MSA
The Safety Company

Chillgard® LC

Control Module

Instruction Manual

⚠ WARNING

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

MSA North America 1-800-MSA-INST or FAX (724) 776-8783
MSA International (412) 967-3354 or FAX (412) 967-3451
In Canada 1-800-267-0672 or FAX (416) 663-5908

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

Manufactured by
MSA NORTH AMERICA
PITTSBURGH, PENNSYLVANIA 15230

(L) REV 4 **I MZ001-036** **10036865**

MSA
Permanent Instrument Warranty

1. **Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of two years from date of shipment, 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 Control 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 Control Module must not be installed in outdoor areas or in locations where explosive concentrations of combustible gases or vapors might occur in the atmosphere: Class 1, Group A, B, C, and D areas as defined by the NEC. Because the Control Module is not explosion-proof, it must be located in non-hazardous areas.
3. Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the Chillgard LC System, beyond the scope of these maintenance instructions or by anyone other than authorized MSA service personnel, could cause the product to fail to perform as designed, and persons who rely on this product for their safety could sustain serious personal injury or death.
4. The Chillgard LC Control Module 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.

5 Protect the Chillgard LC Control Module from vibration and heating; otherwise, improper operation may result, which can result in personal injury or death.

6. Do not exceed the relay contact ratings listed in Section 1, 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.

Table of Contents

Section 1
General Information

Introduction

General Description

The Chillgard LC unit is a control module which can communicate with up to eight Chillgard LS or twelve Chillgard M100 Refrigerant Sensors. The Chillgard LC Control Module can be installed remotely from the sensors, thus enabling remote control of that Chillgard LS or the Chillgard M100 Sensor.

The Chillgard LC comes in two major versions based upon the power supply in the unit:

- 24 Volt AC/DC or 110/220 VAC version
- Internal Transformer version - 120 Volt input, 24 VAC output for powering Remote Sensor Modules.

See FIGURES 1-1 and 1-2 to identify your unit.

Table 1-1. Chillgard LC System General Operating Specifications

OPERATING SPECIFICATIONS	
VOLTAGE RATING	100 to 240 VAC, 50-60 Hz, 25 W 24 VDC +10% -0% 24 VAC ±10% Transformer Version: 120 V, 60 Hz, 75 VA
POWER REQUIREMENTS	.15 amps at 120 VAC; .10 amps at 240 VAC 0.6 amps at 24 VAC 0.1 amps at 24 VDC Minimum wire size: #18 AWG The LC Controller can power the Chillgard LS and seven Chillgard M-100 sensors
TROUBLE RELAY	Normally energized, Form C contact: 240 VAC, 5 amp resistive SPDT
ALARM 1 RELAY	One relay, Form C contacts: 240 VAC, 5 amps resistive SPDT
ALARM 2 RELAY	One relay, Form C contacts: 240 VAC, 5 amps resistive SPDT
ALARM 3 RELAY	One relay, Form C contacts: 240 VAC, 5 amps resistive SPDT
ANALOG OUTPUTS	4 to 20 mA sourcing, 500 ohm load, 0-6 VDC, 2 K ohm load
MAXIMUM OUTPUT SIGNAL LOAD FOR 4-20 mA OUTPUT	600 ohms (includes wiring)

Figure 1-1. Chillgard LC Control Module Standard Version (24 Volt AC/DC or 110/220 AC Version)

Figure 1-2. Chillgard LC Control Module With Internal Transformer

Table 1-1. Chillgard LC System General Operating Specifications

OPERATING SPECIFICATIONS	
AUDIO ALARM DRIVE OUTPUT	24 VDC 50-ohm load maximum (available only with non-beacon models)
OPERATING TEMPERATURE	0 to 40°C (32 to 104°F)
STANDARD VERSION DIMENSIONS	7.5" high, 12.5" wide, 3.5" deep
	19.05 cm high, 31.75 cm wide, 8.89 cm deep
STANDARD VERSION WEIGHT	3.5 pounds (1.59 kilograms)
TRANSFORMER VERSION DIMENSIONS	14.7" high, 11.2" wide, 5" deep
	373 mm high, 284 mm wide, 127 mm deep
TRANSFORMER VERSION WEIGHT	8.4 pounds (3.82 kilograms)
TRANSPORT AND STORAGE CONDITIONS	
TEMPERATURE	-40°C to +60°C (-40°F to 140°F)
HUMIDITY	99% RH non-condensing
POLLUTION DEGREE AND INSTALLATION CATEGORY	2

Terminology

Become familiar with the following terminology.

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

ALARMS- The Chillgard LC System has three alarms to alert the user at specific, user-adjustable refrigerant 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, eight, or 12 areas, sequentially numbered from 1 to 12, can be sampled.

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

TEMPERATURE EFFECT- The gas response displayed by the instrument (PPM) can change ±3 ppm for each degree (C) that the instrument is operating above/below the temperature at which the instrument was last calibrated.

Connection of the Chillgard Instruments Using RS-485 Communications

The Chillgard LC instrument acts as the Master device in the network. The LC instrument initiates and controls all communications on the network. The LC instrument sends out commands and requests for data from individual sensors. When the instruments are powered up, the LC unit automatically detects the number and gas type of all instruments on the network.

In a simple system using a single sensor module and an LC Control module, the two modules are connected together; both units have the RS-485 terminators "IN" (FIGURE 1-3). Refer to Section 2, Installation and Setup, for setting the address switches and FIGURES 2-2 and 2-3 for the location of the termination jumpers.

NOTE: Each sensor must have a different address.

The total length of the RS-485 cable cannot exceed 1000 feet (304 meters). MSA recommends Belden #9841 low-capacitance cable.

Multiple Sensor Modules with a Chillgard LC Control Module (Daisy Chain)

See FIGURE 1-4.

NOTE: Up to eight Chillgard LS Sensors can be connected to a Chillgard LC Controller. (They must be addressed as Points 1 through 8.)

- LS1 devices can be on points 1 through 8.
- LS4 devices must be on point 1 and/or 5 and will also use the next three physical addresses.
- LS4 on point 1 takes addresses 1, 2, 3, and 4.
- LS4 on point 5 takes addresses 5, 6, 7, and 8.
- LS4 cannot be on addresses 9, 10, 11, or 12.

Multiple Sensor Modules with a Chillgard LC Control Module (Two Branch)

See FIGURE 1-5. Each end of the network must have the terminator IN; modules in the middle must have terminators OUT. RS-485 connections from the Chillgard LC Control unit must have no more than two terminations.

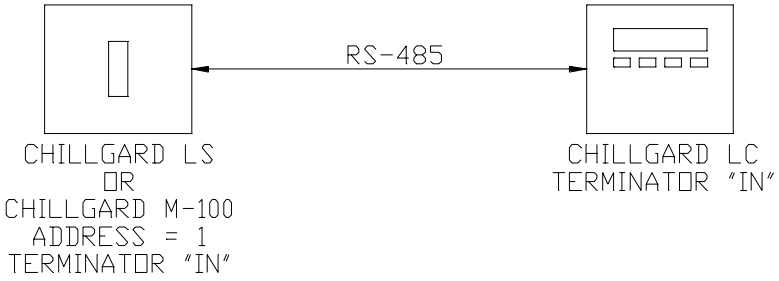


Figure 1-3. Connection of the Sensor and LC Instruments Using RS-485 Communications

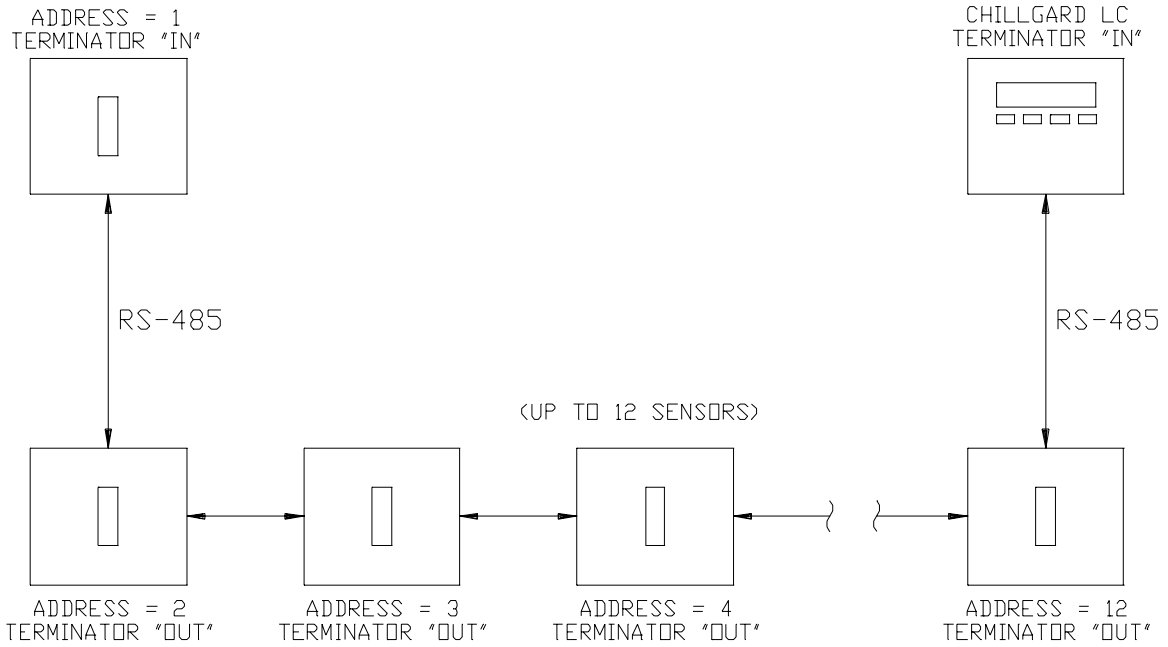


Figure 1-4. Multiple Sensor Modules with a Chillgard LC Control Module (Daisy Chain)

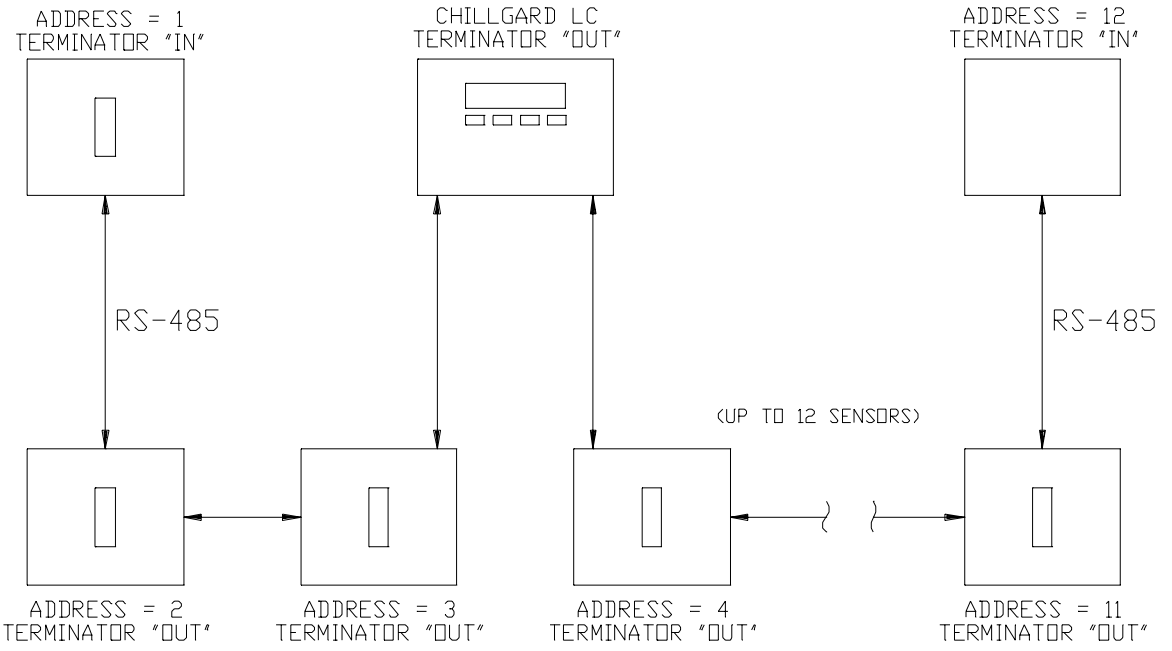


Figure 1-5. Multiple Sensor Modules with a Chillgard LC Control Module (Two Branch)

Section 2
Installation and Set-up

Receiving

Unpacking the System

To unpack the equipment:

1. Carefully remove the Chillgard LC Control Module 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.

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 Control Module

⚠ WARNING

Explosion Hazard!

Unit must not be located in areas that may contain a flammable mixture of gas and air; failure to follow this requirement can result in death, serious injury, or equipment or property damage.

