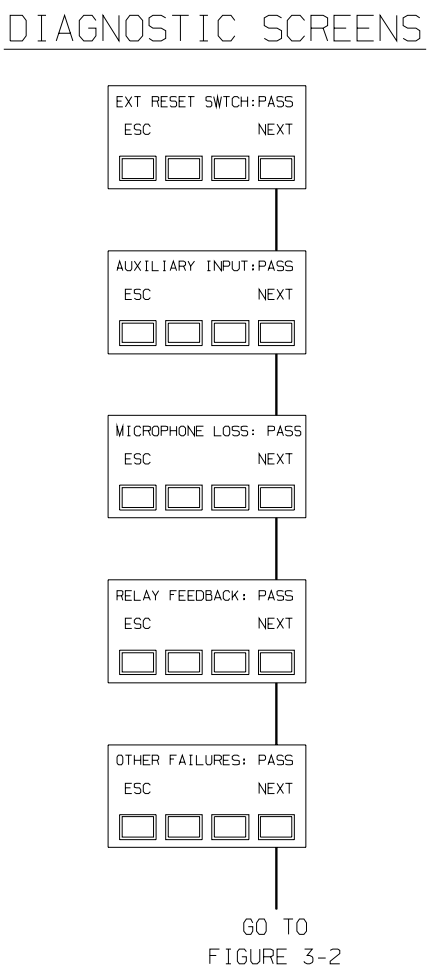


Figure 3-9
Diagnostic Screens

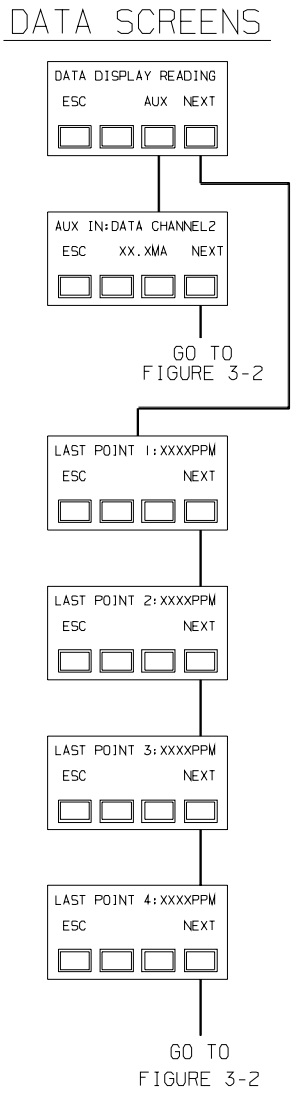


Figure 3-10
Data Screens

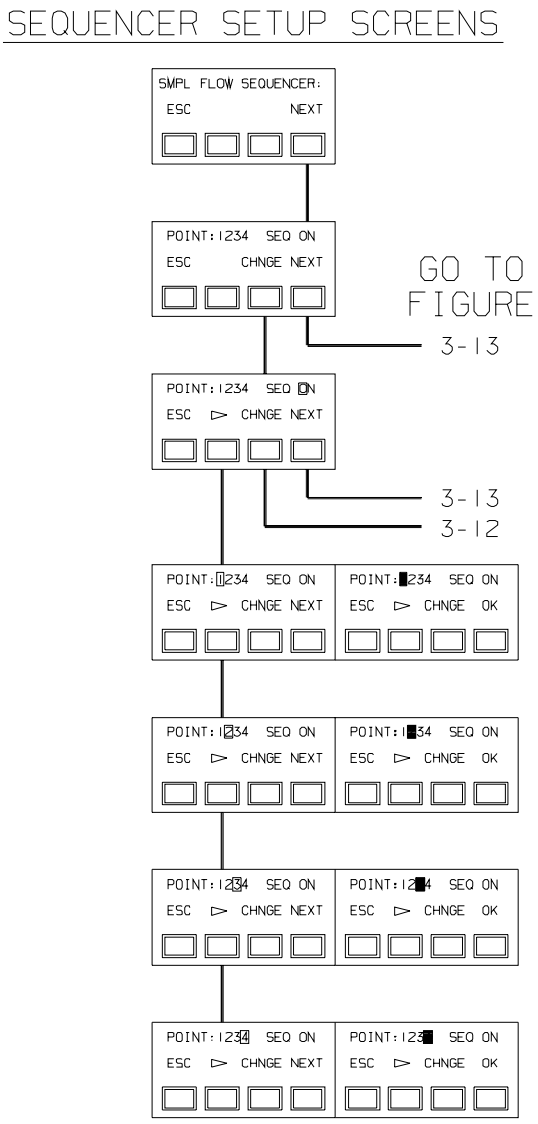


Figure 3-11
Sequencer Set-up Screen

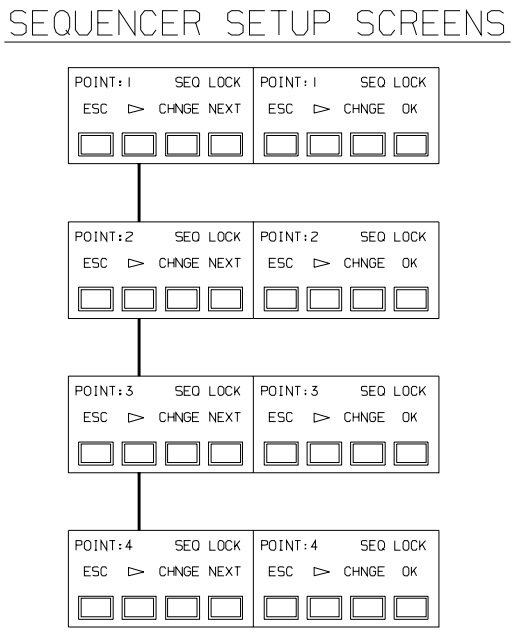


Figure 3-12
Sequencer Set-up Screen

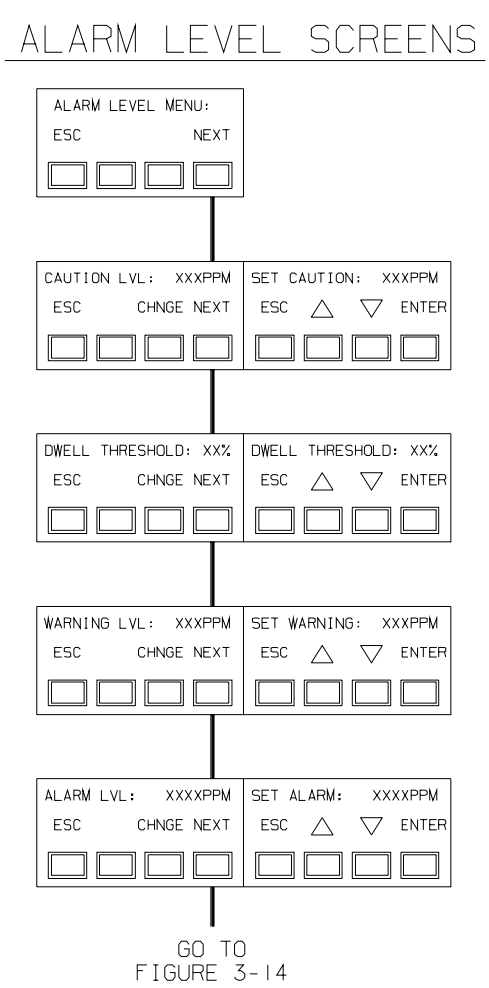


Figure 3-13
Alarm Level Screen

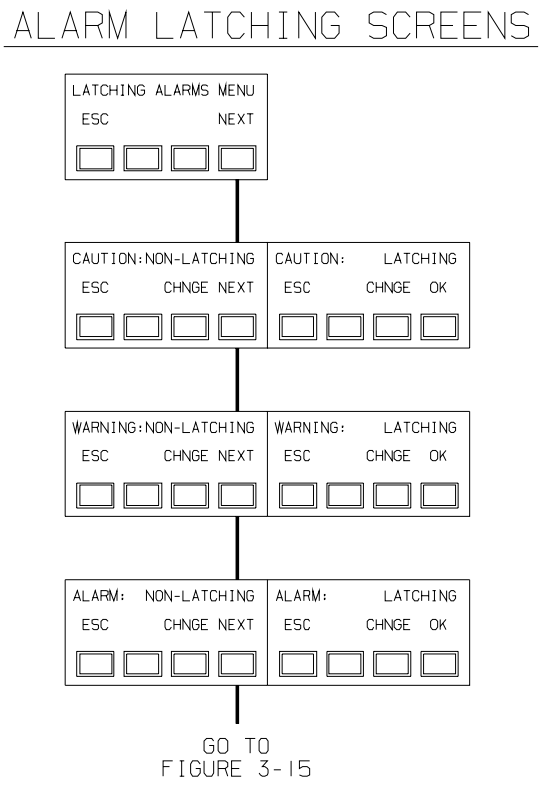


Figure 3-14
Alarm Latching Screen

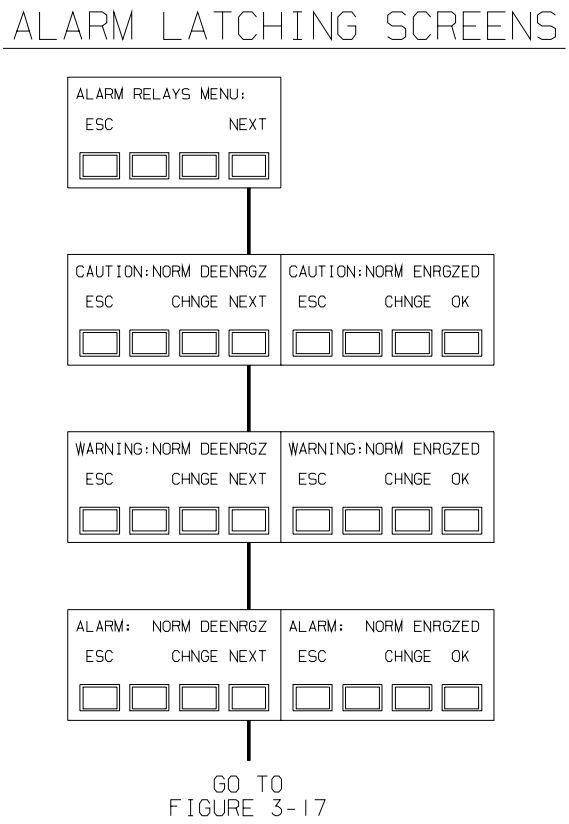


Figure 3-15
Alarm Latching Screen

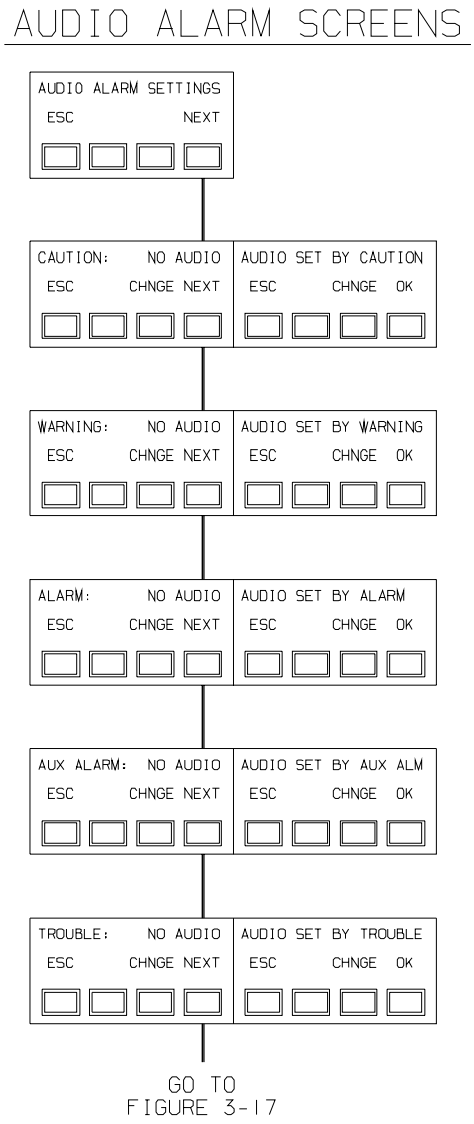


Figure 3-16
Audio Alarm Screen

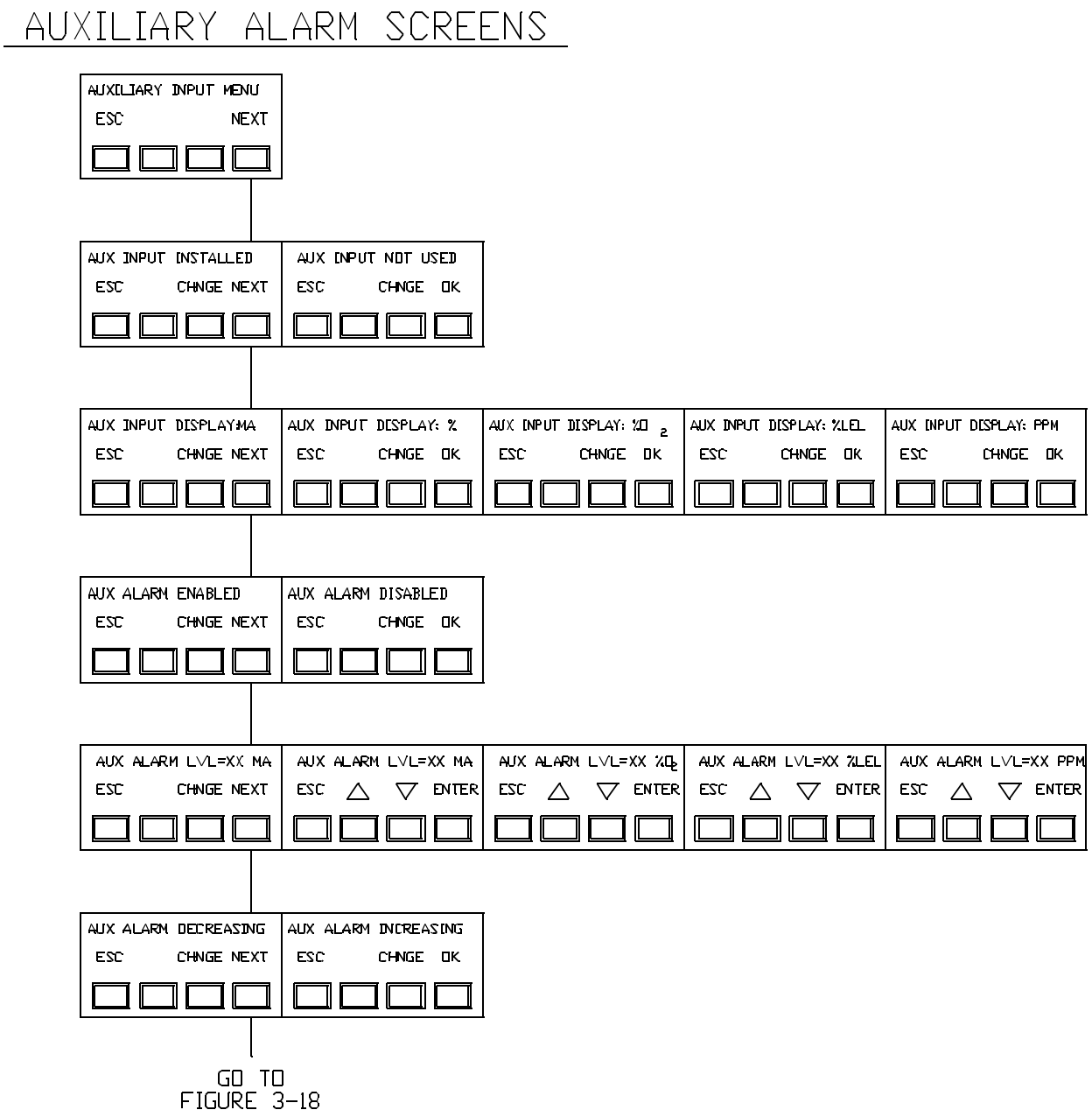


Figure 3-17
Aux Alarm Screen

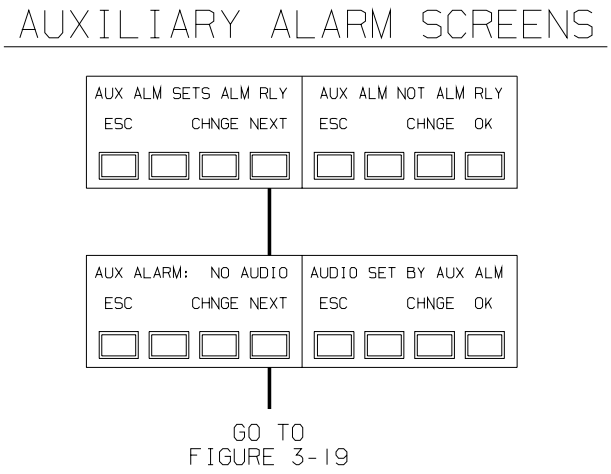


Figure 3-18
Auxiliary Alarm Screen

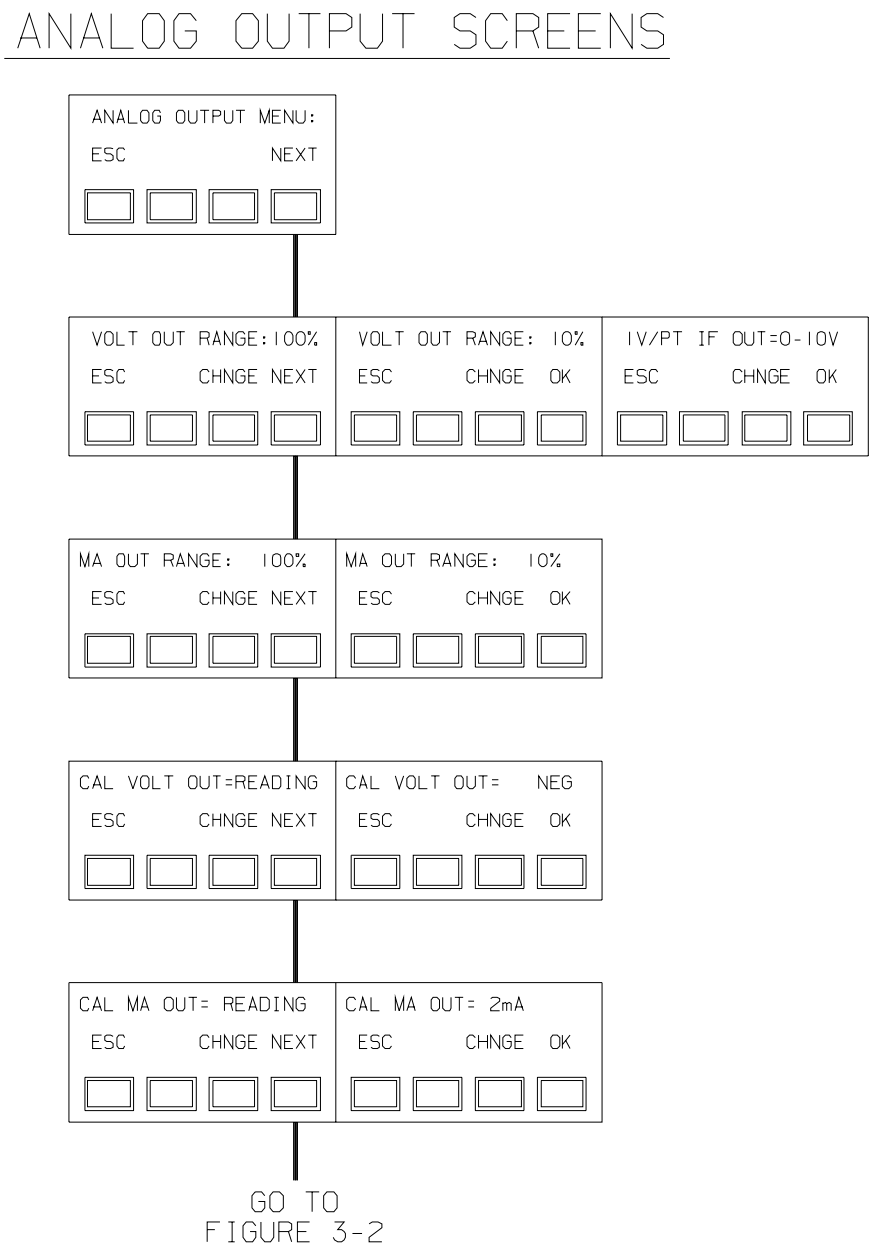


Figure 3-19
Analog Output Screen

