

Model GD-K77D Operator's Manual

Part Number: 71-0046RK

Revision: B

Released: 3/1/11

WARNING

Read and understand this instruction manual before operating detector. Improper use of the detector could result in bodily harm or death.

Periodic calibration and maintenance of the detector is essential for proper operation and correct readings. Please calibrate and maintain this detector regularly! Frequency of calibration depends upon the type of use you have and the sensor types. Typical calibration frequencies for most applications are between 3 and 6 months, but can be required more often or less often based on your usage.

Warranty

RKI Instruments, Inc. warrants gas alarm equipment sold by us to be free from defects in materials and workmanship, and performance for a period of one year from date of shipment from RKI Instruments, Inc. Any parts found defective within that period will be repaired or replaced, at our option, free of charge. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired, or replaced on a routine basis. Examples of such items are:

Absorbent cartridges

Batteries

Pump diaphragms and valves

Filter elements

Fuses

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repairs procedures not in accordance with the instruction manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF RKI INSTRUMENTS, INC. INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RKI INSTRUMENTS, INC. BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND CONNECTED WITH THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

This warranty covers instruments and parts sold to users only by authorized distributors, dealers, and representatives as appointed by RKI Instruments, Inc.

We do not assume indemnification for any accident or damage caused by the operation of this gas monitor and our warranty is limited to replacement of parts or our complete goods.

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Overview

The Model GD-K77D has been specially developed for semiconductor gas-leak monitoring and is one of the most advanced units of its kind. It contains a long-life pump and electrochemical sensor to detect a wide variety of semiconductor gasses quickly and reliably. The long-life sensor has a memory so it can be calibrated separately from the monitor, then installed for quick and easy servicing. The Model GD-K77D's narrow footprint and wall mounting bracket permit flexible placement. Built for reliability and ease of use, the Model GD-K77D includes the latest innovations in gas-leak monitoring technology:

- Digital LED display for readout of gas concentrations
- Sensor information and calibration stored within sensor memory
- Several transmission options available
- Self-diagnostic functions performed by microcomputer
- Easy replacement of pump and sensor
- Two alarm levels plus trouble alarm

WARNING: The Model GD-K77D detects semiconductor gasses that may be toxic or combustible. Users of the Model GD-K77D must follow the instructions and warnings in this manual to assure proper and safe operation of the Model GD-K77D.

About this Manual

This manual is intended for use with the RKI Instruments® Intelligent Gas Detector, Model GD-K77D. It describes the Model GD-K77D's specifications, internal components, operation, calibration, and maintenance.

Important Safety Precautions

To ensure the consistent performance and reliability of the RKI Instruments Intelligent Gas Detector, Model GD-K77D, carefully read and follow the instructions in this manual before using the unit. Keep this manual where you can find it easily. When operating or performing maintenance on the Model GD-K77D, refer back to this manual as required. Also keep maintenance records, and use them to plan for future repairs and maintenance of the Model GD-K77D.

If the Model GD-K77D is not operated according to the instructions in this manual, RKI Instruments, Inc. cannot assume any responsibility for consequential injury or damage.

Because the Model GD-K77D is considered to be safety equipment designed to detect semiconductor gases, which can be toxic or explosive, be sure to check the Model GD-K77D daily. If any problem or malfunction is found, contact your local distributor, or RKI Instruments, Inc. immediately.

Throughout this manual you will see cautionary labels. Read them carefully and heed their warnings. Failure to do so may result in injury or damage.

DANGER: *This label alerts you to the possibility of serious injury or death when using or servicing the Model GD-K77D improperly in potentially hazardous environments or conditions. The Model GD-K77D is not explosion proof. Do not use the Model GD-K77D for gas detection above the lower explosive limit (LEL).*

WARNING: This label alerts you to the potential danger of electrical shock, or other hazards. When electrical safety is not followed, injury or damage to the Model GD-K77D may result. Remember that the Model GD-K77D is an electrically powered device. In some circumstances, the Model GD-K77D may be affected by electrical noise, static electricity, or electromagnetic interference. If the environment in which the Model GD-K77D is to be placed has these electrical hazards, take the appropriate steps to shield the Model GD-K77D properly.

CAUTION: *This label alerts you to the possibility of injury or damage to the Model GD-K77D when operation and maintenance of the Model GD-K77D are not performed in accordance with the instructions in this manual. When replacing parts for the Model GD-K77D, use only RKI replacement parts. Modified or non-RKI replacement parts can damage the Model GD-K77D. Should such damage occur, RKI Instruments, Inc. is not responsible, and the warranty may be voided.*

NOTE: This label indicates that important advice or operating or maintenance tips follow. Read the note carefully and follow its instructions.

Specifications

Table 1: Specifications for the Model KD-K77D

Model	GD-K77D	GD-K77D-NT
Relay output for remote alarm	Electrochemical cell	
Relay output for remote alarm	Refer to the RKI Instrument, Inc. list of detectable gasses	
Target gas and detection range	See RKI List of Detectable Gases	
Accuracy	± 10% of reading or ± 5% of full scale (whichever is greater)	
Signal output	(4-20 mA)	Two-wire digital signal
Display	Digital LED display, 4 digit	
Alarms	Two alarm levels: alarm 1 (yellow LED), alarm 2 (red LED), trouble	
Relay output for remote alarm	Dry contact for each alarm1, alarm2, and trouble alarm	
Self-diagnostic functions	Trouble, low flow, system failure, communication error	
Temperature and humidity ranges	0-40 C, 30-85% relative humidity	
Power requirements	24 VDC+/- 10%, approximately 10W	
Recommended cable (see also RKI wiring chart)	18 gage shielded cable	Shielded twisted pair cable (18 gage)
Dimensions and weight	2.8"(W) x 6.7"(H) x 6.0"(D), 4.4lb.	
Recommended tubing	4 mm x 6 mm PTFE (Teflon tubing, RKI part # 06-1272RK)	
Fuse	5.2 mm diameter x 20 mm length; 2A, 250V	

Specifications subject to change without notice.

Accessories: Dust filter

WARNING: *When using the GD-K77D, you must follow the instructions and warnings in this manual to assure proper and safe operation of the GD-K77D and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the GD-K77D as described in this manual.*

Description

The Model GD-K77D is designed to measure gas leaks in an industrial setting. Gas leaks are detected by an internal electrochemical sensor, and the gas concentration is displayed by a four-digit LED display.

