Foxcroft Equipment & Service, Co. Inc.
Model FX-1500
Single Channel Toxic Gas Detector
Instruction Manual

Warning!
Please Read Carefully and Save.

The FX-1500 Single Channel Toxic Gas Detector includes an instruction manual that contains important information about its operation. Purchasers who install this toxic gas detection system for use by others must leave this instruction manual or a copy with the user.

Table of Contents

IMPORTANT SAFETY INFORMATION

Please read and observe the following:

**All functions of this gas detection system
must be verified on a regular basis.**

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING: A warning looks like this. It warns you of the potential for personal injury

CAUTION: A caution looks like this. It alerts you to the possibility of instrument malfunction or damage.

NOTE: *A note looks like this. It alerts you to important operating information.*

Introduction

General Information

Instrument Description and Capability

The FX-1500 Single Channel Toxic Gas Detector is an electronic system designed to rapidly detect and warn of hazardous toxic gas concentrations or low oxygen levels. The system consists of a toxic gas or oxygen sensor and a remote alarm unit that can be located up to 2000 feet away from the hazard area.

The FX-1500 is designed to give an early warning of developing toxic gas leaks or low oxygen levels by monitoring the air. When it senses toxic gas or low oxygen levels, it sounds its built-in horn and flashes its red blinking LED. The FX-1500 provides 3 alarm trip levels, with each level indicating specific concentration of toxic gas or percentage of oxygen. These levels are fixed and cannot be adjusted.

Put an FX-1500 in every place necessary to protect personnel. Place it in the proper location according to which type of gas the air is being monitored for.

Dimensions

6.000"

6.000"

Figure 1

7.2139"

7.2139"
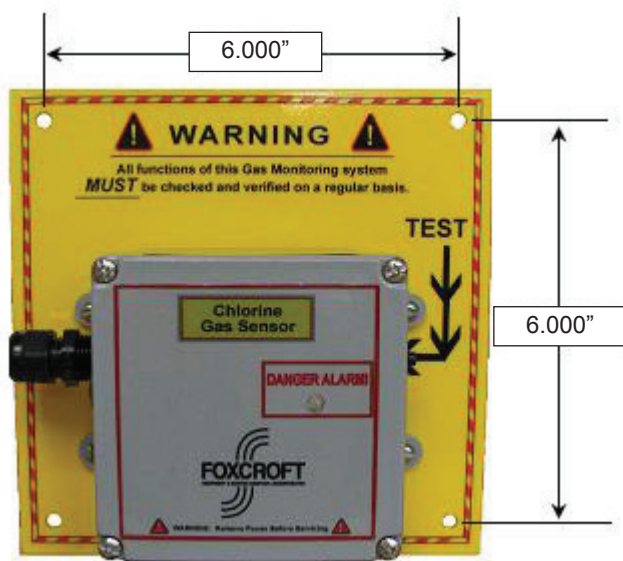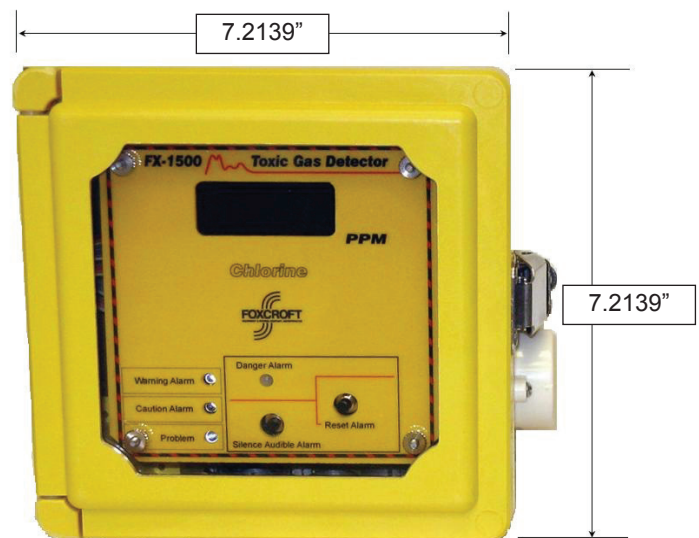
Figure 2

WARNING: If the alarm buzzer sounds a loud pulsating sound and you are not testing the toxic gas detector, it has sensed a gas leak. The alarm buzzer is warning of a possible serious situation and it requires your immediate attention.

WARNING: All functions of the FX-1500 must be checked and verified on a regular basis. Even the ability for the gas sensor to sense toxic gas or low oxygen levels must be verified on a regular basis. It is recommended that the gas sensor be tested by means of a certified gas standard at least once every six months.

WARNING: If the FX-1500 is altered in any way, the warranty will be void (e.g., drilling additional holes in the enclosure to mount conduits, changing operating range of the gas sensor and altering the gas alarm trip points).

WARNING: Never disconnect an AC powered gas detector to stop nuisance alarms. The source of the problem must be corrected.

General Limitations

The FX-1500 Single Channel Toxic Gas Detector will not work without AC power. AC powered gas detectors will not work if the power source is cut off for any reason. Some examples are a power failure at the power station, an open fuse or circuit breaker, corrosion of the electrical system that destroys the wires, a failure of an electrical switching device. **If there are any concerns about the limitations of AC power, a battery backup should be installed.**

The Green LED Digital Display should be clearly illuminated at all times. This indicates the AC power is turned on.

The FX-1500 will not sense toxic gas or oxygen if the gas which it is monitoring for does not reach the sensing chamber.

The FX-1500 may not sense toxic leaks or low oxygen levels in another room or another floor of the building (e.g., an outside mounted gas detector may not sense a toxic gas leak inside a building; therefore, place a gas detector wherever it is needed to protect your personnel).

FX-1500 may not be heard or seen. The loudness of the alarm in the FX-1500 Toxic Gas Detector meets (or exceeds) current standards. However, if the FX-1500 is placed in a closed room, it may not be seen or heard by personnel, especially if the door does not have a window to see the visual alarm. Even normal noise such as traffic, motors running, radios, and air conditioners may prevent personnel from hearing the audible alarm. **FX-1500 Toxic Gas Detectors may not be heard or seen by persons who are hard of hearing or visually impaired.** It is recommended that the remote warning device be installed to alert personnel before entering a room. Several detectors are recommended both outside the building or in any room that contain personnel, where toxic gas or low oxygen levels can develop.

The FX-1500 is not foolproof. Like all other electronic devices, FX-1500 Toxic Gas Detectors have limitations. Detectors cannot be expected to sense a dangerous toxic gas leak or low oxygen levels if the cavity is blocked by debris or the detector is carelessly tampered with by personnel.

The FX-1500 has a limited life. This equipment contains many parts. Just as with any other device any one of these parts could fail at any time. Therefore, you must test your detector on a regular basis. Be sure to have it repaired or replaced when it fails to test properly. In no case should the detector be used for more than 10 years. All functions of this detector must be checked and verified on a regular basis. Even the ability of the sensor must be verified by means of a certified gas standard at least 2 times a year.

Life and Replacement: Most sensors are designed for a minimum life span of 2 years and are warranted for 1 year from date of shipment. Life expectancy can be as high as 10 years. Oxygen sensors have a life span of 2 years and are warranted for a period of 1 year from the date of shipment. To verify expiration date, see serial number data tag or the data sheet provided.

Range and Alarm Trip Point Chart

Standard Range (ppm or %)
Optional Ranges and Alarm Trip Points may be available.

Refer to the Serial Number label inside the remote unit for the type of gas being monitored, or the labeling on the sensor itself.

Gas	Standard Range	Caution Trip Point	Warning Trip Point	Danger Trip Point
Chlorine (Cl_2)	**0-10 ppm**	0.3 ppm	**0.5 ppm**	**1.0 ppm**
Sulfur Dioxide (SO_2)	**0-10 ppm**	0.5 ppm	**1.0 ppm**	**3.0 ppm**
Carbon Monoxide (CO)	**0-500 ppm**	20 ppm	**35 ppm**	**50 ppm**
Hydrogen (H_2)	**0-200 ppm**	5.0 ppm	**35 ppm**	**50 ppm**
Hydrogen Sulfide (H_2S)	**0-10 ppm**	0.5 ppm	**1.0 ppm**	**3.0 ppm**
Nitric Oxide (NO)	**0-50 ppm**	10 ppm	**15 ppm**	**25 ppm**
Nitrogen Dioxide (NO_2)	**0-10 ppm**	0.5 ppm	**1.0 ppm**	**3.0 ppm**
Oxygen (O_2)	**0-25%**	19.5%	**18%**	**16%**
Ammonia (NH_3)	**0-100 ppm**	25 ppm	**35 ppm**	**50 ppm**
Hydrogen Cyanide (HCn)	**0-10 ppm**	0.5 ppm	**1.0 ppm**	**3.0 ppm**
Ozone (O_3)	**0-2 ppm**	0.03 ppm	**0.05 ppm**	**0.1 ppm**
Hydrogen Chloride (HCl)	**0-10 ppm**	0.5 ppm	**1.0 ppm**	**3.0 ppm**
Chlorine Dioxide (ClO_2)	**0-1 ppm**	0.05 ppm	**0.1 ppm**	**0.3 ppm**

Specifications

Sensor input	One sensor
Sensor signal type	4-20 mA, 200 ohms
Warranty	1 year (remote electronics only); Sensor warranty varies depending on gas type - see individual toxic gas specifications sheets.
Range and alarm trip Points	See page 7 for specific gas trip levels and ranges.
Response time	Less than 8 seconds to full alarm
Accuracy (ppm @ 20°C)	0.1 percent
Resolution	0.1ppm
Operating temperature range	-15°C to 40°C (5°F to 104°F)
Operating humidity	15% to 90% (non-condensing)
Drift	Less than 2% per month
Operating pressure	900 to 1100 mBar
Digital display type	Standard, Red LED 3 digits, 0.56" high
Output signal	4-20 mA, 600 VDC (optional)
Auxiliary relay contacts	Problem - SPST Normally open (NO), 1A @ 125 VAC non-latching relay
Configurable relay	Relay 1 - SPDT, 10A @ 125 VAC Relay 2 - SPDT, 10A @ 125 VAC
Primary sensitivity	Direct PPM
Audible alarm	Pulsating piezo buzzer (90dB)
Visual alarms	Caution - yellow LED Warning - yellow LED Danger - red blinking LED Problem - green blinking LED
Local sensor	Danger alarm - red blinking LED
Power	110 or 220 VAC - 50/60 Hz @ 200 mA
Sensor distance	25' Std. (2000' max)
Enclosure	Remote unit - NEMA 4X Sensor unit - NEMA 4X

Installation

Unpacking

After unpacking, it is recommended to save the shipping carton and packing materials if the instrument must be stored or re-shipped. Inspect the equipment and packing materials for signs of shipping damage. If there is any evidence of damage, notify the transit carrier immediately.

The shipping container consists of the following:

1   FX-1500 Single Channel Toxic Gas Detector
1   Calibration Nose
1   Calibration Nose O-Ring
2   Calibration Nose Caps
1   Set of Four Mounting Feet with Four Screws
1   Instruction Manual
1   Calibration Manual

Serial Number

Should technical assistance be required, refer to the serial number to identify your system.

Installation (Mechanical)

Mechanical Installation

Sensor Location

Proper placement of the sensor is essential to the operation of the FX- 1500 Single Channel Toxic Gas Detector. Depending on its location, the FX-1500 will either sound a rapid alarm of hazardous leaks or low oxygen levels, or may delay or fail to warn of hazardous conditions.

Correct installation of the sensor depends mostly on what type of gas the detector is monitoring the air for. If the gas is heavier than air, then the sensor should be placed closer to the floor. If the gas is lighter than air, the sensor should be placed further from the floor.

- <u>Never</u> mount the FX-1500 in direct sunlight or direct light.

- <u>Do not install in very dusty or dirty areas.</u> Dust and dirt can build up on the sensing chamber, making it overly sensitive. Dirt can block openings to the sensing chamber and keep the gas detector from sensing toxic gas or low oxygen levels.

- <u>Do not install in areas of wash down.</u> The toxic gas detector should not be washed with water or mounted in areas where water is used for cleaning.

- <u>Do not install near fresh air vents, or very drafty areas.</u> Take into account ventilation air flow patterns. If installing in an outdoor area, the sensor should generally be placed downwind of the source. More than one system may be needed to efficiently protect some outdoor locations.