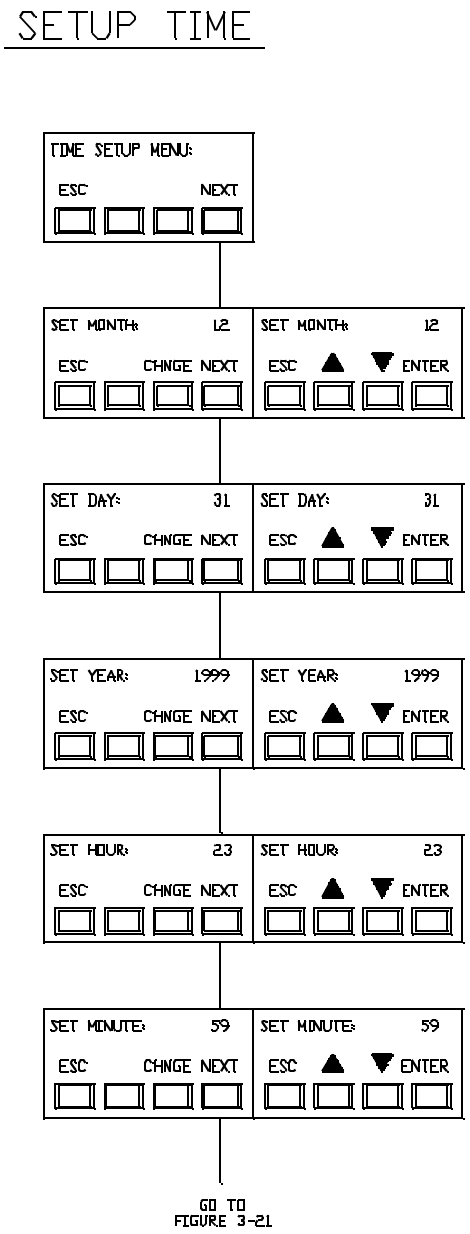


Figure 3-20
Setup Time

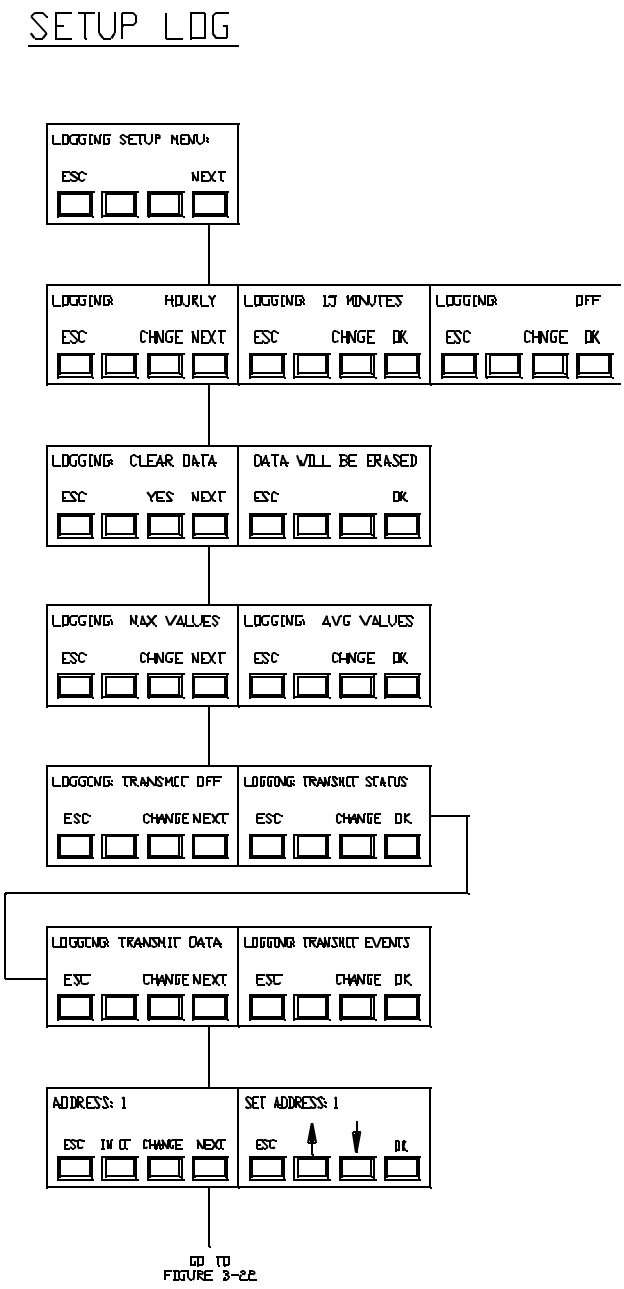


Figure 3-21
Setup Log

SETUP PASSWORD

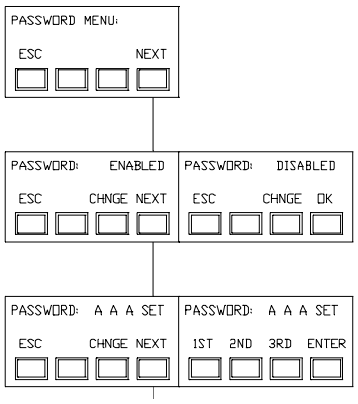


Figure 3-22
Setup Password

REVIEW DATA

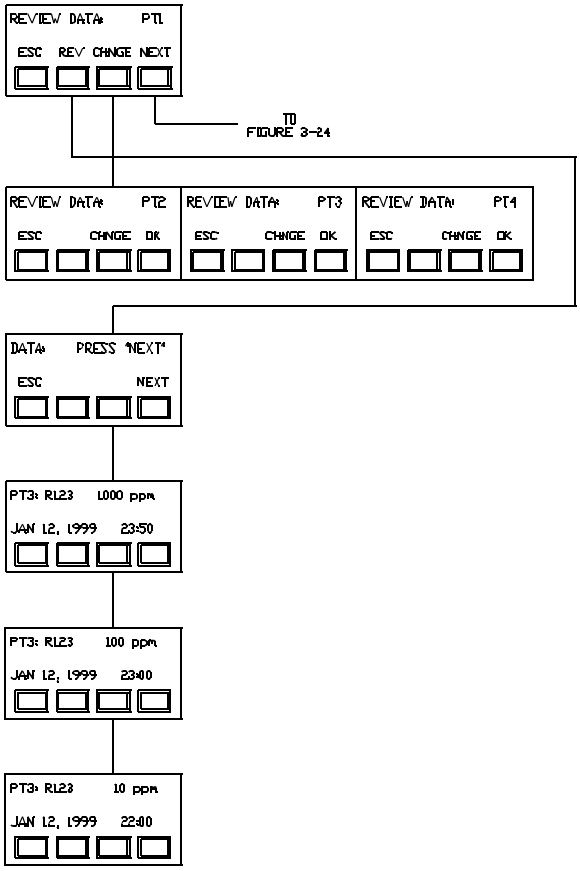


Figure 3-23
Review Data

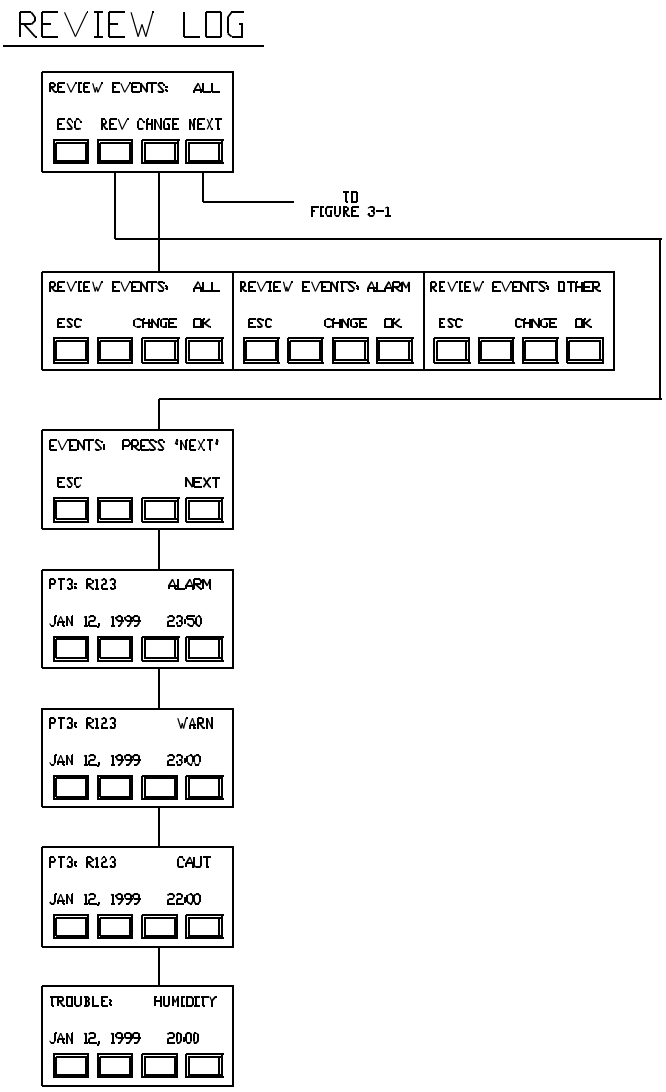


Figure 3-24
Review Log

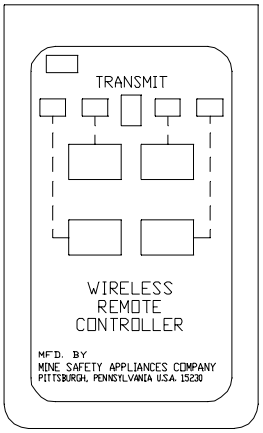


Figure 3-25. Wireless Remote Controller

Using the Wireless Remote Controller with the XP Unit

- The four Controller keys correspond to the same four pushbuttons shown in the Display Screens.
- The Calibrator mimics these buttons via an infrared link through the front-panel window.
- Point the Controller at the front-panel window and push the appropriate key to obtain the desired front-panel function indicated on the display.