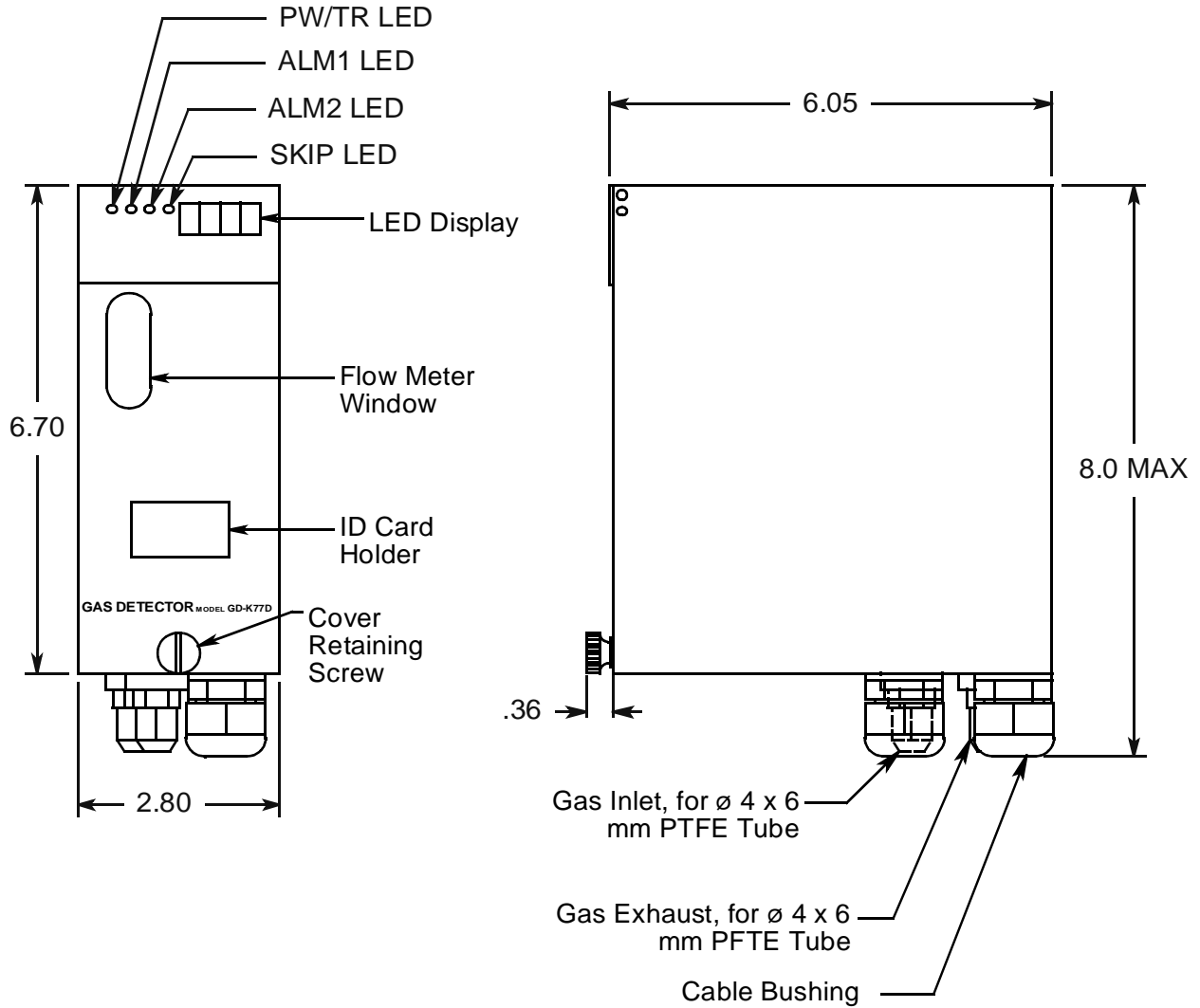


Figure 1: External Component Location

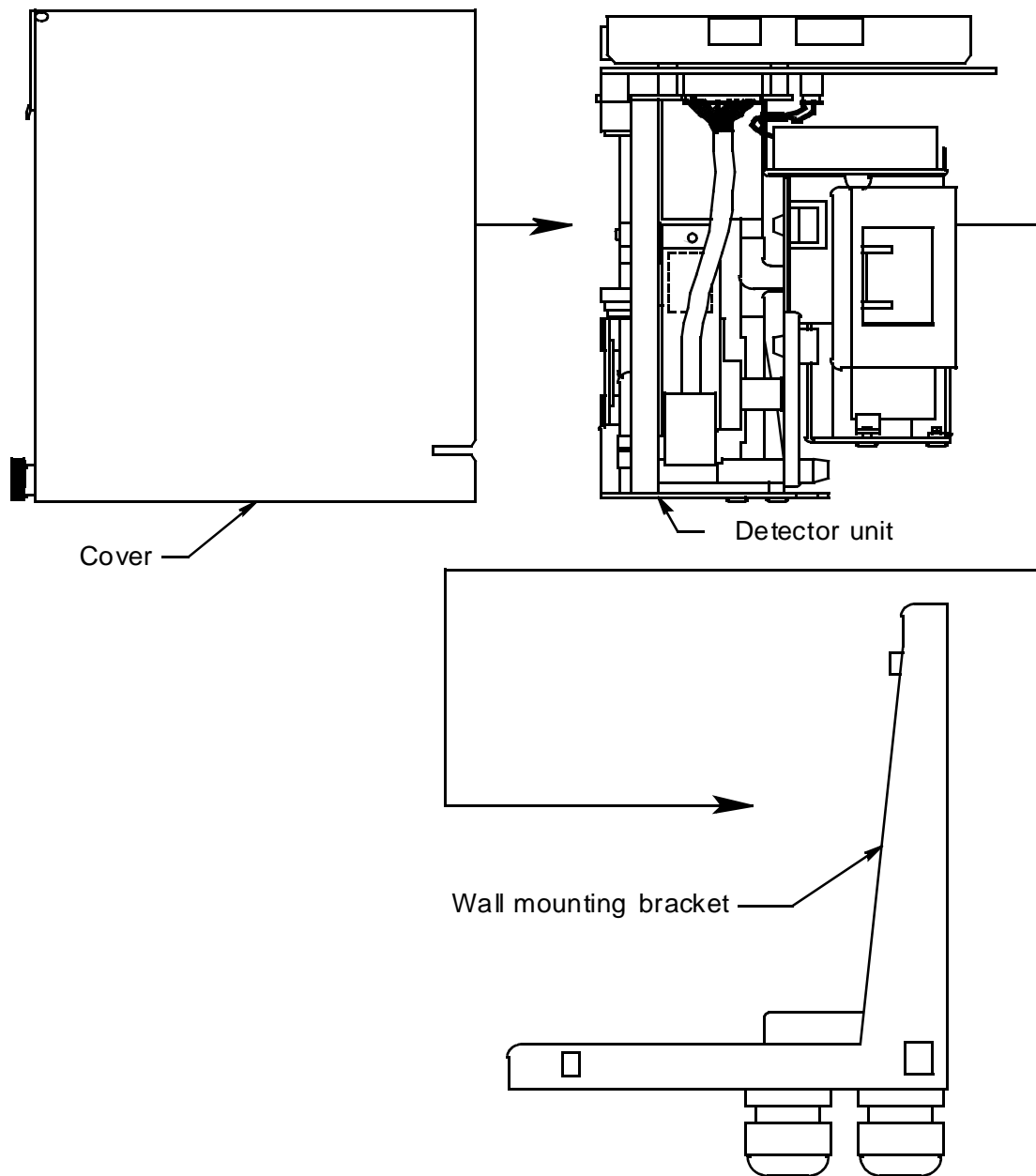


Figure 2: Removing the Cover and Detector Unit

The Model GD-K77D provides a three-wire 4-20mA signal output for a controller. The Model GD-K77D-NT provides a two-wire digital signal which is used by the RM-77NT accessory and is then converted to either an RS-232C or RS-485 signal. It has two gas alarm levels, two sets of gas alarm relay contacts, a trouble alarm, and trouble relay contacts.

The Model GD-K77D is a sample draw gas detection head. The Model GD-K77D draws in the sample gas from a remote location using an internal pump. The flow system directs the gas to an internal gas sensor. Various lengths of inlet tubing can be used, and tubing length is determined by the target gas and the operating environment. When using the Model GD-K77D in areas containing dust or other particulate contamination, use the appropriate sample filter. The correct sample filter is dependent on the target gas.

Case

The Model GD-K77D has a rugged metal case. A sturdy wall mounting bracket is supplied that allows the Model GD-K77D to be securely attached to a wall for convenient operation and maintenance.

On the front of the case are four LEDs, a LED display, a flowmeter, and a large screw that is used to open and close the case cover. On the bottom are located a gas inlet, a gas exhaust, and two cable bushings for external wiring.

Alarm Lights

Four light-emitting diodes (LEDs) provide visual alarms for gas concentrations and malfunctions, and are part of the detector panel along with the LED display. These LEDs are located on the front of the unit in the upper left corner for greatest visibility. They perform the following functions:

PW/TR. Indicates power on or off and warns that the Model GD-K77D is not operating normally. When PW/TR is lit (green color), the Model GD-K77D is fully powered and is operating normally. When the PW/TR is off, power to the Model GD-K77D has been shut off. When the PW/TR is flickering, the Model GD-K77D is not operating normally.

- ALM1. Indicates the first gas alarm (orange color).
- ALM2. Indicates the second gas alarm (red color).
- SKIP. Indicates that the Model GD-K77D is in Maintenance Mode and has temporarily stopped gas detection.

Display

An LED display shows gas concentration in parts per million (PPM). The LED display is located on the front of the unit in the upper right corner for easy viewing.

Flowmeter

The flowmeter checks the sample flow rate of the target gas reaching the sensor inside the Model GD-K77D. The flowmeter is a glass tube on which are marked two red flow lines. A flow ball indicates whether the flow rate is within, or outside, the red flow lines.

During normal operation, the standard flow rate to the sensor is approximately 0.5 L/min, and the flow ball should be within the two red flow lines. When the ball drops below the bottom flow line, the Model GD-K77D cannot accurately detect the target gas. Increase the flow rate. When the ball rises above the top flow line, reduce the flow rate. For more information about adjusting the gas flow rate, see "Flow Adjustment Up/Down" under "Internal and Back Panel Components."

Internal and Back Panel Components

Refer to the diagram below for the location of Model GD-K77D internal and back panel components, which are described below. After each component name is a number, which corresponds to the same number in the diagram.

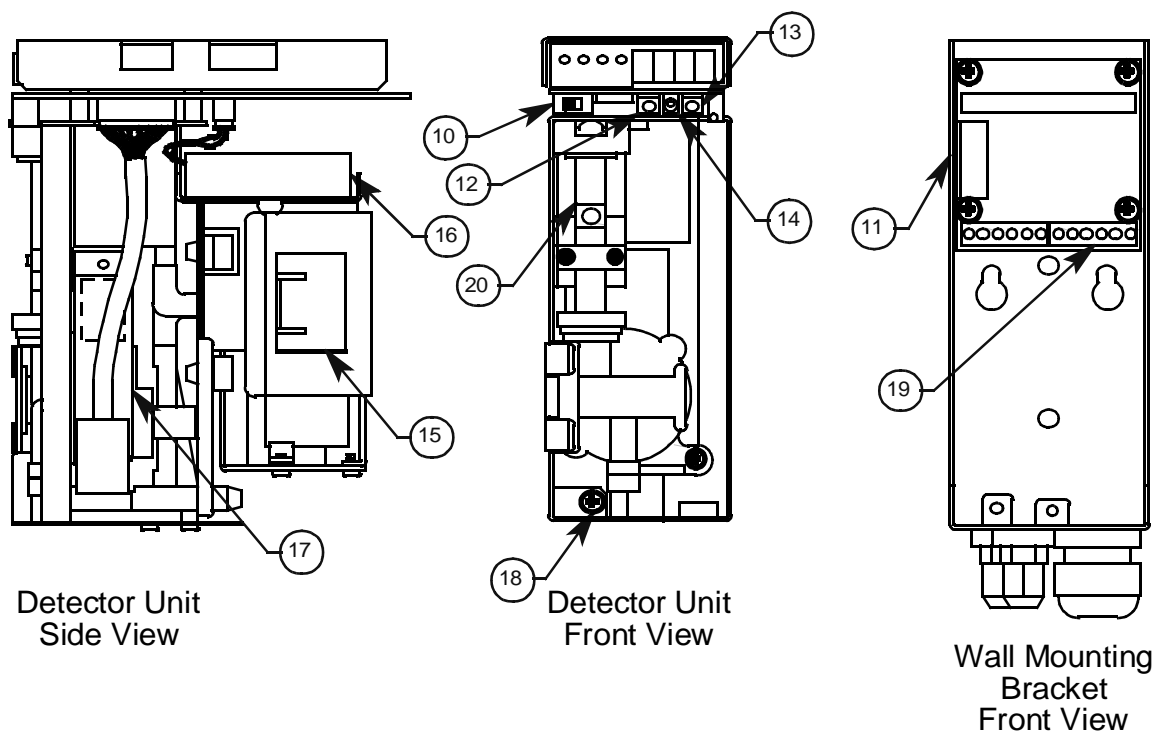


Figure 3: Internal Components

Power Switch (10). Turns power on or off to the Model GD-K77D.

Power Fuse (11). Protects the Model GD-K77D from a power overload.

Mode Switch (12). Toggles the Model GD-K77D's operating mode between detection and maintenance. When the Model GD-K77D is being used for gas detection, the Model GD-K77D is in normal operation; when performing maintenance on the Model GD-K77D, use this switch to put the unit into Maintenance Mode.

Test/Set Switch (13). This switch has several functions in Maintenance Mode.

FLOW ADJ Switch (▲/▼) (14). Increases or decreases the gas flow rate to the Model GD-K77D when the unit is in normal operation. Gas flow adjustments are made when the flow ball is outside the red flow lines. When the flow ball is above the top flow line, press the FLOW ADJ switch down to reduce the flow rate. When the flow ball is below the bottom flow line, press the FLOW ADJ switch up to increase the flow rate. This switch is also used to increase or decrease parameters in Maintenance Mode.

Pump (15). Draws the sample gas by suction to the sensor inside the Model GD-K77D.

Lithium Battery (16). Provides a bias voltage to the Model GD-K77D sensor in the event of a power outage or a drop in line voltage.

CAUTION: *When the Model GD-K77D is not used for long periods of time, the lithium battery may lose power. The lithium battery, under normal operating conditions, has a life expectancy of about three (3) years from the date of manufacturing. When the lithium battery is replaced, put the unit into maintenance mode before replacing the battery by pressing the Mode switch for 3 seconds. Then calibrate the unit as described in the Calibration section. If the Model GD-K77D has been stored for a long time, calibrate the Model GD-K77D when the unit is put back into service.*

Sensor (17). Detects the target gas.

Detector Unit Set Screw (18). Tighten this screw when attaching the wall mounting bracket to the Model GD-K77D's case.

Terminals (19). Provides terminations for external wiring.

Flowmeter (20). The flowmeter indicates whether the sample flow rate of the sample reaching the sensor inside the Model GD-K77D is okay. See "Flowmeter" for more information.