- <u>Do not install in insect-infested areas.</u> If insects enter a sensing chamber, they may cause a nuisance alarm. They can also block the sensing chamber and prevent toxic gas or oxygen from entering the chamber.

- <u>Outdoor areas may require more than one FX-1500 for protection.</u>

Physical Installation
Installation of the FX-1500 consists of physically mounting the remote alarm unit and sensor, and wiring in AC power, sensor connections, and output alarm contacts.

Remote Alarm Unit
Attach the four mounting feet to the rear of the remote enclosure. Anchor securely to a wall. Be sure the remote alarm unit is mounted in a location that can be seen clearly by all personnel. The remote alarm unit must be mounted outside the hazard area.

Detector Mounting
Physical installation of the gas detector simply requires mounting the detector to a wall.

Figure 3

Gas Sensor Opening

WARNING: The toxic gas detector cannot efficiently monitor the air if the sensing chamber is blocked in any way.
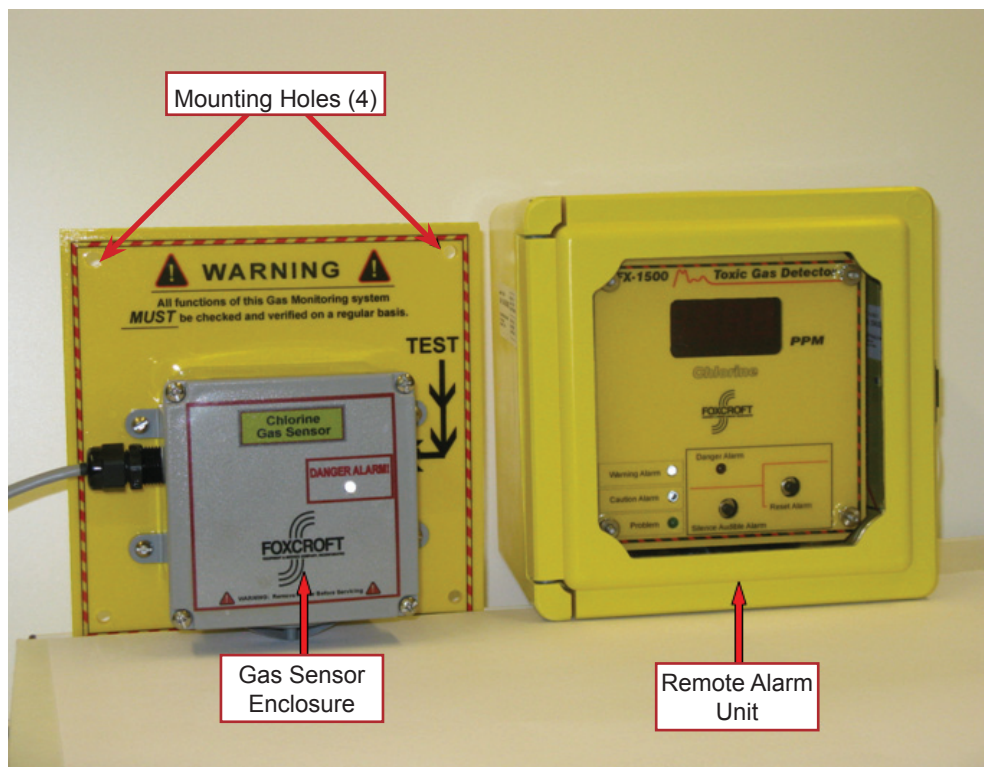
Layout

Mounting Holes (4)

Gas Sensor Enclosure

Remote Alarm Unit

Figure 4

NOTES: *It is recommended that the remote alarm be mounted outside the hazard area. Always mount the sensor chamber facing down towards the floor.*

Installation (Typical)

Typical Installation

Physical Installation

This drawing indicates recommended locations for minimum security and a higher degree of security.

The FX-1500 Single Channel Toxic Gas Detector will not sense a toxic gas leak or oxygen if the gas does not reach the sensing chamber.
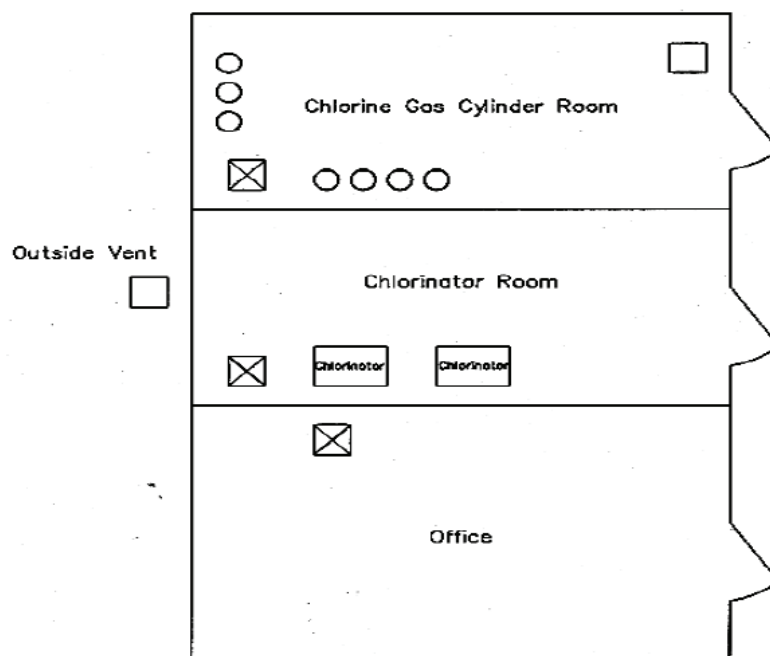
⊠ FX-1500 Toxic Gas Detector for minimum security.

☐ FX-1500 Toxic Gas Detector for more security.

Figure 5

Example: Chlorine gas <u>ONLY</u>

Figure 6

Installation (Electrical)

Wiring

The FX-1500 Single Channel Toxic Gas Detector should be wired to its own AC power source which is uninterrupted. A battery backup is recommended where AC power may be interrupted.
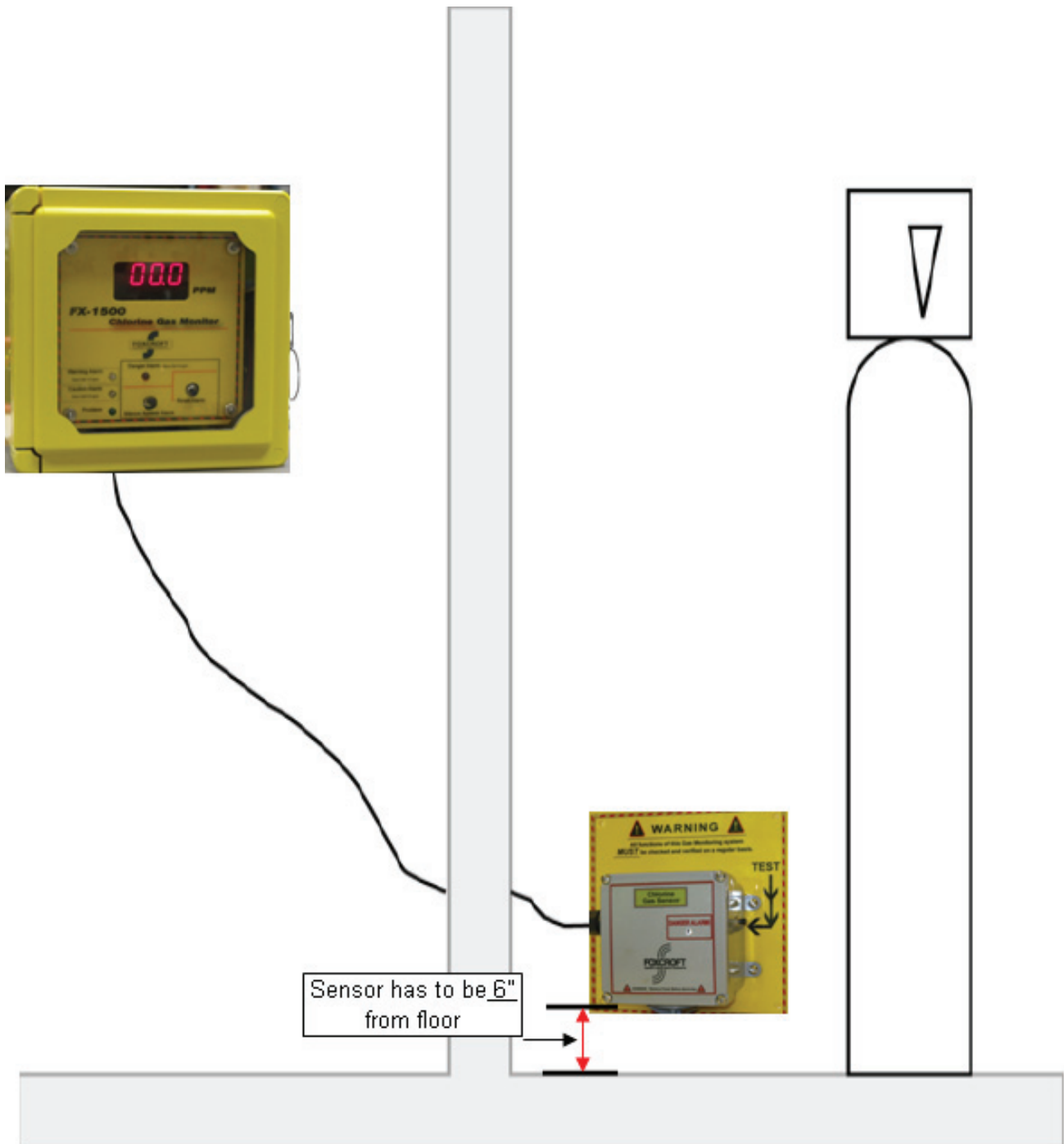
The FX-1500 will not work without AC power.

Use 14 gauge stranded wire only (maximum).

All electrical connections are made to a terminal strip located on the power supply card. The power supply card is located in the remote unit. To gain access to the terminal strip open the door and remove the yellow control panel by unscrewing 4 thumb screws. Next remove the 4 short standoffs then remove the upper amplifier card. Be careful not to pull the amplifier card out of the enclosure too far. The cards are attached together by a ribbon cable. Set the amplifier card on top of the enclosure. The ribbon cable may also be disconnected from the amplifier card. Be careful not to bend the pins on the connector. Four conduit holes are provided. The power supply is wired to the conduit hole on the far back right. The unit is equipped to operate on 110VAC or 220VAC, 50/60 Hz. The other conduit holes are provided for relay outputs. The danger relays are non-configurable. Relay 1 and Relay 2 are configurable. Factory set of these relays is Relay 1, (Caution Trip Alarm) and Relay 2, (Warning Trip Alarm). Refer to Configuration Chart on page 18.

The sensor wires come attached to the sensor input terminals. The sensor wires may be disconnected from the sensor input terminals only. Do not disconnect the sensor wires from the Sensor Unit Enclosure. The sensor cable may be shortened or installed in a conduit. It is recommended the sensor cable be installed in a metal conduit where RF noise is present. Do not splice the sensor cable because a continuous length of cable must be installed. The metal conduit must be secured to an earth ground however, do not earth ground the sensor unless instructed by the factory.

Use a 4 conductor, 22 gauge stranded wire only for sensor connections.