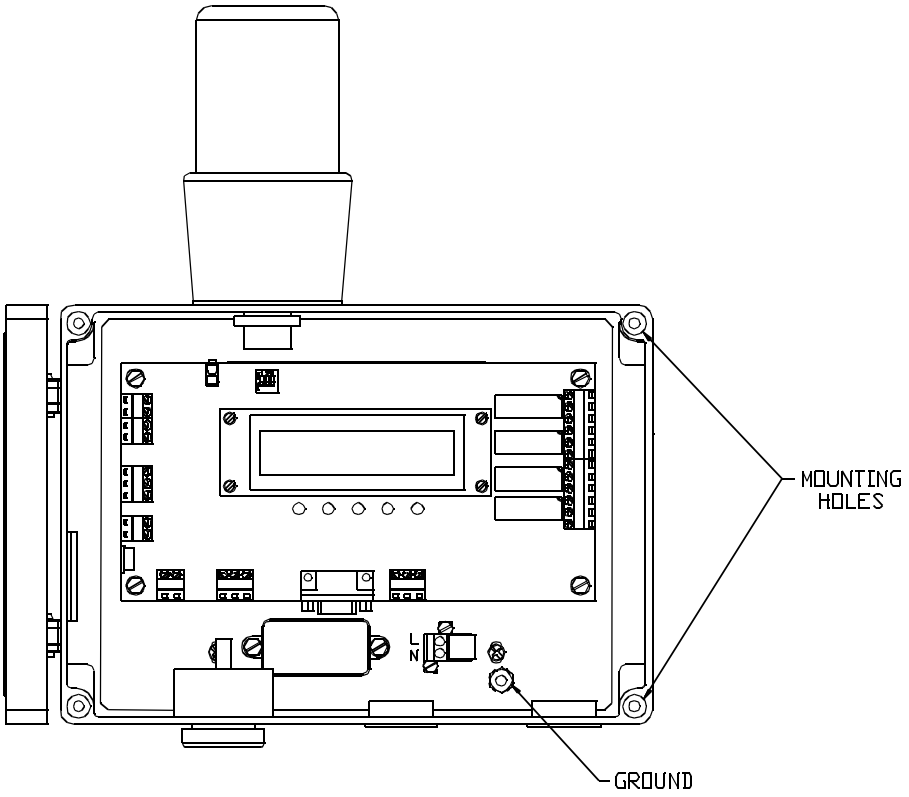


Figure 2-1. Basic LC Control Module with Door Open

Wiring Connections

Opening the Unit

All wiring to the Chillgard LC unit is made via the bottom 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

Component Damage!

Monitor components must be protected from splashing, spraying, or dripping water. Failure to do so may cause damage to internal components.

Unit Power Wiring

⚠ CAUTION

Instrument Damage!

Correct power voltage must be connected to the instrument. Failure to use correct voltage may result in instrument damage.

A separate, dedicated power source is recommended for the refrigerant control module to ensure that the unit remains powered when other circuits are shut down for servicing, routine maintenance or shift changes. Supply earthground is installed on lug first and all component earthgrounds are connected afterwards.

Standard Version

The control module uses a wide range power supply which can accept AC power from 100 to 240 volts, 50 or 60 Hz. If 24 Volt AC or DC is available, power can be supplied directly to the control board (FIGURE 2-3). The 24 Volt power source used with this equipment must be separated from mains by double or reinforced insulation. If the 110/220 Volt power option is available, power can be supplied to terminal block as shown in FIGURE 2-1.

Transformer Version

If the Chillgard LC unit contains the internal transformer, supply power as shown in FIGURE 2-4. The resulting 24 VAC output from the transformer can be used to power up to five diffusion LS units or two pumped four-point LS units. However, voltage drop will occur over extended line lengths with multiple sensors. Ensure minimum required voltage is present at the sensor terminals for each sensor module.

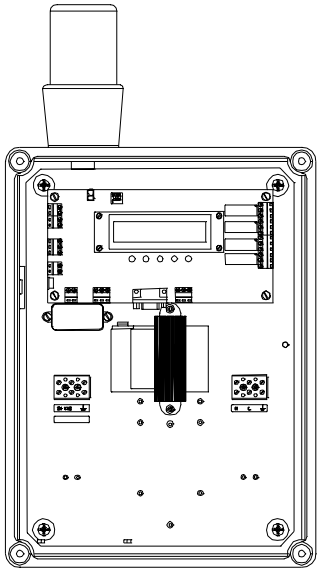


Figure 2-2. Transformer Version LC Control Module with Door Open

⚠ WARNING

If insufficient voltage is supplied, unit could display incorrect readings. check each sensor module for minimum required voltage at each unit.

With 18 AWG wire, a Chillgard LS Sensor Module can be located a maximum distance of 450 feet from the Chillgard LC Control Module. Two Chillgard LS four-point Sensor Modules daisy-chained from the Chillgard LC Control Module can be connected a maximum of 150 feet from the Chillgard LC Control Module. With 18 AWG wire, seven Chillgard M-100 sensors can be daisy-chained from the LC Control Module to a distance of 1500 feet.

⚠ CAUTION

If the Chillgard LC transformer or other AC power is used to power the Chillgard M-100 Sensor, the Chillgard M-100 AC power must be isolated from the LC power for proper operation.

Table 2-1. Option Switch Table

SWITCH 1 CUSTOMER RS232 PORT SPEED SET	19,200 BPS 8, N, 1	UP
	9,600 BPS 8, N, 1	DN
SWITCH 2	N/A	
SWITCH 3	N/A	

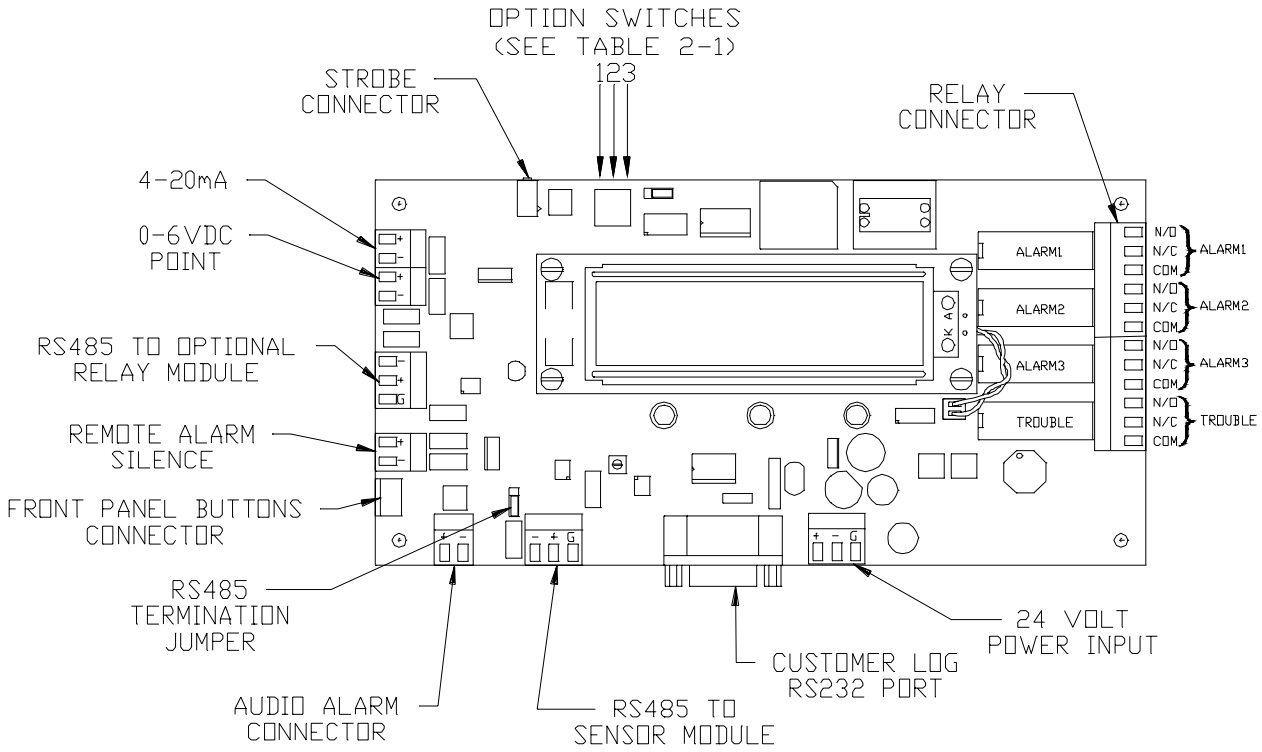


Figure 2-3. Standard Version Wiring Diagram

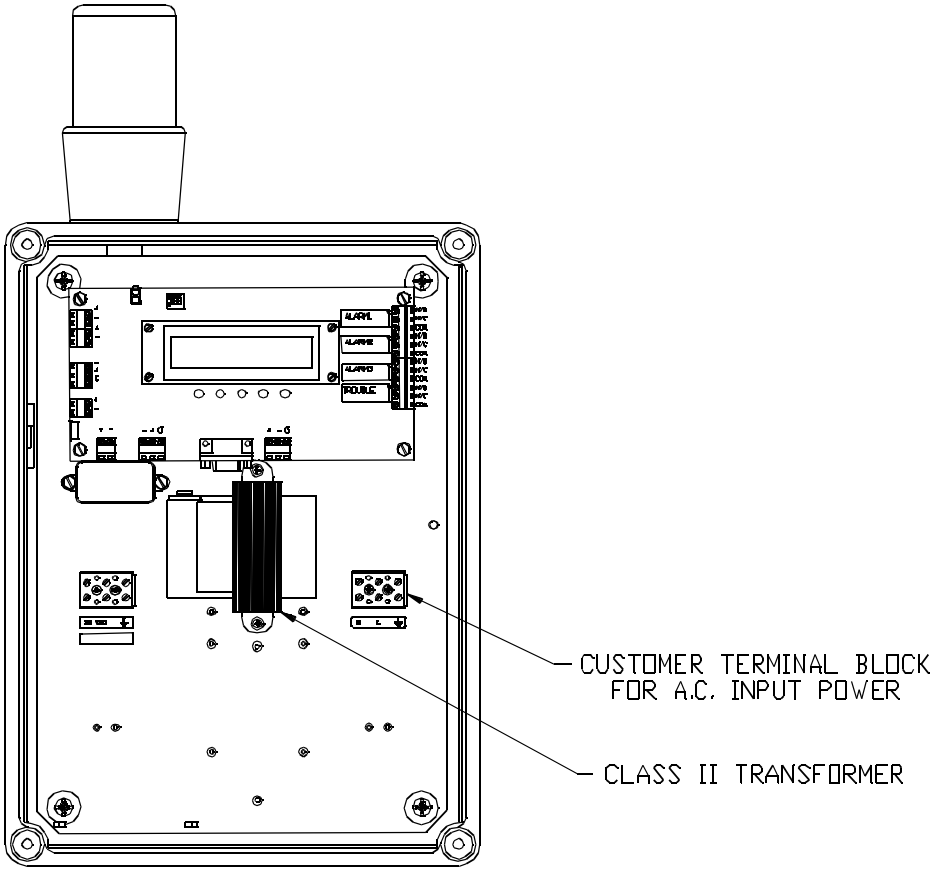


Figure 2-4. Transformer Version Wiring Diagram

Wiring to the Chillgard Sensors

The Chillgard LC Control Module can communicate to up to 12 sample points. Communication between these devices is achieved through RS-485 modbus protocol [see the Chillgard LS Instruction Manual (P/N 10035164) and/or the Chillgard M-100 Instruction Sheet (P/N 10073591) for definition of protocol]. This protocol allows for daisy-chaining of the sensor modules to the control module. See FIGURE 2-3 for wiring to the control module.

Addressing

Each sensor module must have a distinct address. The sensor module address switch is used to specify the addresses of each sensor module (FIGURE 2-5 and 2-6). The addresses also determine the point number on the display.

⚠ WARNING

If the addresses of each sensor module are not unique to each unit, the control module may not recognize one or more of the sensor modules.

The dip switch positions are shown in TABLE 2-2.

Table 2-2. Chillgard LS Dip Switch Positions

POINT	ID	DIP SWITCH			
		1	2	3	4
1	100	0	0	0	--
2	101	1	0	0	--
3	102	0	1	0	--
4	103	1	1	0	--
5	104	0	0	1	--
6	105	1	0	1	--
7	106	0	1	1	--
8	107	1	1	1	--
NOTE: 1 indicates closed.					

For four-point sensor modules, there are two valid dip switch settings: 100 and 104.

- If dip switch setting 100 is chosen, addresses 101 to 103 will be assigned to the four-point unit and will not be available for use on other units.