⚠ CAUTION

Do not use the Wireless Remote Controller without fully reading and understanding all operating instructions, labels, cautions, warnings, and literature supplied with this equipment. Failure to do so may result in property damage, severe bodily injury or death.

Purpose

The Wireless Remote Controller Transmitter provides a source of digitally encoded infrared energy for control of the Chemgard XP unit. Its primary use is in hazardous and/or high security areas where the wireless commands can effect instrument adjustment and control without breaking safety or security seals.

General Operation and Usage

Infrared energy is transmitted from the upper center portion of the device when any one of the four selector buttons is pressed. Although the infrared transmission is not visible, operation is indicated when the TRANSMIT LED is ON. A flickering TRANSMIT LED is normal, and corresponds to the encoded message. Power is consumed by the Transmitter only when one of the four buttons is pressed. Most visibly transparent material will also pass these infrared signals.

Aim the red lens on the end of the Transmitter at the target device, the desired function key is pressed, and the RECEIVE LED on the target turns ON to verify the infrared message is received.

NOTE: If more than one button is pressed simultaneously, the RECEIVE ACKNOWLEDGE LED will turn ON, but there can be no other response; this mode serves as a test function only.

To ensure reliable operation, hold the Transmitter no more than 12 inches from the target assembly, and point the red lens of the transmitter at the RECEIVE ACKNOWLEDGE LED. The range will restricted in direct sunlight or extremely high illumination areas.

Battery Installation and Replacement

⚠ CAUTION

Perform the following in a known safe area.

1. Remove the four screws from the bottom and carefully open the case, keeping the top in close proximity to the bottom so as not to strain the interconnecting cable. Retain the front plastic shield that is loosely held by the top and bottom slots.
2. Note the polarity markings inside the holder, and install a 9 Volt Alkaline Duracell, Inc. MN1604 or an Eveready No. 522 type battery in the battery holder. Properly dispose of the battery.
3. Before re-assembling the case, individually press each of the four keys, and verify that the TRANSMIT LED lights in a blinking pattern.
4. If it has been removed, place the front plastic shield into its lower slot, and carefully align it with the corresponding slot in the top cover.
5. Re-install the four screws.

Section 4
Calibration

Introduction

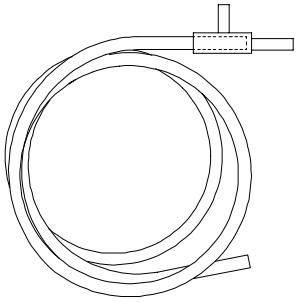
As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor. The frequency of the calibration gas test depends on the operating time and exposures of the sensors. New monitors should be calibrated more often until the calibration records prove stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.

Perform the calibration procedure regularly and maintain a log of calibration adjustments. Calibration frequency may increase for a variety of reasons. If calibration cannot be performed at any step, STOP; consult MSA at 1-800-MSA-INST.

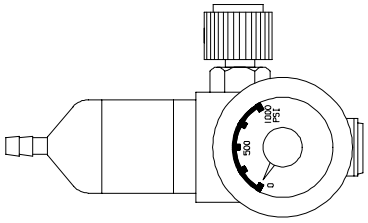
Calibration Equipment

Equipment needed:

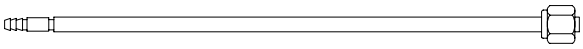
- Calibration Kit (MSA ATO #50; FIGURE 4-1)



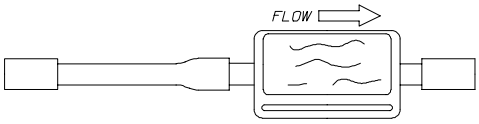
Item 1 - *Tube and Tee Assembly (P/Ns 603806 and 636866)*



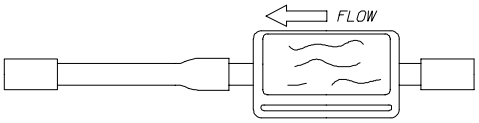
Item 2 - *1.5 LPM Flow Controller (P/N 478358)*



Item 3 - *Connector Assembly (P/N 711533)*



Item 4 - *Span Gas Scrubber (P/N 803874)*
NOTE: *Replace protective caps after use.*



Item 5 - *Zero Gas Scrubber (P/N 803873)*
NOTE: *Replace protective caps after use.*

Figure 4-1.
Kit Components

- A SPAN gas cylinder
- Optional ZERO gas cylinder.
  - A ZERO gas cylinder may not be needed.

The Calibration Kit contains a ZERO gas scrubber which can be used in place of a ZERO gas cylinder if the ambient air around the Chemgard Infrared Gas Monitor contains little or no interfering gas.

⚠ CAUTION

The zero gas scrubber must be replaced periodically because the filter can become saturated by ambient gas vapors. The frequency of replacement depends on the concentration of the ambient gas vapors.

The SPAN or ZERO cylinders (if needed) may be included with the Calibration Kit; cylinders shown in TABLE 4-1 are available from MSA:

Table 4-1. Calibration Gas Cylinders

DESCRIPTION	CONCENTRATION	PART NO.
Carbon Monoxide	100 ppm	806734
Pentane	.75%	804532
Pentane	1000 ppm	10014894
Iso Butylene	100 ppm	494450
R22	100 ppm	804868
Nitrous Oxide	100 ppm	806736
R11	100 ppm	803499
R134a	100 ppm	803500
Zero Air		801050
Carbon Dioxide	100 ppm	806755
R113	100 ppm	804870
R12	100 ppm	804866
R134a	30 ppm	812787
Propane	0.6%	493579
R123	30 ppm	812784

Become familiar with the Calibration Kit components (FIGURE 4-1).

For Carbon Monoxide, Carbon Dioxide and Nitrous Oxide Chemgard Monitors

An affect observed on these infrared monitors is a reduction in signal at low relative humidities. The gas sample being drawn into the instrument MUST contain a humidity level greater than 0.3% by volume. At 72^{o}F, this would represent a relative humidity level of approximately 10%.

To ensure that the sample is humidified, MSA recommends placing an air-tight water bubbler in the sample line. If the humidity level in the sample stream will be above 0.3% by volume at all times, the water bubbler is not necessary. Care MUST be used to ensure that sufficient water is present in the bubbler such that the humidity level is greater than 0.3% by volume at all times, including during calibration.

⚠ WARNING

Failure to properly humidify the sample at all times can cause erroneous monitor readings. If the instrument is not properly humidified, the Chemgard Monitor may fail to perform as designed and persons who rely on this product for their safety could sustain severe personal injury or death.

Calibration of the infrared sensor can be achieved by following the calibration procedure in this manual. The sample MUST be properly humidified during the calibration procedure.

Chemgard Infrared Gas Monitor identification

You must identify your unit as a single-point monitor or a multi-point monitor for proper calibration gas connection. Refer to FIGURE 4-2 to help identify your unit.

Calibration Procedures

Before calibrating the Chemgard Monitor, leak-check the sample line(s) connected to the monitor:

1. Temporarily block the sample inlet at the end-of-line filter(s) and verify that the monitor gives a trouble alarm.
   - If the monitor is a Multipoint Sequencer, the trouble alarm will not activate until the blocked sampling point is selected by the Sequencer.
2. After checking for leaks, remove the sampling line for the Chemgard inlet.
   - On Multipoint Monitors, use sample inlet Point 1.
3. Attach the Calibration Kit connector assembly to the inlet.
4. Before applying gases, familiarize yourself with the calibration screens by stepping the monitor through the whole sequence. Press the keys in the following order:

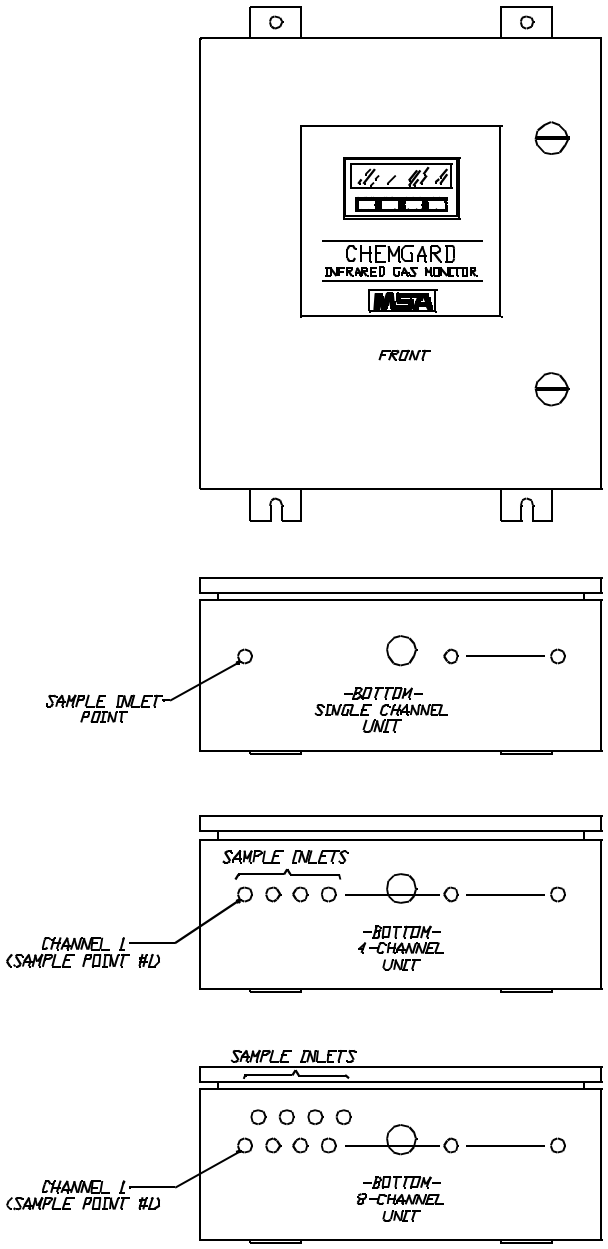


Figure 4-2.
Chemgard Models

Table 4-2. Calibration Sequence Screens

#	PRESS	RESULT
1	ANY KEY	BRINGS UP MENU
2	CAL	BRINGS UP CAL MENU
3	USER	ALLOWS ADJUSTMENTS
4	ZERO	ALLOWS ZERO CALIBRATION
5	NEXT	PROMPT: ALARMS ARE NOW OFF
6	NEXT	PROMPT: SAMPLE POINT 1 TO BE USED
7	NEXT	PROMPT: APPLY ZERO GAS
8	NEXT	PROMPT: ADJUST OR OK READING
9	OK	PROMPT: REMOVE ZERO GAS
10	SPAN	PROMPT: GO INTO SPAN CALIBRATION
11	NEXT	PROMPT: ALARMS ARE NOW OFF
12	NEXT	PROMPT: SAMPLE POINT 1 TO BE USED
13	NEXT	PROMPT: APPLY SPAN GAS
14	NEXT	PROMPT: ADJUST OR OK READING
15	OK	PROMPT: REMOVE SPAN GAS
16	NEXT	PROMPT: ALARMS ARE NOW ACTIVE
17	NEXT	RETURNS TO NORMAL OPERATION

- When this sequence is done with zero and span gases, adjust the zero and span readings (if necessary) in TABLE 4-2 steps #9 and #15, respectively.
- If adjustments are needed, press ADJ to access the UP, DOWN and ENTER keys; enter the zeroing and spanning adjustments.

4. **Zeroing the Monitor:**
   When zero gas is required, attach a zero gas scrubber or zero gas cylinder to the connector as shown in FIGURE 4-3.

   NOTE: Use only the zero gas ***cylinder*** on monitors calibrated for ammonia.

5. **Spanning the Monitor:**
   When span gas is required, a span gas cylinder must be attached to the connector as shown in FIGURE 4-5.

   NOTE: The span gas must be appropriate for monitor calibration. For many applications, a span gas cylinder of the gas of interest is available from MSA. If a span gas cylinder of the specific gas is not available, MSA has determined an appropriate synthetic span gas. See TABLE 4-1 for calibration cylinders available from MSA. If a synthetic span gas is used, refer to the calibration label on the inside of the monitor door (FIGURE 4-6).