TB-9 AC Power input terminal is shown below. Maximum 14 gauge stranded wire only. Do not use solid wire. Always connect to an earth ground.
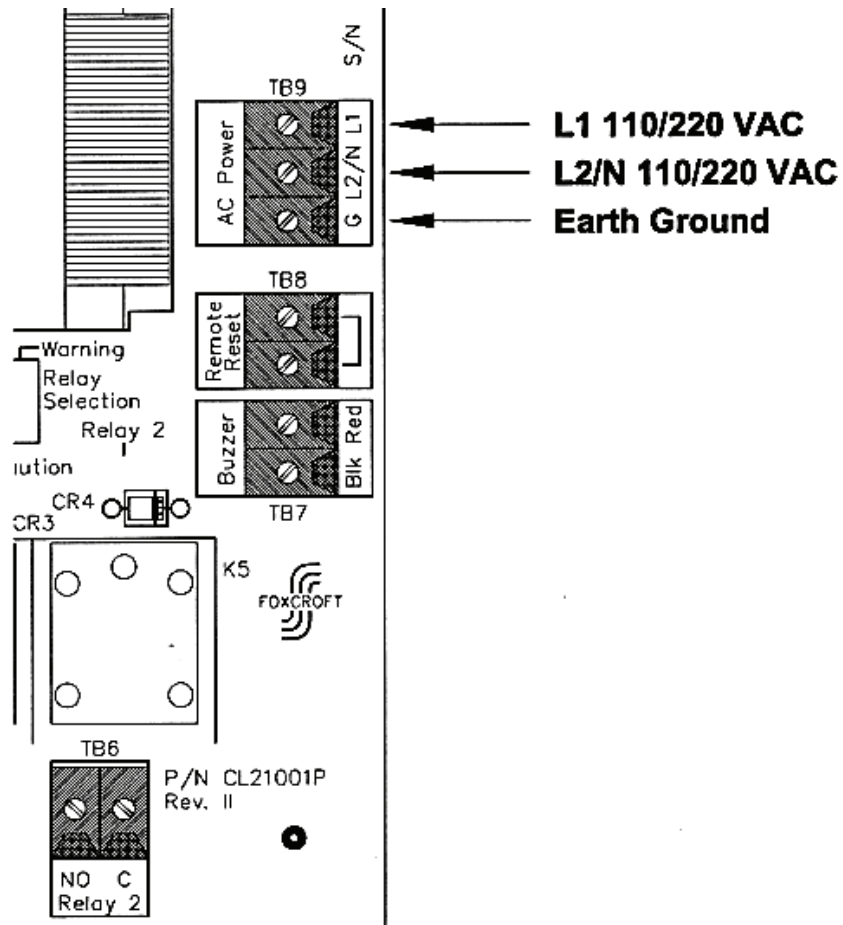
Figure 7

Remote Reset

A remote reset switch terminal (TB-8) is provided. This permits the Gas Detector to be reset from a remote location. A normally closed switch must be used. The normally closed switch is not provided and is optional. First, remove the jumper from the terminal and then attach the normally closed switch.

Only remove the jumper when connecting a remote normally closed (NC) switch.

Finally, replace the amplifier card and standoffs and secure the control panel. If the ribbon cable was removed, be very careful when reconnecting, be sure pins are lined up properly and polarity is observed.

Remote reset switch part number see page 60.

Figure 8

Alarm relay terminals shown below. Located on bottom circuit board, power supply card.
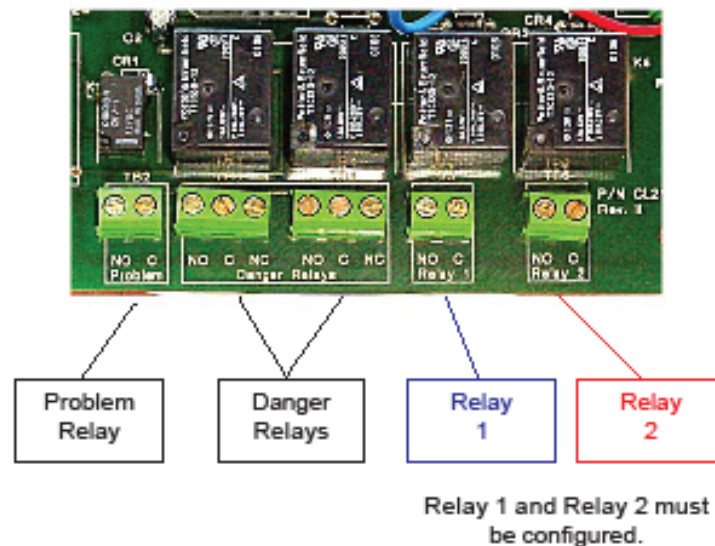
Figure 9

Danger Alarm Relays

Two (2) latching relays are provided for the Danger Trip Point. These relays have a maximum rating of 10A @ 125VAC. They are non- configurable and must be manually reset either by pressing the reset button or remotely.
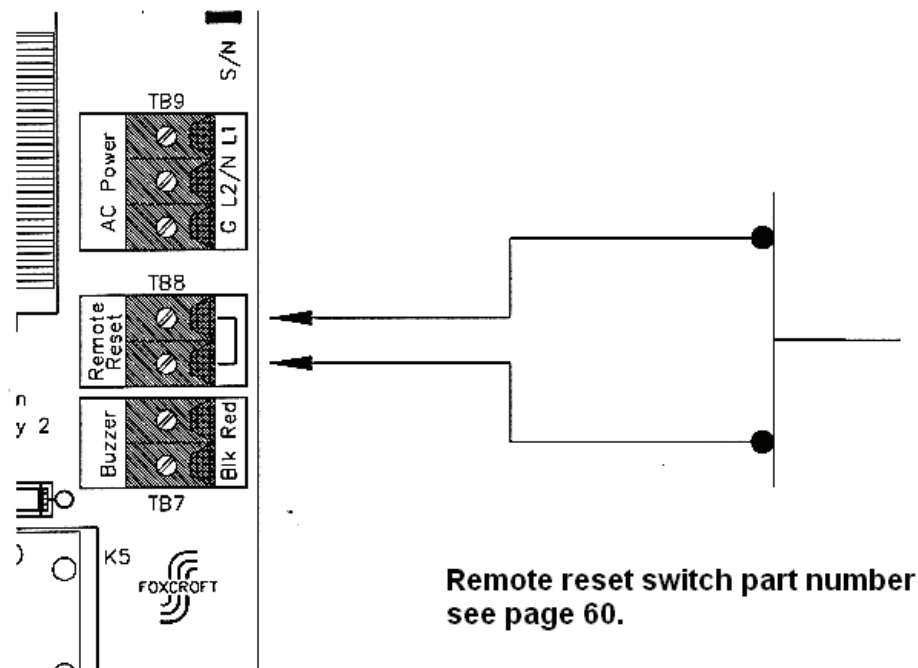
<u>Do Not Over Load Relays</u>
<u>10 amp Maximum, @ 125 VAC</u>

<u>Circuit Board Damage will occur if relays are over loaded.</u>

Auxiliary Relays

Two (2) auxiliary relays are provided, Relay 1 and Relay 2. They are both normally open (NO) with a maximum rating of 10A @ 125 VAC. DO NOT OVERLOAD RELAYS. Each relay is user configurable to one of any four combinations. To configure the relays simply move the blue relay 1 jumper and the red relay 2 jumper to the selection required.

The selections are as follows:

1.   **Danger** - 2 points provided (latching relay, this option allows two additional latching relays or 4 total danger relays. The alarm trip points for these relays are factory set. To unlatch these relays, they must be manually reset by either locally pressing the reset button or by a user remote reset button).

2.   **Danger Auto/Reset** - 2 points provided (*non-latching relay, this option allows the relay to trip at the danger alarm point. When the concentration of toxic gas falls below the alarm trip point, the relay will automatically reset*).

3.   **Warning** - 2 points provided (*non-latching relay, this option allows the relay to trip at the warning point. When the concentration of toxic gas falls below the alarm trip point, the relay will automatically reset*).

4.   **Caution** - 2 points provided (*non-latching relay, this option allows the relay to trip at the caution level. When the concentration of toxic gas falls below the trip level, the relay will automatically reset*).

Refer to page 7 for alarm trip points and gas ranges.

Auxiliary Relay Configuration Chart

Before configuring the relays, the AC power source of the FX-1500 Single Channel Toxic Gas Detector MUST be turned off. The relay configuration is located on the power supply card just above the relays themselves. To configure simply move the blue relay 1 and or the red relay 2 jumpers to any of the four selections. Be sure the plug is secured properly and the selection is what is required. After configuration is complete, the AC power may be turned back on.

Factory configuration:
Relay 1 (blue jumper) - Caution Alarm
Relay 2 (red jumper) -Warning Alarm
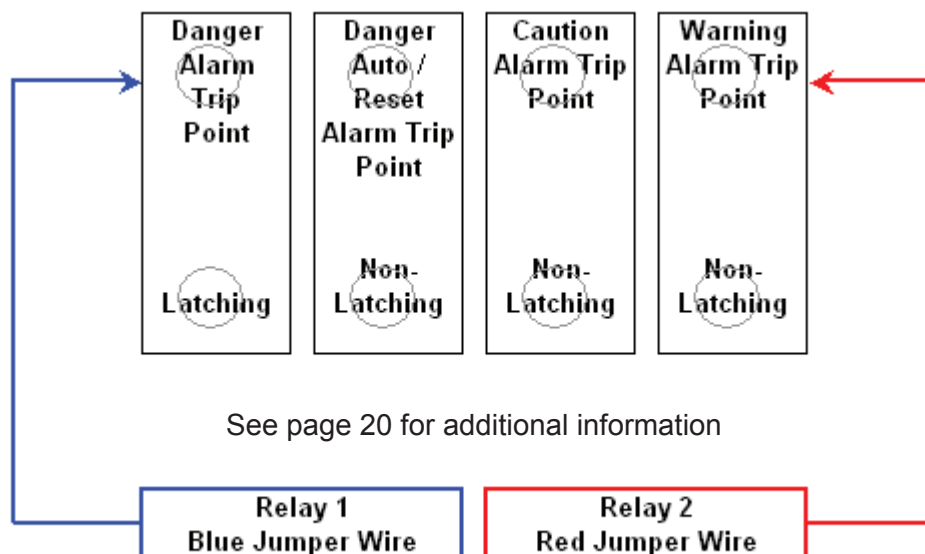
Figure 10

Below is shown the auxiliary configuration area for relay 1 and relay 2. Relay 1 blue jumper and Relay 2 red jumper. Select one configuration for each relay.

Factory relay configuration:
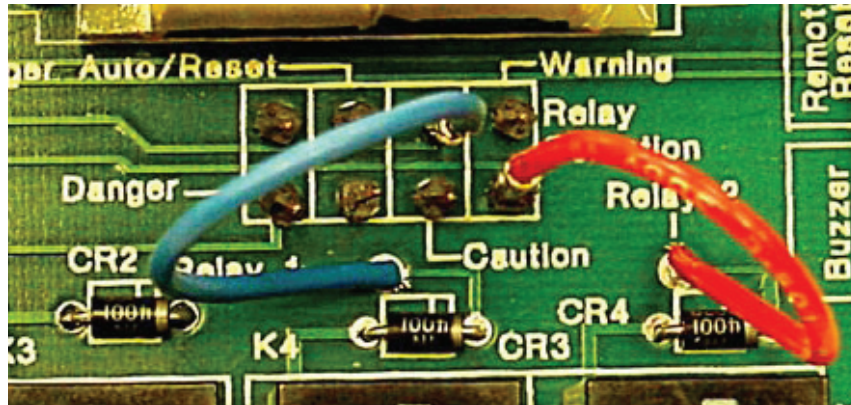
Figure 11

WARNING: Do Not Over Load Relays; 10 amp Maximum, @ 125 VAC. Circuit Board Damage will occur if relays are over loaded.

Important: *The Danger Alarm Relays associated with the "Danger Alarm" LED is normally a latching relay. When the alarm is energized, the relay will hold in until it is manually reset using the "Reset" button on the front panel. However, relay 1 and or relay 2 can be configured to a non- latching relay by selecting the auto/reset option.*

Alarm trip points are factory set and calibrated. Warranty is automatically voided if any alarm trip points are adjusted.

WARNING: Never create a toxic gas leak to test and verify the function of a toxic gas detector. A certified method of testing is recommended.