Block Diagrams

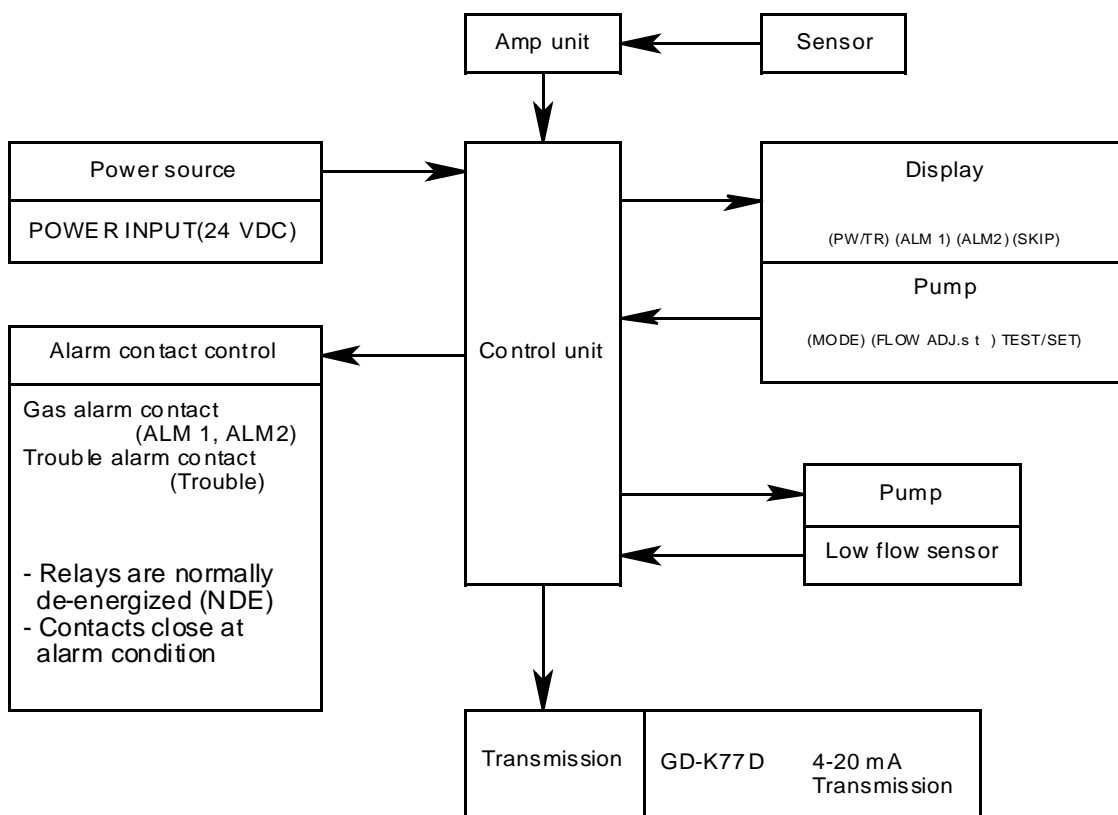


Figure 4: Electrical Block Diagram

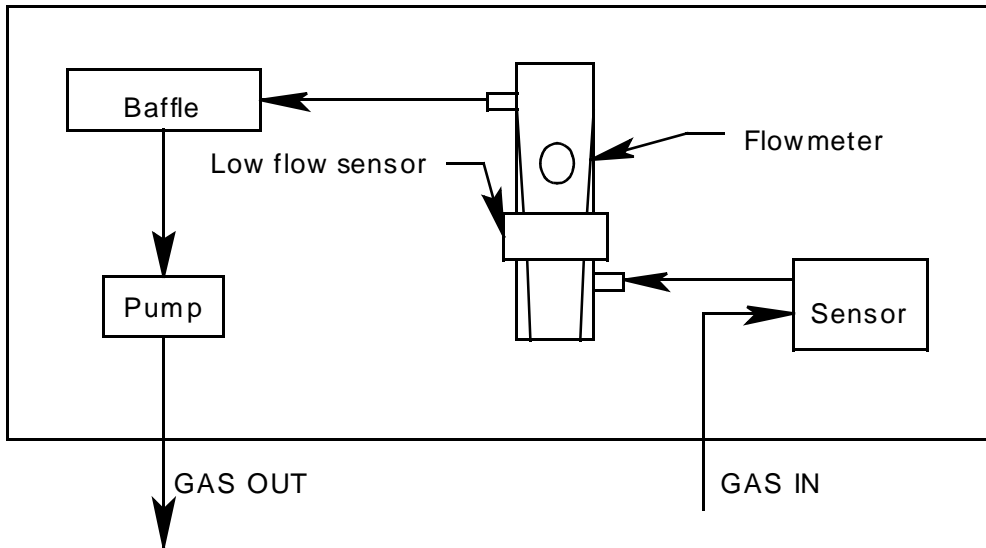


Figure 5: Flow Diagram

Important Safety Procedures

WARNING: Before installing and operating the Model GD-K77D, please read the following list of precautions before continuing:

Power Source. Check the power source before turning on the Model GD-K77D. Make sure the power source voltage is within the specified voltage range.

Ground Wire. Do not cut or remove the ground wire to the Model GD-K77D.

Fault Protection. When an electrical fault has occurred (e.g., the fuse blows), do not attempt to operate the Model GD-K77D. Before starting up the Model GD-K77D, make sure an electrical fault has not occurred.

Fuse. When replacing the Model GD-K77D's fuse, turn off the power to the unit. Use only replacement fuses that have the correct current and voltage ratings. Do not use any fuse other than the one specified for the Model GD-K77D. Using a non-specified fuse will cause a short and damage the Model GD-K77D.

Explosive Gases. Do not operate the Model GD-K77D in environments containing explosive gases. The Model GD-K77D is not explosion-proof; its internal circuitry may cause a spark which could ignite combustible gas or vapors.

External Connections. After making sure the Model GD-K77D is properly grounded and an electrical fault has not occurred, wire all external connections to the Model GD-K77D.

Lithium Battery. When the lithium battery is replaced, turn all power off to the Model GD-K77D before removing the battery. Do not recharge, burn, mutilate, or expose the lithium battery to temperatures greater than 212° F (100° C) because it may leak or explode. Do not immerse the battery in water.

Sensor. Use caution when handling the sensor. The electrolyte contains a dilute acid that can damage to clothing or other materials, and it can cause skin burns or blindness should the acid come in contact with the eyes. If the electrolyte makes contact with the skin or eyes, wash the affected area very thoroughly with water. With eye contact, seek medical attention immediately.

High Gas Levels. Should the target gas reach levels greater than the alarm present level, swift and appropriate action is crucial to avoid a potentially hazardous condition.

Communication Devices. Do not use portable telephones or two-way radios near the Model GD-K77D. The electrical emissions or radio waves of such devices may affect the Model GD-K77D's readings.

Power On. When turning the power back on to the Model GD-K77D, wait 25 seconds before taking readings; otherwise abnormal output may result.

Flowmeter. When the Model GD-K77D is drawing in the sample gas, make sure the flow ball is between the top and bottom flow lines. When the ball drops below the bottom flow line, the Model GD-K77D cannot accurately detect the target gas. Increase the flow rate.

Dust Filter. When sampling gas from a dusty environment, use the recommend filter to avoid drawing dust into the Model GD-K77D. Place the external dust filter on the end of the hose used to draw in the sample gas. When changing the dust filter, turn off the Model GD-K77D.

Installation

Precautions

Professional installation of the Model GD-K77D by a licensed contractor is highly recommend for the best and safest results. The following is a list of precautions that will ensure the operating performance of the Model GD-K77D:

- **Dusty Environments.** When extracting gas from a dusty environment, the recommend filter should be used to avoid drawing dust into the Model GD-K77D. Place the external dust filter on the end of the hose used to draw in the sample gas. When changing the dust filter, turn off the Model GD-K77D.
- **Sun Light.** Do not install the Model GD-K77D in direct sun light, which may affect the operation and performance of the Model GD-K77D.
- **Vibration.** Do not install the Model GD-K77D in areas affected by shock and vibration, which may damage the Model GD-K77D's electronics.
- **Electronic Emissions.** Do not install the Model GD-K77D in areas with high levels of radio interference or electronic noise. This electronic interference may cause abnormal readings. And do not place the Model GD-K77D near electrical wiring or other electrical devices, such as industrial motors.
- **Target Gas.** Do not place the Model GD-K77D where the target gas is to be detected. Use the sampling hose to place the Model GD-K77D at a safe distance from the gas source.
- **Dangerous or Inconvenient Locations.** The Model GD-K77D requires regular maintenance. Do not place it in environments that are potentially hazardous (e.g., near high voltage cables), or in locations in which maintenance is very inconvenient (e.g., near objects that prevent easy access to the controls inside the Model GD-K77D).

- **Grounding.** Make sure to ground the Model GD-K77D properly during installation.

Wall Mounting the Model GD-K77D

CAUTION: When installing the wall mounting bracket, make sure to attach it securely to the wall. If not securely attached, the Model GD-K77D may fall causing damage to the unit.

Find a suitable location for the Model GD-K77D. Allow enough room around the wall mounting bracket for the Model GD-K77D to be mounted easily. See “Precautions” on the previous page for installation warnings.

1. Attach the wall mounting bracket to the wall using #10 screws.
2. Mount the Model GD-K77D to the wall mounting bracket.
3. Fasten the screw on the front bottom of the Model GD-K77D.

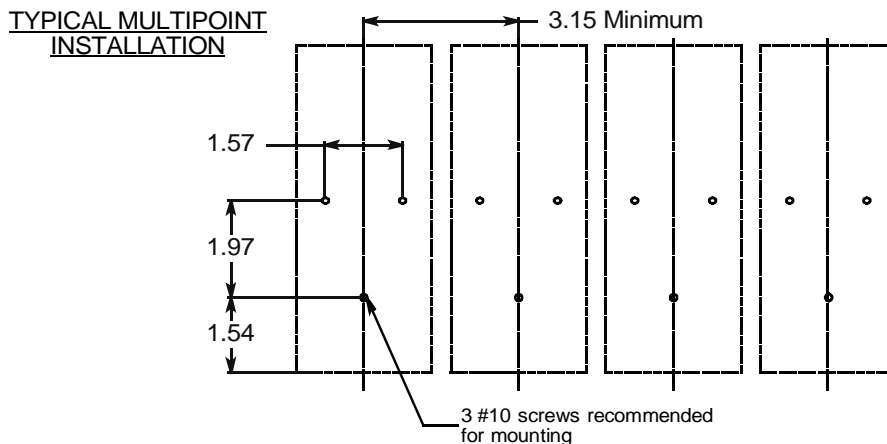
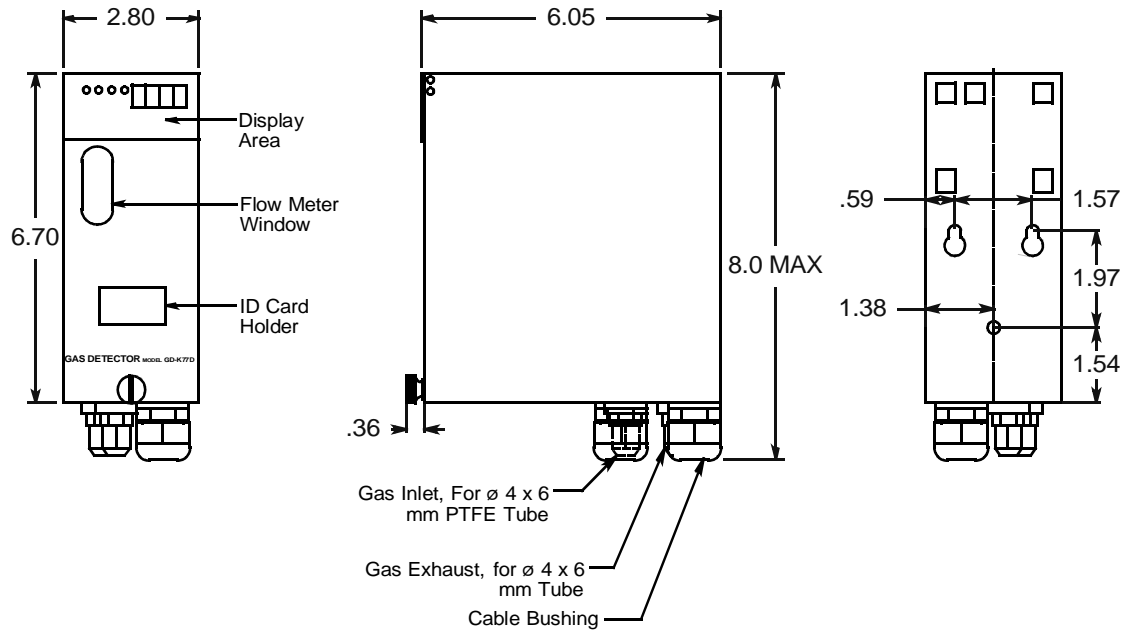


Figure 4: Outline & Mounting Dimensions

Removing the Model GD-K77D Detector Unit

When connecting tubing, making electrical connections, or servicing the Model GD-K77D, it is more convenient to remove the Model GD-K77D detector unit from its wall mounting bracket.