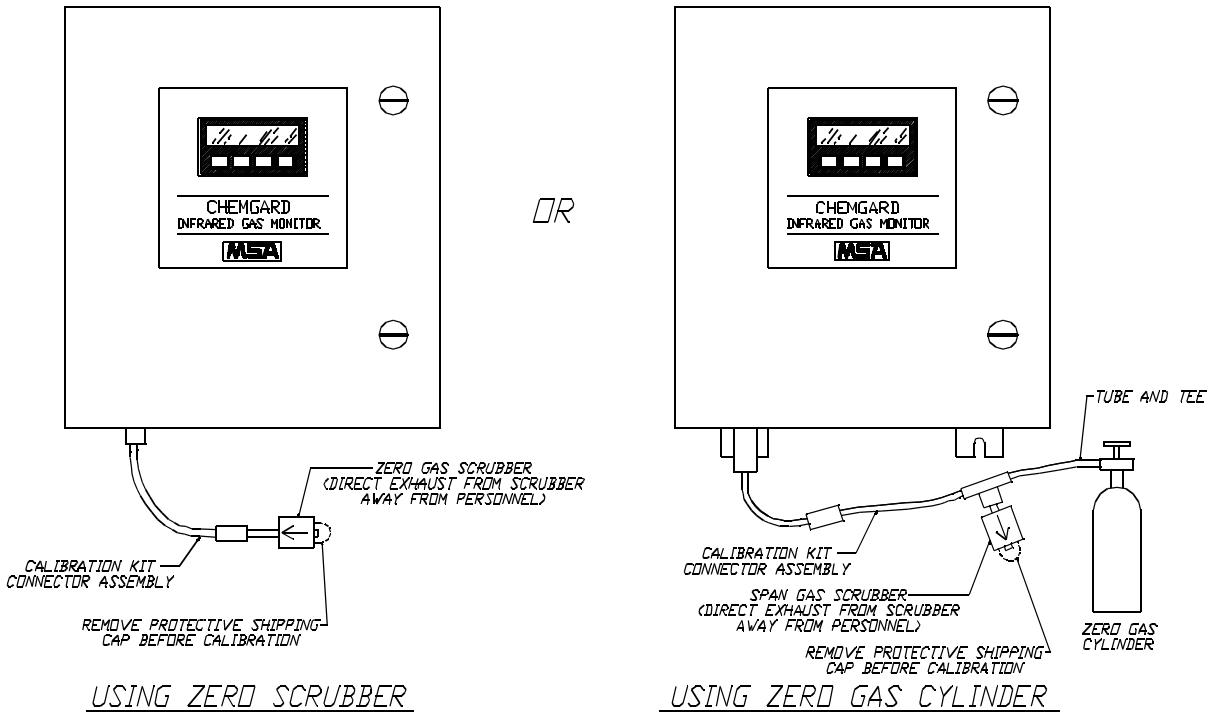


Figure 4-3.
ZERO Calibration

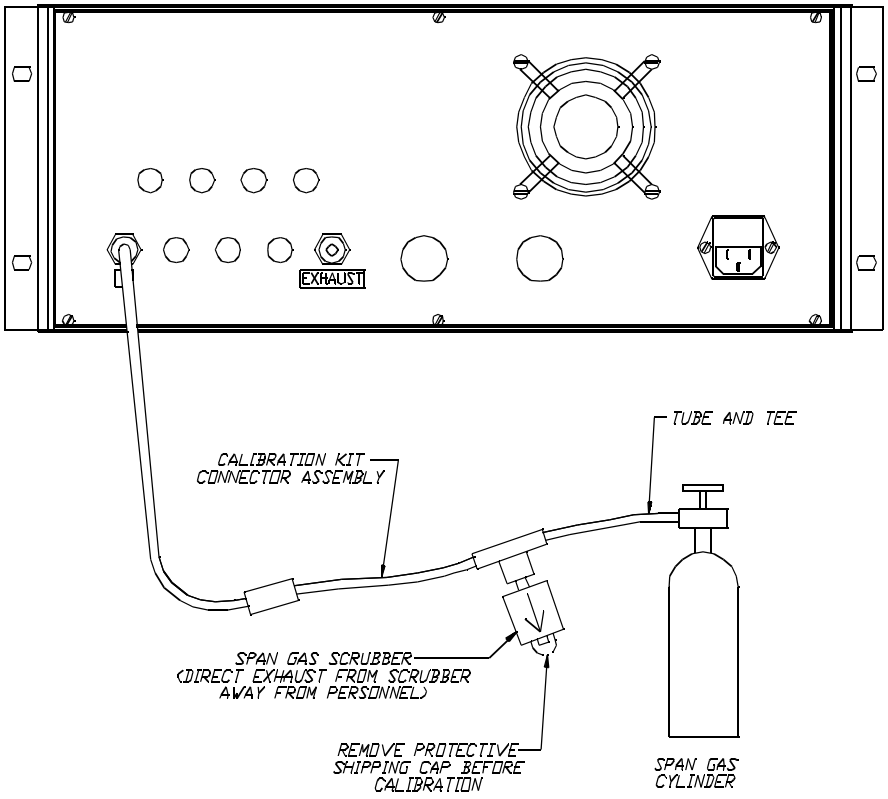


Figure 4-4. Unit Span Calibration

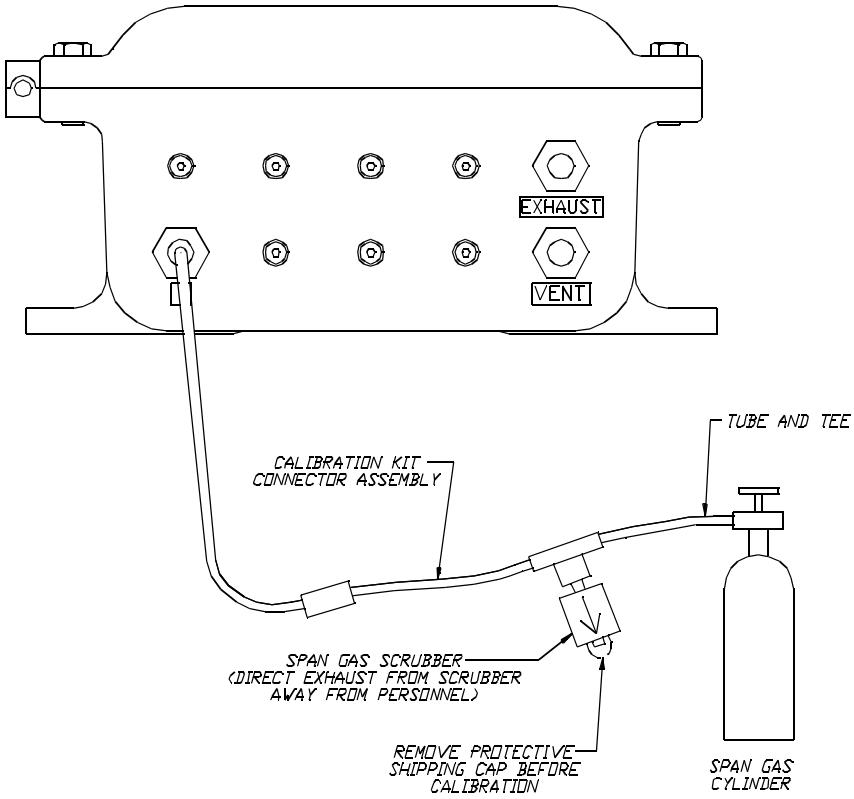


Figure 4-5. Unit Span Calibration

- Set the unit to the value given on the "synthetic span" label shown in FIGURE 4-6.

6. Perform the TABLE 4-2 sequence.
   a. Apply zero gas when requested.
      - Allow enough time for a stable reading.
   b. Accept (OK) or adjust ("ADJ") and enter a zero reading.
   c. Apply span gas when requested.
      - Allow enough time for a stable reading.
   d. Accept (OK) or adjust ("ADJ") and enter the correct span reading.
7. Remove the connector assembly and re-attach the sampling line to the monitor inlet.

⚠ WARNING

If the sampling line is not re-attached, the monitor cannot sample from the remote location.

During calibration, the alarm relays do not activate; ensure that a hazardous condition does not exist when calibrating the Chemgard system.

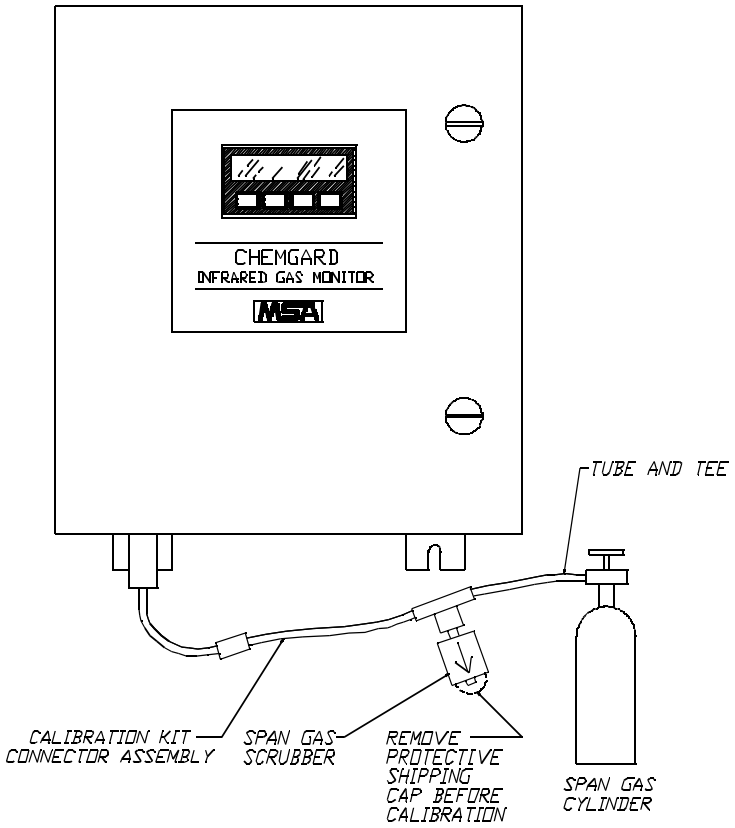


Figure 4-6.
SPAN Calibration

Factory Performance Test/Verification

Calibration Gas Mixture:_____

Synthetic Span:_____

MSA Cylinder P/N:_____

Cylinder Reading:_____

Certified Sensitivity Range:_____

Certified Accuracy:See Installation Literature Specifications

Test Date:_____

Test Reference Number:See Unit Serial Number

Instruction Manual Revision Number:_____

Inspector:_____

Figure 4-7. Unit Calibration Label

Section 5
Maintenance

General Maintenance

Under normal operation conditions the Chemgard Monitor requires minimal maintenance. The end-of-sample-line filter(s) should be examined regularly for dirt/dust build-up and replaced when necessary. If the filter(s) become severely clogged with dust, the flow rate will eventually fail and a flow alarm will occur. If the end-of-sample-line filters are used and serviced correctly, the filters installed inside the monitor should rarely require replacement; however, these internal filters must be inspected periodically.

Obtaining Replacement Parts

To obtain replacement parts, address the order or inquiry to:

Mine Safety Appliances Company
Instrument Division
P.O. Box 427, Pittsburgh, PA 15230

or call, toll-free, 1-800-MSA-INST.

⚠ WARNING

Use only genuine MSA replacement parts when performing any maintenance procedures. Failure to do so may seriously impair unit performance. Repair or alteration of the Chemgard Monitor, beyond the scope of these 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 5-1. Replacement Parts

PART	PART NO.
Internal Filter, Single Point	711561
Internal Filters, all Multipoint and single-point Ammonia	655533
Filter, End-of-Line	711561
Ammonia Unit, Filter, End-of-Line	655652
2.0 amp, 250 volt Fuse	638091
Display	655786
Front Panel Printed Circuit Board Assembly (gray ribbon cable)	10014705
Power Supply	637394
Pump Assembly	711479
Low Flow Switch	637824
Polyurethane Tubing, 1/4" OD, 1/8" ID	603806
Polyethylene Tubing, 1/4" OD, 0.17" ID	29264
Nylon Tubing, 1/4" OD, 0.180" ID	29207
Teflon-Lined Tubing	603876
Equalization Valve	711371
Strobe, Beacon Assembly	634674
Gasket, Beacon Assembly	711168
Connector, Beacon Assembly	637523
Sonalert	629693
Zero Gas Scrubber	803873
Span Gas Scrubber	803874
Front Panel Printed Circuit Board Assembly (black/orange cable)	711386
Printed Circuit Board, Membrane Switch, Keypad	711340
Label, Keypad	711615

Troubleshooting Guidelines

See TABLE 5-2.

Table 5-2. Troubleshooting Guidelines

TROUBLE	DESCRIPTION	SOLUTION
Unit will not turn ON	No power	1. Check AC power to unit.
		2. Verify AC power to unit is wired properly.
		3. Replace L1 and/or L2 fuse.
		4. Check for loose wires on terminal barrier input.
		5. Check wiring to the unit power supply. Remove power supply cover and check fuse; replace if necessary.
		6. Check input cable to main board on left side of power supply.
		7. Check for 12 VDC power supply output. Connect the DVM negative lead to TP5 and the positive lead to TPSPD1. Adjust Volt 2 pot on the power supply if necessary.
		8. Move the DVM positive lead to TPSPD3. The voltage should be 5 VDC. Adjust Volt 1 pot on power supply if necessary.
Beacon will not light	Beacon alarm	1. Check that plug is connected to circuit board: J10
		2. Verify the audio option is used in the setup screens.
		3. Replace beacon assembly.
Under-range failed	Zero limit is minus 10 ppm	1. Adjust display zero to 0.0 via the keypad with zero air or zero scrubber applied.
		2. Check the zero air cylinder; replace if necessary.
		3. Check the zero scrubber; replace if necessary.
Calibration failed	Coefficients out of range	1. Replace zero scrubber or change zero air supply.
		2. Check span gas supply.
		3. Check all tubing, filters and fittings for leaks.
		4. For sequencer units, make sure the unit is locked on the selected sample port used for calibration.
		5. Leak test the flow system.
		6. Return to MSA for service.
Bypass flow failed	Leaky or blocked bypass line	1. Remove all input lines to unit. Attach one line at a time to check for bypass input. The line that causes flow failure is the problem; check the line's end-of-line filter.
		2. Check inlet fitting, tubing, orifices, bypass pressure switch, and bypass manifold tubing.
		3. Check pressure switch for 4 VDC ON and OFF switching (if sequencing); if single-point, it will be ON constantly. Check cable terminals and plug end at BP/SCN. Replace the bypass pressure switch if necessary.
		4. Check operation of all bypass valves in manifold.
		5. Leak test the flow system.