Relay Schematic
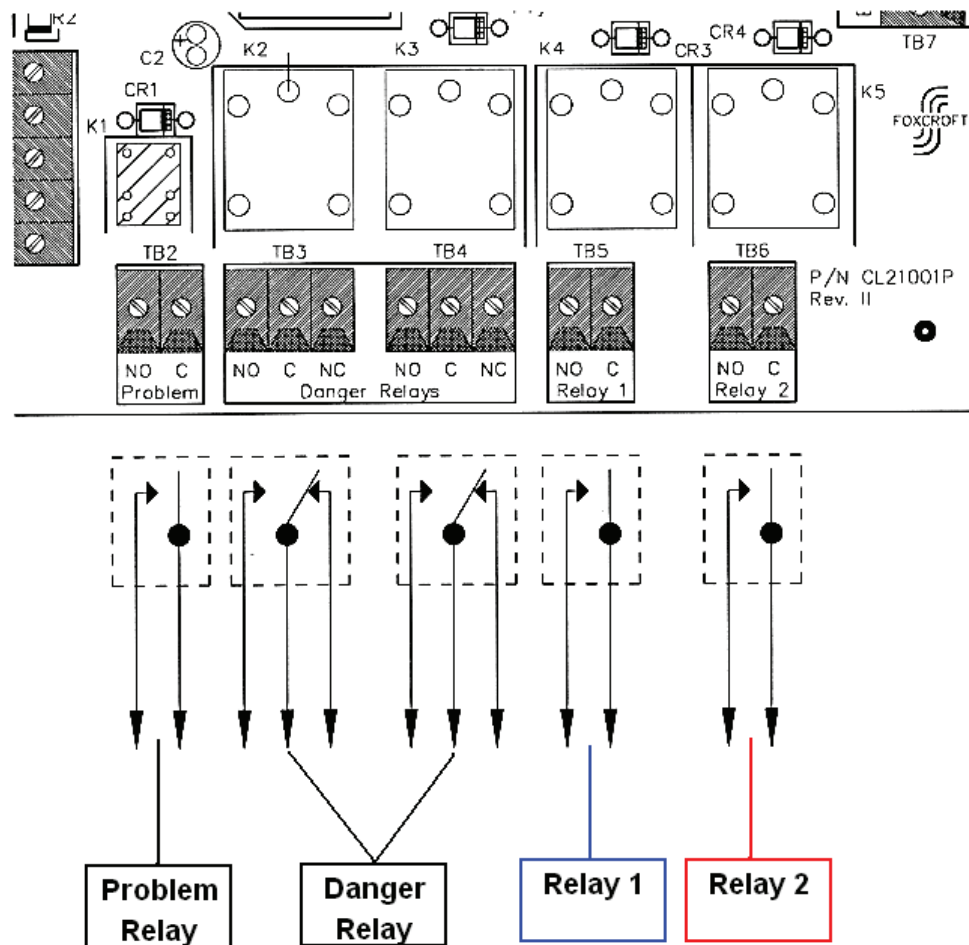
Figure 12

TB2 Problem Relay non-latching, 1 amp rating @125VAC
TB3 Danger Alarm Relay latching, 10 amp rating @ 125VAC
TB4 Danger Alarm Relay latching, 10 amp rating @ 125VAC

TB5 Relay 1 configurable, 10 amp rating @125VAC
TB6 Relay 2 configurable, 10 amp rating @125VAC

Battery Backup System

Battery Backup Terminal Block

AC Power Input   AC Power Output

See Battery Backup instruction
book for additional information and wiring

L1 110/220 VAC
L2/N 110/220 VAC
Earth Ground

Up to 5 FX-1500
Toxic Gas Detectors
per Battery Backup.

FX-1500 AC Input
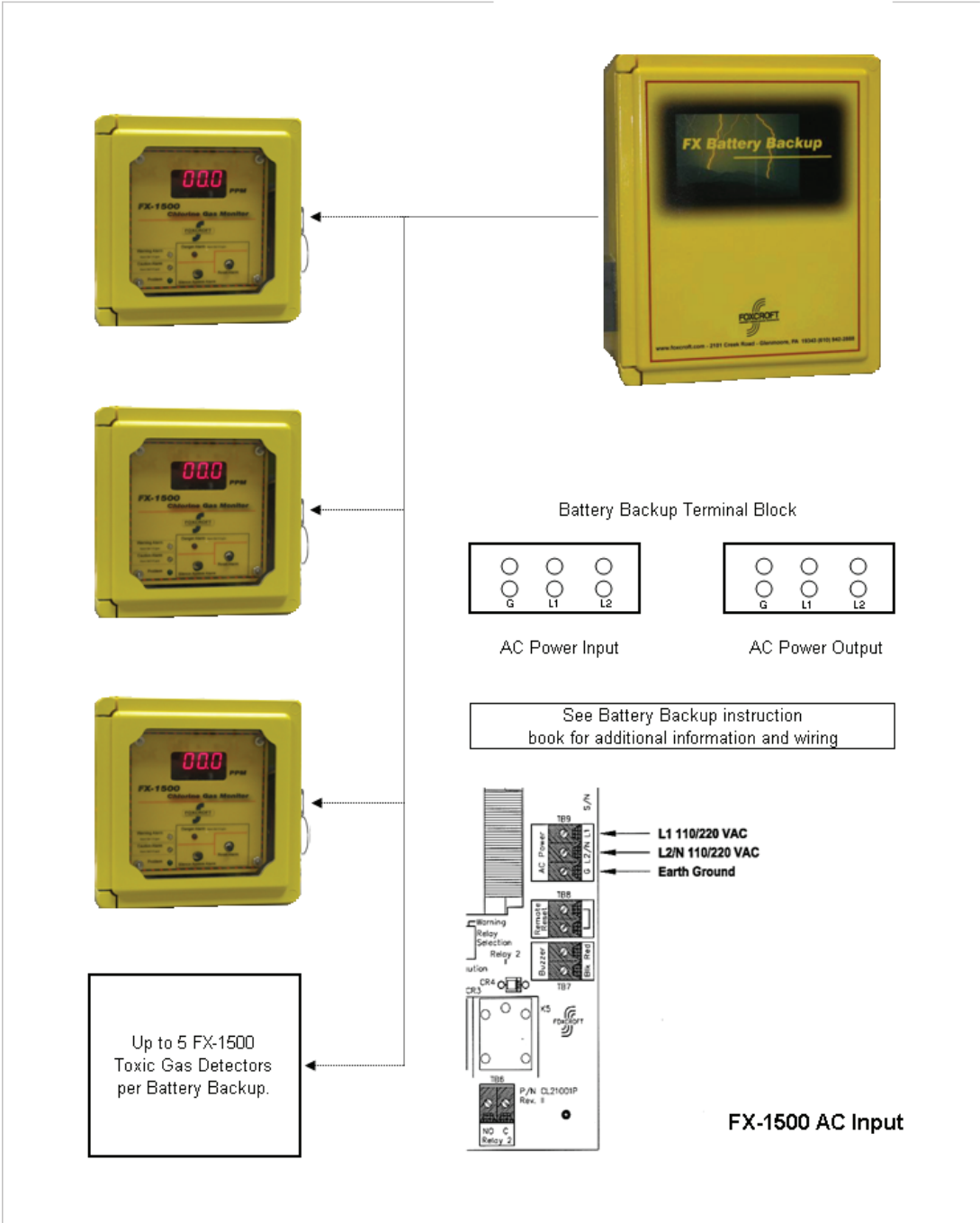
Figure 13

4-20 mA Retransmitter Card (optional)
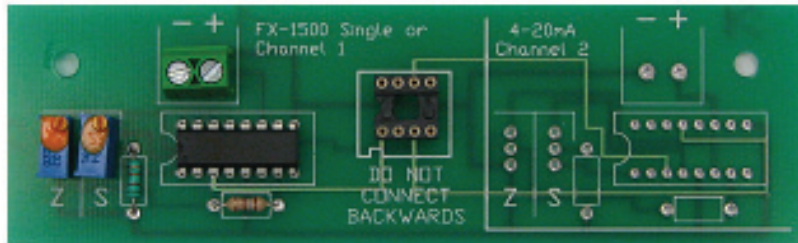
Figure 14

Important: *Be careful not to connect the ribbon cable backwards. Follow all polarity markings on cable and printed circuit board.* <u>*Damage will occur if ribbon cable is connected backwards.*</u>

WARNING: Do not connect any external device to the 4-20mA sensor signal loop. Connecting an external device will prevent the monitor from alarming.

Typical Audible Horn and Visual Lamp Wiring
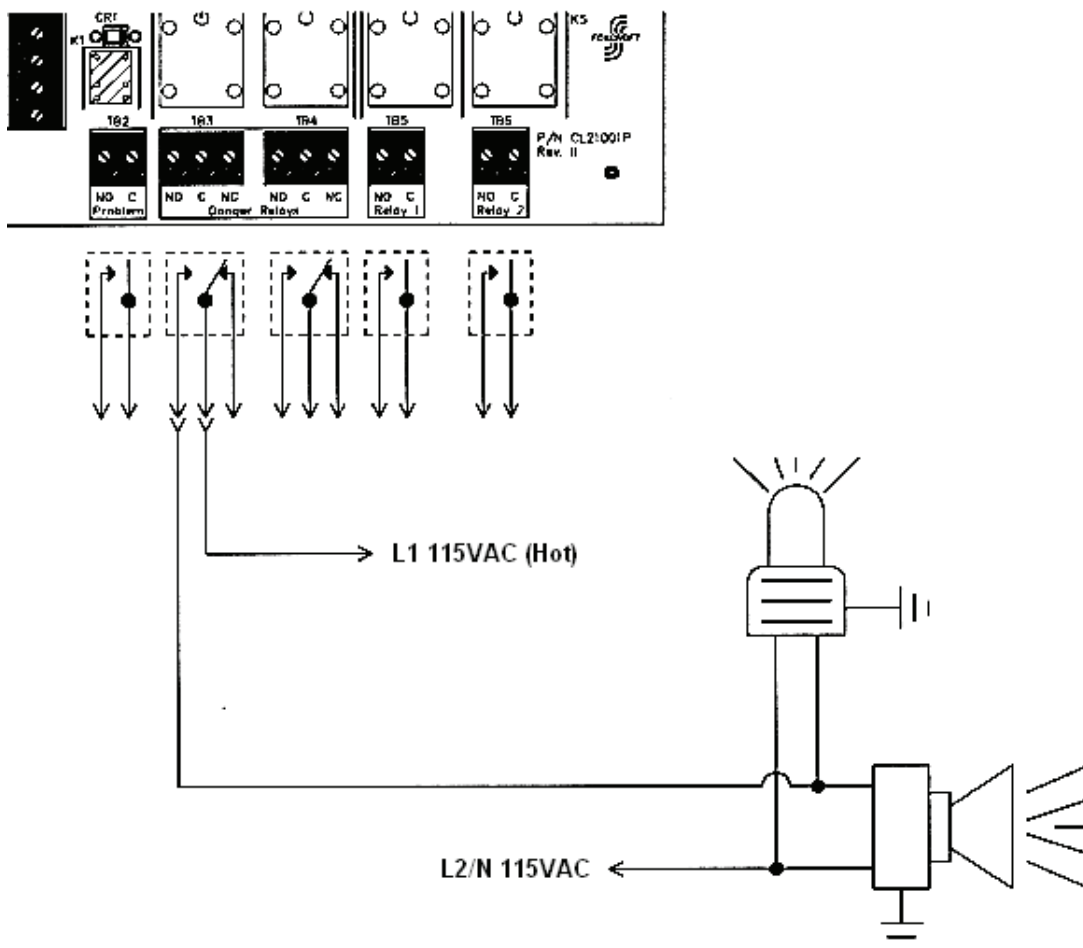
Figure 15