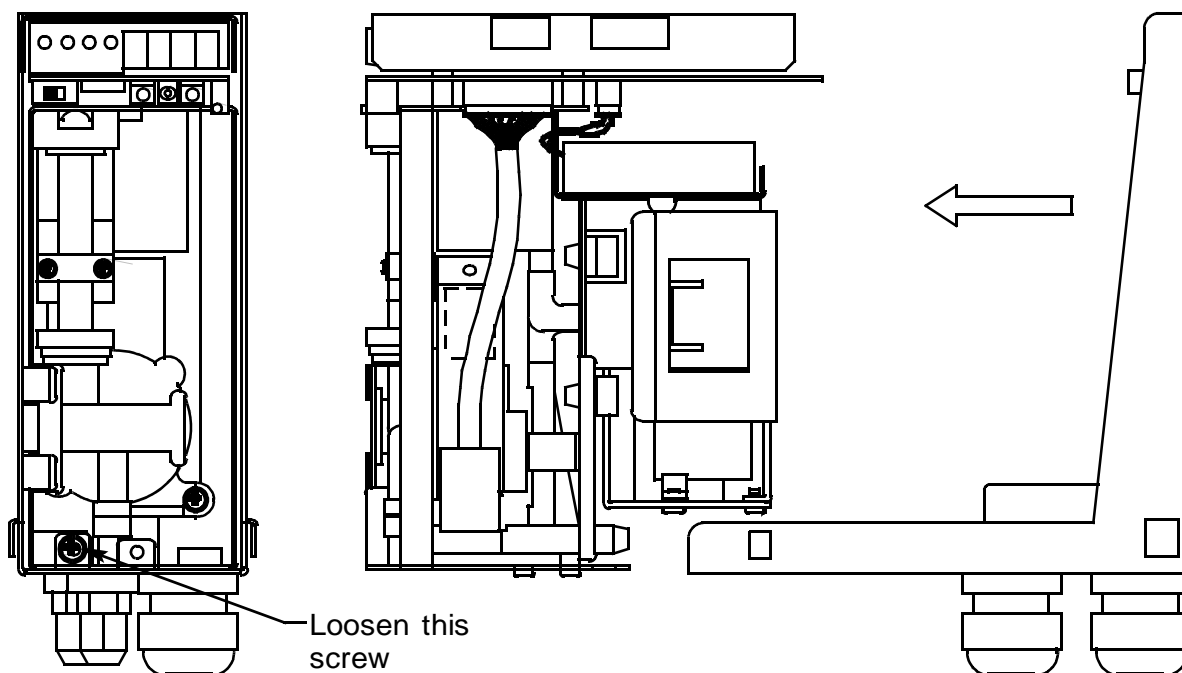


Figure 5: Removing the Detector Unit

1. Loosen the large screw on the front of the unit and remove the cover.
2. Loosen the screw on the lower part of the unit.
3. Remove the Model GD-K77D detector unit from the wall mounting bracket.

NOTE: When returning the Model GD-K77D detector unit to the wall mounting bracket, assemble the unit in reverse order.

Electrical Connections

CAUTION: *Unstable power or power with electrical noise may cause the Model GD-K77D to give false readings or to trigger a false alarm. When connecting the Model GD-K77D to a power source, carefully follow the instructions in this manual.*

During warm up at power on and during a power failure, unwanted alarms may occur depending on the relay logic and wiring used. Take any steps necessary to address this situation.

Power Requirements

Table 2: Power Requirements for the Model GD-K77D

Power Voltage	DC-24V +/- 10% (Terminal Voltage)
Power Failure Tolerance (Time)	Approximately 10 milliseconds. After a power failure of 10 milliseconds, the Model GD-K77D re-starts. To ensure continuous operation, install a standby battery.
Requirements	Do not connect power to the Model GD-K77D containing a high power load or with high frequency noise. If noise is present, use a line filter to separate the power from the noise source. When rack-mounting the Model GD-K77D in an area with restricted ventilation, allow for adequate ventilation by mounting fans near the unit.

External Alarm

The Model GD-K77D can be used to control an external buzzer or alarm light. The Model GD-K77D's external alarm contacts are rated for 0.5 A @ 125 VAC, 1A @ 30 VDC, and 0.5 A @ 60 VDC. Use the alarm contacts on the Model GD-K77D to control only low power devices. If heavier loads or inductive loads need to be controlled, use a slave relay to accommodate the load. A CR circuit device (or Spark Killer) should be installed to protect the alarm contacts if there is any question about the load. When driving a slave relay, use a Spark Killer since the slave relay is an inductive load.

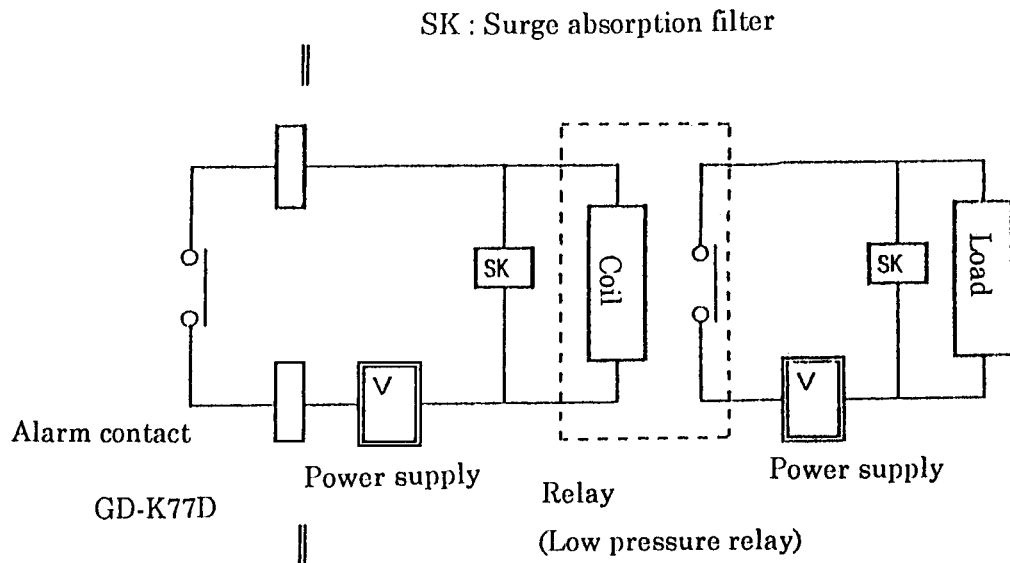


Figure 4: CR circuit for Alarm Relay

WARNING: The alarm contacts on the Model GD-K77D are designed to take a resistance load and not an inductive load. (An inductive load can be created by a patlight, external relay, buzzer, siren, fan, fluorescent light, motor, etc.)

When an inductive load is present, a very high reverse voltage may be generated that can melt the alarm contacts on the Model GD-K77D, damage the external alarm, or damage the CPU if one is connected to the system. Also note that the intrusion of electrical noise in the alarm circuit can cause the same problems generated by an inductive load. To avoid these problems, whether created by an inductive load or by noise, do not use an inductive load and protect the alarm contacts on the Model GD-K77D with the appropriate surge protectors.

Grounding

Attach ground wires to the ground terminals on the Model GD-K77D, labeled chassis (earth) ground bolts in the diagram below, before turning on the power to the Model GD-K77D.

WARNING: Be sure to ground the Model GD-K77D properly for safe operation. Do not connect the ground wires to the sample tubing.