Table 5-2. Troubleshooting Guidelines

TROUBLE	DESCRIPTION	SOLUTION
Start bypass flow failed	Leaky or blocked bypass line at startup of unit	1. Same as bypass flow failure. Check as above, turn unit off and restart unit.
		2. Leak test the flow system and restart unit.
Sensor flow failed	Leaky or blocked sample line	1. Remove all input lines to the unit. Attach one line at a time to check for sample input. Check all end of line filters. Sample flow failure is always the present point being sampled.
		2. Remove the optical bench cover. Check the inlet fitting, tubing, sample filter, tubing to the optical bench inlet fitting, outlet fitting from the optical bench, sample pressure switch, and sample manifold tubing.
		3. Check the sample pressure switch for 4 VDC ON and OFF switching. Check the cable terminals and plug end at press/sample connector. Replace pressure switch if necessary.
		4. Check operation of all manifold sample valves. Check the optical bench inlet and outlet valves.
		5. Check the optical bench inlet and outlet valve connectors on J22 and J21.
		6. Leak test the flow system.
Start sensor flow failed	Leaky or blocked sample flow line at unit startup	1. Same as sensor flow failure. Check as above; turn unit OFF and re-start unit.
		2. Leak test the flow system.
Case temperature failed	Main board component	1. Return to MSA for service.
Case temperature range failed	Case temperature is 0 to 90 ^{o}C	1. Return to MSA for service.
Thermostat sensor failed	Controls optical bench inside temperature	1. Replacement of optical bench requires MSA service.
Sensor temperature range failed	Checks for temperature range of 45 to 90 ^{o}C	1. Replacement requires MSA service.
Humidity sensor failed	Checks H_2O sensor output	1. Return to MSA for service.
Infrared source failed	Checks the I of source assembly	1. Return to MSA for service.
Photo synchro failed	Checks the chopper for operation	1. Return to MSA for service.
PA IR sensor failed	Checks the sensor microphone for output	1. Return to MSA for service.
Memory protect	Checks checksum	1. Return to MSA for service.
External reset failed	Checks the external reset button	1. If not used, check for jumper between RST minus and RST plus on J16.
		2. If used, verify switch is wired normally closed.
Display failure	Display communications	1. Check RS485 connector on J15, terminals 1 and 2.
		2. Check for broken or cracked display.
		3. Remove rear panel cover and check cables between the display and the display board.
Audio alarm failure	Audio alarm	1. Check output terminals 6 and 7 on J17.
		2. Check for faulty horn buzzer.

Section 6
Data Logging

Log Size

The Chemgard unit allows 1,078 sets of data and events to be logged. This data is either the maximum or average of the "last" data calculated.

Last Values

The maximum value is taken from the 'last' data; this is not always the highest value displayed, but the last valid data taken from a point. The average is an average of 'last' data values. Usually, the last data is the fourth reading during normal operation (or the twelfth reading if the monitor is in an extended dwell). Invalid (blank) and under-range data are not recorded. Over-range is recorded as 1000 ppm.

Number of Data Points Used

If the unit is only a single point monitor or all but one point is inactive, the value is recorded every sixteenth reading; this is 30 values per hour. With four points active, 15 values per point are recorded every hour. The number of values can be considerably lower if the monitor enters extended dwell because of high gas concentrations.

User Setup Options

When the monitor enters the Ready State, the data array is cleared. Then, four valid concentration values are needed before any data is recorded. Concentrations are recorded either every 15 minutes or hourly. If the logging function is turned OFF, the clock/calendar chip is stopped to save battery energy.

- Before the logging is turned ON, the clock/calendar must be set.

Setting any value starts the clock/calendar. Hours or days may be skipped or repeated. The log can be cleared in the Setup Menu.

Viewing Alarms/Events and Data

From the Review Events Screen, the user can view just alarms, just events, or both. The latest event is presented first. When the memory is filled, the entries wrap around.

From the Review Data Screen, the user can view the recorded concentrations. The particular point must be selected. Again, the latest data is presented first; when the memory is filled, the entries wrap around.

Appendix A
Check List

Before applying power to the Chemgard Infrared Gas Monitor, check for the for all items in the following table:

ITEM	CHECK FOR:	CHECKED OR INITIALED
1	Proper mounting of Chemgard Infrared Gas Monitor on a non-vibrating surface which does not block the front panel. Mounting must be away from direct solar heating.	
2	Correct electrical connections and wiring to Chemgard Infrared Gas Monitor. Wiring must be done for proper voltage.	
3	Proper tubing for sample line.	
4	Removal of all caps and plugs at sample line inlets and exhaust.	
5	Proper end-of-line filters installed.	
6	Disabling of unused sampling points.	
7	Possession of proper calibration kit and check gases for calibration.	
8	An established routine calibration schedule.	

Appendix B
Relay Module

This accessory module has not be evaluated by Underwriters Laboratory, Inc.

General Description

The Chemgard Relay Module is intended to provide discrete relay outputs for the Chemgard Infrared Gas Monitor equipped with a multi-point sequencer.

The Chemgard Infrared Gas Monitor has three alarm threshold levels (CAUTION, WARNING, and ALARM), each with a corresponding form C relay output. The user can obtain alarm level information via the set of three relay contacts.

The Chemgard Infrared Gas Monitor relays do not convey point-wise alarm level information. These relays provide information at the monitor level only, one set of relay contacts (CAUTION, WARNING and ALARM) per sequencer point.

Used as intended, the Chemgard Relay Module enables the user to obtain point-wise alarm level information.

The Chemgard Relay Module monitors the current state of the Monitor and sets its installed relays according to information received. While the Chemgard Relay Module receives its information from the Chemgard Infrared Gas Monitor, it is important to note that the Relay Module operates independently with respect to the Reset Switch and Audio operation. Refer to "Operation" later in this appendix for details.

NOTE: The use of ALARM in capital letters refers to the specific Chemgard Infrared Gas Monitor third alarm threshold level.

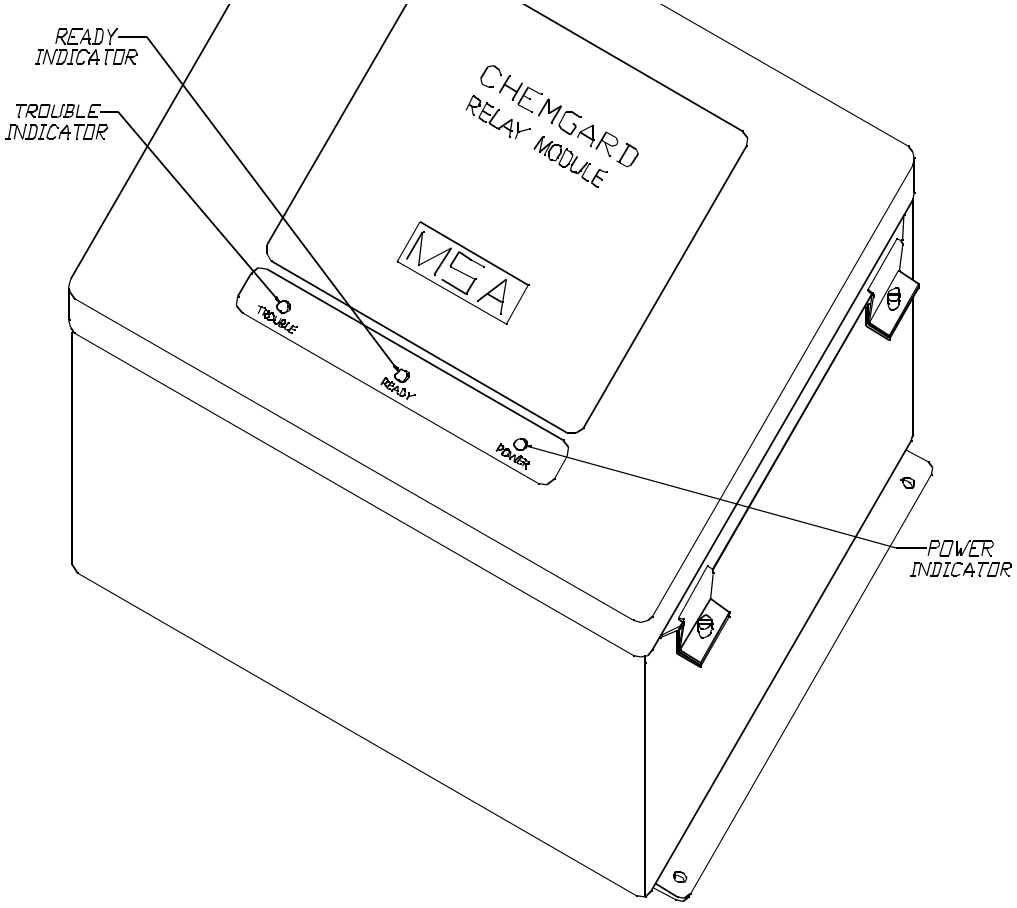


Figure B-1. Relay Module

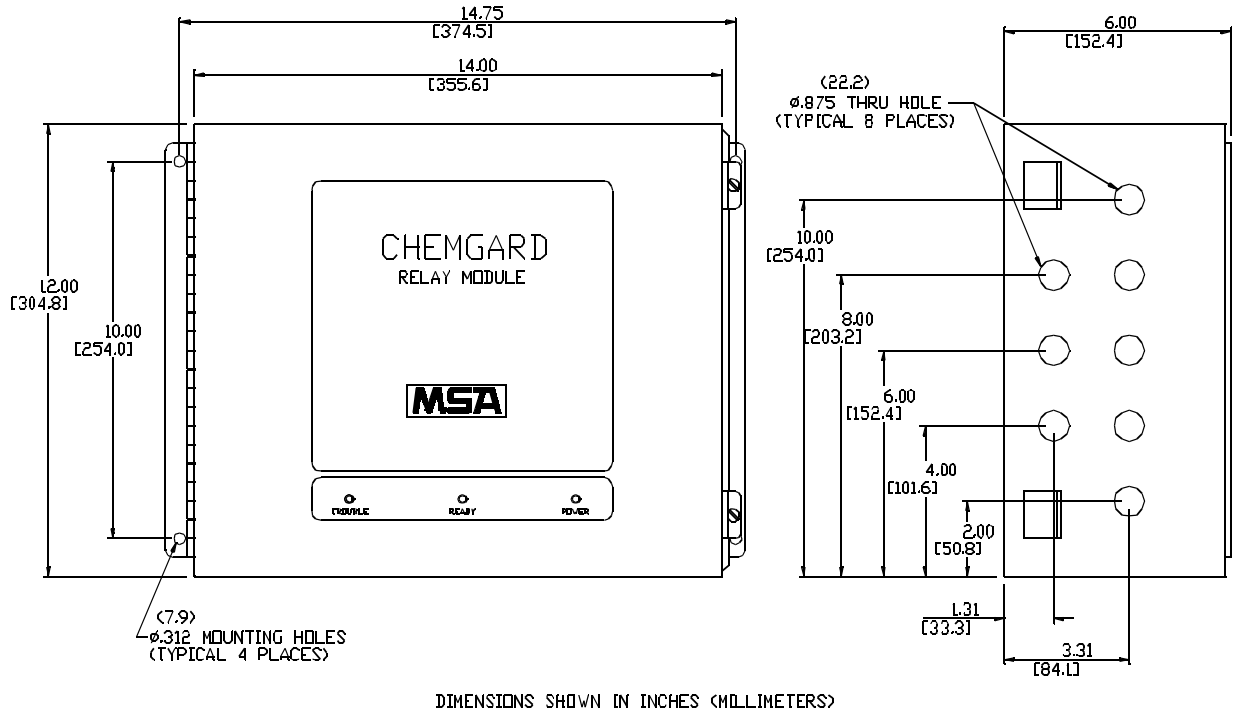


Figure B-2. Mounting the Relay Module

Specifications

Table B-1. Specifications

TEMPERATURE RANGE	**OPERATING**	0 to 50°C
	STORAGE	-20 to 60°C
POWER	85 - 264 Volts @ 40 Watts max.	
MAXIMUM WARM-UP TIME	30 seconds	
HUMIDITY	0 to 99% RH non-condensing	
SYSTEM COMMUNICATION	RS-485	
RELAYS	**COMMON TROUBLE AND HORN RELAY**	10 Amps @ 125, 250 VAC
		10 Amps @ 30 VDC
	CAUTION, WARNING AND ALARM RELAYS	4 Amps, 1/20 H.P. @ 125, 250 VAC
		3 Amps @ 30 VDC
	TERMINAL BLOCK	can accept up to 12 AWG wire.
HORN	80 db (2 feet at ambient temperature and pressures)	
DIMENSIONS	12.5" wide x 6.5" deep x 15" high (317.5 mm wide x 165 mm deep x 381 mm high)	
WEIGHT	Approximately 25 lbs. (.453 kg.)	

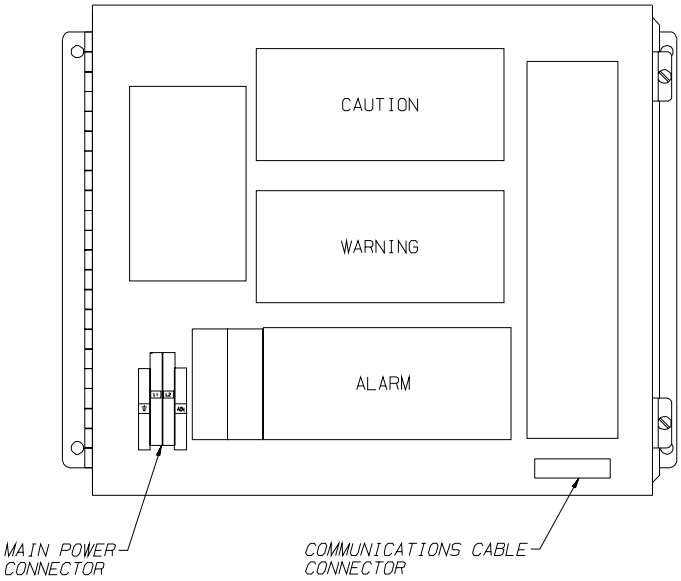


Figure B-3. Relay Module Main Power Connector and Communication Cable Connector Locations

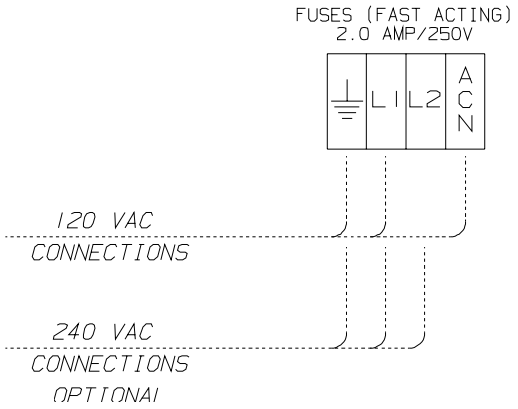


Figure B-4. Chemgard Relay Module Power Wiring Diagrams for 120 Volts and 240 Volts AC