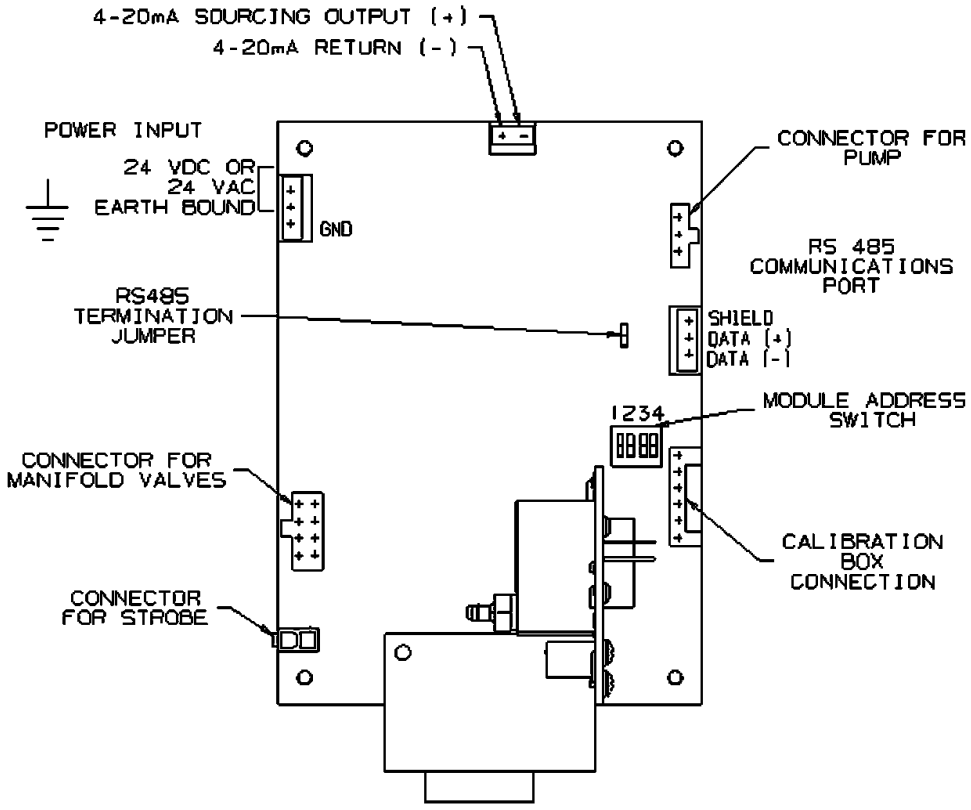


Figure 2-5. Chillgard LS Sensor Board Connections

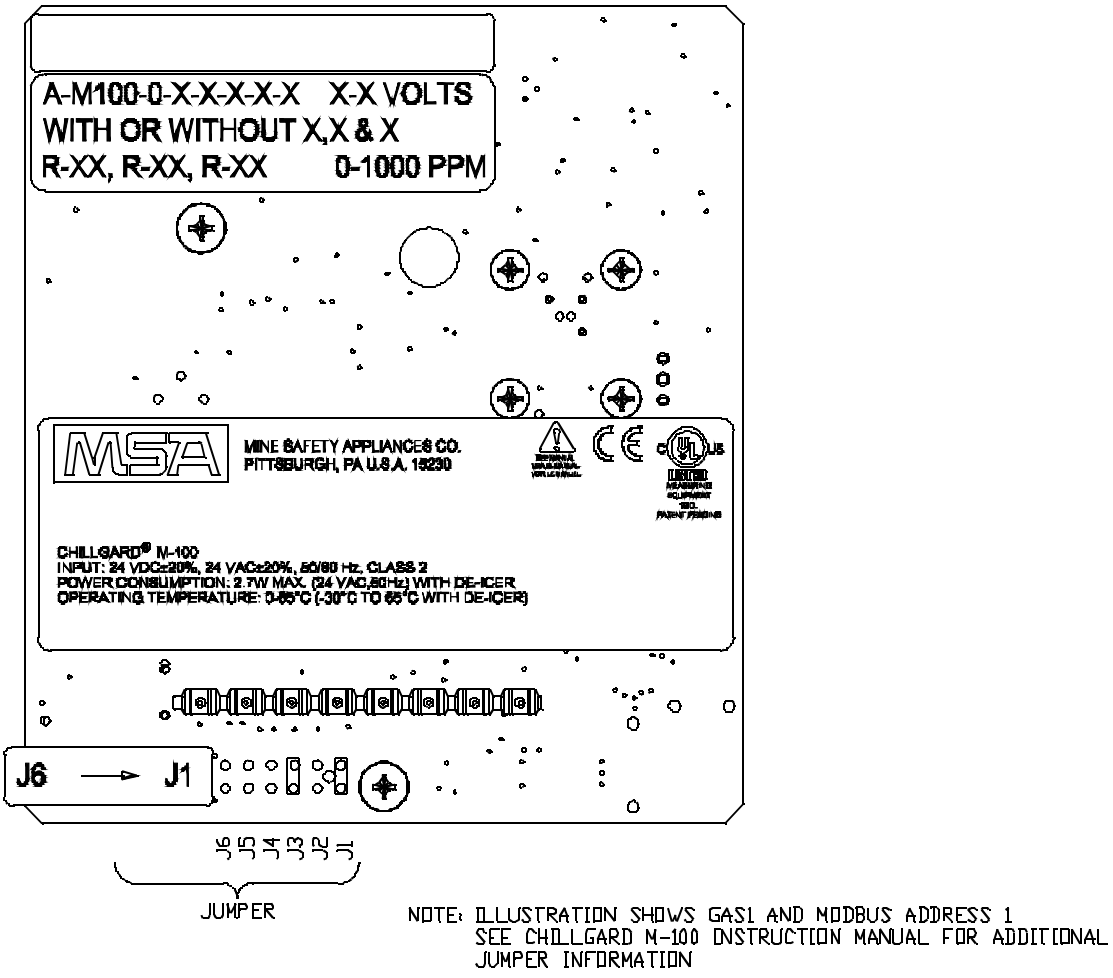


Figure 2-6. Chillgard M-100 Jumper Locations

- If dip switch setting 104 is chosen, addresses 105 to 107 will be assigned to the four-point unit and will not be available for use on other units.

Analog Signal Output Wiring

The unit has two available analog outputs. The 4 to 20 mA analog output is software-selectable between 10% or 100% of full scale:

- 4-20 mA, isolated, current sourcing
- 0-6 VDC outputs, 0.5-Volt steps to indicate point being monitored. For example, 1.5 V represents point 3 at the milliamp output.

Analog output wiring should enter the unit through the hole provided on the left side of the unit. 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 Chillgard LC Control Module. See FIGURE 2-2 for connecting the analog outputs.

⚠ CAUTION

Bundle low voltage wiring together (lower than 30 volts), separate from high voltage wiring (higher than 30 volts).

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 an Alarm 3 indication is given by the instrument. Connection is made to the strobe connector (FIGURE 2-2). IP rating shown on the strobe light applies to the strobe only.

Relay Outputs

Alarm Relays

There are three alarm relay outputs:

- **Alarm 1** (factory-set to trip at 50 ppm)
- **Alarm 2** (factory-set to trip at 150 ppm)
- **Alarm 3** (factory-set to trip at 1000 ppm; 300 ppm for R 123)

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 5 amps resistive. User can adjust alarm trip points via the front panel (see Section 3, FIGURE 3-11).

Alarm Relay Connections Wiring

Three refrigerant 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. Use copper conductors only.

Each relay has contacts for:

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

The function of each relay connector terminal is indicated on FIGURE 2-2.

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

Fault Relay

There is one relay (the Fault 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 2-2 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.

Remote Alarm Silence Switch

The audible alarm and latched refrigerant level alarms can be remotely reset through a switch that has a momentary contact opening (normally closed set of contacts). Connections are made as shown in FIGURE 2-3 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 control module, 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 horn on the bottom of the unit (FIGURE 2-2).

⚠ CAUTION

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

Start-Up

The following steps outline the procedures to power-ON the Chillgard LC Control Module:

1. Before applying power to the unit, verify proper power will be applied to the unit.
2. Turn the instrument ON at the circuit breaker or fuse that supplies power to the instrument. (The instrument does not have a power switch.)
   - A green LED indicates that power is ON and communication is established to a sensor module.

NOTE: The display will begin to indicate the gas concentration of each point connected to the Chillgard LC Control Module.

After power-ON, allow for unit stabilization (about 30 minutes) before checking calibration of instrument.

Setup Date, Time, and Logging

The data log on the LC unit must be initialized by setting the date and time under the Setup - Setup Time and Date Menu.

Setup logging next on the following menu:

1. Turn ON logging.
2. Set the log frequency.
3. Clear the log file to reset any readings.
4. Reset the LC unit to re-initialize the log to a clean start.

⚠ CAUTION

If this is not done, data recorded will not have a time stamp and data review will not be possible.

Initial Calibration

⚠ WARNING

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

See Chillgard LS Instruction Manual (P/N 10035164) for calibration or calibration check instructions. See Chillgard M100 Instruction Sheet (P/N 10073591) for calibration or calibration check instructions.

Section 3
Display Screens

All instrument operation is performed via the front panel which consists of four keys and a two-line by 20-character LCD 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 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 3-5)
  - Information Screens (FIGURES 3-7 through 3-8 and FIGURE 3-16)
  - Set-up Screens (FIGURES 3-3 and 3-10 through 3-15).