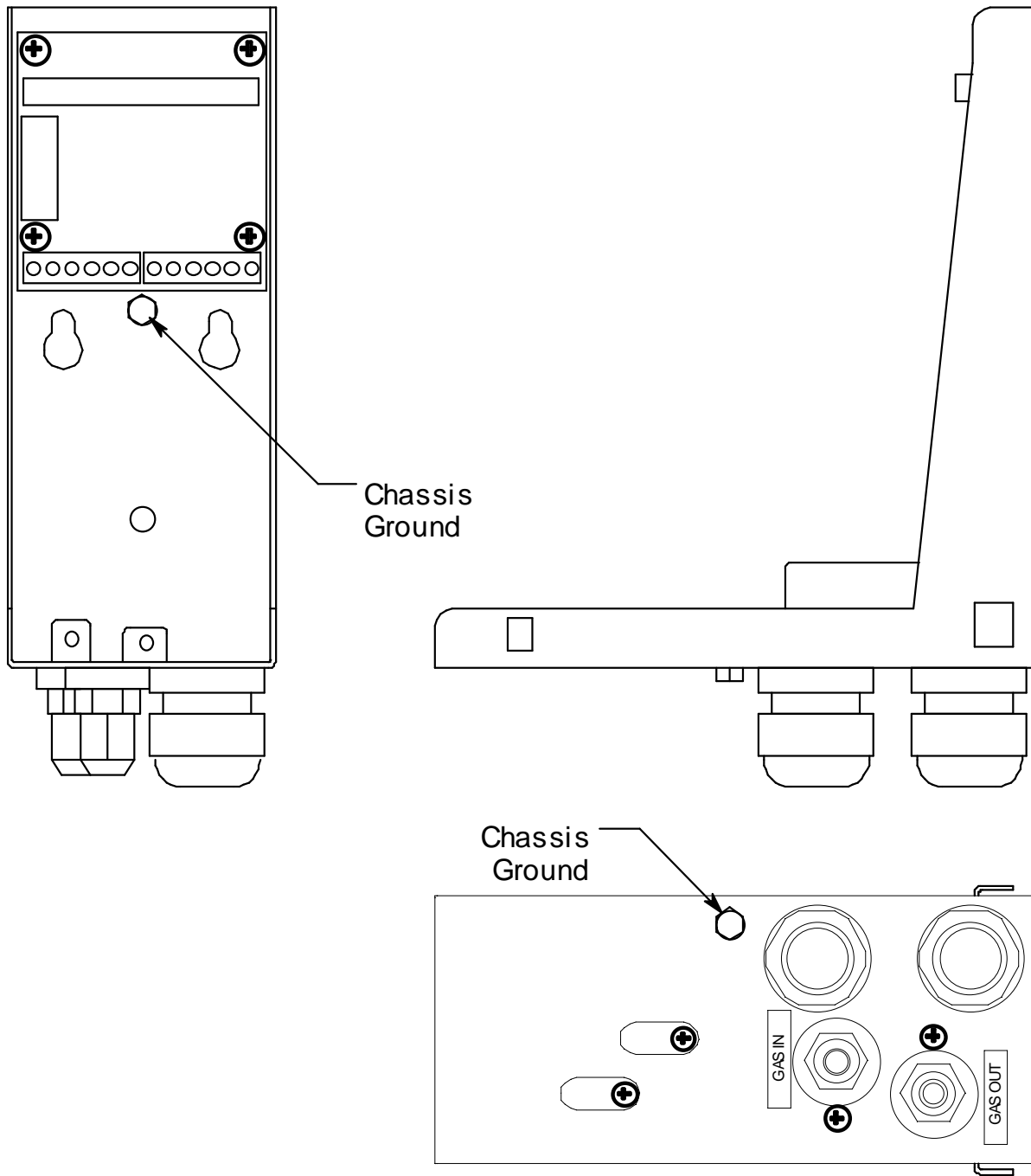


Figure 5: Grounding the GD-K77D

GD-K77D Terminal Strip

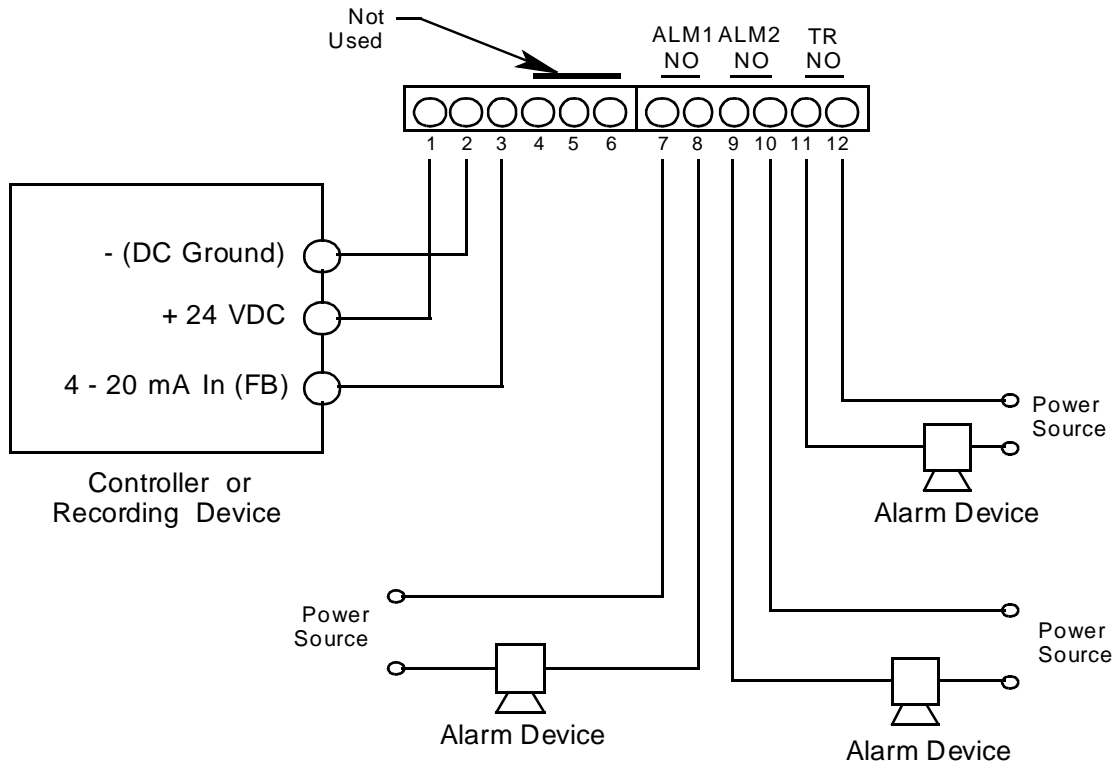


Figure 7: Wiring to a Generic Controller, Typical 3-wire

Tubing Connections

Tube Fittings

Two tube fittings are provided for sampling, one for inlet and one for exhaust. The fittings accept 4 mm (ID) x 6 mm (OD) Teflon tubing.

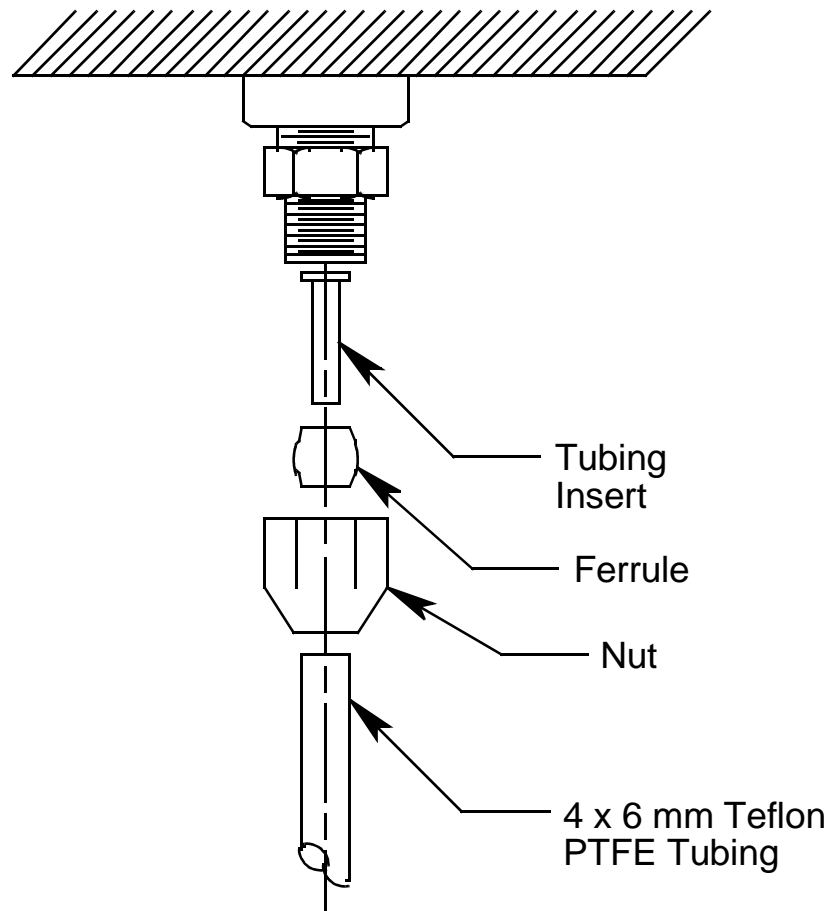


Figure 8: Inlet/Exhaust Fitting Use

Flow Rate

The flow rate of the Model GD-K77D is 0.5 L/M (liters per minute)

Tubing Material

The tubing materials you choose will depend upon the target gas being detected. Some target gases are corrosive while others are absorptive. Choose your tubing materials carefully for both length and material. RKI Instruments recommends PTFE Teflon tubing.

Operation

Start-up Preparations

To avoid the possibility of electrical shock or damage to the Model GD-K77D, follow the precautions listed below before turning on the unit:

- Make sure the Model GD-K77D has been properly grounded.
- Check all wiring connections to external devices.
- Make sure the power voltage is within specification (DC-24V +/- 10%, Terminal Voltage).
- Check the wiring connections to any external alarms.
- Make sure the correct dust filter has been properly installed.

CAUTION: *Because dust filters are designed for specific target gases, it is very important to check whether the correct dust filter has been installed on the Model GD-K77D.*

- Check whether the Model GD-K77D's fuse has the correct current and voltage.

Basic Operation Flow and Operating Modes

The diagram below shows the basic operation flow of the Model GD-K77D. There are three basic operating modes:

- Detection Mode (Normal operation)
- Alarm Test Mode
- Maintenance Mode

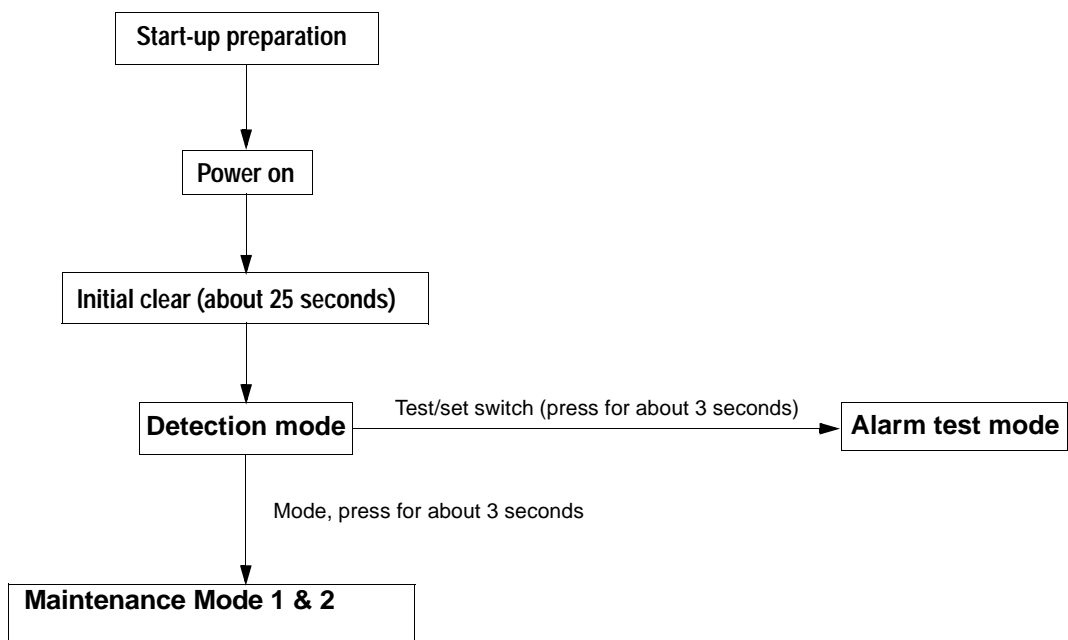


Figure 9: Operation Flow Chart

The basic operation flow and the three operating modes are described in this section of the manual.

Start Up

Power On

1. Before turning on the power to the Model GD-K77D, read “Start-up Preparations” described above.
2. Remove the front cover of the Model GD-K77D if it is still attached to the Model GD-K77D. See “Removing the Model GD-K77D Detector Unit” for more information.
3. The power switch is located on the front panel beneath the alarm lights and above the flowmeter.
4. To turn the power on, move the switch to the right. To turn the power off, move the switch to the left. After the power has been turned on, the PW/TR light turns on and after several seconds the pump begins working. An initial warm up is performed for approximately 25 seconds in which the Model GD-K77D’s system is checked. This system check includes the external output, alarm, and trouble action, and shut-off (lamp and contact).

Flowmeter Adjustment

1. Check the flowmeter to make sure the flow ball is between the two red flow lines.
2. If the flow ball is not between the red flow lines, adjust the air flow. When the flow ball is above the top flow line, press the FLOW ADJ switch down to reduce the flow rate. When the flow ball is below the bottom flow line, press the FLOW ADJ switch up to increase the flow rate.