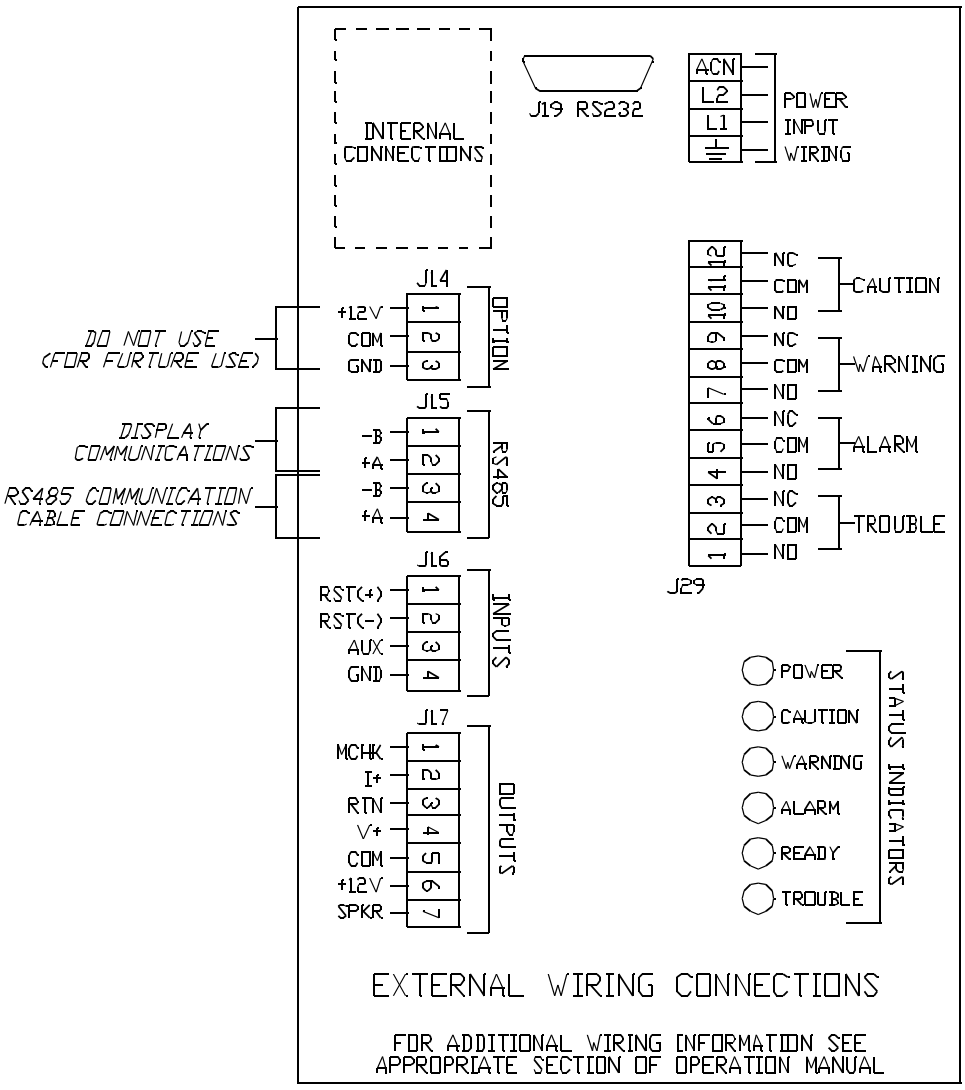


Figure B-5. Chemgard Infrared Gas Monitor Communication Cable Connections

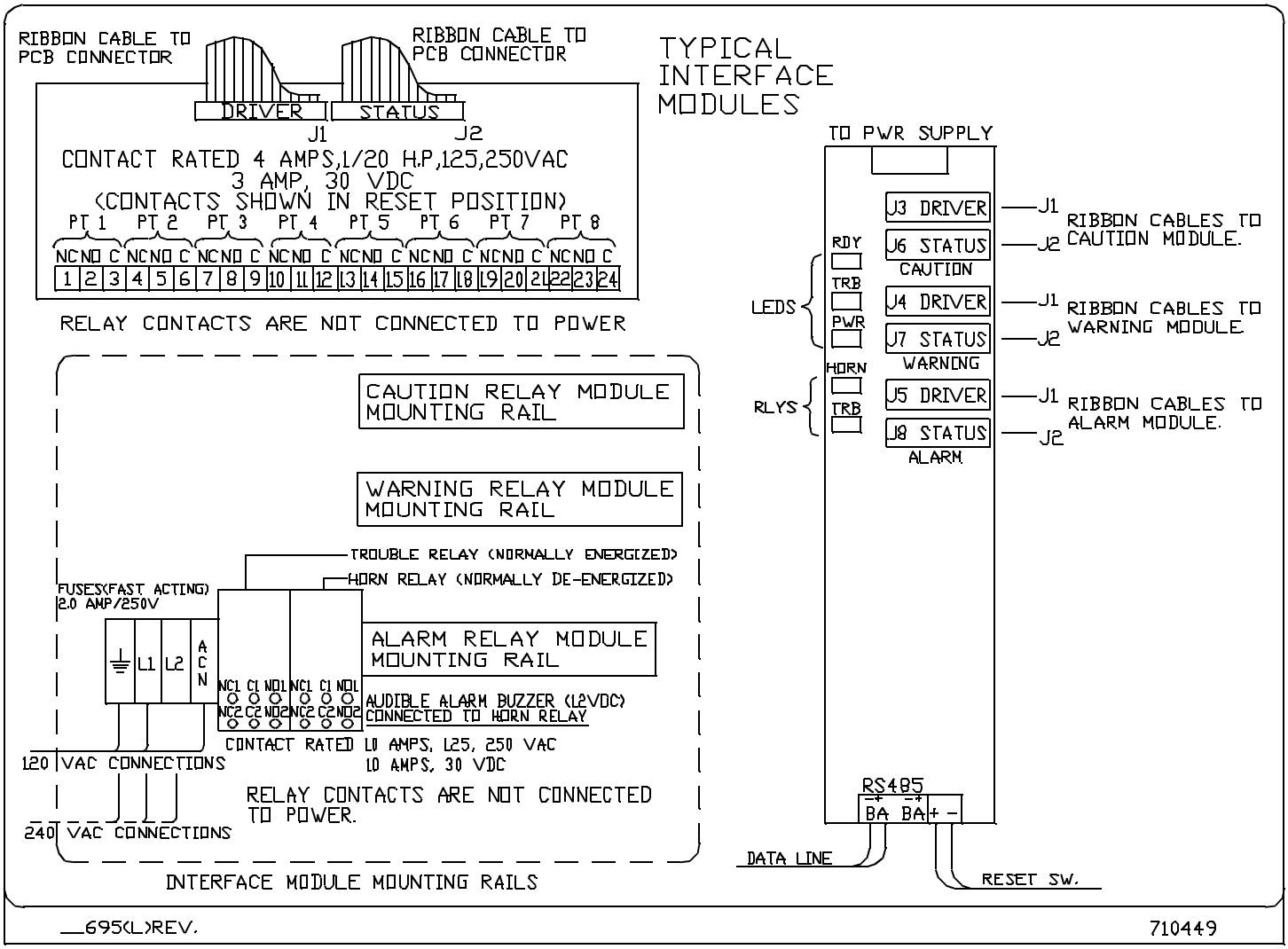


Figure B-6. Typical Interface Modules

Unpacking the Shipping Carton

The shipping carton should contain the Chemgard Relay Module.

Identifying the Unit

Each bank of relays (see FIGURE B-3) is assigned to a particular alarm level. Chemgard Relay Modules can be purchased with one, two, or three internal relay banks (TABLE B-2).

Table B-2. Part Numbers and Supplied Relays

UNIT P/N	RELAY P/N	QUANTITY OF RELAYS	DESCRIPTION	DEFAULT RELAY ASSIGNMENT
710847	COMPLETE UNIT	N/A	1 BANK OF RELAYS	ALARM
710847	490558	1	2 BANKS OF RELAYS	WARNING
				ALARM
710847	490558	2	3 BANKS OF RELAYS	CAUTION
				WARNING
				ALARM

The default relay assignment may be changed. Consult the factory for more information.

Mounting Your Unit

Mount the Chemgard Relay Module adjacent to the controlling Chemgard Infrared Gas Monitor using the four mounting holes as shown in FIGURE B-2 (hardware not supplied).

Electrical Connections for the Chemgard Relay Module

Follow all applicable practices and local codes. Use appropriate conduit and cable glands when installing the Chemgard Relay Module and Chemgard Infrared Gas Monitor.

Main Power Connections

Ensure that all primary power is turned OFF at the circuit breaker or fuse. Do not wire the Chemgard Relay Module with power ON.

⚠ WARNING

Wiring the Chemgard Relay Module with the power ON may result in electrocution which may cause injury or death.

Identify the main power voltage that will power the Chemgard Relay Module; if unsure of your primary power, consult an electrician or local power utility.

⚠ CAUTION

Application of improper power to the Chemgard Relay Module will result in damage to the unit.

Refer to FIGURES B-3, B-4 and B-5 to identify the location of the main power connections within the Chemgard Relay Module.

1. Locate the power wiring entry on the lower left hand side of the unit and remove the hole plug.
2. Route the power wiring through the hole using proper hardware/conduit (not supplied).
3. Strip the power wiring conductors.
4. Insert each stripped conductor into its proper location in the power cable connector (FIGURE B-4).
5. Tighten each screw within the connector to secure each wire.
6. Pull on each wire to ensure that it will remain in place. If a wire comes out of the connector, loosen the screw, reinsert the wire, and re-tighten the screw.
7. The Relay Module must have the same electrical ground as the Monitor unit.

Communication Cable Connections

Use the factory-recommended RS485 communication cable. Low capacitance wire for RS485 communications, such as Beldon #9841, is recommended.

⚠ CAUTION

Maximum length of the communication cable is 1000 feet; otherwise, the Chemgard Relay Module will not operate properly.

⚠ WARNING

Use only the recommended cable. Using inferior or wrong communication cable causes improper operation of the Chemgard Relay Module.

Do not exceed the maximum length of communication cable listed; otherwise, the Chemgard Relay Module may not operate properly and may not indicate a trouble condition.

Communication Cable Connections to the Chemgard Relay Module

1. Locate the RS-485 communication cable inside the Chemgard Relay Module enclosure.
2. Locate the eight cable entries on the right side of the relay module (FIGURE B-2). From these eight cable entries, choose one of the three bottom entries and remove the hole plug.
3. Route the communication cable through the hole using proper hardware (not supplied) to secure the cable. A 30 mm distance must be maintained between this communication cable and the electronic assembly or power line feeds.

Communication Cable Connections to the Chemgard Infrared Gas Monitor

1. Route the communication cable to the Chemgard Infrared Gas Monitor.
2. Find an unused entry in the Chemgard Infrared Gas Monitor enclosure and remove the hole plug.
3. Route the communication cable through the hole using proper hardware (not supplied) to secure the cable.
4. Strip each communication cable conductor.
5. Insert each stripped conductor into its proper location on the communication cable connector (Refer to FIGURE B-5 for connector location and function designation). The connector labeled "+" on the Relay Module must be connected to the

RS485 connector labeled "+" on the Monitor. Likewise, the connector labeled "-" on the Relay Module must be connected to the RS485 connector labeled "-" on the Monitor.

6. Tighten each screw within connector to secure each wire.
7. Pull on each wire to ensure that it will remain in place. If a wire comes out of the connector, loosen the screw, reinsert the wire, and re-tighten the screw.

Relay Wiring

Before installing any wiring to the relays within the Chemgard Relay Module, refer to the manual for the specific equipment being connected to the relays for wiring procedures and requirements. If your unit is a four-point Chemgard model, use the first four relays. The remaining four relays within the bank are not used.

⚠ WARNING

Use the proper size wire to any equipment connected to the Chemgard Relay Module relay; otherwise, a fire or electrical damage may result.

1. Refer to FIGURE B-2 for the relay wiring entries into the Chemgard Relay Module.
2. Remove the hole plug(s) required and route the relay wiring through the hole(s) using proper hardware/conduit (not supplied).
3. Strip each relay wiring conductor.
4. Determine the relay functions necessary (see front door label for relay locations and contact information). Insert each stripped relay wiring conductor into the connector for the desired function.
5. Tighten each screw within the connector to secure each wire.
6. Pull on each wire to ensure that it will remain in place. If a wire comes out of the connector, loosen the screw, reinsert the wire and re-tighten the screw.
7. Once wiring is complete, close and secure the front panel of the Chemgard Relay Module.

⚠ CAUTION

Do not allow the front panel of the Chemgard Relay Module to remain open during use.

Operation

Front Panel Indicators

(see FIGURE B-1).

Power Indicator

The power indicator shows that power is properly applied to the unit.

- If this indicator is not ON when power is applied, refer to the Section 4, Troubleshooting Guidelines.

Trouble Indicator

The Trouble Indicator turns ON and remains ON when a trouble condition is detected. The trouble condition may exist at the controlling Chemgard Infrared Gas Monitor or it may exist locally at the Chemgard Relay Module.

Possible trouble conditions:

- Chemgard Remote Relay Module losing communication with the Chemgard Infrared Gas Monitor for longer than two seconds
- Monitor internal trouble
- Relay Module inoperative relay.

See Section 4, Troubleshooting Guidelines for other possible trouble conditions.

Ready Indicator

- The Ready Indicator turns ON and stays ON when the controlling Chemgard Infrared Gas Monitor is ready and Relay Module is operating properly
- This indicator remains OFF during the initial warm-up
- This indicator remains OFF during the initial Chemgard Infrared Gas Monitor warm-up, setup and calibration.

Chemgard Relay Module Relays

There are three types of relays in the Chemgard Relay Module:

- common horn relay
- common trouble relay
- discrete alarm relays

The Common Horn Relay:

- is a double-pole, double-throw (DPDT) type relay
- contacts are normally connected to equipment to alert personnel of an alarm condition

The Trouble Relay:

- is a double-pole, double-throw (DPDT) type relay
- is normally-energized during normal operation for fail-safe operation

- de-energizes if power is removed
- contacts may be connected to equipment to alert personnel that a trouble condition exists

The Discrete Caution, Warning and Alarm Relays:

- are single-pole, double-throw (SPDT) type relays.
- contacts may be connected to equipment to alert personnel that an alarm condition exists.

Applying Power

Apply power to the Chemgard Infrared Gas Monitor and Chemgard Relay Module. The Power Indicator on the Relay Module should illuminate.

The Trouble Relay in the Relay Module will energize when communications from the Chemgard Infrared Gas Monitor have been received, no internal relay faults have been detected, and the Chemgard Infrared Gas Monitor is not in the Trouble state.

The Ready Indicator will illuminate when the Chemgard Infrared Gas Monitor is in the Ready state, and the conditions described above remain valid.

Note that during the Warm-Up state of the Chemgard Infrared Gas Monitor, all alarm relays in the Relay Module are cleared.