Typical Exhaust Fan Wiring
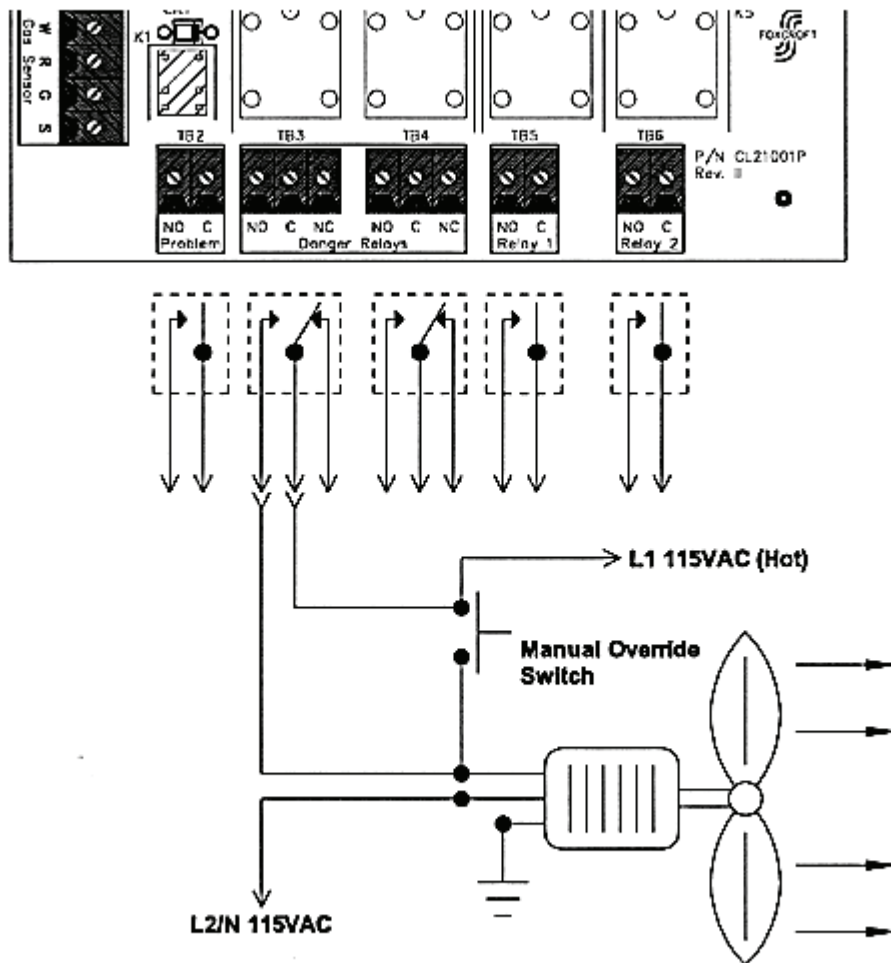
Figure 16

Do Not Over Load Relays
10 amp Maximum, @ 125 VAC

Typical Telephone Dialer Wiring
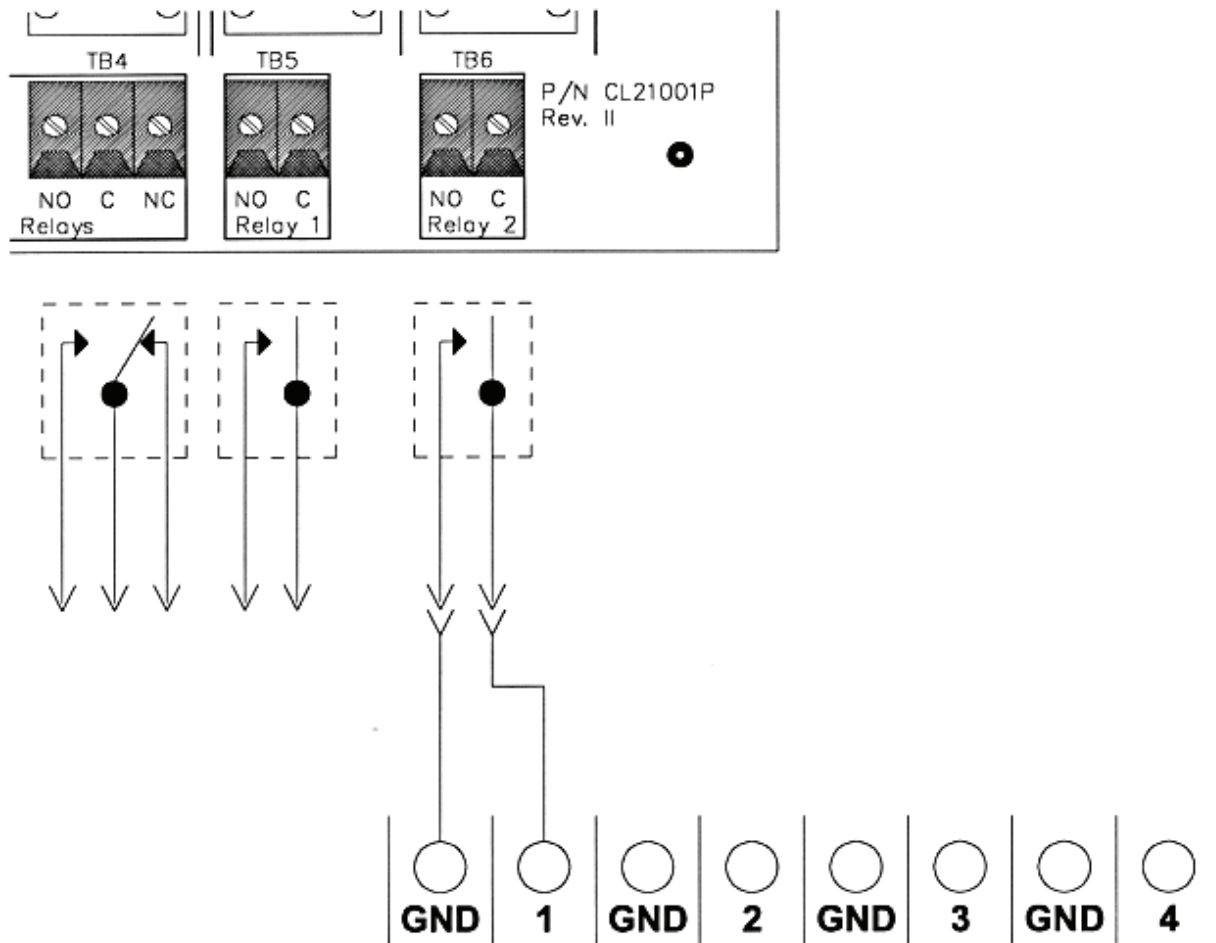
Figure 17

The drawing demonstrates a typical wiring of the FX-1104 or FX-1108 Telephone Dialing System. For more information refer to the FX- 1104 and FX-1108 manuals.

Important: *Configure Relay 2 to Auto/Reset Selection*

Installation (Internal Wiring)

Sensor Cable

Only use style number 2576 if sensor cable requires lengthening. It is recommended that whenever possible the proper length of cable be factory installed.

Standard 25 feet of cable, up to 2000 feet maximum!

Figure 18

Sensor Input Wiring
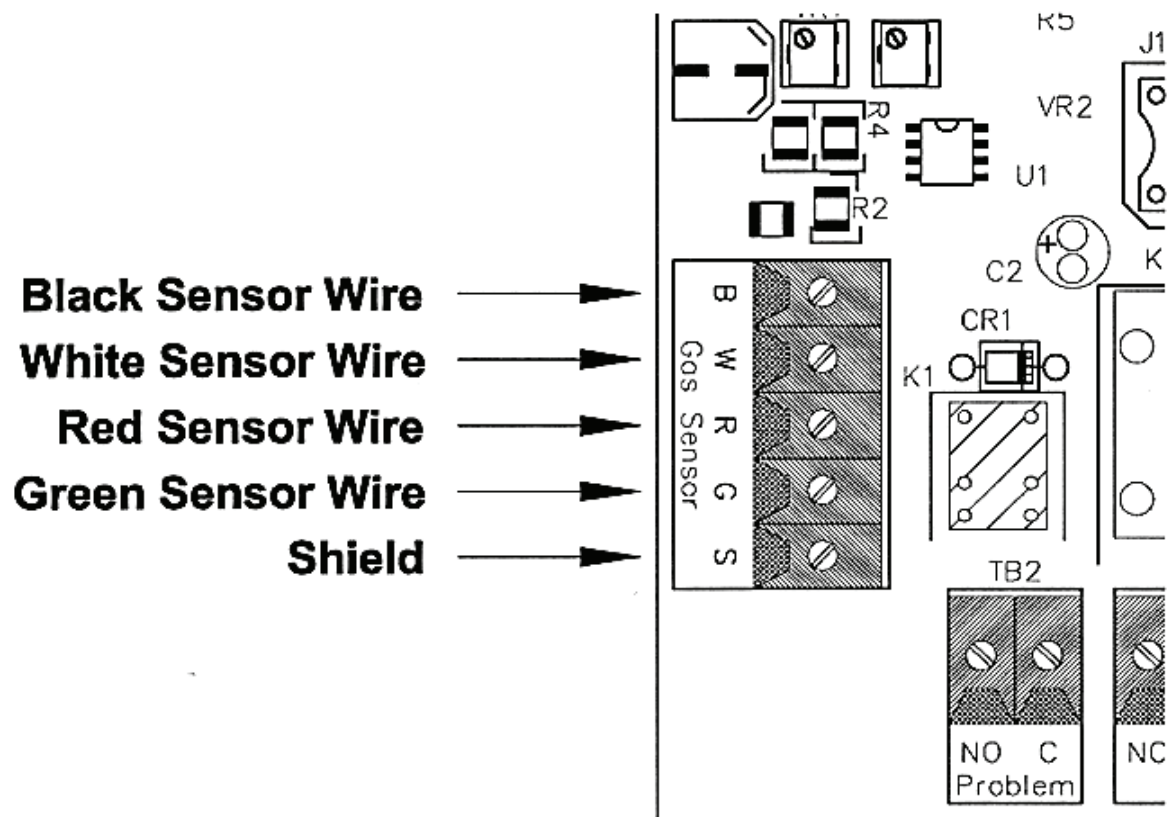
Figure 19

WARNING: Do not connect any external device to the 4-20mA sensor signal loop. Connecting an external device will prevent the monitor from alarming.

Audible Alarm
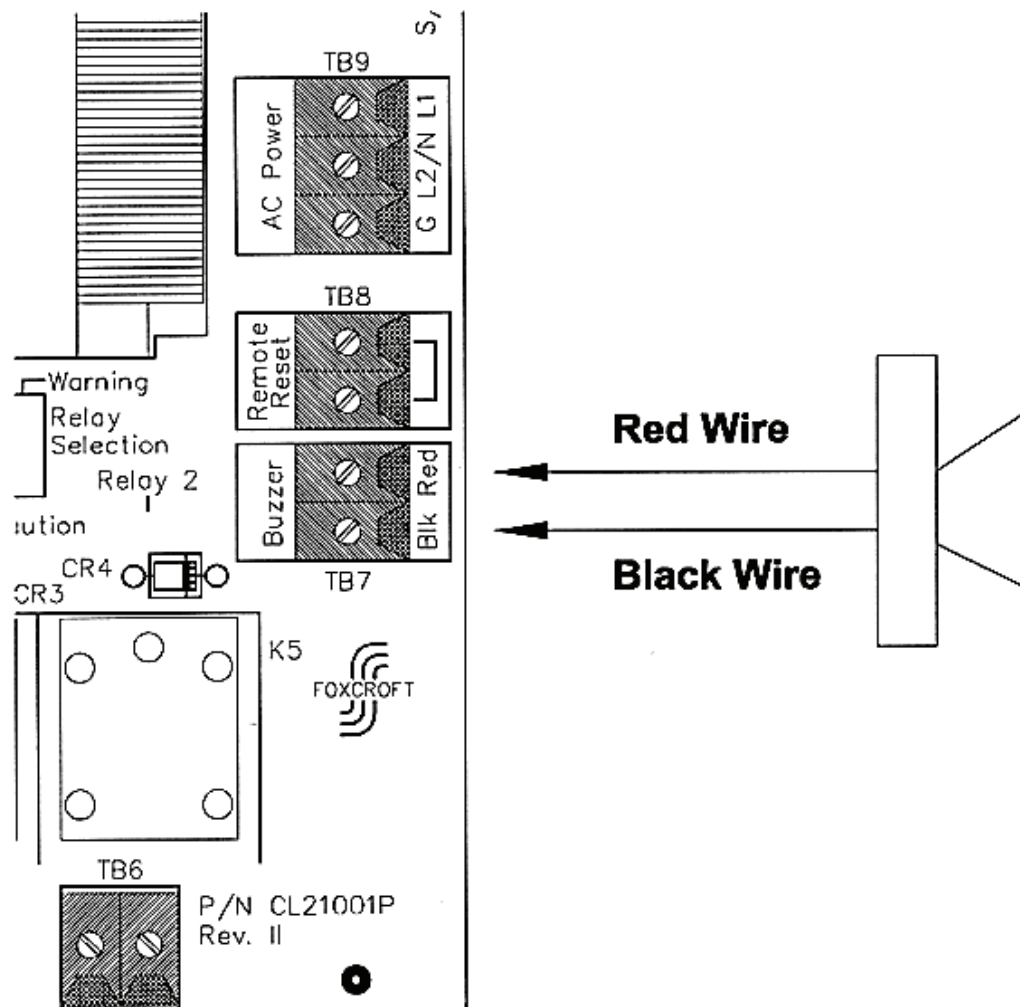
Figure 20

Never connect an audible alarm to the piezo buzzer output terminal. This connection is only for the factory piezo buzzer provided.

Control Panel

Remote Alarm Unit

1. **Digital Readout Direct PPM**
    Red LED Displays concentration of toxic gas in parts per million (ppm) or % of oxygen. Standard, 3 digits, .56" high.

2. **Caution Alarm**
   Yellow LED
    Please refer to page 7 for caution alarm trip point.

3. **Warning Alarm**
    Yellow LED
    Please refer to page 7 for warning alarm trip point.

4. **Danger Alarm**
    Red Blinking LED
    Please refer to page 7 for danger alarm trip point.