NOTE: The flow rate of the Model GD-K77D is 0.5 LPM. When the flow ball drops below the bottom flow line, the Model GD-K77D cannot accurately detect the target gas. Increase the flow rate.

CAUTION: *Allow the unit to warm-up for 2 hours before setting the zero reading.*

Set the Zero Reading

See the Zero Adjustment section below for instructions on how to set the zero.

Detection Mode

Displays

The Model GD-K77D’s Detection Mode uses two types of indications:

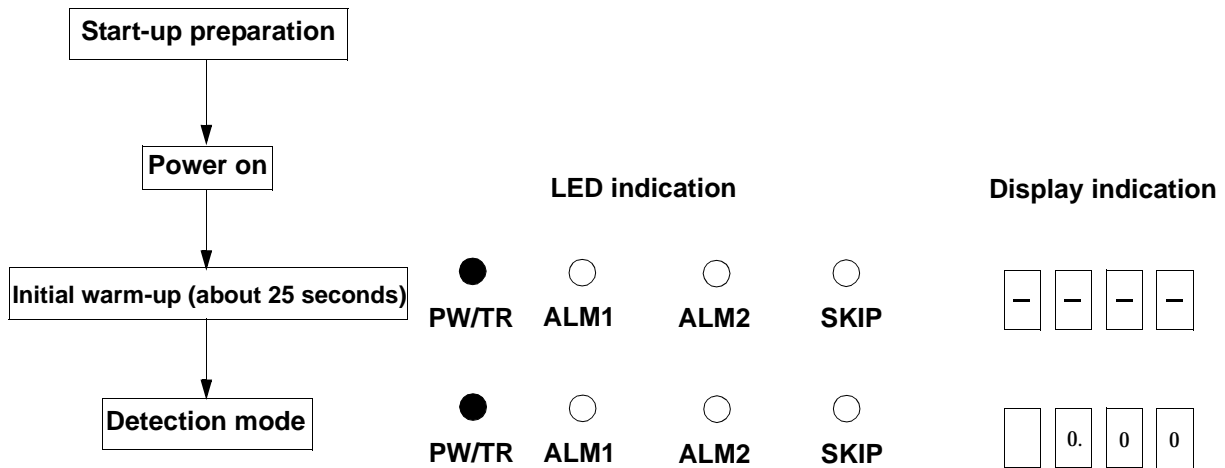
- An LED (light emitting diode) display, which shows the gas concentration
- LED lamps show:
 - Power/Trouble (PW/TR)
 - Alarm 1 (ALM1)
 - Alarm 2 (ALM2)
 - Skip (SKIP)

Operation Flow

The diagram below shows the operation flow for Detection Mode. In Detection Mode, the PW/TR light is on and the LED display shows the concentration of the target gas.

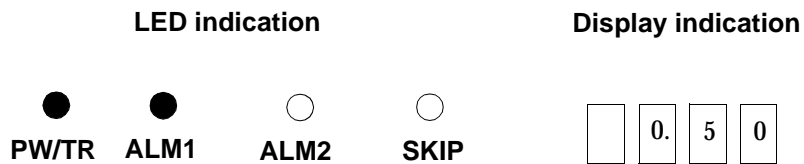
LED lamp function

○ Light off ● Light on ◉ Flashing



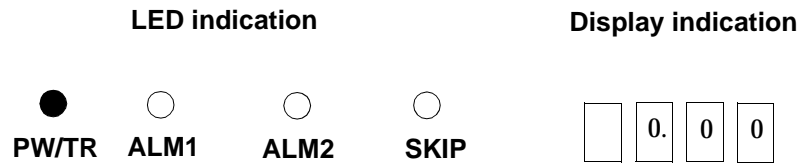
Gas Alarm

During an alarm condition, ALM1 will be on if the gas concentration rises above the alarm 1 set point, and ALM2 will be on if the gas concentration rises above the alarm 2 set point. The LED display will show the concentration of the target gas. The example below illustrates an alarm 1 condition with a gas concentration of 0.5 ppm.

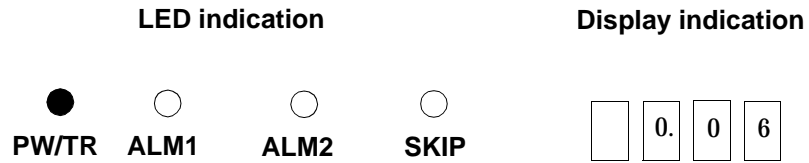


Zero Suppression

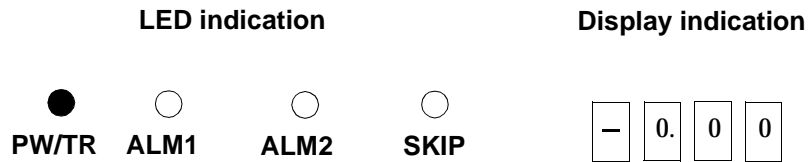
During Detection Mode, the display indicates “0” if the reading is below +6% of full scale.



During Detection Mode, the display shows readings above +6% of full scale.



“-0.00” displays when the reading falls below -10% of full scale.



WARNING: When the display shows a “-0.00,” adjust the zero reading as described in the calibration section of this manual.

Trouble Conditions

The following table shows the possible trouble conditions that may occur:

Table 3: Trouble Conditions

Display	Condition
E-00	System Fault
E-01	Sensor Disconnected
E-04	Zero Suppression Trouble
E-05	Low Flow Alarm

4-20mA Output

The following graph illustrates the relationship between the 4-20mA output and the gas concentration.

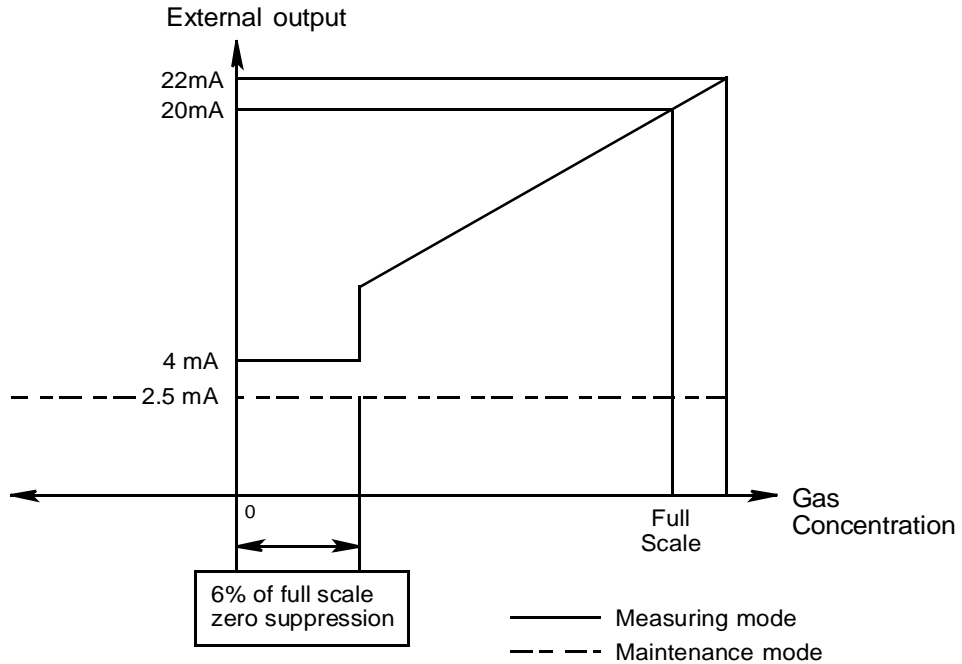


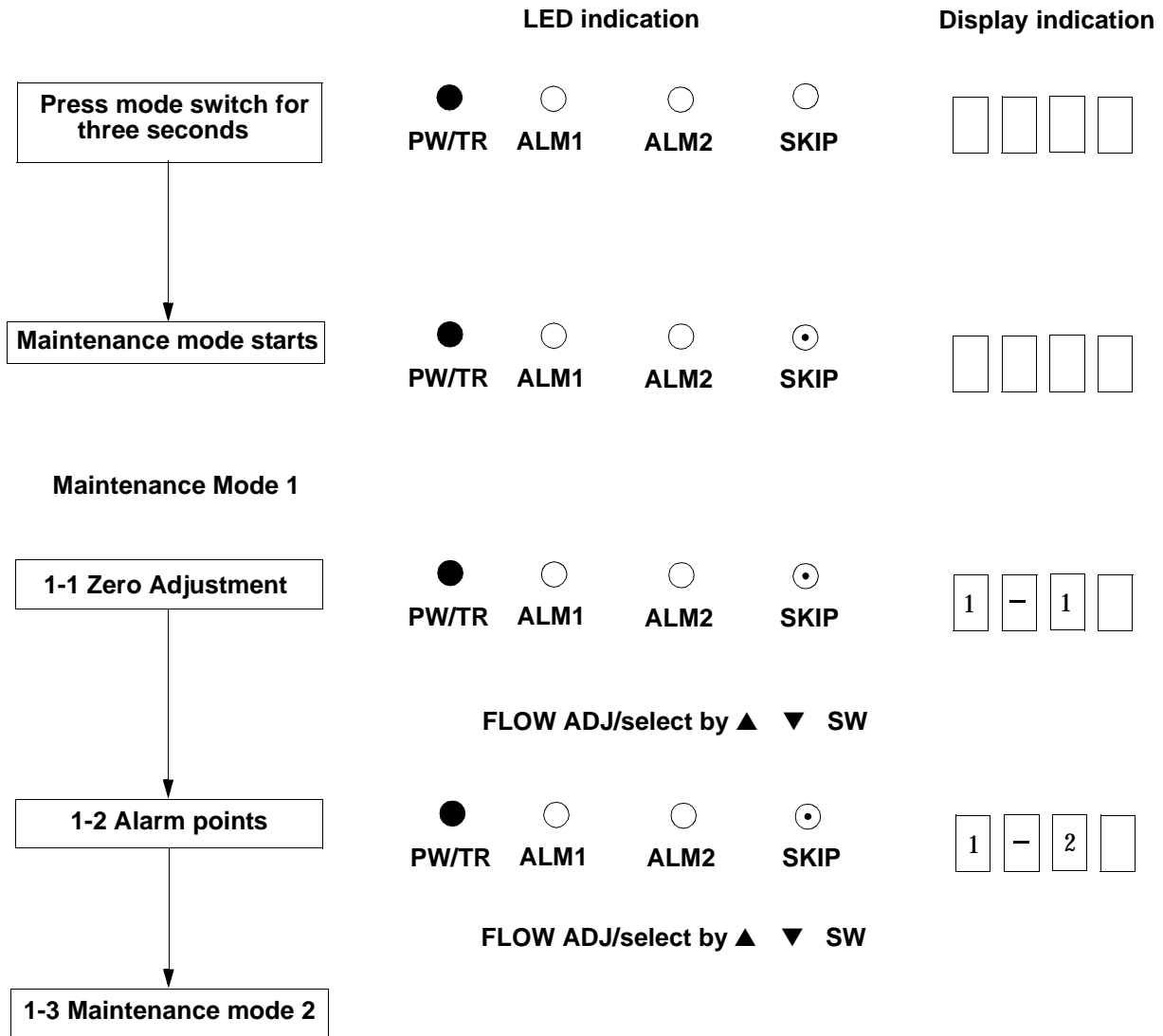
Figure 10: 4-20 mA output vs. Gas Concentration

Maintenance Mode

There are two maintenance modes for the Model GD-K77D: Maintenance Mode 1 and Maintenance Mode 2. Under Maintenance Mode 1, you can perform a zero adjustment and confirm the alarm points. Under Maintenance Mode 2, you can confirm bias voltage (optional), perform a zero adjustment, perform a span adjustment, and determine a sensor's start-up time. See "Calibration" under "Maintenance" for more information about using Maintenance Mode 2.