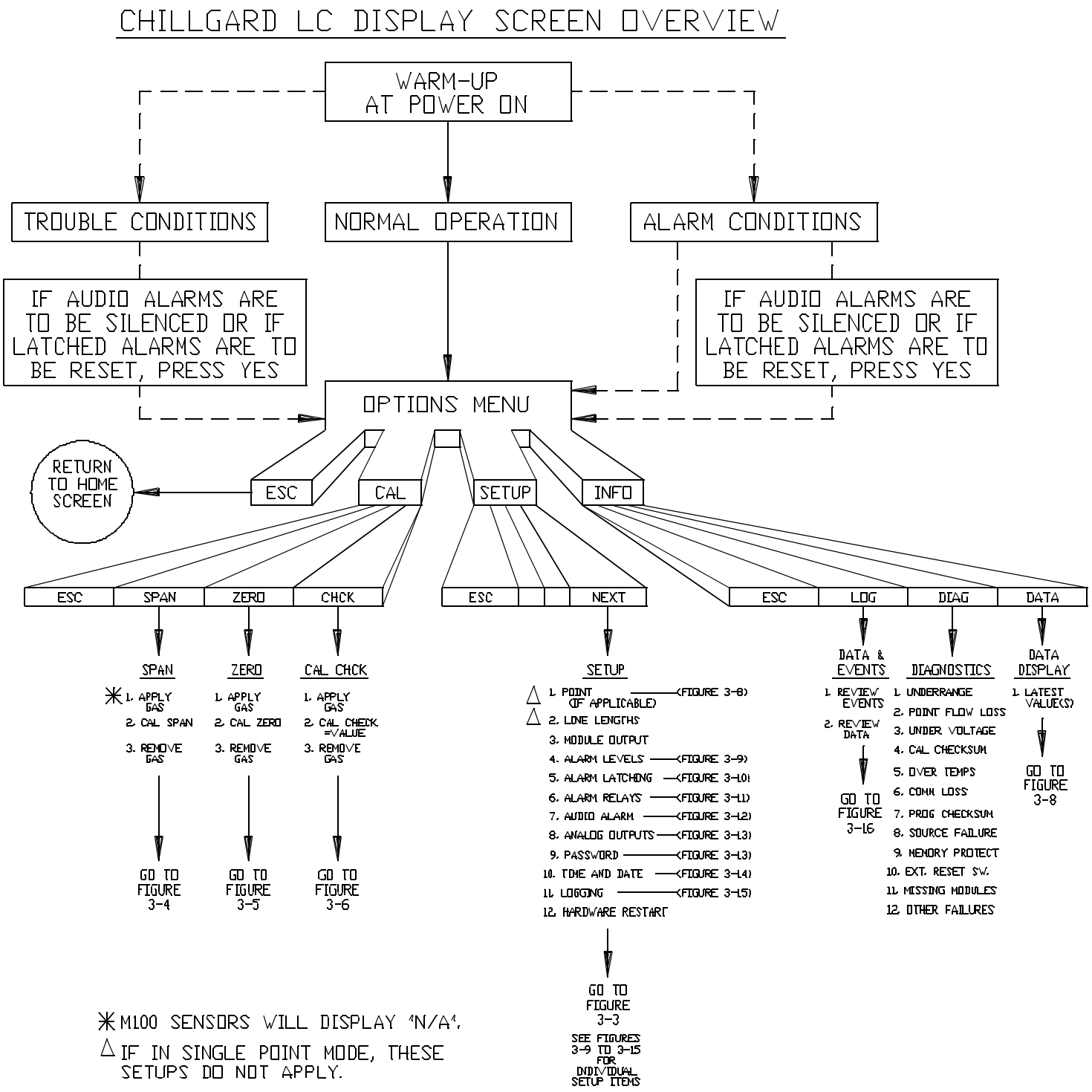


Figure 3-1. Display Screen Overview

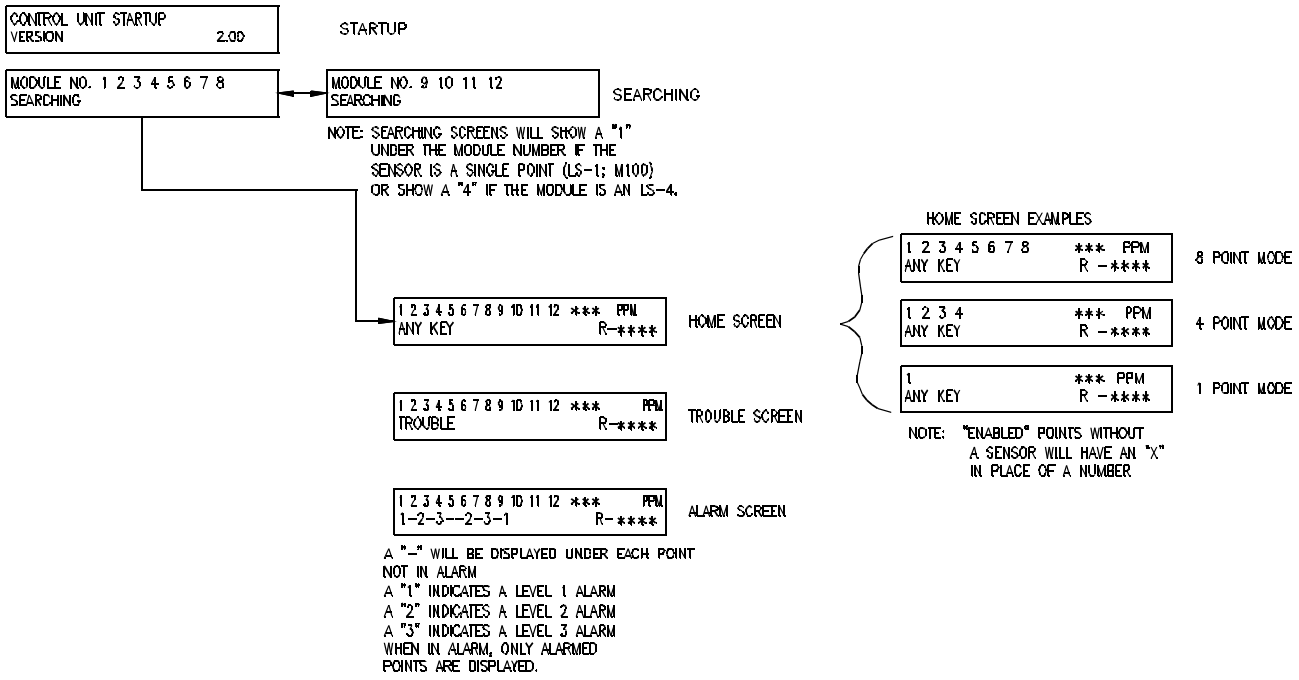


Figure 3-2.
Start-up and Normal Operation Screens

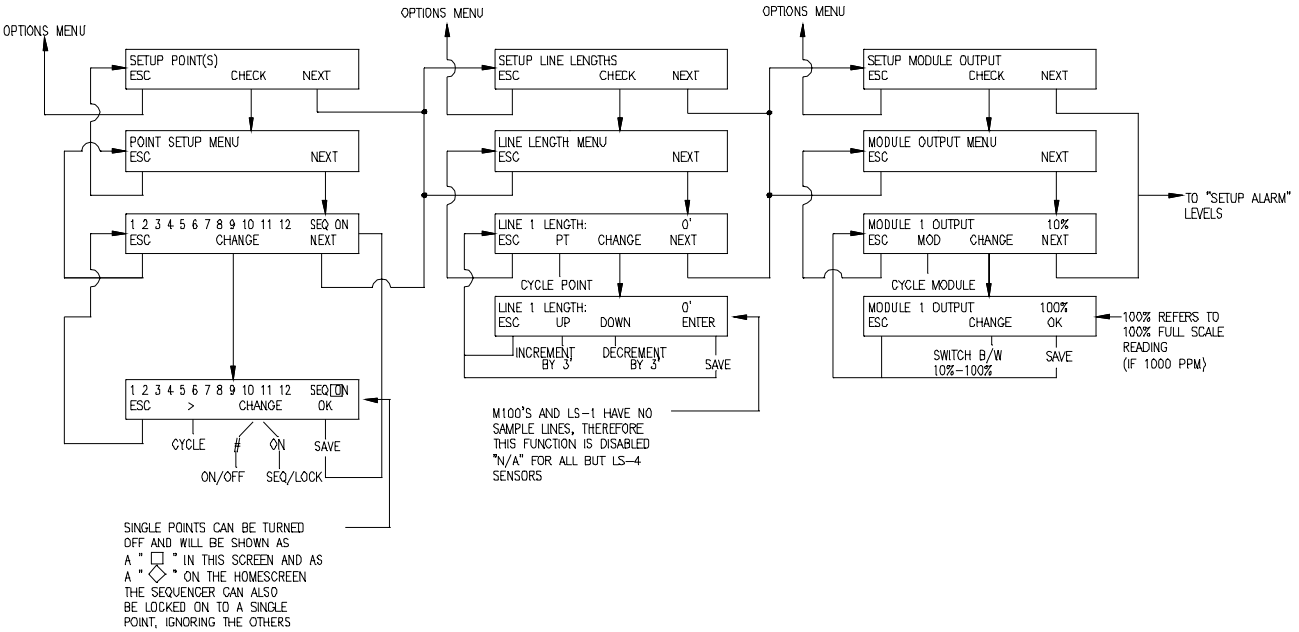


Figure 3-3.
Set-up Screens

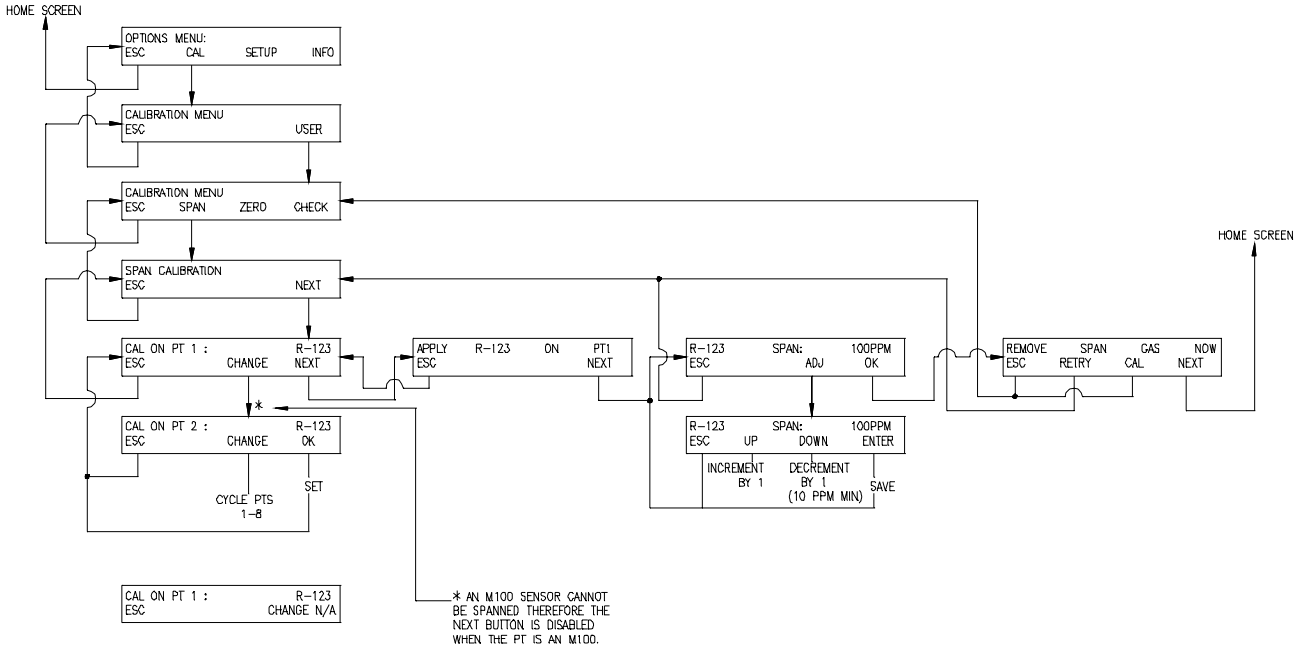


Figure 3-4.
Span Calibration Screens

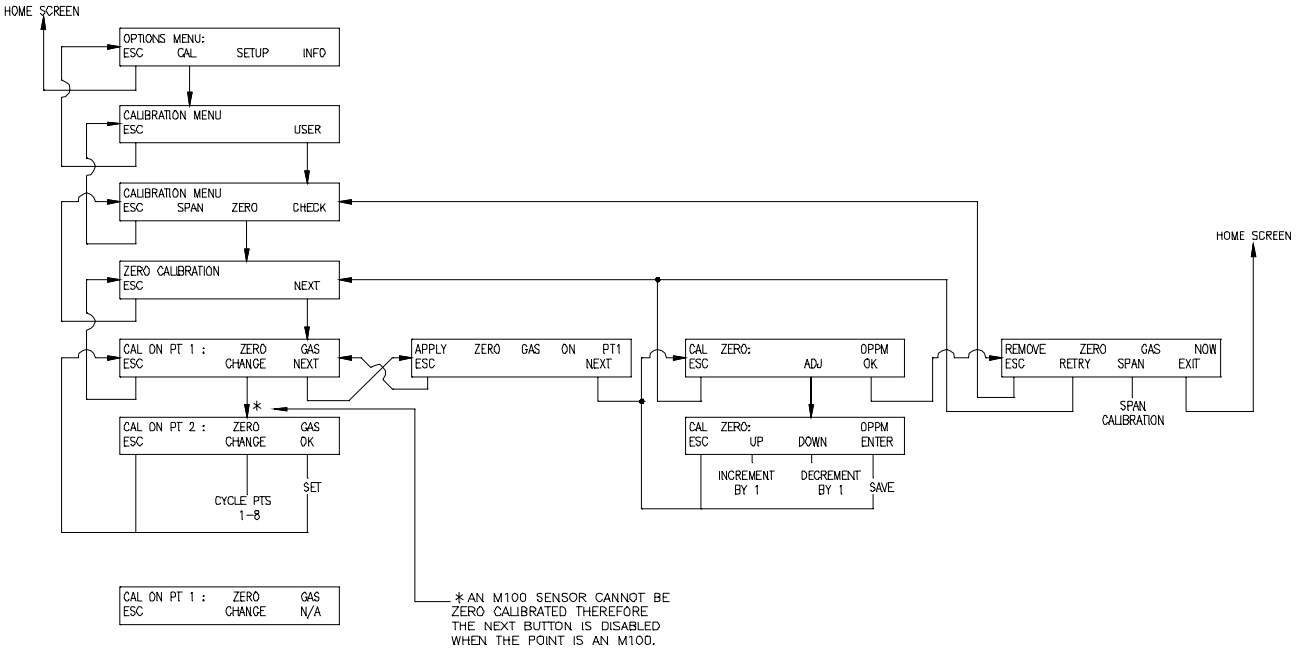


Figure 3-5.
Zero Calibration

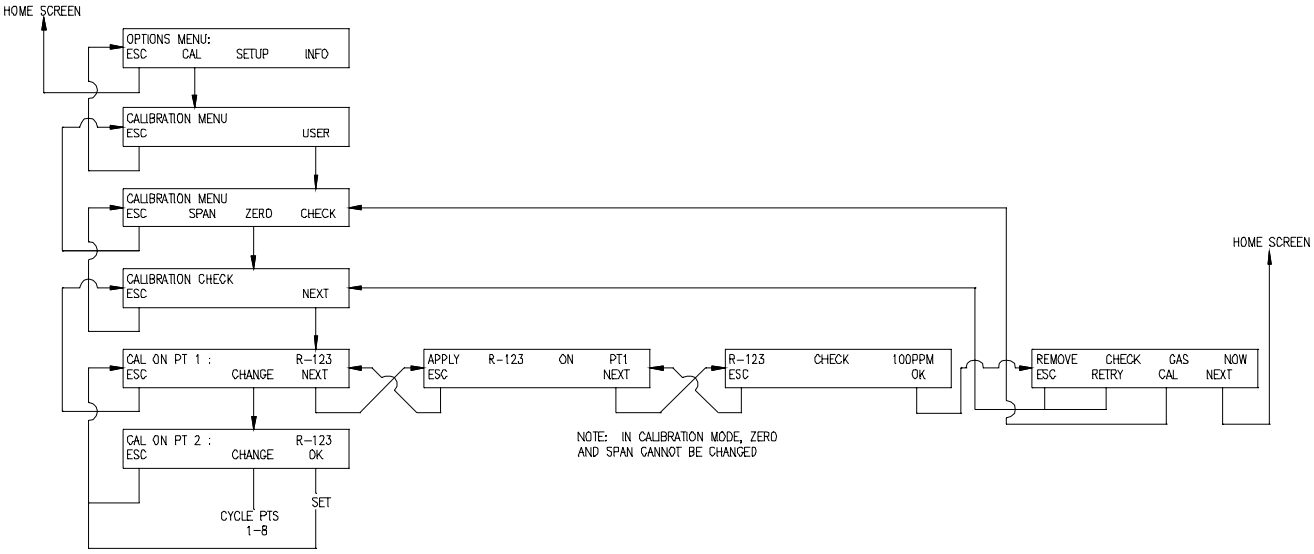


Figure 3-6.
Calibration Check

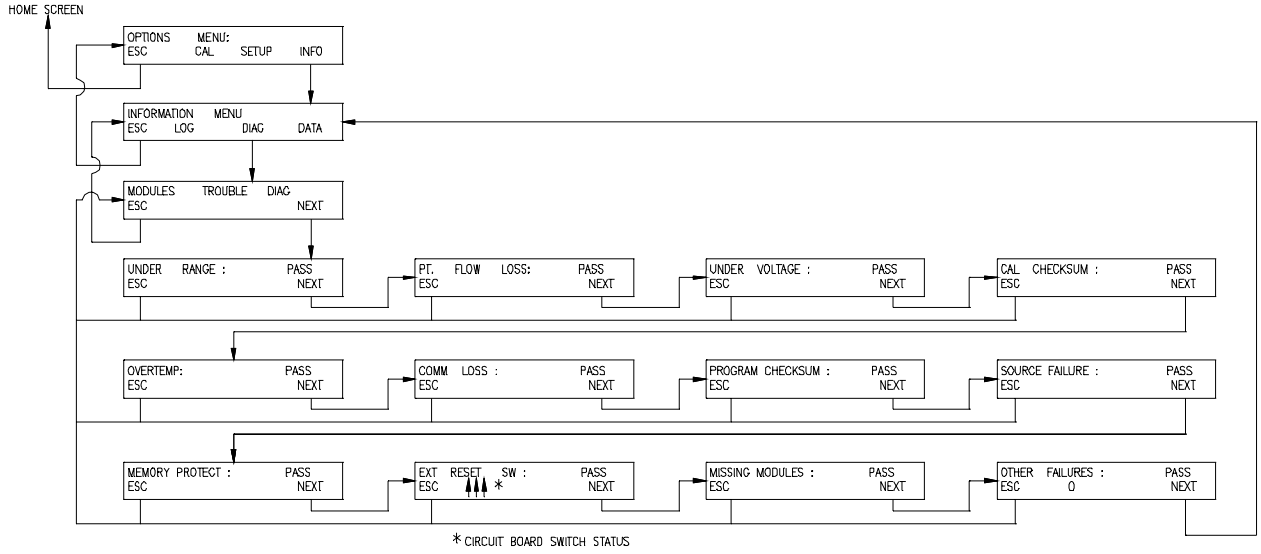


Figure 3-7.
Diagnostics Menu

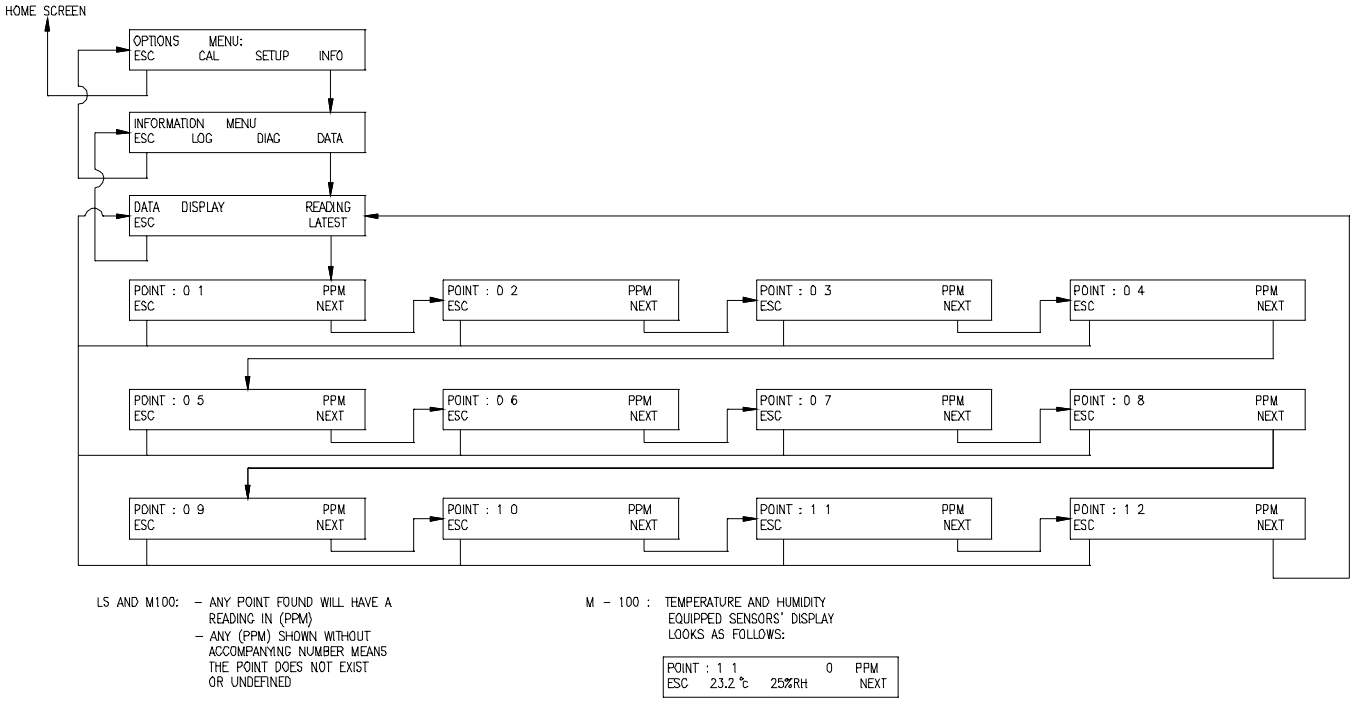


Figure 3-8.
Data Screens

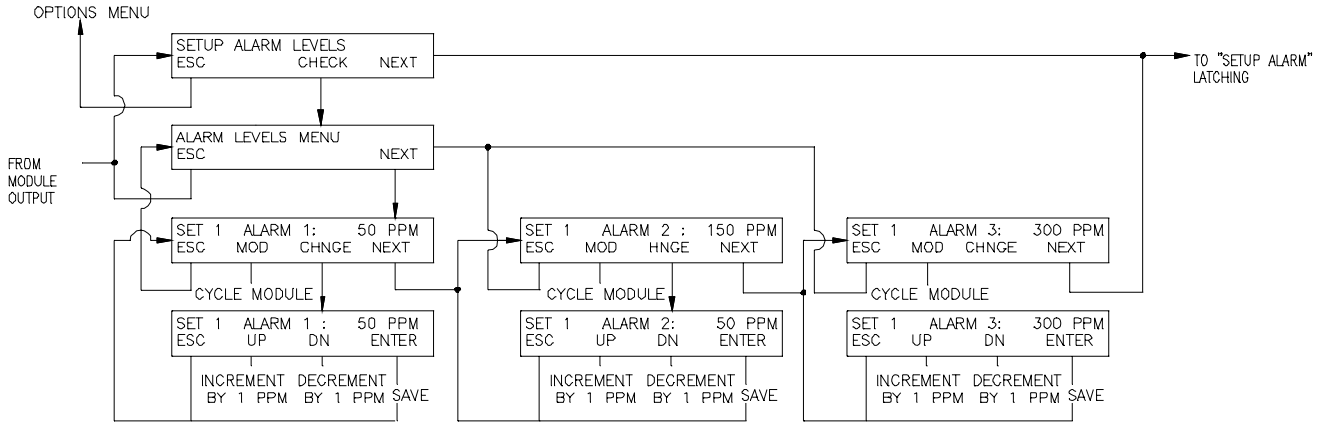


Figure 3-9.
Alarm Level Screen

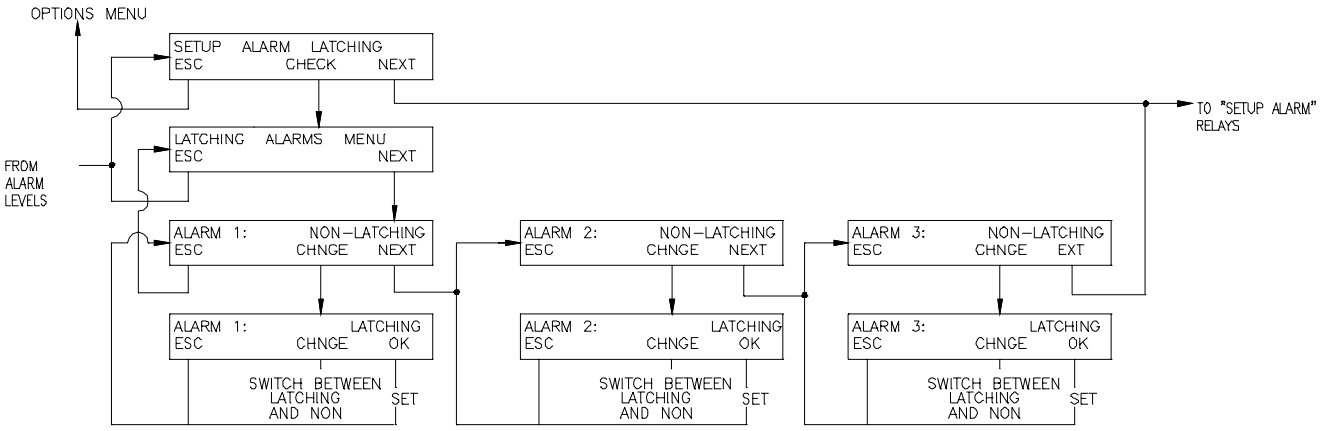


Figure 3-10.
Setup Alarm Latching

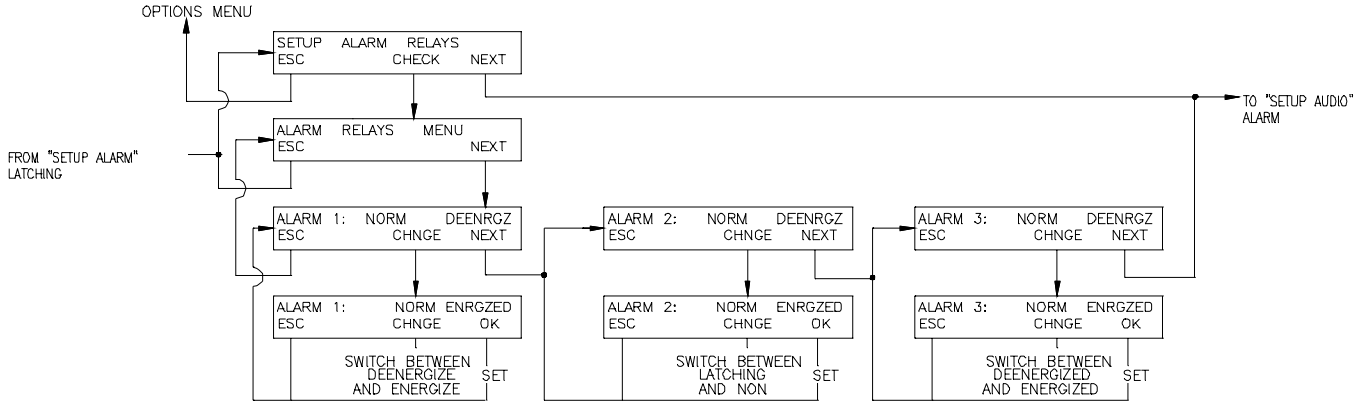


Figure 3-11.
Setup Alarm Relays

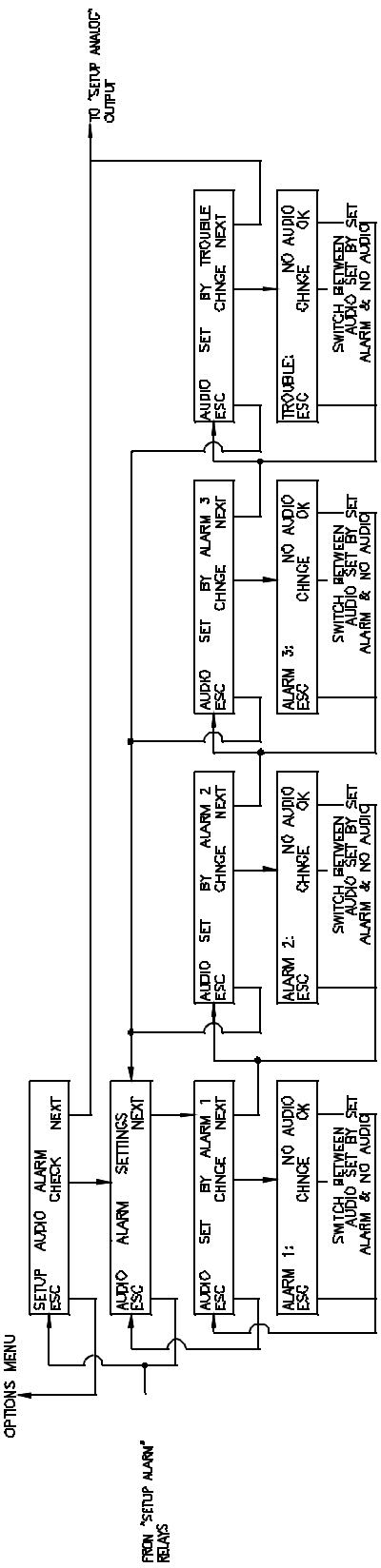


Figure 3-12.
Audio Alarm Screen

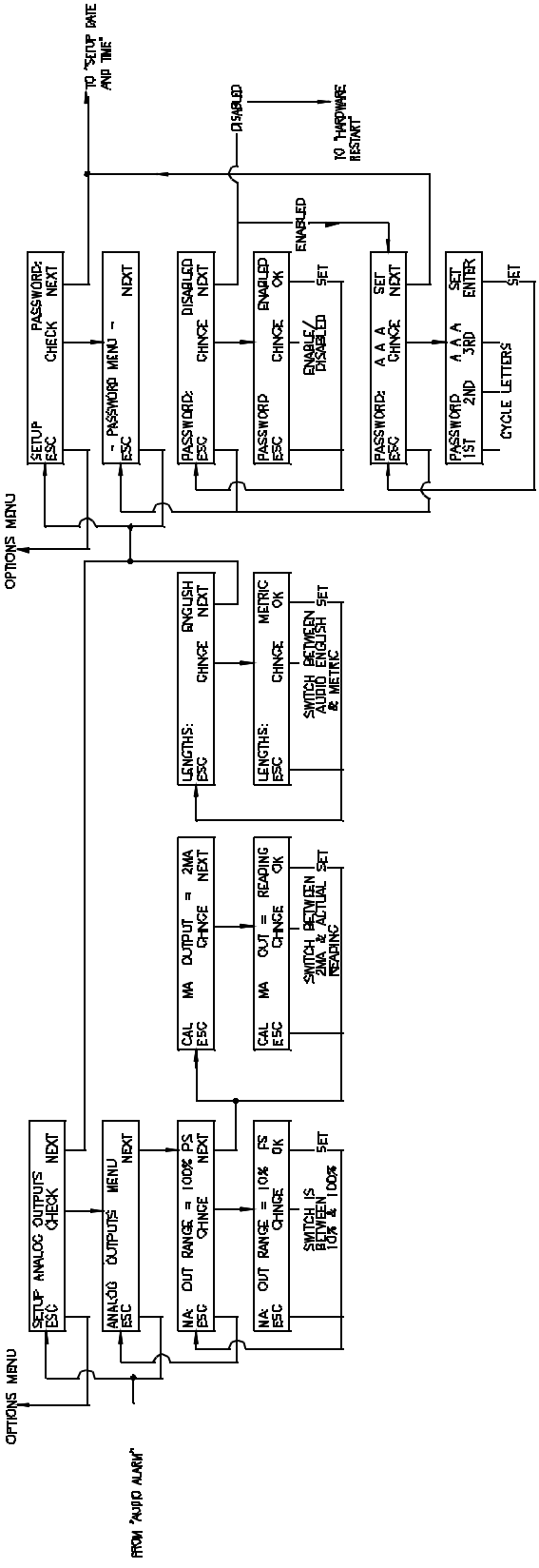


Figure 3-13.
Analog Outputs and Password

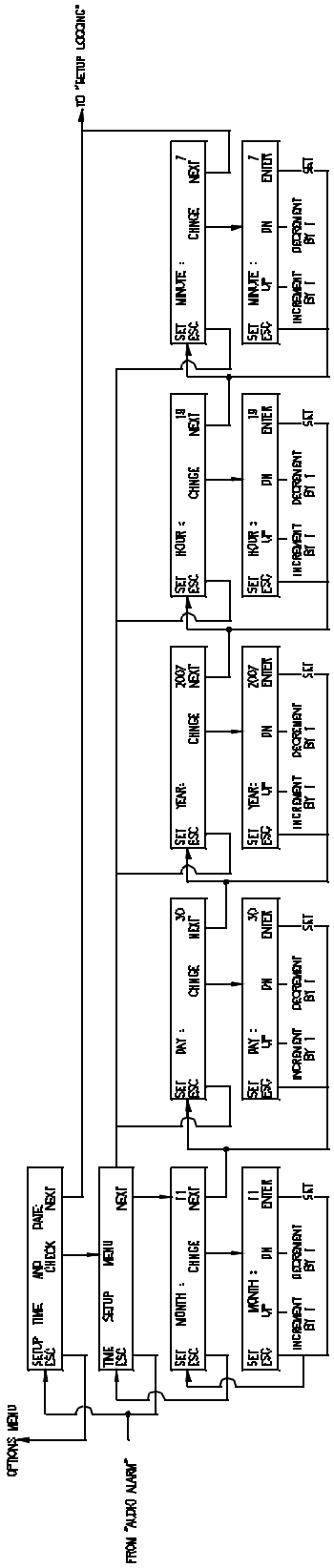


Figure 3-14.
Setup Times

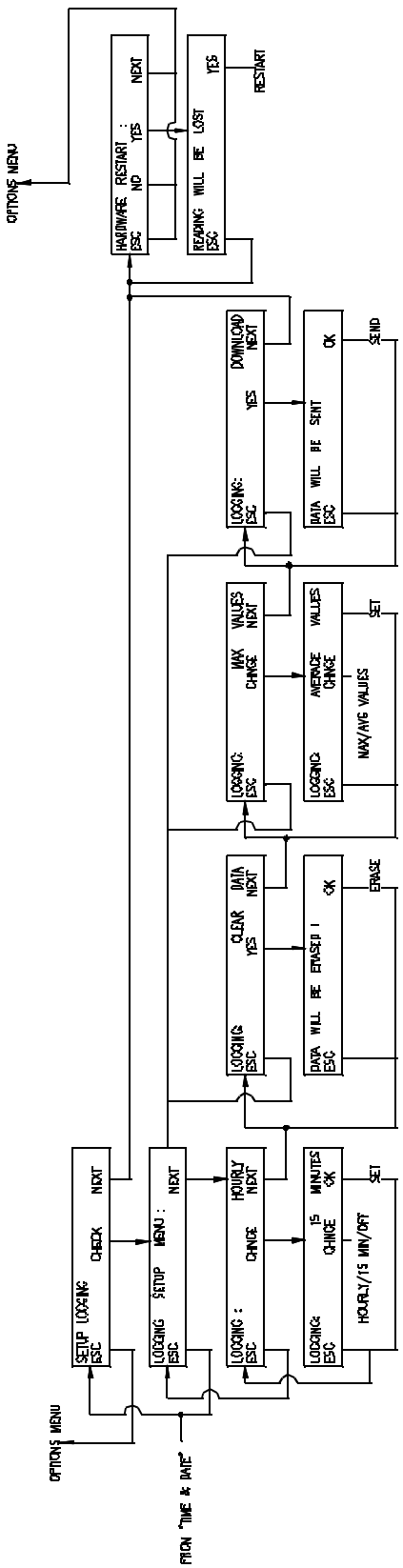


Figure 3-15.
Setup Logging

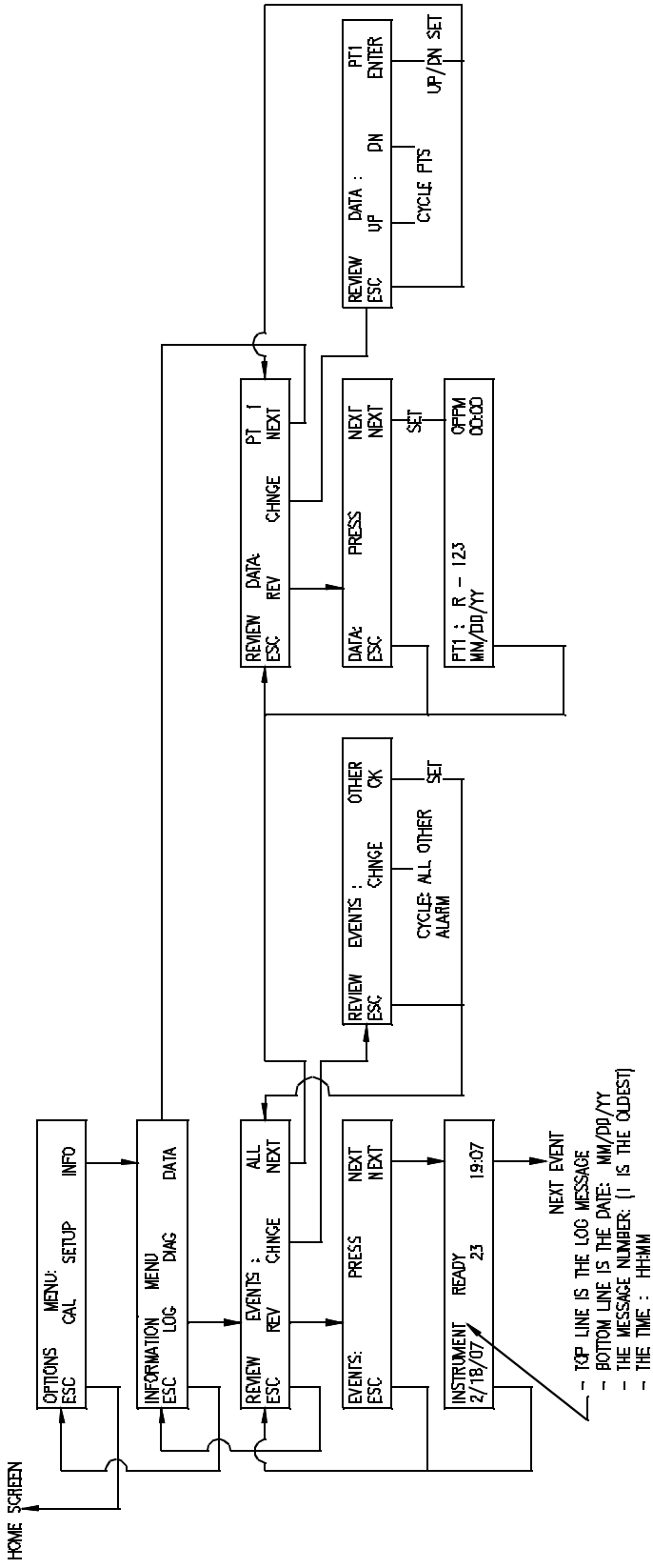


Figure 3-16.
Review Log

Section 4
Maintenance

General Maintenance

Under normal operation conditions, the Chillgard LC Control Module requires minimal maintenance.

Obtaining Replacement Parts

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

MSA North America
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 Chillgard LC Control Module, 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 4-1. Replacement Parts

PART	PART NO.
Mounting Panel, Chillgard LC	10033888
RFI Filter	10034402
Display Assembly, Chillgard LC	10039866
Transformer, Chillgard LC	10039002
Printed Circuit Board Assembly, Control	10033233
Printed Circuit Board, Membrane Switch	10034274
Strobe Light, red, 24 VDC	634674
Buzzer	637123
Horn	10034190

⚠ WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Table 4-2. 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. Check for loose wires on terminal barrier input.
		4. Check wiring to the unit power supply. Remove power supply cover and check fuse; replace if necessary.
		5. Check input cable to main board on power supply.
		6. Check for 24 VDC power supply output.
		7. Check communications
Beacon will not light	Beacon alarm	1. Check that plug is connected to circuit board
		2. Beacon is controlled by Alarm 3; check that the unit has exceeded Alarm 3.
		3. Replace beacon assembly.
Under-range failed	Zero limit is minus 20 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.

Table 4-2. Troubleshooting Guidelines

TROUBLE	DESCRIPTION	SOLUTION
Sensor flow failed	Leaky or blocked sample line	1. Remove all input lines to the sensor module. 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. Check operation of all manifold sample valves.
		3. Leak test the flow system.
		4. Return the unit to MSA for service.
Sensor temperature range failed	Checks for temperature range of over 67°C	1. Sensor temperature exceeded; mount unit in a lower temperature location.