5. **Problem Alarm**
    Green Blinking LED
    Indicates a possible problem with the sensor signal. The cell failure indicating LED is not foolproof. Like all other electronic devices, it contains many parts. Any of these parts could fail at any time. Therefore, you must test your detector on a regular basis.

6. **Silence Button**
    Silences piezo buzzer. (Not Shown)
    Piezo Buzzer Audible alarm which sounds at 90 db. when toxic gas concentration reaches danger trip level.

7. **Reset Button**
    Manually resets the danger alarm.

Sensor Enclosure

8. **Toxic Gas Sensor Chamber**

9. **Remote Danger**
    Alarm Red Blinking LED
    Provides local sensor danger trip point indication. Indicating light only, no audible alarm provided with sensor enclosure.

10. **Electronic Test Button**
    Tests all electronic functions. Does not check the ability of the sensor to sense toxic gas or oxygen levels.

Electronic Test Button

Gas Sensing Chamber

Remote Danger Alarm

Figure 21

Electronic Test Button (10)

Gas Sensing Chamber (8)

Remote Danger Alarm
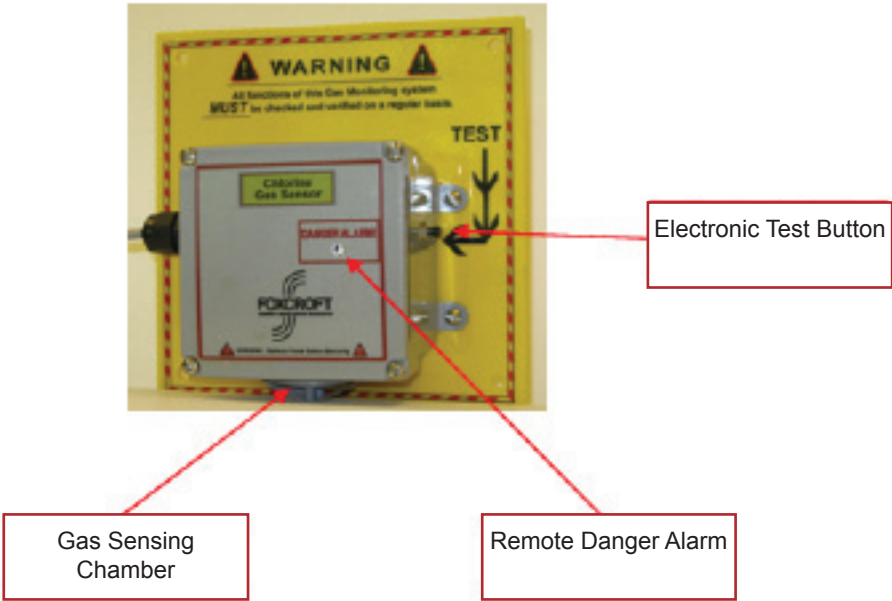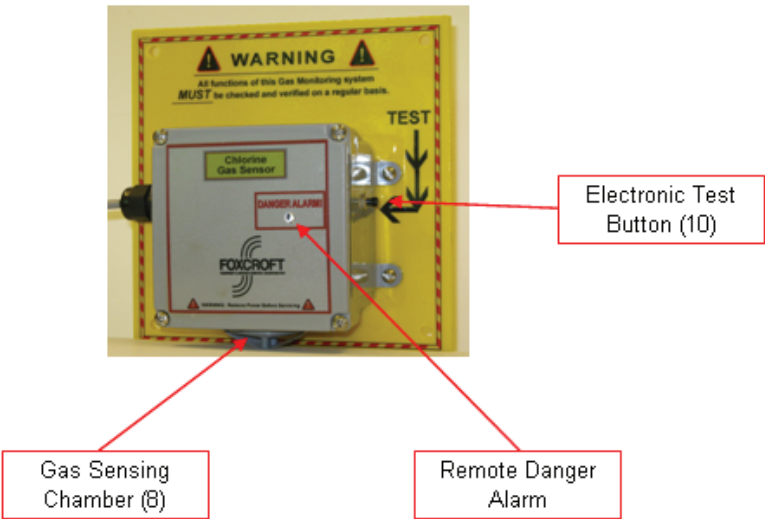
Figure 22

Startup

CAUTION: Remove the protective plug nose from the sensor cavity. This plug is clearly marked with a sticker. "Remove protective plug before operating". Store protective nose in a safe place. It will be required for verification and calibration of the sensor.

Operations

1. Apply AC power to the FX-1500 Single Channel Toxic Gas Detector.

2. The Red LED Digital Display will illuminate and may start out with a negative number. The digital display within 5 minutes should settle down and indicate 00.0 ppm.

3. The "problem" LED indicator will blink when you first apply AC power. It will go out in approximately 5 minutes.

4. The Danger Alarm may alarm during startup, press the reset button to reset alarm.

5. Wait 5 minutes for the monitor to warm up.

6. Press the "Test" button located on the sensor enclosure and hold 10 seconds.

7. All alarms should illuminate and the piezo buzzer should sound.

8. Silence the piezo buzzer by pressing the "Silence" button.

9. After 2 minutes press the "Reset" button.

10. Never operate the detector if any or all of the alarm trip points fail to illuminate the LED's or sound the piezo buzzer

11. Allow 24 hours for full sensor stabilization before placing detector into operation.

12. System is now ready for operation.

Sensor Test System

Sensor Test System

While the electronic "TEST" will only test all electronic functions, it is important that the sensor be tested periodically to ensure its gas sensitivity. A certified method is recommended.

Important: *It is very important to maintain Weekly and Monthly Test Logs. Regular testing ensures the proper operation and life of the detector.*

Frequency of testing your Toxic Gas Detector

Bump Test
The Toxic Gas Sensor is designed to be used in safety critical applications. To ensure that the sensor and/or instrument in which it is used, are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas DAILY. Failure to carry out such tests may jeopardize the safety of people and property.

Calibration Check
The Toxic Gas Sensor is designed to be used in safety critical applications. To ensure that the sensor and/or instrument in which it is used, are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas MONTHLY. Failure to carry out such tests may jeopardize the safety of people and property.

Full Calibration
The Toxic Gas Sensor is designed to be used in safety critical applications. To ensure that the sensor and/or instrument in which it is used, are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas EVERY SIX MONTHS. Failure to carry out such tests may jeopardize the safety of people and property.

Definitions

a.   Bump Test (Function Check) - A qualitative function check where a challenge gas is passed over the sensor(s) at a concentration and exposure time sufficient to activate all alarm indicators to present at least their lower alarm setting. The purpose of this check is to confirm that gas can get to the sensor(s) and that all the alarms present are functional. This is typically dependent on the response time of the sensor(s) or a minimum level of response achieved, such as 80% of gas concentration applied. Note this check is not intended to provide a measure of calibration accuracy.

b.   Calibration Check - A quantitative test utilizing a known traceable concentration of test gas to demonstrate that the sensor(s) and alarms respond to the gas within manufacturer's acceptable limits. This is typically ±10-20% of the test gas concentration applied unless otherwise specified by the manufacturer, internal company policy, or a regulatory agency.

c.   Full calibration – The adjustment of the sensor(s) response to match the desired value compared to a known traceable concentration of test gas. This should be done in accordance with the manufacturer's instructions.

Calibration

The FX-1500 Single Channel Toxic Gas Detector has been factory calibrated prior to shipment. If you wish to check its calibration, a low toxic gas standard is required. The best method for this is to use a certified calibration mixture.

It is recommended that the FX-1500 be verified by the use of a low level toxic gas standard at least once every six months.

Important: *It is very important to maintain Weekly and Monthly Test Logs. Regular testing ensures the proper operation and life of the detector.*

All functions of this gas detection system must be checked and verified on a regular basis.

WARNING: Do not attempt to calibrate any trimmers in the Remote Alarm Unit. These trimmers are factory set.

Important: *All trimmers required in the calibration procedures are in the Gas Sensor Enclosure.*

Important: *To calibrate the gas sensor a certified target calibration kit is required. The Calibration Gas Kit includes one target gas cylinder, regulator, tubing and certification sheet. A separate calibration kit is required for each type of gas you monitor.*

Tools required:

- Jeweler's Screwdrivers (full calibration only)
- Calibration nose with O-Ring and caps (Provided with all gas sensors)
- Calibration Gas Kit (pictured below)
- Digital Voltmeter (full calibration only, optional)

Figure 23

WARNING: Toxic gas sensors are supplied precalibrated, and the sensitivity of the sensor should not drift by more than 2% of full signal per month.

The full calibration procedure is not a requirement for normal operation of the FX-1500 Single Channel Toxic Gas Detector. Full calibration is only necessary when it has been determined that there is a problem with the sensor, and only after the problem has been repaired, or the sensor has been replaced. However, full gas calibration is a good safety procedure, and is recommended as such, in this instruction manual, for the gas detector. If your on-site safety procedures require a gas detector test (which they should), we recommend a short gas leak test rather than a full calibration. There are two reasons for this:

1.   The gas sensor is designed for ambient air conditions, and can eventually be "poisoned" by repeated overexposure to the test and target gases. This is usually noted as a gradual elevation in the zero reading over time and exposure to the test and target gases.

2.   If the calibration is done improperly, or with old test gas (it has a shelf life listed on the cylinder), it could seriously impair the sensitivity and function of the gas detector.

WARNING: Target calibration gas contains toxic gas and should only be used by personnel who are fully trained in gas calibration procedures. All safety procedures and warnings on the gas cylinder should be read, understood, and observed.
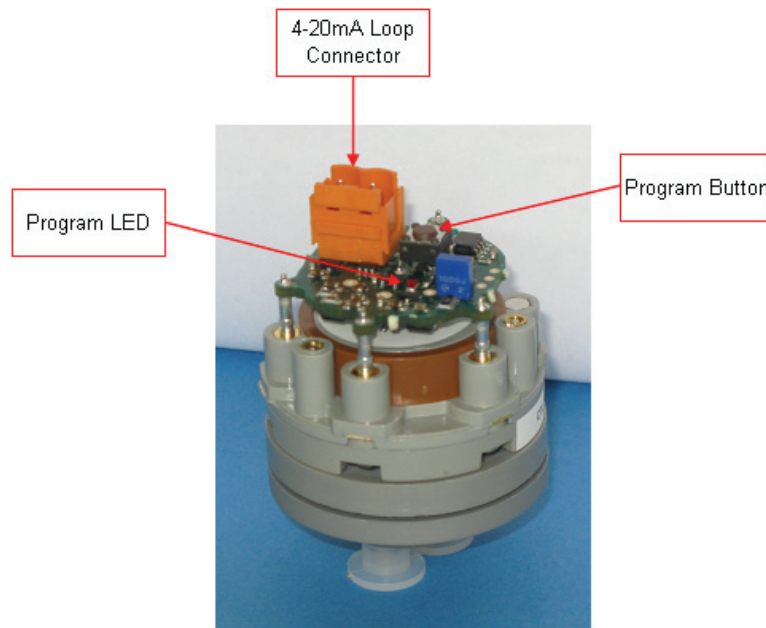
Figure 24

Short Gas Leak Test

Important: *This test is not a calibration; it is only to test the gas sensor response to a gas leak. Short gas leak tests can only be done with a known target concentration gas.*

It is **very important** *that this test sets off all the alarms and the target concentration gas level is displayed on the LED display.*

Full calibration is required if the test fails to set off alarms and the target concentration gas level is not displayed on the LED display.

1.   The Remote alarm unit must be at zero on the LED display.

2.   Install the calibration nose in the collar plug; be sure the nose is sealed properly and is isolated from the atmosphere.

3.   Connect the target calibration gas sample tubing to the nose.

4.   Apply target calibration gas with a known concentration.

5.   Wait for a stable reading to be obtained (five minutes is a suitable period).

6.   The known target gas concentration level should be indicated on the LED display and all the alarms should be set off including the buzzer.

7.   If the target calibration gas level is indicated on the LED display and the alarms are set off including the buzzer, the test is complete. Remove calibration nose, LED display should zero in a few minutes. Reset danger alarm.

8.   If the target calibration gas level is not indicated on the LED display and or fails to set off all alarms a full calibration is required.