To activate Maintenance Mode, remove the Model GD-K77D's cover, then press and hold the Mode switch for three (3) seconds.

Maintenance Mode Operation Flow



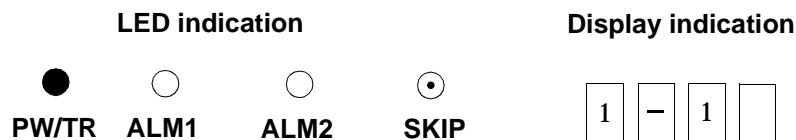
CAUTION: *When Maintenance Mode is entered during a gas alarm, the alarm condition will be cancelled. The relay contact will be reset and the 4-20 mA output will lock on 2.5 mA.*

Zero Adjustment

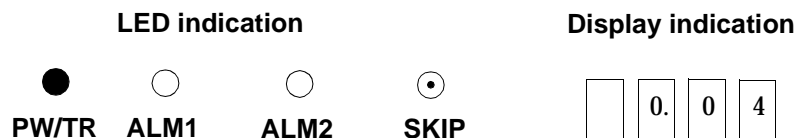
A zero adjustment resets the Model GD-K77D's gas detecting system to zero so it can accurately sample the target gas. This test should be done periodically, such as once a month. This procedure illustrates how to use the zero function in Maintenance Mode 1. If a full calibration is being done, use the zero function in Maintenance Mode 2 (see calibration section).

NOTE: If you suspect the target gas is in the area being monitored, supply zero air to the Model GD-K77D before setting the zero adjustment.

1. With the front control cover of the Model GD-K77D flipped open, press and hold the Mode switch for three seconds to start Maintenance Mode 1. The display will show 1-1 and the Skip light will flash.



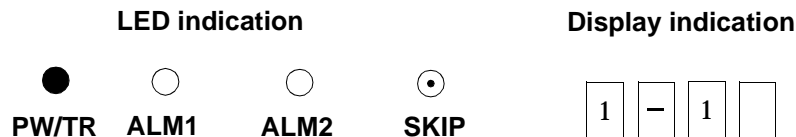
2. Press the TEST/SET switch. The display will indicate the current zero reading. In the example below 0.04 pm is indicated.



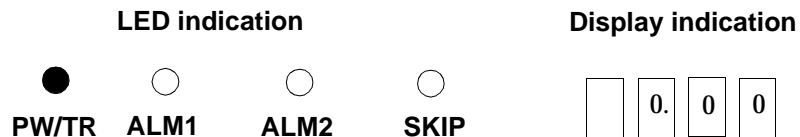
3. Press the TEST/SET switch again. The GD-K77D will automatically set the zero.

NOTE: If the reading drifts from zero at this time, use the Flow Adjustment switch to adjust the zero reading.

4. After adjusting the zero, press the TEST/SET switch to save the adjustment. If you do not want to save the adjustment, press the Mode button.



5. To return to Detection Mode, press and hold the Mode switch for three seconds.



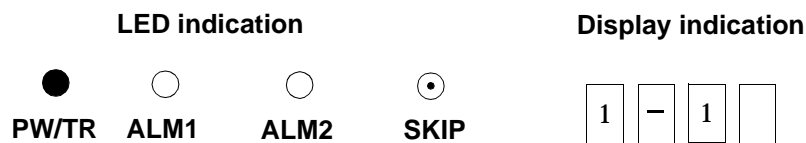
NOTE: After the Model GD-K77D returns to Detection Mode, the SKIP light turns off.

CAUTION: *The gas alarms will only work in Detection Mode. If the Model GD-K77D is left in Maintenance Mode for ten hours or more, it will switch to Detection Mode automatically.*

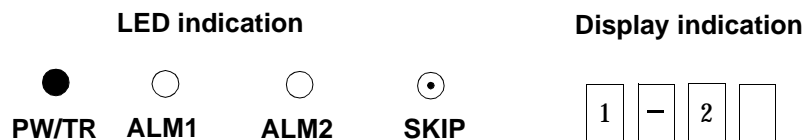
Alarm Point Confirmation

When checking the alarm point, follow these steps:

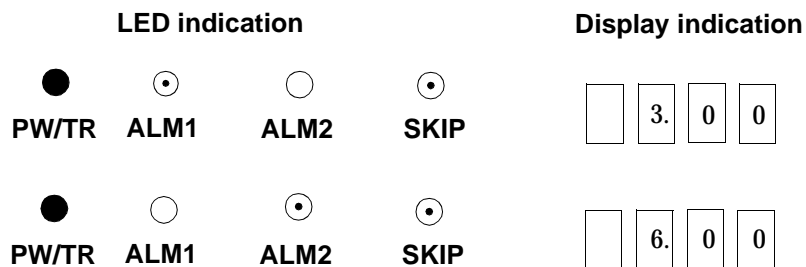
1. With the front control cover of the Model GD-K77D flipped open, press and hold the Mode switch for three seconds to start Maintenance Mode. The display will show 1-1 and the Skip light will flash.



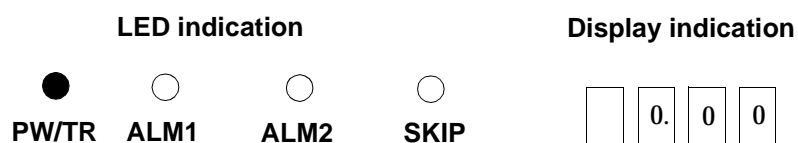
2. Select 1-2, Alarm Check Point by using the FLOW ADJ switch.



3. Press the TEST/SET switch to display the Alarm Set-point. The ALM1 LED will flash. **The readings shown below are typical.** Use the FLOW ADJ switch to display the ALM2 set-point. The ALM2 LED will start flashing.



4. To return to Maintenance Mode item 1-1, press and release the Mode switch. To return to Detection Mode, press and hold the Mode switch for three seconds.



CAUTION: *The gas alarms will only work in Detection Mode. If the Model GD-K77D is left in Maintenance Mode for ten hours or more, it will switch to Detection Mode automatically.*

Maintenance Mode Summary

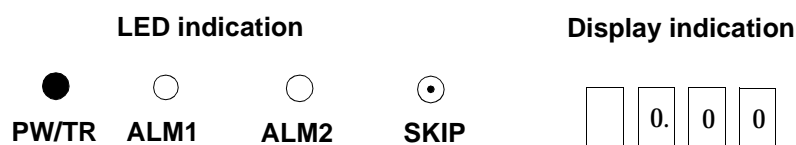
Mode No.	Set Item	Purpose
1 - 1	Zero adjustment	This zero adjustment is done when unit calibration is not required.
1 - 2	Alarm point check	Used to confirm alarm points of unit.
1 - 3	Maintenance check mode	Used to put unit in Maintenance Mode 2.
2 - 1	Check bias voltage	This is an optional test. The bias voltage is set at the factory.
2 - 2	Zero adjustment	Used when calibrating the unit.
2 - 3	Span adjustment	Used when calibrating the unit.
2 - 4	Sensor start-up time	Used when new sensor is installed.

Alarm Test Mode

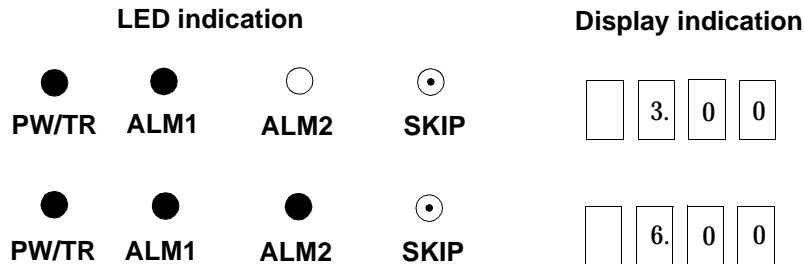
Alarm Test Mode is used to increase the display reading and 4-20 mA output. Any external device connected to the 4-20 mA output will indicate upscale readings. This allows testing of any alarms it may control.

CAUTION: *Before making an alarm test, notify the appropriate departments at your site, or anyone who might hear the alarms, and let them know that alarm testing and maintenance are being performed on the Model GD-K77D.*

1. With the front control cover of the Model GD-K77D flipped open, press and hold the TEST/SET switch for three seconds to start alarm test mode. The Skip light and display indication will flash.



2. Increase the display indication on the Model GD-K77D. Press the FLOW ADJ switch up until the indication reaches the Alarm 1 setting and the ALM1 light turns on. Continue to increase the indication until the ALM2 light turns on. **The readings shown below are typical.** Once an alarm level is reached, there is a 3 second



delay.

NOTE: During alarm testing, the Model GD-K77D alarm contacts do not change condition.

3. Press the TEST/SET switch for three seconds to return to Detection Mode.

Turning Off the Model GD-K77D

1. With the front control cover of the Model GD-K77D flipped open, move the power switch left to turn off the power.
2. Turn off the main power (DC 24V) to the Model GD-K77D.

Alarms

Alarm Types

There are two types of alarms: gas alarms and trouble alarms.

Gas Alarm. When the target gas reaches or exceeds an alarm set point, the gas alarm is activated. The gas alarms are self-resetting. They will automatically clear once the alarm condition has passed.

NOTE: The alarm point is factory set to 1/3 (first alarm) and 2/3 (second alarm) of full scale. To prevent a false alarm, a three-second alarm time delay is provided.

Trouble Alarm. A trouble alarm is activated when a fault is detected in the Model GD-K77D. Except for system fault (E-00), a trouble alarm is self-resetting. When the Model GD-K77D returns to normal after a trouble alarm has occurred, the unit starts its warm-up cycle, which runs for 25 seconds before Detection Mode commences.

Gas Alarm

Performance

- Display

Gas Concentration Display. Shows the gas concentration in parts per million (ppm) of the target gas. When the gas detection range is exceeded, the following displays on the LED display:



Power Light (Green). Remains on.

Alarm Lights (ALM1 -- Yellow; ALM2 -- Red). When the concentration of the target gas reaches or exceeds the ALM1 set-point, the yellow ALM1 light turns on. When the concentration reaches the ALM2 set-point, the red ALM2 light turns on.

- Analog Output

4-20mA Output. The output is proportional to gas concentration. If the concentration rises above full scale, the maximum output will be 22 mA.

Alarm Point. When the target gas concentration reaches or exceeds the alarm point, the alarm contact is activated. The alarm contact is self-resetting when the gas concentration falls below the alarm point.