Infrared source failed in sensor module	Checks the power of source assembly	1. Check the connection of the IR source into the motherboard.
		2. Replace optical bench.
		3. Return to MSA for service.
Memory protect	Checks checksum of setup and cal values	1. Replace the control board
		2. Return to MSA for service.
External reset failed	Checks the external reset button	1. If not used, check for jumper.
		2. If used, verify switch is wired normally closed.
Display failure	Display communications	1. Repower unit.
		2. Check for broken or cracked display.
		3. Replace display.
Audio alarm failure	Audio alarm	1. Check output terminals.
		2. Check for faulty horn buzzer.
No data in the Data Log	Logging not set	1. See Chapter 2, "Initial Calibration"
Unit fails startup	Password is set inadvertently	1. Call MSA for service

Section 5
Data Logging

The Chillgard LC unit allows 798 sets of data and events to be logged. This data is either the maximum or average of the concentration calculated. The structure of the data stored and transmitted is shown in Appendix C. The download can be initiated by sending the ASCII character "L" or "0x4C." Datalog information can be downloaded by connecting to the RS232 port (see FIGURE 2-3).

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 continuously. With four points active, 12 values per point are evaluated every hour. The number of values can be considerably lower if the monitor enters extended dwell because of high gas concentrations.

User Setup Options

Concentrations are recorded either every 15 minutes or hourly (FIGURE 3-15). If the logging function is turned OFF, the clock/calendar chip is stopped to save battery energy.

- Before logging can be used, the user must:
  1. Turn logging ON.
  2. Select an interval of 15 minutes or one hour for readings to be logged.
  3. Clear the log.
  4. Restart the hardware.

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 oldest entries are overwritten.

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 oldest entries are overwritten.

The log entry number displays to give the user a sense of where in the log they are located (FIGURE 5-1).

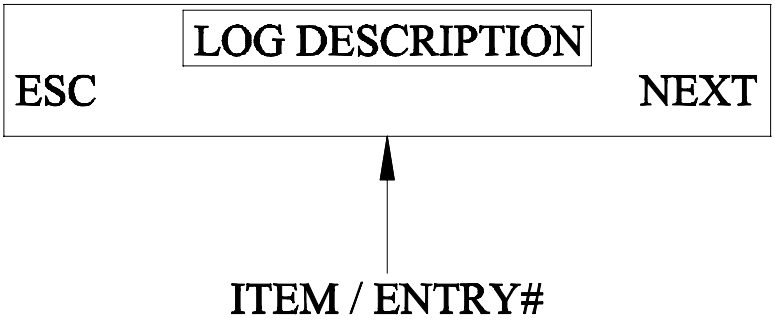


Figure 5-1. Log Description

Section 6
Calibration

Two calibration procedures are available:

1. Diffusion for non-pumped sensors like a single-point, non-pumped Chillgard LS Module
2. Pumped for sensors which incorporate a pump to draw air through tubing to the sensor.

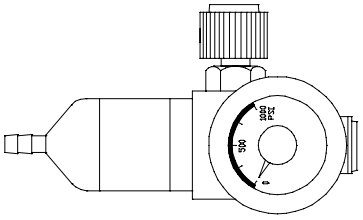
NOTE: The Chillgard M-100 sensor can be cal-checked, but does not require calibration.

Diffusion Version Calibration

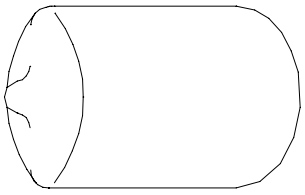
Calibration Equipment - (FIGURE 6-1)

Calibration of the monitor requires a supply of:

- ZERO GAS (air or nitrogen) It may be possible to use ambient air if you are sure it does not contain any possible interferant gases or contaminants.



0.25 LPM Flow Controller P/N 478359



Calibration Adapter P/N 10034395

Figure 6-1. Calibration Equipment

- SPAN GAS (A known refrigerant concentration) that measures approximately 10% of the full-scale calibration of the unit. See TABLE 5-3 for available refrigerant gas cylinders.