Full Sensor Calibration
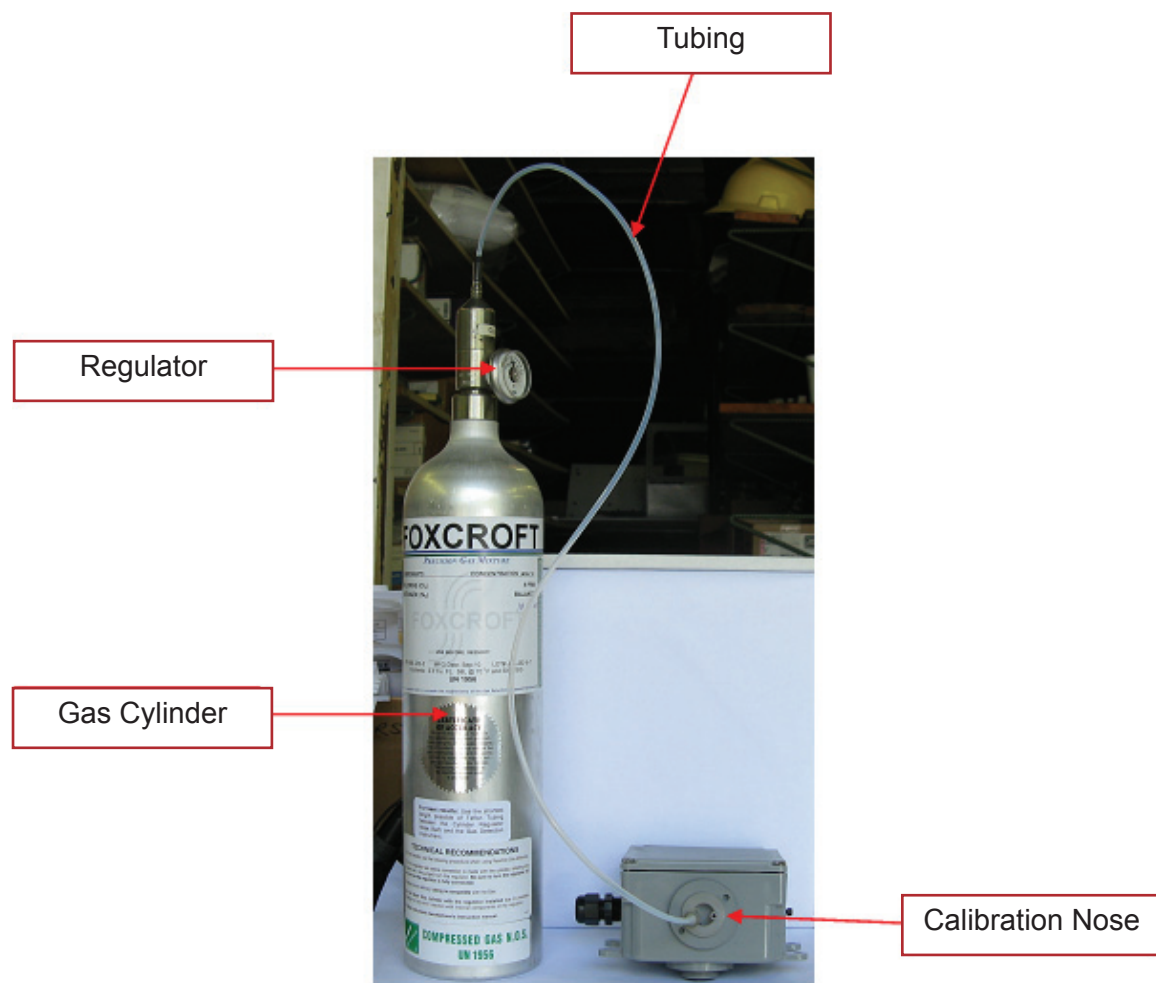
Each sensor is supplied precalibrated, and the sensitivity of the sensor should not drift by more then 2% of full signal per month. The oxygen sensor has a single trimmer for span adjustment (see page 37) and has a separate calibration routine.

Important: *Full sensor calibration is only as accurate as the digital millivolt meter being used (or the FX-1500 Single Channel Toxic Gas Detector LED display), and the freshness of the target gas being used. So it is important to use an accurate digital meter and a fresh target gas cylinder. The FX-1500 remote alarm unit already has a factory precalibration and calibration should not be required. If you have reason to believe that the display or alarm level calibration of the FX-1500 remote alarm unit is off, we recommend that you contact Foxcroft, to arrange an "RMA", to return the entire unit with the sensor, for a complete calibration. Foxcroft maintains a serial numbered calibration database for all of our gas detectors. Foxcroft does not recommend electronic calibration of the remote unit in the field.*

1.   The gas sensor enclosure mounting system allows easy zeroing and aspiration using the calibration nose provided (see page 43). With the plug in place and sealing caps fitted, the sensor is completely isolated from the atmosphere. Removing the cap seals allows the calibration target gas to be connected to one of the inlets and exhausted through the other. A flow of 500 milliliter/minute is recommended.

2.   Ensure the sensor is free from the target gas being measured either by purging the sensor with an inert gas, or blanking the sensor from the atmosphere with the calibration nose supplied.

3.   Apply a target calibration gas of a known concentration to the sensor.

4.   Wait for a stable reading to be obtained (five minutes is a suitable period of time).

Important: *It is very important to maintain weekly and monthly test logs (see pages 45-47). Regular testing ensures the proper operation and life of the detector.*

Oxygen Sensors

Calibration should be carried out in ambient air, and is done simply by adjusting the span potentiometer until a reading of 20.9% on a scale of 0-25% is displayed on the LED display.
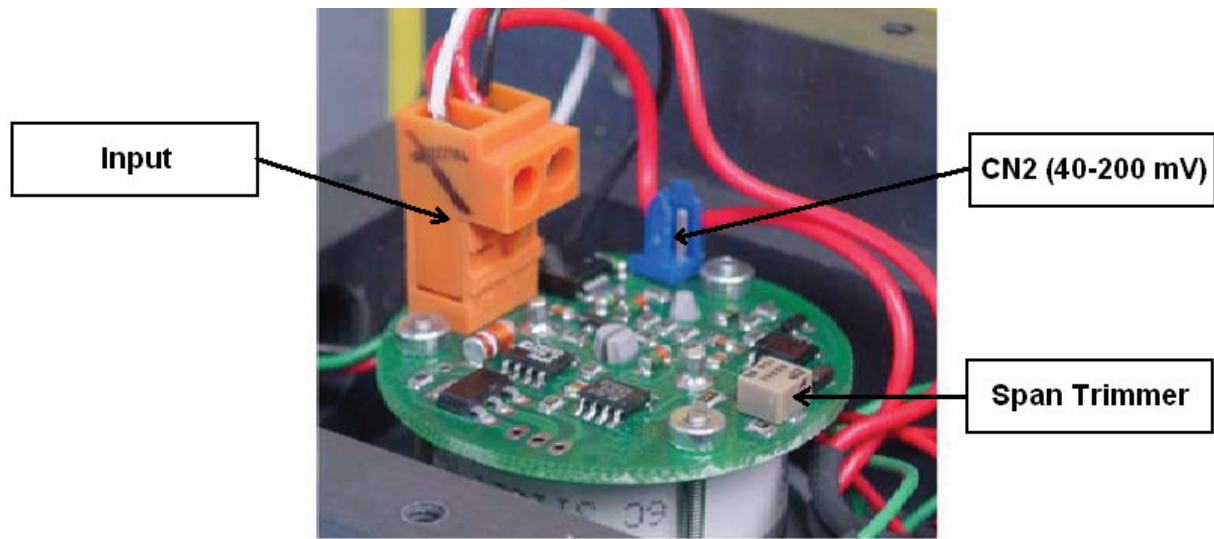
Figure 25

FX Easy Calibration

Performance Characteristics (Chlorine only)

Sensor Type Used	3CLH
Expected Operating Life	Two years in air
Resolution	0.1ppm
Temperature Range	-20°C to +50°C
Pressure Range	Atmospheric +/- 10%
Pressure Coefficient	No data
T$_{90}$ Response Time	≤ 60 seconds
Relative Humidity Range	15-90% non-condensing
Maximum Zero Shift (20°C - 40°C)	-0.2ppm equivalent
Long Term Output Drift	< 2% signal loss/year
Repeatability	2% of signal
Output Linearity	Linear

N.B. All performance data is based on conditions at 20C, 50%RH and 1013mBAr.

Electrical Properties (Chlorine only)

Minimum Input Span	5uA
Maximum Input Span	+/-100uA
Linearity @ 25°C	0.01% Full Scale
Thermal Drift (Input)	0.02% per °C
Linearisation	Linear Response
Output	4-20mA, 2 wire loop powered
Maximum Output Range	3.8 to 21mA
Operating Voltage	10 to 30VDC
Thermal Drift (Output)	2uA per °C
Output Accuracy	+/- 5uA
Protection	Reverse Polarity Protected
Maximum Loop Load	$R_{LOAD} = (V_{supply}-10)*50$ e.g. 700Ω at 24V

Physical Characteristics (Chlorine only)

Weight	58g (including mounting accessory)
Position Sensitivity	None
Storage Life	Six months in CTL Container
Recommended Storage Temperature	0-20°C
Linearisation	Linear Response
Warranty Period	12 months from date of despatch

Calibration Notes

Recalibration is only possible if the output of the sensor at full scale is greater than 50% of the original factory calibration. Failure can occur if:

1.   Attempts to recalibrate to a range less than 50% of the original factory calibrated range
2.   The output of the sensor has fallen by more than 50% (replace sensor)
3.   Incorrect span gas used (use correct span gas)
4.   Insufficient time for output to settle after exposing sensor to span gas (apply span gas for 2-5 mins before setting 20mA level)

Transmitter Error Condition

Any time the error condition is set the output will be forced to 21mA and the LED will be held on. Carry out the Reset function to reset the error.

Reset to Factory Calibration

1.   Remove loop power from transmitter.
2.   Hold down push button and connect loop power to transmitter.
3.   LED will blink as soon as power is applied (approx. 2Hz).
4.   Transmitter output set to 21mA.
5.   Releasing button will start an 8 second timout period.
6.   After 8 seconds the factory calibration will overwrite user calibration.
7.   LED cleares and transmitter goes back into normal mode.

User Calibration Method
(Span gas = 20mA signal)

1.   Connect loop power to the transmitter.
2.   Apply required zero gas/air to transmitter for 2 minutes.
3.   Hold down button until LED flashes at approx. 1Hz. (4mA level now set)
4.   Apply required span gas to transmitter for 2 to 5 minutes.
5.   Press and release button (20mA level now set)
6.   There will be an 8-second timeout period and flashing LED approx. 8Hz.
7.   Calibration is complete, LED clears and returns to normal mode.

Non Standard Span Gas Calibration (Span gas ±5% full range)

1.   Calculate the mA signal expected for span gas.

Example:

1. Required 4-20mA range is 0-500ppm	5. Expected signal at 480ppm = (15.36mA + 4mA) = 19.36mA
2. Available span gas is 480ppm	6. Each time button is pressed signal increases by 40uA. When the output reaches 20.8mA the next button press will take the output to 19.2mA. Further button presses will again increase the output by 40uA.
3. Dynamic range is 16mA	
4. Therefore 1mA = 31.25ppm	7. The output range available is 19.2mA to 20.8mA.

2.   Carry out steps 1-4 of User Calibration Method

3.   Press and release button to set 20mA level.

4.   Continued momentary pressing of the button within an eight second period will trim the output by 40uA. When the required output is reached, allow the transmitter to timeout.

5.   Calibration is complete, LED clears and returns to normal mode.

Non Standard Span Gas Calibration (Span gas not within ±5% of full range; current source required)

1.   Measure the current of the sensor with a known gas concentration. This can then be used to calculate the µA/ppm for the specific sensor.

2.   Now calculate the expected current when the sensor is exposed to the full scale of target gas.

Example:

1. Required 4-20mA range is 0-500ppm	4. Therefore sensitivity = 0.11 uA/ppm
2. Available span gas is 300ppm	5. Expected sensor output at 500ppm = 55uA
3. Current from sensor when exposed to span gas = 33uA	

3.   Connect current loop power to the transmitter.

4.   Connect a current source to the transmitter. For oxidizing sensors (CO, H_2S, SO_2, NO, ...) connect the negative to 'SEN' and positive to 'CNT'. For reducing sensors (Cl_2 or NO_2) connect the positive to 'SEN' and negative to 'CNT'. 'CNT' and 'REF' terminals on the transmitter board should be connected.