Alarm Relay Configuration

Latching

The configuration of all alarm relays is controlled by the Chemgard Infrared Gas Monitor.

- If the Chemgard alarm relay (CAUTION, WARNING, ALARM) is configured as latching, all eight relays of the corresponding bank in the Relay Module are configured for latching operation.
- Likewise, if the Chemgard alarm relay (CAUTION, WARNING, ALARM) is configured as non-latching, all eight relays of the corresponding bank in the Relay Module are configured for non-latching operation.

Normally Energized/De-energized

While the alarm relays in the Chemgard Infrared Gas Monitor can be configured as either normally energized or normally de-energized, all alarm relays in the Chemgard Relay Module are magnetically latching; therefore the normally energized/de-energized designations do not apply. The contact labels "normally open," "normally closed" and "common" are assigned for convenience. The "normally open" contacts close and "normally closed" contacts open to signal an alarm condition. These relays DO NOT change state when power is removed.

Operation

Proper operation of the alarm relays requires maintaining successful communication between the Relay Module and the controlling Chemgard Infrared Gas Monitor since all alarm relay operations are based on cumulative information received from the Monitor.

Alarm level information for each point of the multi-point sequencer is received from the controlling Chemgard Infrared Gas Monitor. This information is used to set the CAUTION, WARNING, and ALARM relays corresponding to each sequencer point.

- In non-latching configurations, relay(s) will reset when information from the controlling Monitor indicates that the alarm condition(s) for the specific point has abated.
- In latching configurations, relay(s) remain set (latched) when the condition abates, and do not reset until the Relay Module reset switch is pressed.

Reset Switch

The reset switches of the Chemgard Relay Module and controlling Chemgard Infrared Gas Monitor act independently. Pressing the reset switch on the Monitor does not affect the Relay Module alarm relays, and pressing the reset switch on the Relay Module does not affect the Monitor alarm relays.

- In non-latching configurations, the Relay Module reset switch does not affect the state of the alarm relays.
- In latching configurations, the reset switch resets the alarm relay only if the alarm condition has abated.

Trouble Relay

While a trouble condition in the Chemgard Infrared Gas Monitor activates the trouble relay in the Chemgard Relay Module, a trouble condition in the Relay Module does not activate the trouble relay in the controlling Chemgard Infrared Gas Monitor.

Horn Operation

Configuration

The configuration of the horn relay is controlled by the Chemgard Infrared Gas Monitor.

- The Horn Relay in the Relay Module is configured by the “Caution sets Audio Alarm,” “Warning sets Audio Alarm,” “Alarm sets

Audio Alarm" and "Trouble sets Audio Alarm" configuration in the Chemgard Infrared Gas Monitor.

- The "Aux sets Audio Alarm" and "Trouble sets Audio Alarm" configurations of the Monitor apply to the Relay Module Horn relay.
- The Horn relay of the Relay Module is only latching when the alarms are configured latching in the Chemgard Infrared Gas Monitor.

Reset Switch

The reset switches of the Chemgard Relay Module and controlling Chemgard Infrared Gas Monitor act independently. Pressing the reset switch on the Monitor does not affect the Relay Module horn, and pressing the reset switch on the Relay Module does not affect the Monitor horn.

If the Chemgard Relay Module reset switch has been used to silence the Relay Module horn, and any alarm condition (configured to activate the horn) occurs at a new sequencer point, the horn relay will activate to signal the new alarm condition.

Maintenance

Under normal operating conditions, the Chemgard Relay Module requires no maintenance. However, periodic testing of the relays may be done to ensure that complete system operation is possible.

Troubleshooting Guidelines

Table B-3. Troubleshooting Guidelines

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
Alarms do not activate	Chemgard Infrared Gas Monitor alarms not enabled or communication is lost	Enable alarms at the Chemgard Infrared Gas Monitor
		Check wiring
		Check power supply
	Inoperative processor board	Replace processor board

Table B-3. Troubleshooting Guidelines

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
Trouble LED flashes	Loss of communication	Check wiring between Chemgard Infrared Gas Monitor and Relay Module
		Check power wiring or power supply
		Check wiring in the Chemgard Relay Module
Power LED not ON	Power fault	Check wiring, power supply and fuse
Trouble LED ON	Relay trouble or controlling Chemgard Infrared Gas Monitor in Trouble state	Check relay and relay wiring within Chemgard Relay Module

Obtaining Replacement Parts

To obtain replacement parts, 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

Table B-4. Replacement Parts

ITEM	PART NO.
Relay Board (PCB)	490558
Power Supply Board (PCB)	655116
Processor Board (PCB)	710392

Appendix C
RS-232 Output

Introduction

Your Chemgard Infrared Gas Monitor is ordered and built for the particular types of gas in use. The monitor full scale range may differ from the standard 0 to 1000 ppm range. Check the calibration label on the reverse side of the front cover (FIGURE C-1) to determine your instrument's full scale range.

The instrument is ready to monitor; however, it is necessary to configure the unit to your specific requirements. Your Chemgard Infrared Gas Monitor may contain an internal Multi-Point Sequencer, enabling your unit to sample from up to eight individual sampling locations.

Your unit also contains several other features described in this appendix:

- RS-232 output
- Password protection
- Remote Front Panel capability
- Sampling point identification.

Table C-1. RS-232 Parameters

COMMUNICATION PARAMETERS	9600 Baud
	8 bits
	No parity
	One stop bit

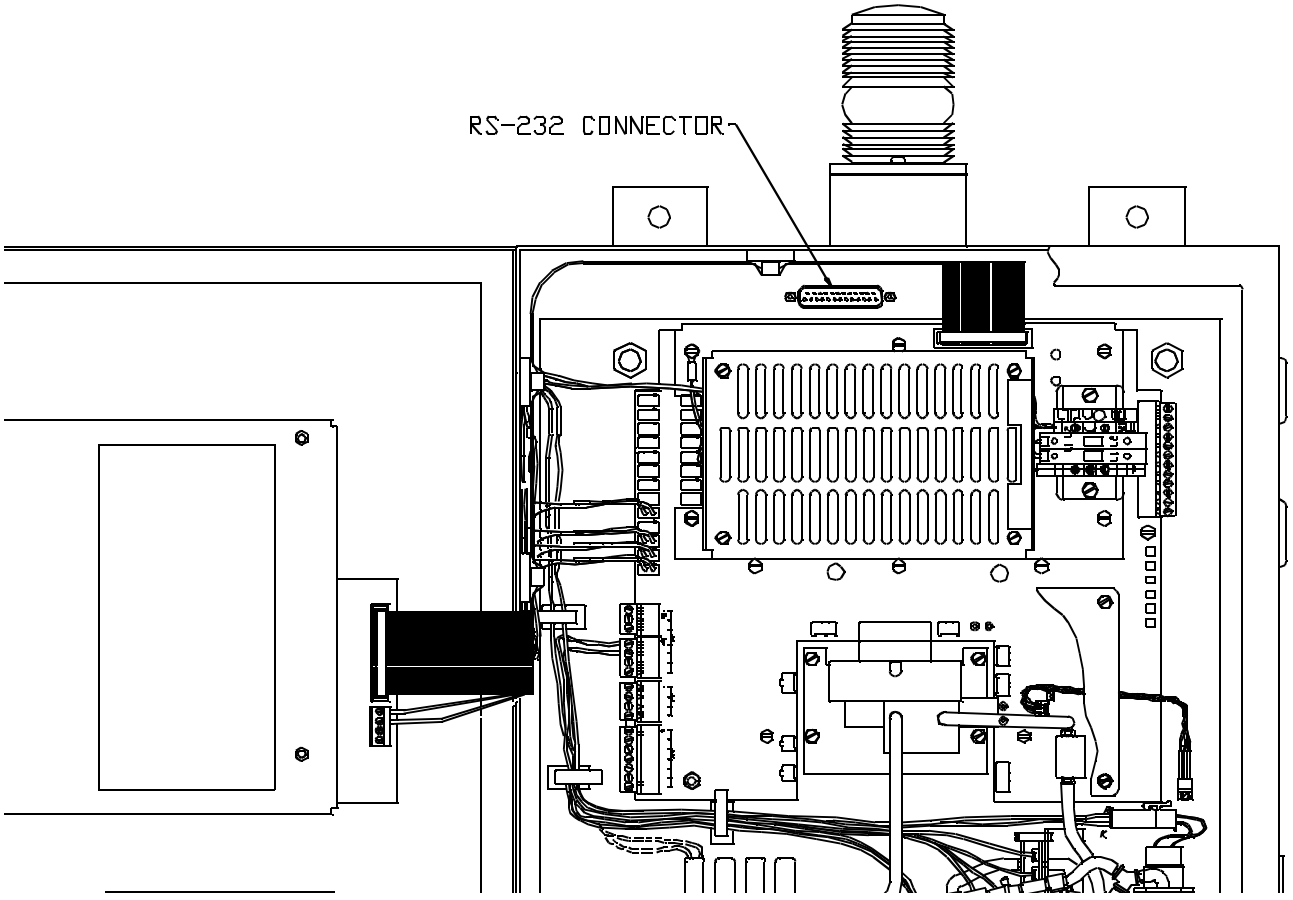


Figure C-1. RS-232 Location

Three types of messages can be transmitted from the RS-232 port:

- status
- data and
- events.

Status

Status is the first message.

- The first seven characters are the gas type.
- The next three characters are the point number, followed by the concentration and the units.
- The second line is the instrument state and the alarm level.
- The Trouble State shows the type of fault detected; see TABLE C-2
- This message is sent every 10 seconds.

Data Logged Value

The data logged value is the next message.

- The first line indicates the date and time.
- The second line shows the:
  - point
  - gas type and
  - logged concentration.
- The message is generated for every point and sent every 15 minutes or hourly, depending on the setup selection.
- The concentration is an average or the maximum values for the selected time frame; see TABLE C-3.

Alarm Events

Alarm events is the last message type.

- The first line is the date and time.
- The second name is the:
  - point
  - gas name and
  - alarm level.
- See TABLE C-4.

All of these messages are initiated by the sync character, followed by a binary address byte, 40 ASCII characters, and terminated with a line feed and carriage return.

Table C-2. Status Message

STATUS MESSAGE
GAS PT X CONC UNITS
STATE ALARM n AUX
TROUBLE TYPE

0	SYNC	*0x16*																								
1	address	*0x01 -> 0xff*																								
2	A																									
3	M																									
4	M																									
5	O																									
6	N																									
7	I																									
8	A																									
9																										
10	P																									
11	T																									
12	1	2	3	4	5	6	7	8																		
13																										
14	1																									
15	0																									
16	0																									
17	0																									
18																										
19	P																									
20	P																									
21	M																									
22	W	R	C	T	U																					
23	A	E	A	R	N																					
24	R	A	L	O	K																					
25	M	D	"/"	U	N																					
26	U	Y	S	B	O																					
27	P		E	L	W																					
28			T	E	N																					
29																										
30											S		S					H								
31									C	B	T	S	T	C			S	U		P	P	M			R	O
32								U	A	Y	A	E	A	A	C	T	E	M		H	A	E		M	E	T
33	C	W	A	A	A			N	L	P	R	N	R	S	A	H	N	I	I	O		M	A	I	L	H
34	A	A	L	U	U			D	I	A	T	S	T	E	S	E	S	D	R	T	A	O	U	C	A	E
35	U	R	A	X	X		U	E	B	S		O			E	R	O			O	D	R	X	R	Y	R
36	T	N	R				N	R	R	S	B	R	S	S		M	R	S	S			Y	I	O		
37	I	I	M	F	A		K	R	A		Y		E	E	R	O		E	E	S	R		L	P	F	F
38	O	N		A	L		N	A	T	F	P	F	N	N	A	S	T	N	N	Y	A	L	I	H	B	A
39	N	G		I	A		O	N	I	L	A	L	S	S	N	T	E	S	S	N	N	O	A	O	A	U
40				L	R		W	G	O	O	S	O	O	O	G	A	M	O	O	C	G	S	R	N	C	L
41					M		N	E	N	W	S	W	R	R	E	T	P	R	R	H	E	S	Y	E	K	T
42	CR	*0x0d*																								
43	LF	*0x0a*																								

Table C-3. Data Logging

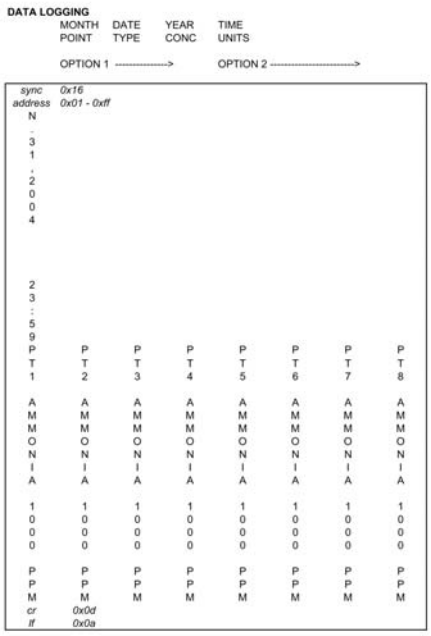
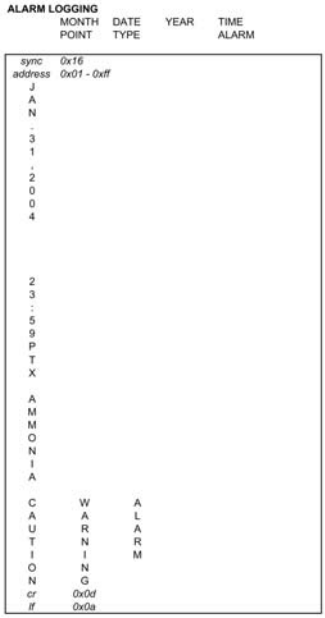


Table C-4. Alarm Logging



RS-232 Output

The RS-232 output broadcasts certain information about the Chemgard Infrared Gas Monitor (TABLE C-3). This output conforms to the specification for RS-232 signal levels and is capable of driving its signal up to 200 feet when using low capacitance RS-232 cable. See FIGURE C-1 for RS-232 connector location.

Connection to the RS-232 output is via a 25-pin sub "D" female connector. See FIGURE C-2 for the wiring definition. To enable this communication, pins 4 and 5 on the sub "D" connector must be connected. FIGURE C-2 shows the connector and wiring as it is wired to a computer. FIGURE C-3 shows the rear view wiring of the connector.