Relative humidity may have a small effect on the output of the unit. If dry gas is used, Nafion Tubing (P/N 813628) can be used to humidify the sample stream going to the monitor.

Both ZERO gas and SPAN gas must be carefully applied to the unit to avoid pressurizing the internally mounted optical bench.

See Chillgard LS manual (P/N 10035164) TABLE 5-2, Calibration Accessories Parts List, for the appropriate calibration parts and calibration gases available for the Chillgard LS Refrigerant Monitor.

⚠ WARNING

Exercise care during the span calibration to ensure that the unit can accurately detect refrigerant gas. Improper calibration can cause improper readings across the full-scale range of the monitor.

Initial Calibration Procedures

Refer to FIGURES 3-4 and 3-5 for calibration menus.

During the initial calibration procedures, alarm relays of any connected control instrumentation may activate. Disconnect or disable any equipment or alarms.

The following equipment is required for initial calibration:

- Tubing Assembly with calibration adapter (FIGURE 6-1)
- Calibration Gas
- Flow Controller (0.25 LPM) (FIGURE 6-1)

Preparation for Calibration

To verify the instrument is operating properly and to make initial calibration adjustments, perform the following:

1. Remove the light gray cover to open the enclosure on the Chillgard LS and LC.

⚠ CAUTION

Component Damage!

Monitor components must be protected from splashing, spraying, or dripping water. Failure to do so may cause damage to internal components.

2. Deactivate the equipment connected to the outputs, or disconnect the wiring to the outputs.
3. Replace lid on the enclosures.

⚠ CAUTION

If any control instruments connected to the Chillgard LS or Chillgard LC Refrigerant Monitor are wired to external devices (e.g., horns, exhaust fans, and fire suppression systems), these devices may activate while adjustments or repairs are performed during the following procedures.

To prevent activating these devices while adjusting the Chillgard LC Monitor, disconnect the wiring from the relay. Return all wiring to the relay when the calibration procedure is completed.

Calibration Guidelines

Once the Chillgard LS Refrigerant Monitor is operating, perform periodic calibration checks to ensure proper instrument operation.

Perform calibration to monitor long-term changes (drift) in both the ZERO and SPAN readings. If there is an unacceptable change in either of these readings, make adjustments to obtain proper readings.

When routine calibration does not restore proper readings, perform the procedures outlined under "Initial Calibration."

If following Calibration procedures fails to restore proper readings of the instrument, see Chillgard LS manual (P/N 10035164) Section 4, "Troubleshooting Guidelines" for guidelines to correct the instrument.

Keep written records of the calibration readings obtained and any adjustments made. Analysis of these records enables review and control of the time between checks.

Check a new Chillgard LS Refrigerant Monitor installation at least once a week by performing the steps outlined in the following section.