5.   Set the current source to zero.

6.   Hold down button until LED flashes at approx. 1Hz.

        (4mA level now set in RAM)

7.   Set the current source to the value calculated for the full scale of target gas.

8.   Press and release button

        (20mA level now set into RAM)

9.   There will be an 8-second timeout period and flashing LED approx. 8Hz.

10.   Calibration is complete, LED clears and returns to normal mode.
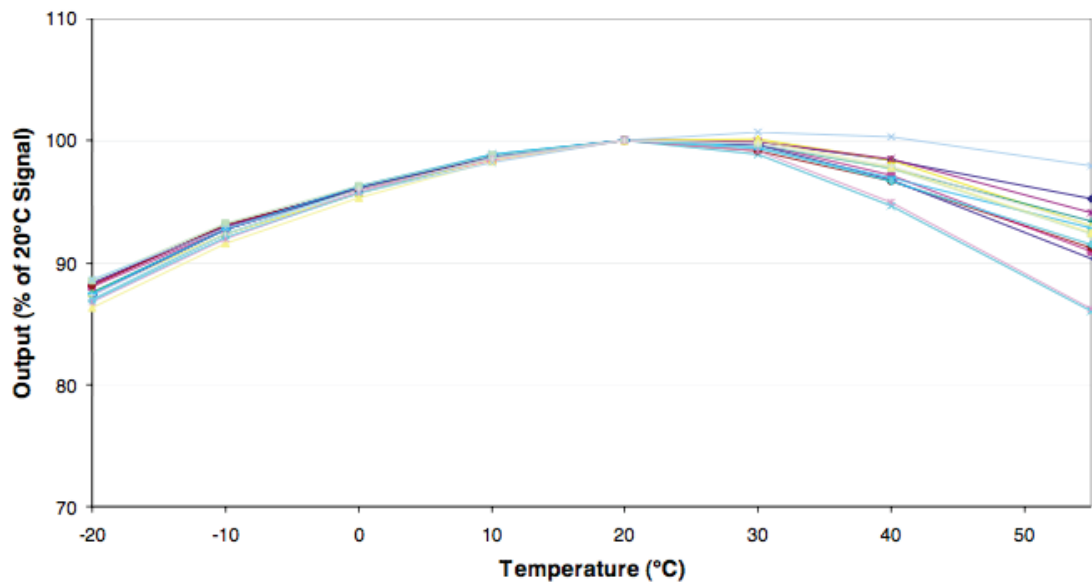
Chlorine - Output vs Temperature

Figure 26

Gas Sensor Replacement

WARNING: Even the ability of the gas sensor to sense toxic gas or low oxygen levels must be verified on a regular basis. It is recommended that the gas sensor be tested by means of a certified gas standard at least every six months.

WARNING: All functions of this FX-1500 Gas Detector must be checked and verified on a regular basis.

Gas sensor replacement in the FX-1500 Single Channel Toxic Gas Detector is easily done with minimal tools.

Tools required:
- Small Jeweler's Screwdriver
- General Small Screwdriver
- Needlenose Pliers

1. Disconnect the AC power from the detector.

2. Remove the sensor enclosure cover by removing (4) screws.

3. Remove the front cover of the sensor enclosure.

4. Carefully pull off the orange wire connector.

5. Unscrew the bulk head nut (see page 43 for diagram). Place the tips of a pair of needlenose pliers in the two holes of the sensor bulk head nut. Turn the ring counterclockwise to loosen the ring, and remove the entire sensor from the enclosure.

6. The transmitter PC board is mounted to the sensor with disconnect pins. Hold the PC board by the edges and carefully pull the board off of the sensor. Some very early sensors, pre- "1994," had the PC board soldered directly to the sensor. This type is not removable. If you have this type, stop here. Do not attempt to solder the new sensor to the transmitter board. The heat from the soldering process will damage the new sensor. You will need to replace the entire sensor/ transmitter assembly. All new sensors have removable boards, so future sensor replacements will not be hindered by the additional cost of the transmitter board.

9. Remove the shorting wire from the gold pins on the new sensor, and carefully line up the 3 gold pins on the new sensor with the 3 sockets on the bottom of the transmitter board. Press evenly on the board until it fully seats on the gold pins.

10. Installation of the completed sensor/transmitter assembly is the reverse of its removal.

11. After completing the sensor replacement procedure, power-up the gas detector and allow it to stabilize for 20 minutes (some sensor gas types take up to 24 hours to stabilize). The LED display, should show 0.0 ppm +/-0.1 ppm. If the display is off by more than 0.2 ppm, or the cell failure/problem light is blinking, the sensor requires a full sensor calibration.

12. Refer to page 35 and follow the short gas leak test.

Cap Seals | Calibration Nose Plug O-ring | Bulkhead Nut | Collar Plug O-ring | TFE Mesh Membrane | O-ring | Gas Sensor | Transmitter

Figure 27

Disconnect Pins | Program Button | Program LED

4-20mA Loop Connector | Transmitter Board

Inner O-Ring | Toxic Gas Sensor

Membrane | Collar

Mounting Screw | Outer O-Ring

Bulkhead Nut | Enclosure Wall

Calibration Nose | Calibration O-Ring

Cap Seals

Figure 28

43
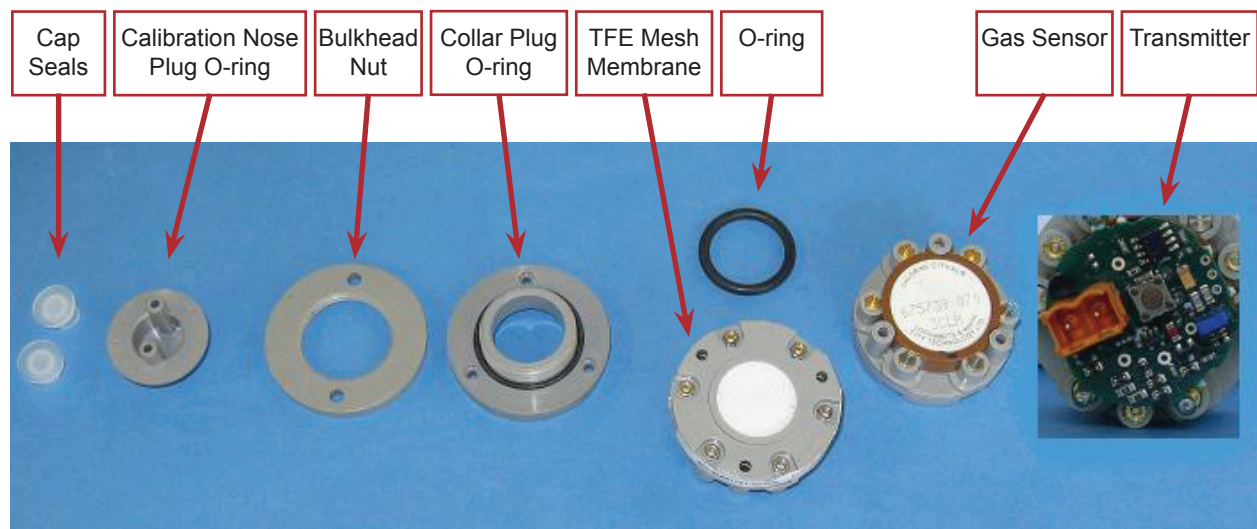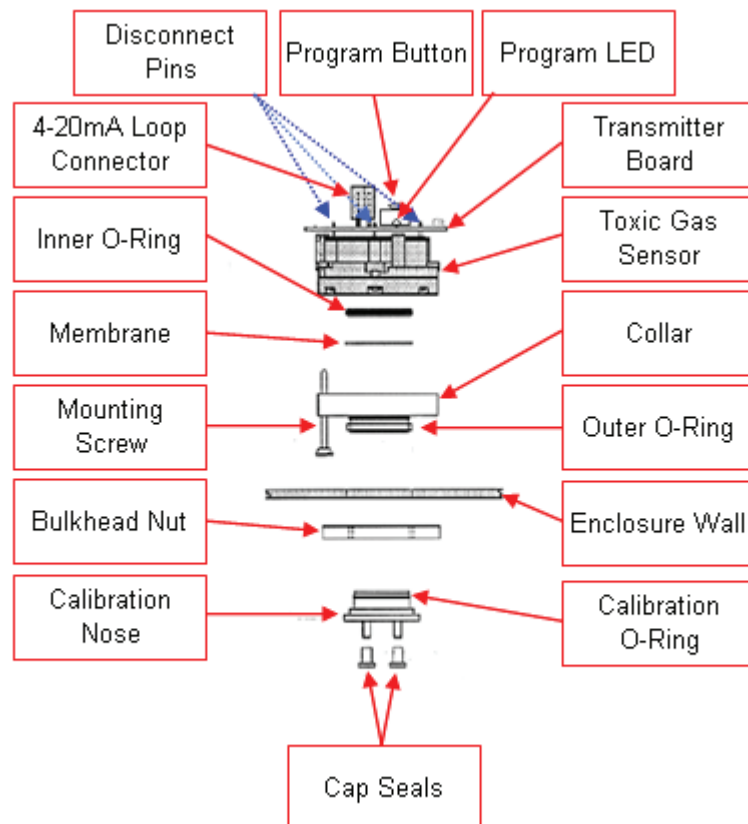
Parts Listing

Electronics

Item Number	Description	Part Number
1	Gas Sensor Only	Specify gas type
2	Gas Sensor Transmitter Only	Specify gas type
3	Gas Sensor with Transmitter	Specify gas type
4	Amplifier Card	FX-CL21001A
5	Power Supply Card	FX-CL21001P
6	Ribbon Cable	FX-9431323-07
7	Sensor Cable (25' standard)	FX-2W979-25
8	Sensor Cable (specify length)	FX-2W979
9	4-20mA Retransmitter Kit	4-20 MA XMT
10	Normally Closed Switch Kit	FX-2751548

Calibration Gas Kits

Remote Alarm

Telephone Dialing Systems

Figures 29-31

Monthly Sensor Test Log

Date	Initials	Date	Initials
Month of		Month of	
Month of		Month of	
Month of		Month of	
Month of		Month of	
Month of		Month of	
Month of		Month of	
Month of		Month of	
Month of		Month of	

Weekly Electronic Test Log

Date	Initials	Date	Initials
Week of		Week of	
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Week of		Week of	
Week of		Week of	
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Weekly Electronic Test Log

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Service

System Repair

Customer Service Department

If you need spare parts, assistance in troubleshooting, or repair service, please contact Foxcroft Customer Service at:

> **Foxcroft Equipment and Service, Co. Inc.**
> **2101 Creek Road, P.O. Box 39**
> **Glenmoore, PA 19343**
>
> **Tel:** (800) 874-0590
> (610) 942-2888
> **Fax:** (610) 942-2769
> **Email:** service@foxcroft.com
> **www.foxcroft.com**

Customer Repair / Returns Policy

All systems returned for repair or replacement must be freight prepaid and include the following information:

1. A clearly written description of the malfunction.

2. Name of person to contact and the phone number where they can be reached.

3. Proper return address for shipping system back. Include preferred shipping method.

4. A purchase order if the system is out of warranty to cover costs of repair.

5. A Return Material Authorization Number (RMA) is required before shipping any products for service. Call telephone number above to receive a RMA number.

NOTE: *Returns will only be held at Foxcroft for 90 days. If a decision is not made regarding the repair, the product will be returned.*

Product Warranty

Foxcroft Equipment & Service warrants all products obtained hereunder to be free from defects in material and workmanship for a period of one year from the date of shipment. In the event of a product failure or defect requiring warranty repair, the customer must obtain an RMA number by calling 1-800-874-0590, before returning the product, at the customer's expense to Foxcroft for repair. Warrantor (Foxcroft Equipment and Service) will repair the unit, without charges for parts, labor and return freight.

Foxcroft Equipment & Service is not responsible for damage to its products through improper installation, maintenance, act of God, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or for any unauthorized repair.

Buyer agrees to hold Foxcroft Equipment & Service harmless from all claims for damages arising out of injury or death to any person or damage to any facility, or any other property, or loss of use of any such property, whether such person or property is on or off the installation or activity site for which the equipment or material furnished hereunder is destined and whether such damage, loss destruction or loss of use, injury or death results directly or indirectly from a nuclear incident or for any other cause.

Statements and instructions set forth herein are based upon the best information and practices known to Foxcroft Equipment & Service but it should be assumed that every acceptable safety procedure is contained herein. Of necessity this company cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

Serial Number Label of FX-1500 Single Channel Toxic Gas Detector:

Foxcroft Equipment and Service, Co. Inc.
2101 Creek Road, P.O. Box 39
Glenmoore, PA 19343

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**   (610) 942-2888**
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www.foxcroft.com