When connecting RS-232 cable to the instrument:

- The strain relief cover or shell on the 25-pin sub "D" connector must be removed. It is not possible to use a pre-wired or molded cable because its shell or strain relief is not removable. The connector's shell or strain relief does not fit within the instrument.
- It may be necessary to remove the metal covers from the printed circuit boards to attach the 25-pin sub "D" connector to its mate on the unit. If the metal covers are removed, replace them when the cable's connector is mated to the connector on the printed circuit board.

Remote Gas Sampling Channel Identification

Chemgard Infrared Monitors have two analog outputs:

- 4-20 mA and
- 0-10 Volts.

The voltage output can be programmed to correspond to the channel presently being sampled. The front panel screen indicates:

1V/PT IF OUT = 1-10V

(1 volt per point if output equals one to 10 volts). When enabled and the unit is monitoring from:

- channel 1, the voltage output is one volt
- channel 2, the voltage output changes to two volts.

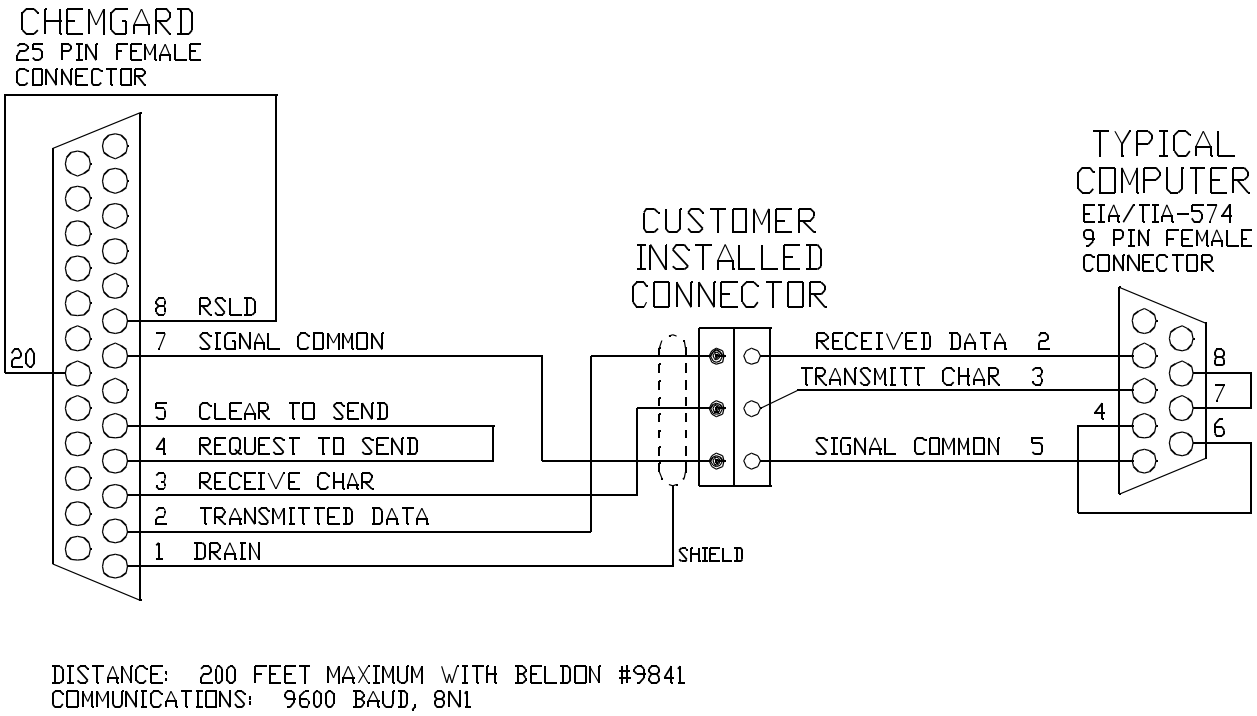


Figure C-2. Typical RS-232 Wiring

Table C-5. Voltage Output Corresponds to Channel

CHANNEL NUMBER	VOLTAGE OUTPUT
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

During unit setup, configure the voltage output to stepping, thus enabling the voltage output to reflect the channel being sampled.

Password Protection (Remote Display Only)

To prevent accidental re-configuration or discourage unit tampering, a password entry can be enabled. This password prevents setup values from being changed. If the password entry is selected, the user must enter three alphabetic characters before any additional information is available.

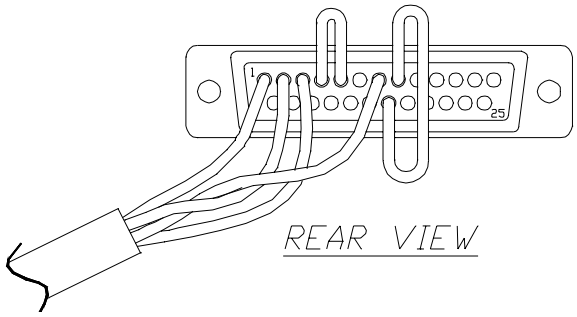


Figure C-3. RS-232 Connector

The password feature is especially useful when a Remote Front Panel is connected to the Chemgard Infrared Gas Monitor. The Remote Front Panel or the Chemgard Infrared Monitor may have no password or it may have a different password.

To enable this feature, a switch on the front display card must be set. This switch is under the metal cover. To set this switch:

1. Open the front door of the unit.

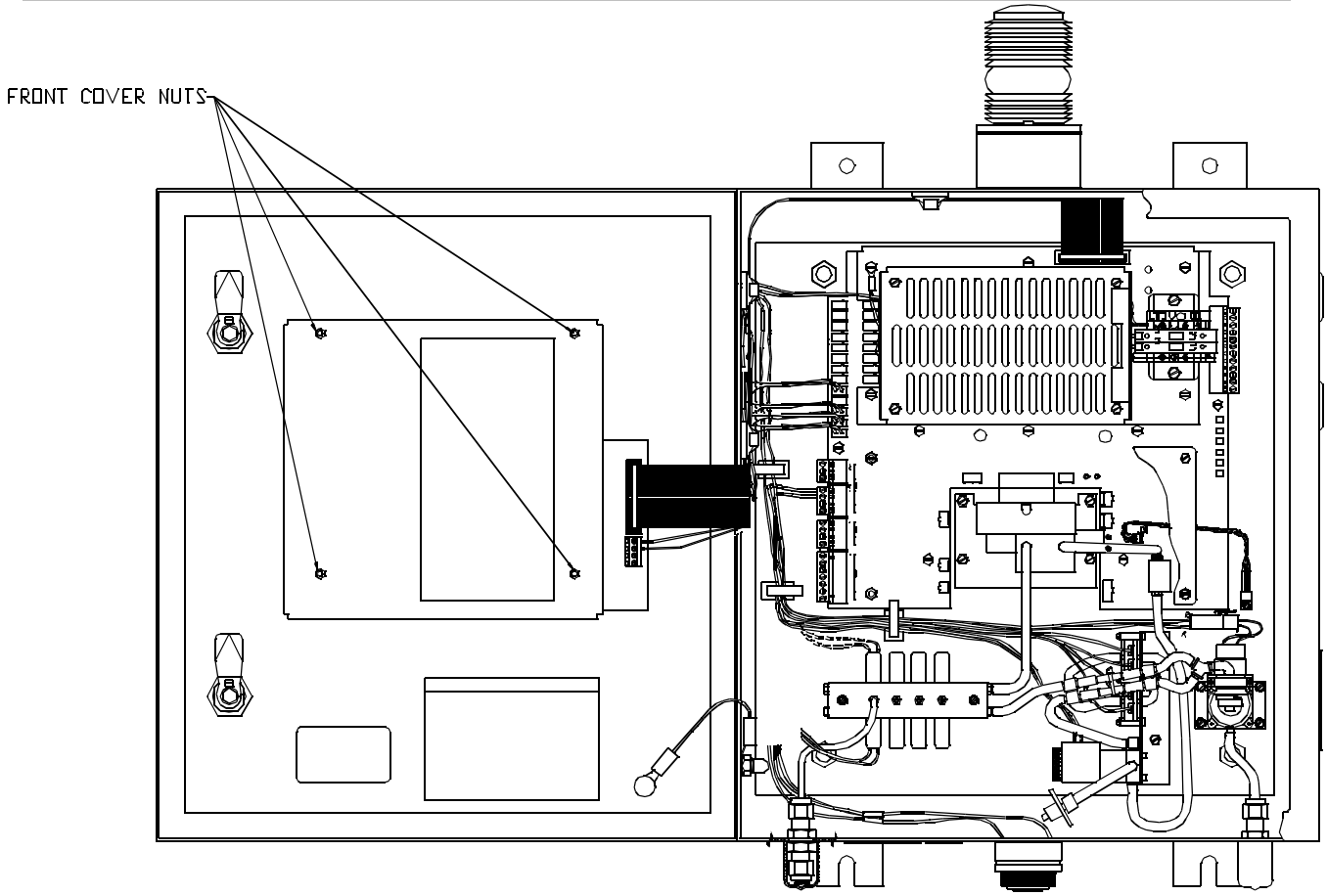


Figure C-4. Access to Switches

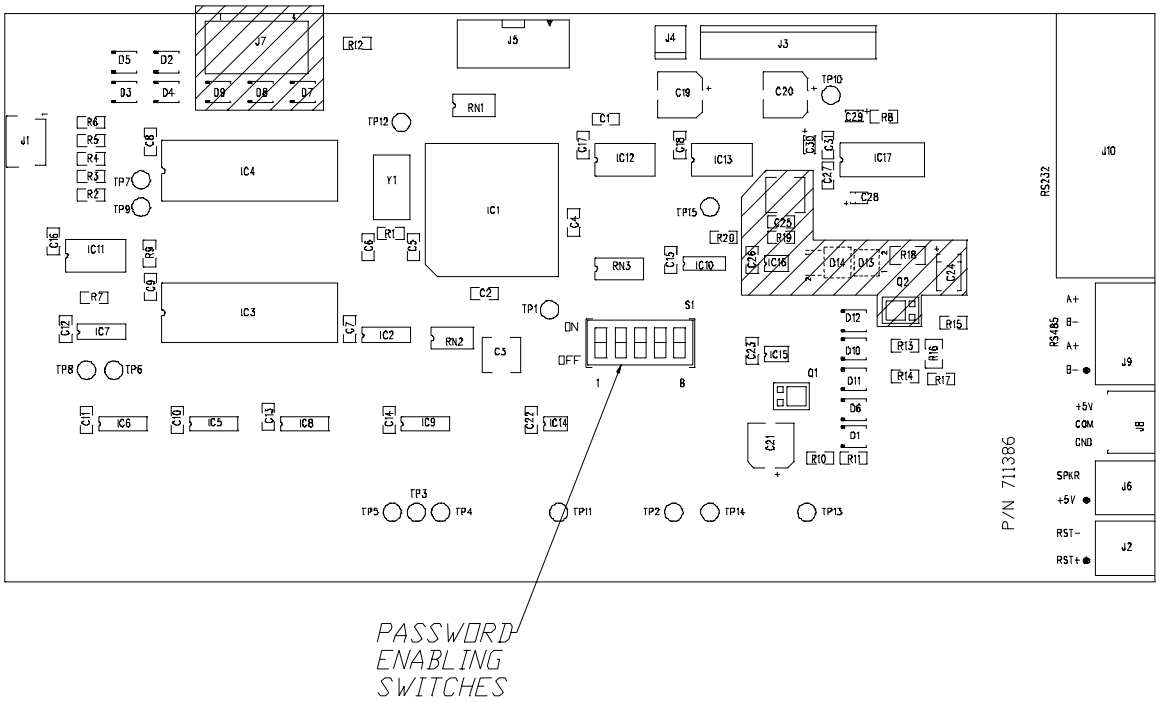


Figure C-5. Switch Bank Location

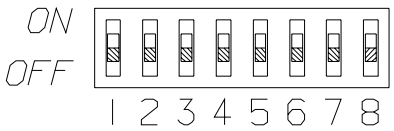


Figure C-6. Password Enabling Switches

2. On the inside of the front door, locate the four front cover nuts securing the metal cover (FIGURE C-4).
3. Unscrew and remove these four front cover nuts and lift off the metal cover.
4. Locate the bank of switches on the printed circuit board exposed when the front cover is removed (FIGURE C-5).
5. Each switch is labeled with its number and its position. FIGURE C-6 also shows the switch bank with its numbered switches.
   - Each switch in this bank activates a different feature.
   - TABLE C-8 describes each switch and its function.
   - Read, mark and initial each function you are going to use.
6. To enable the password option, set switch 1 to the ON position.
7. To set or change the password, put switch 2 in the ON position.
   - The front panel display shows:
     - the word **SET** and
     - the new password.

   To change the password, press three buttons on the front panel.
   - The password will be the last three letters displayed on the front panel display.
   - The button sequence is stored when ENTER is pressed.

   After selecting the password, return this switch to the OFF position.

   NOTE: The password must be re-entered when:
   - the unit is de-energized
   - a bad or wrong password is entered
   - a loss of communications is detected between the Chemgard Infrared Gas Monitor and any optional Remote Front Panel
   - no password is entered within the last hour.
8. Switch position 3 allows the following without entering the password:
   - resetting latched alarm relays
   - silencing the audio output.

   When setting Switch 3 to the ON position while an audio alarm or a latched relay can be reset, the following message displays:
   - **MAIN RESET ALARM.**
9. Switch 4 enables communication between the Chemgard Infrared Gas Monitor and a Remote display.
   - When a loss of communications occurs with the Remote Display within 3.5 seconds, the following message displays:
     - **LOSS OF COMMUNICATION.**
   - This switch position also allows the Remote Display speaker to follow the Chemgard Infrared Gas Monitor speaker operation.
10. Switch 5, in the ON position, allows the audio output to automatically reset if the Chemgard Infrared Gas Monitor audio output is reset.
    - Normally, if the Remote Display audio output is energized, it is latched ON until any panel key is pressed.

Table C-7. Function of Switches

SWITCH	SWITCH POSITION	DESCRIPTION	INITIALS
1	ON	Enables the password option	
1	OFF	Disables the password option	
2	ON	Set the password	
2	OFF	Normal operation	
3	ON	Resetting alarm without the password	
3	OFF	Password is necessary to reset alarms	
4	ON	Remote Front Panel connected	

Table C-7. Function of Switches

SWITCH	SWITCH POSITION	DESCRIPTION	INITIALS
4	OFF	No Remote Front Panel connected	
5	ON	Allows the audio output to automatically reset	
5	OFF	Manual resetting of the audio output	
6	ON	Not used	
6	OFF	Not used	
7	ON	Not used	
7	OFF	Not used	
8	ON	Not used	
8	OFF	Not used	