Calibration Check Procedure

The calibration check procedure involves checking the SPAN and ZERO readings on the instrument.

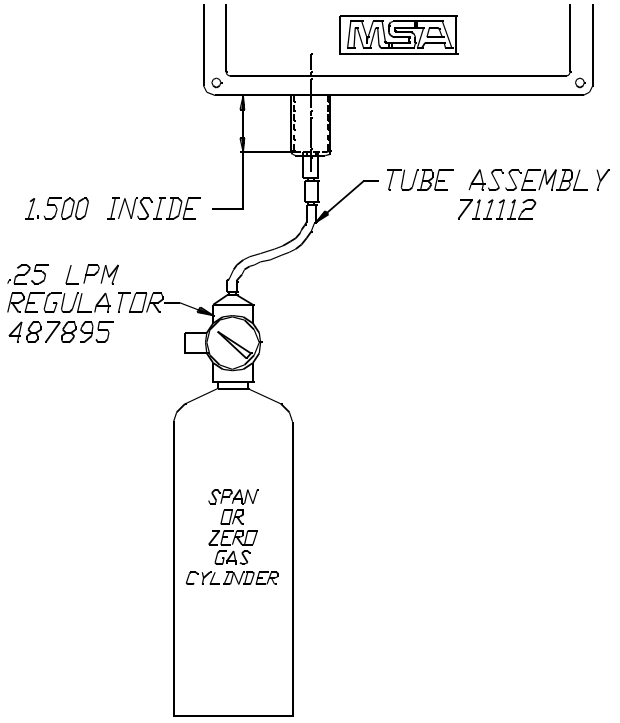


Figure 6-2. Applying Calibration Gas to the Chillgard LS Refrigerant Monitor

During the calibration check procedure, any control instrumentation connected to the Chillgard LS Refrigerant Monitor may activate. Disconnect or disable any equipment or alarms connected to the monitor during the calibration procedure.

Applying Calibration Gases to the Instrument

Arrange Span and Zero gas cylinders with regulator, tubing, and cal cap as shown in FIGURE 6-2. Refer to FIGURE 3-6 for the calibration menus.

⚠ WARNING

Refrigerant Hazard!

During calibration, the Chillgard LS Monitor is not sampling and monitoring the intended area. Exercise caution in the area as appropriate. Failure to do so may result in death or serious personal injury.

1. Lock the Chillgard LC Control Module to the point being calibrated.
   - Only the point being calibrated displays.
2. Perform the Zero Calibration first.
   - Use Nitrogen, not room air, to calibrate the zero point and avoid any contamination.

- Be sure sure to apply gas to the sensor for three minutes.

3. Enter the CAL - USER - ZERO - NEXT - CHANGE Menu to select the point to be calibrated (see FIGURE 3-5).
4. Press OK on the correct point; then, press NEXT.
5. After a reading displays, press ADJ; then, press UP or DN to return the displayed gas value to 0 ppm.
6. Perform Span Calibration using the appropriate sensor gas at 100 ppm.
   - Be sure to apply gas for three minutes.
7. Enter the CAL - USER - SPAN - NEXT - CHANGE Menu to select the point to be calibrated (see FIGURE 3-4).
8. Press OK on the correct point; then, press NEXT.
9. Press ADJ; then, press UP or DN to set the span to the gas concentration of the type being used (100 ppm).
10. Close the regulator valve and remove the span gas cylinder from the sampling tubing.
11. Remove the calibration cap and return to normal operation.

⚠ CAUTION

Equipment Failure!

Do not leave any alarm device or equipment disabled or disconnected during normal operation of the instrument; otherwise, the equipment will not function as intended when the instrument detects an alarm situation. Failure to do so may result in serious personal injury.

Single or Four-Point Pumped Version 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 6-3)
- 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 Chillgard LS contains little or no refrigerant.

Relative humidity may have a small effect on the output of the unit. If dry gas is used, Nafion Tubing (P/N 813628) can be used to humidify the sample stream going to the monitor.

⚠ CAUTION

The zero gas scrubber must be replaced periodically. The frequency of replacement depends on the concentration of the ambient refrigerant vapors.

The SPAN or ZERO cylinders (if needed) may be included with the Calibration Kit; cylinders shown in TABLE 6-1 are available from MSA.

Table 6-1. RP Calibration Gases

DESCRIPTION	CONCENTRATION	PART NO.
R-11 in Nitrogen	100 ppm	803499
R-12 in Nitrogen	100 ppm	804866
R-123 in Nitrogen	100 ppm	803498
R-134A in Nitrogen	100 ppm	803500
R-22 in Nitrogen	100 ppm	804868

Become familiar with the Calibration Kit components (FIGURE 6-3).

⚠ WARNING

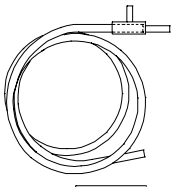
Exercise care during the span calibration to ensure that the unit can accurately detect refrigerant gas. Improper calibration can cause improper readings across the full-scale range of the monitor.

Calibration Procedures

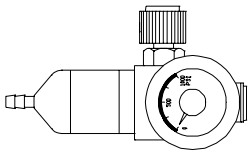
Preparation for Calibration

To verify the instrument is operating properly and to make initial calibration adjustments, perform the following:

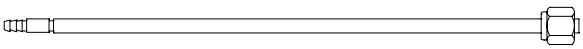
1. Remove the light gray cover to open the enclosures on the Chillgard LS and LC Monitors.



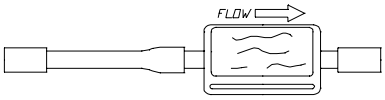
Tube and Tee Assembly
(P/Ns 603806 and 636866)



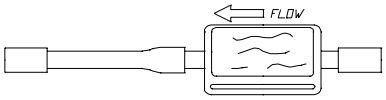
1.5 LPM Flow Controller
(P/N 478358)



Connector Assembly (P/N 711533)



Span Gas Scrubber (P/N 803874)
(Replace protective caps after use)



Zero Gas Scrubber (P/N 803873)
(Replace protective caps after use)

Figure 6-3. Kit Components

⚠ CAUTION

Component Damage!

Monitor components must be protected from splashing, spraying, or dripping water. Failure to do so may cause damage to internal components.

2. Deactivate the equipment connected to the outputs, or disconnect the wiring to the outputs.

⚠ CAUTION

If any control instruments connected to the Chillgard LS or LC Refrigerant Monitor are wired to external devices (e.g., horns, exhaust fans, and fire suppression systems), these devices may activate while adjustments or repairs are performed during the following procedures.

To prevent activating these devices while adjusting the Chillgard LC Refrigerant Monitor, disconnect the wiring from the relay. Return all wiring to the relay when the calibration procedure is completed.

Before calibrating the Chillgard LS 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 Fault alarm.
2. After checking for leaks, remove the sampling line for the Chillgard LS inlet.
3. Attach the Calibration Kit connector assembly to the inlet.

Calibration Guidelines

Once the Chillgard LS Refrigerant Monitor is operating, perform periodic calibration checks to ensure proper instrument operation.

Perform calibration to monitor long-term changes (drift) in both the ZERO and SPAN readings. If there is an unacceptable change in either of these readings, make adjustments to obtain proper readings.

When routine calibration does not restore proper readings, perform the procedures outlined under "Initial Calibration."

If following Calibration procedures fails to restore proper readings of the instrument, see Section 5, "Troubleshooting Guidelines" for guidelines to correct the instrument.

Keep written records of the calibration readings obtained and any adjustments made. Analysis of

these records enables review and control of the time between checks.

Calibration Equipment

Calibration of the monitor requires a supply of:

- ZERO GAS (nitrogen) It may be possible to use ambient air if you are sure it does not contain any possible interferant gases or contaminants.
- SPAN GAS (A known gas concentration that measures approximately 10% of the full-scale calibration of the unit.

Carefully apply both ZERO gas and SPAN gas to the unit to avoid pressurizing the internally mounted sensing cell. See TABLE 5-2, "Calibration Accessories Parts List" for the appropriate calibration parts and calibration gases available for the Chillgard LS Refrigerant Monitor.

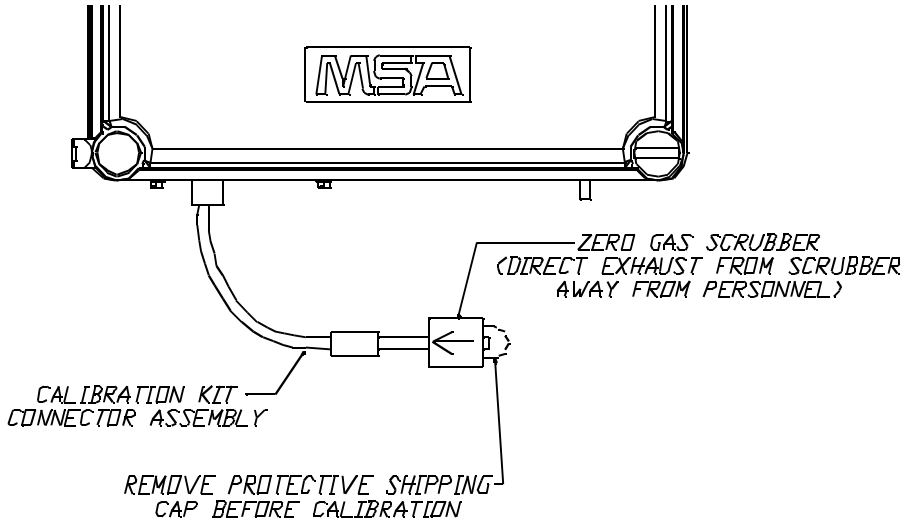


Figure 6-4. Using Zero Scrubber for Zero Calibration

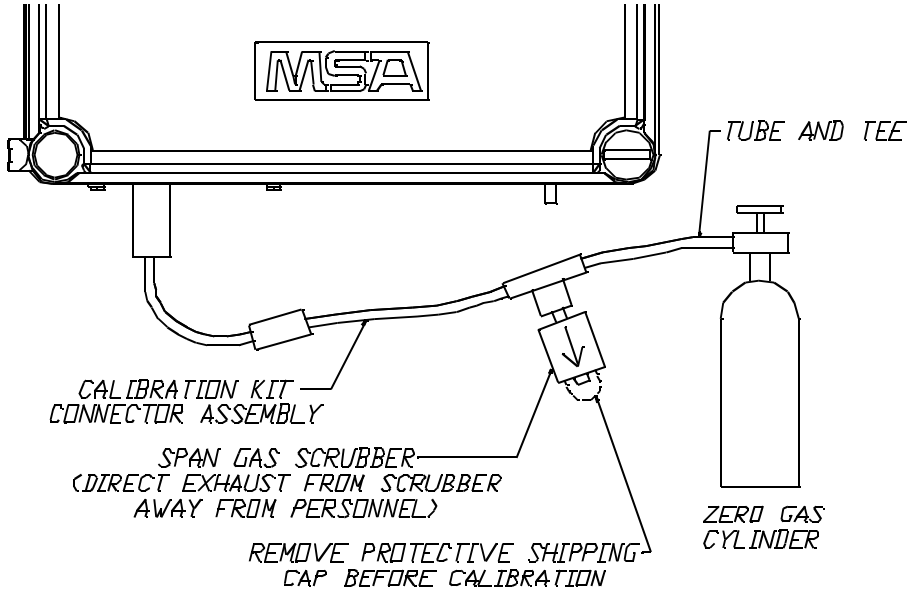


Figure 6-5. Using Zero Gas Cylinder for Zero Calibration

Calibration Check Procedure

The calibration check procedure involves checking the SPAN and ZERO readings on the instrument. During the calibration check procedure, any control instrumentation connected to the Chillgard LS Refrigerant Monitor may activate. Disconnect or disable any equipment or alarms connected to the monitor during the calibration procedure.

Zeroing the Monitor

When zero gas is required, attach a zero gas scrubber or zero gas cylinder to the connector as shown in FIGURES 6-4 and 6-5.

⚠ WARNING

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

⚠ CAUTION

During calibration, the Chillgard LS Refrigerant Monitor is not sampling and monitoring the intended area. Exercise caution in the area as appropriate.

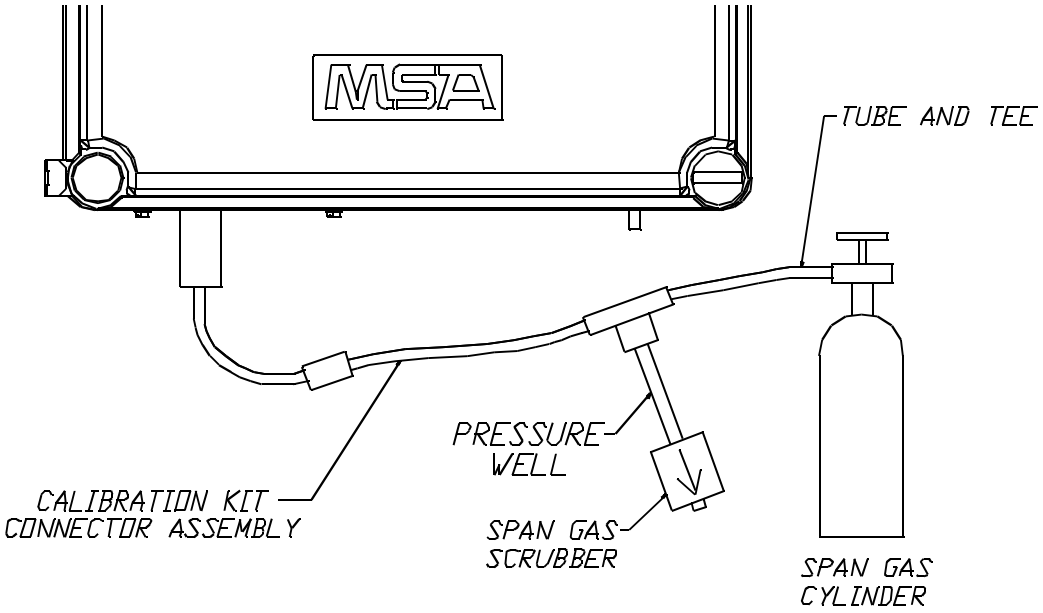


Figure 6-6. Span Calibration

Assemble this setup when calibrating a Chillgard LS-4 sensor. Be sure that the pressure well outlet is at least six inches long to minimize dilution by the outside air. This pressure well allows for a flow outlet when the flow regulator has a higher flow than the Chillgard LS-4 sensor. Trying to limit the flow from the regulator is quite difficult and may lead to under-pressurization of the Photo acoustic Bench. If this under-pressurization occurs, concentration readings from that sensor will be low.

1. Lock the Chillgard LC sensor onto the first sampler address of the Chillgard LS-4 sensor (point 1 or point 5).
2. Remove any sampling tubes from the first point; calibration gases will be applied directly to the sampler.
3. Perform Zero Calibration first.
   - Use Nitrogen, not room air, to calibrate the zero point and avoid any contamination.
   - Be sure sure to apply gas to the sensor for three minutes.
4. Enter the CAL - USER - ZERO - NEXT - CHANGE Menu to select the point to be calibrated (point 1 or point 5). (See FIGURE 3-5.)
5. Press OK on the correct point; then, press NEXT.
6. After a reading displays, press ADJ; then, press UP or DN to return the displayed gas value to 0 ppm.
7. Perform Span Calibration using the appropriate sensor gas at 100 ppm.
   - Be sure to apply gas for three minutes.
8. Enter the CAL - USER - SPAN - NEXT - CHANGE Menu to select the point to be calibrated. (See FIGURE 3-4.)
9. Press OK on the correct point; then, press NEXT.
10. Press ADJ then UP or DN to set the span to the gas concentration of the type being used (100 ppm).
11. Close the regulator valve and remove the SPAN gas cylinder from the sample tubing.
12. Remove tubing from the sensing cell on the unit.
13. Re-connect or enable all equipment and alarm devices connected to any control equipment monitoring the Chillgard LS Refrigerant Monitor.

⚠ CAUTION

Do not leave any alarm device or equipment disabled or disconnected during normal operation of the instrument; otherwise, the instrument will not function as intended when it detects an alarm situation.

Appendix A
RS-232 Output

Introduction

The instrument is ready to monitor; however, it is necessary to configure the unit to your specific requirements. Your Chillgard LC Control Module may be connected to Multi-Point Sequencer(s) and/or multi-sensor modules, enabling your unit to sample from up to 12 individual sampling locations.

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

- RS-232 output
- Password protection
- Sampling point identification.

RS-232 Output

The RS-232 output broadcasts certain information about the Chillgard LC Control Module (TABLE A-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.

Connection to the RS-232 output is via a 9-pin sub "D" female connector.

Table A-1. RS-232 Parameters

COMMUNICATION PARAMETERS	9600 Baud or 19,200 (See TABLE 2-1)
	8 bits
	No parity
	One stop bit

The log data is an array of structures. The array size is 792 and the structure length is 22 bytes. The first byte is a sync character "R" followed by 23,760 bytes. The first structure is the Log Information**.**

Table A-2. Information Structure (Chillgard LC Control Module)

ITEM NO.	DESCRIPTION	VALUE OR TYPE	SIZE (BYTES)
0	Monitor type	ASCII "R"	1
1	Monitor Type	ASCII "L"	1
2	Monitor Type	ASCII "C"	1
3	Scale	char 0x03	1
4	ID Number	unsigned integer	2
5	Year (0 - 99)*	bcd number	1
6	Month (1 - 12)	bcd number	1
7	Date (1 - 31)	bcd number	1
8	Hour (0 - 23)	bcd number	1
9	Minute (0 - 59)	bcd number	1
10	Average or Max	char	1
11	Point 1 Gas Type	char	1
12	Point 2 Gas Type	char	1
13	Point 3 Gas Type	char	1
14	Point 4 Gas Type	char	1
15	Point 5 Gas Type	char	1
16	Point 6 Gas Type	char	1
17	Point 7 Gas Type	char	1
18	Point 8 Gas Type	char	1
19	Point 9 Gas Type	char	1
20	Point 10 Gas Type	char	1
21	Point 11 Gas Type	char	1
22	Point 12 Gas Type	char	1
23	Sequencer Points	char	1
24	Log Index	unsigned integer	2
Total			30

***The base/year is 2000.**
The last structure is filled with 0xff.

The information structure is followed by data and event structures. Data structures are always identified by Alarm/Event value of 0x01. Empty structures have Alarm/Event value of 0x00.

Table A-3. Data Structure

ITEM NO.	DESCRIPTION	VALUE OR TYPE	SIZE (BYTES)
1	Alarm or Event	char = 0x00	1
2	Year*	bcd	1
3	Month	bcd	1
4	Date	bcd	1
5	Hour	bcd	1
6	Minute	bcd	1
7	Concentration Point 1	integer	2
8	Concentration Point 2	integer	2
9	Concentration Point 3	integer	2
10	Concentration Point 4	integer	2
11	Concentration Point 5	integer	2
12	Concentration Point 6	integer	2
13	Concentration Point 7	integer	2
14	Concentration Point 8	integer	2
15	Concentration Point 9	integer	2
16	Concentration Point 10	integer	2
17	Concentration Point 11	integer	2
18	Concentration Point 12	integer	2
Total		integer	30

***The base/year is 2000.**

Table A-4. Alarm Structure

ITEM NO.	DESCRIPTION	VALUE OR TYPE	SIZE (BYTES)
1	Alarm or Event	char	1
2	Year	bcd	1
3	Month	bcd	1
4	Date	bcd	1
5	Hour	bcd	1
6	Minute	bcd	1
7	Point (1 - 12)	char	1
8	spaces	0x00	15
Total			30

***The base/year is 2000.**

Table A-5. Alarms and Events

DATA	CONCENTRATION	0x01
ALARMS	LOG_ALARM 1	0x02
	LOG_ALARM 2	0x04
	LOG_ALARM 3	0x08
EVENTS	LOG_WARMUP	0x10
	LOG_READY	0x20
	LOG_FAULT	0x40
	LOG_CAL_SETUP	0x80

Appendix B
Installation Outline Drawing

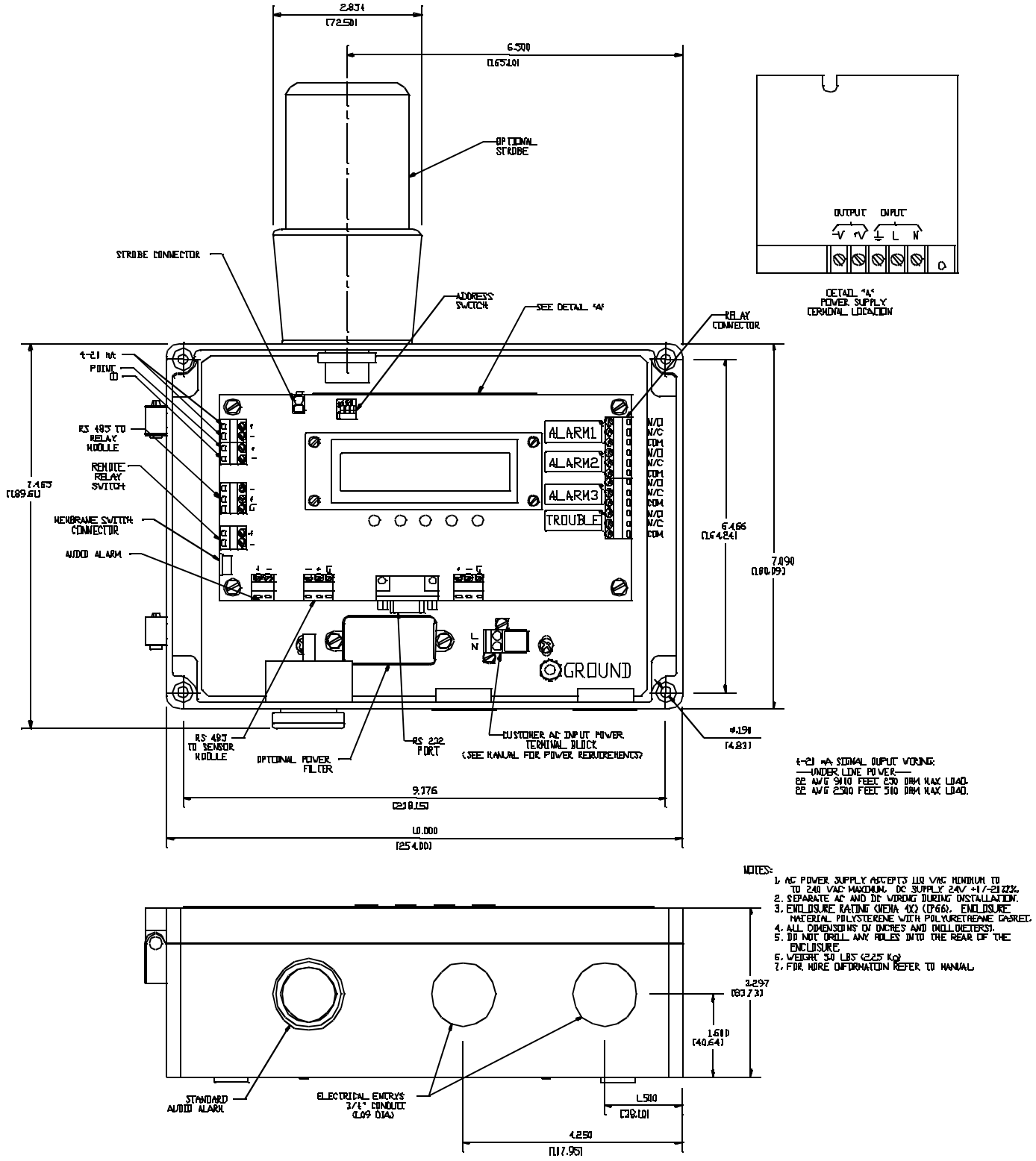


Figure B-1. Installation Outline Drawing
for Standard Version

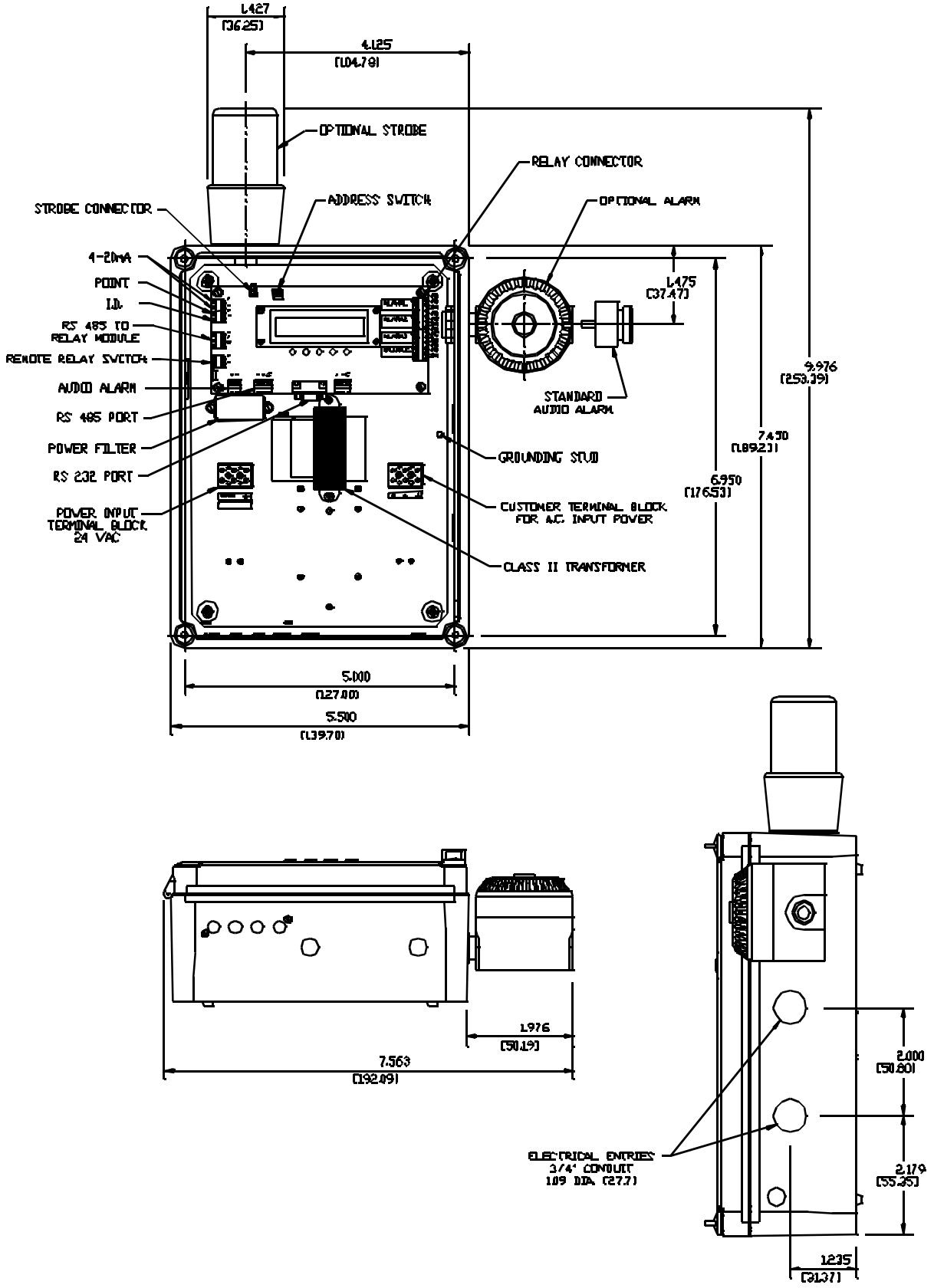


Figure B-2. Installation Outline Drawing for Transformer Version