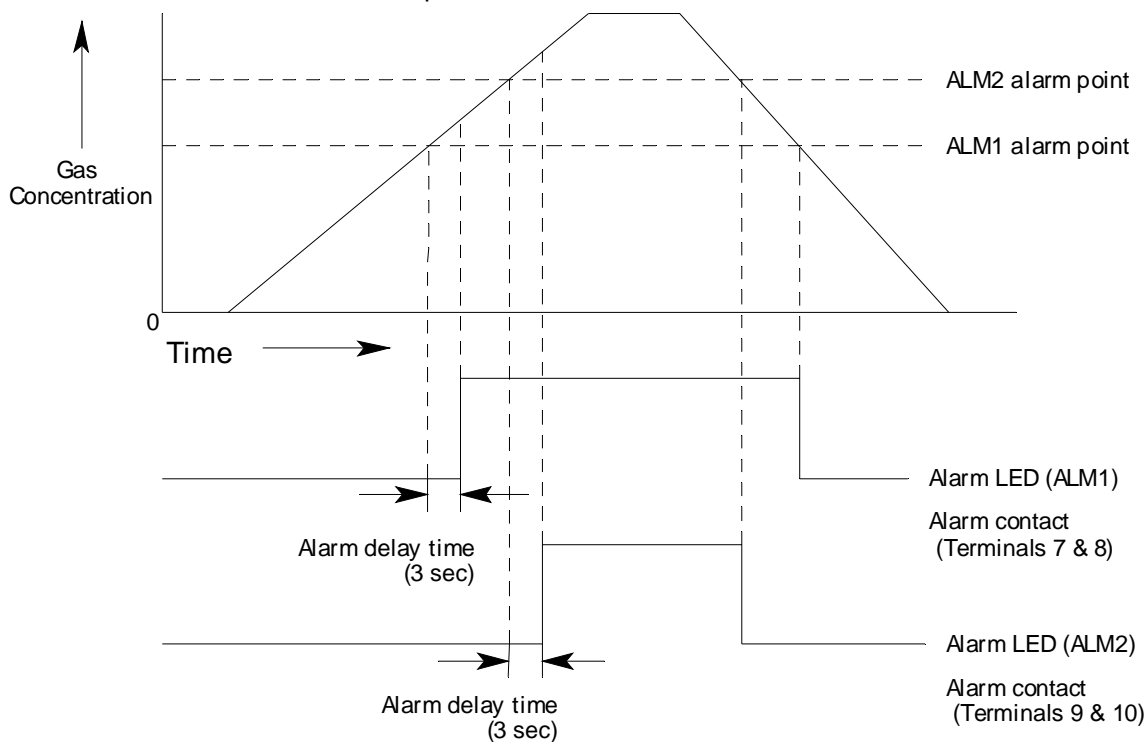


Figure 11: Alarm Operation

Responding to Alarms

This section suggests responses to gas and fail alarms.

Gas Alarms

Follow your established procedure for an increasing toxic gas condition. When the target gas concentration reaches or exceeds the alarm point, the alarm contact is activated. The alarm contact is self-resetting when the gas concentration falls below the alarm point.

Fail Alarms

Set the correct flow rate with the flow adjust valve. If you cannot set the correct flow rate, check the sample lines for obstructions or kinks. Calibrate the Model GD-K77D. If the fail condition continues, contact RKI Instruments, Inc. for further instruction.

Interfering Gas

If you suspect gasses other than the target gas as the cause of an alarm, contact RKI Instruments, Inc.

Maintenance

This section covers maintenance, calibration, and storage.

There are two levels of maintenance:

- Monthly maintenance requires that you check the proper functioning of the flowmeter, power light, LED display, and dust filter.
- Semiannual maintenance requires that you perform a zero adjustment, do an alarm test, check the gas inlet and outlet, and replace the sensor or dust filter if required.

Monthly Maintenance

- **Flowmeter.** Check the flowmeter to make sure the flow ball is between the two red flow lines. The flow rate of the Model GD-K77D is 500cc/min. If the flow ball is not between the red flow lines, adjust the air flow. When the flow ball is above the top flow line, press the FLOW ADJ switch down to reduce the flow rate. When the flow ball is below the bottom flow line, press the FLOW ADJ switch up to increase the flow rate. When the flow ball drops below the bottom flow line, the Model GD-K77D cannot accurately detect the target gas.
- **PW/TR Light.** During normal operation, the PW/TR should be on (i.e., green).
- **LED Display.** In the absence of a gas leak, the LED display should read 0.00. If the LED display does not show zero, there may be a gas leak or you may need to make a zero adjustment to the Model GD-K77D. If you suspect a gas leak, use a portable gas detector to verify the leak in the monitoring area, then take the necessary actions to remedy the problem, which may include checking the Model GD-K77D's alarm contacts and the alarm system connected to the unit. If a leak is not detected, perform a zero adjustment on the Model GD-K77D. (See "Zero Adjustment" under "Maintenance Mode" for more information).

Semiannual Maintenance

- **Zero Adjustment.** A zero adjustment resets the Model GD-K77D's gas detecting system to zero so it can accurately sample the target gas. See "Zero Adjustment" under "Maintenance Mode" and "Calibration" for more information.
- **Gas Tubing.** Check the gas tubing connected to the gas inlet and gas exhaust of the Model GD-K77D. Make sure that the tubing is not bent or damaged.
- **Dust Filter.** Examine the dust filter and replace it as required. If the flow ball in the flowmeter drops below the bottom flow line, and increasing the flow rate by pressing up on the FLOW/ADJ switch does not raise the flow ball, the filter may be clogged and requires replacement. Also check the flow path to make sure the gas inlet tube is not bent or damaged.

NOTE: Calibrate the Model GD-K77D every six months. See the Calibration section below.

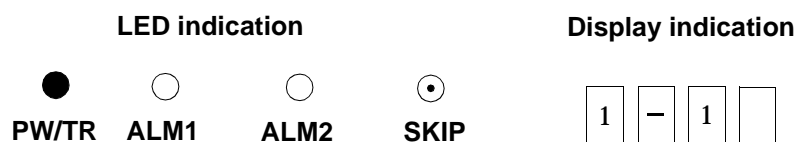
Calibration

Calibration requires you to perform both a zero adjustment and a span adjustment while in Maintenance Mode 2. Calibration should be done on a periodic basis, or when you install a new sensor or notice unusual gas readings. RKI Instruments Inc. recommends you calibrate the Model GD-K77D every six months.

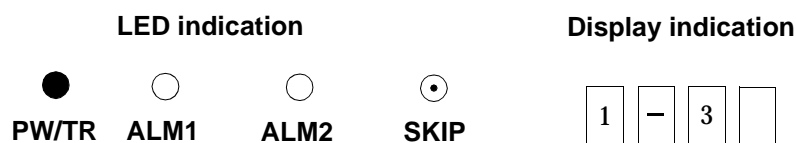
NOTE: If the GD-K77D is installed in a clean room environment, the calibration frequency may be extended to yearly.

Adjusting the Zero Setting

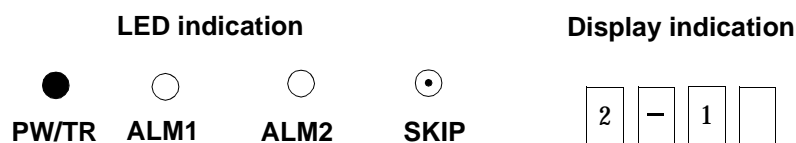
1. Turn on the power to the Model GD-K77D. See “Start Up” for more information.
2. Activate Maintenance Mode 1 by flipping up the control cover, then pressing and holding the Mode switch for three (3) seconds until 1-1 appears on the display and the SKIP lamp flashes.



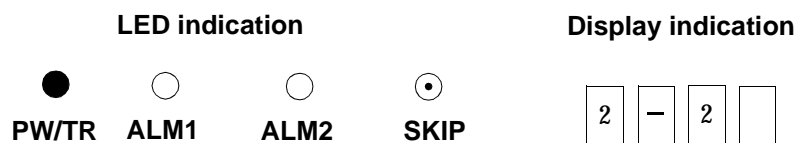
3. Use the FLOW ADJ switch to indicate 1-3 on the display.



4. Press the TEST/SET switch. The display will show “ADJ.”
5. Press and hold the TEST/SET switch until 2-1 appears on the display. The unit is now in Maintenance Mode 2.



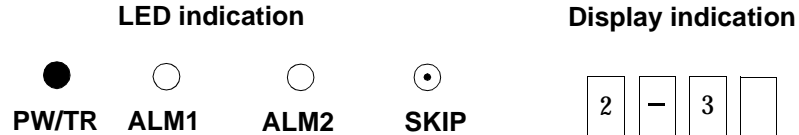
6. Use the FLOW ADJ switch to show 2-2 on the display.



7. Press the TEST/SET switch to put the unit in Zero Adjustment Mode.
8. Press the TEST/SET switch to zero the unit. The GD-K77D is finished adjusting the zero after the display stops flashing.
9. Press the MODE switch to return to Maintenance Mode 2.

Setting the Span Adjustment: Part Two of Calibration

1. After setting the zero for the unit, use the FLOW ADJ switch to show 2-3 on the display.



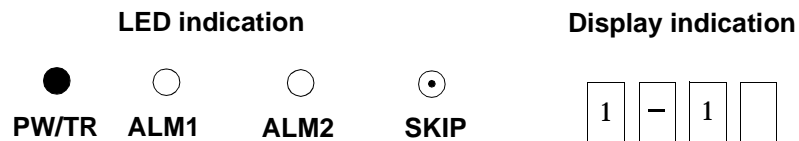
2. Press the TEST/SET switch to put the unit in Span Adjustment Mode.
3. Apply calibration gas for two minutes until the gas reading stabilizes.
4. After the reading has stabilized, use the FLOW ADJ switch to adjust the reading up or down to match the concentration of the calibration gas.
5. Press the TEST/SET switch. The reading will flicker a few times and the unit will save the span calibration and to return the unit to Maintenance Mode 2.
6. Disconnect the calibration gas.
7. Press and hold the MODE switch until the Skip lamp shuts off; this action will return the unit to Detection Mode.

Other Adjustments

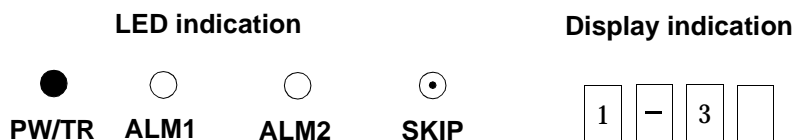
You can confirm the bias voltage of the unit, although the bias has been set at the factory. You can also set the sensor’s start-up time using Maintenance Mode 2. Setting the start-up time is done whenever the sensor is replaced in the GD-K77D.

Confirming Bias Voltage (Optional)

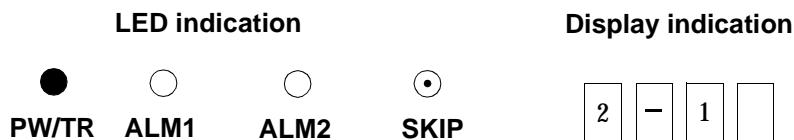
1. Turn on the power to the Model GD-K77D. See “Start Up” for more information.
2. Activate Maintenance Mode 1 by removing the Model GD-K77D’s cover, then pressing and holding the Mode switch for three (3) seconds until 1-1 appears on the display and the SKIP lamp flashes.



- Use the FLOW ADJ switch to show 1-3 on the display.



- Press the TEST/SET switch. The display will show “ADJ.”
- Press and hold the TEST/SET switch until 2-1 appears on the display. The unit is now in Maintenance Mode 2.

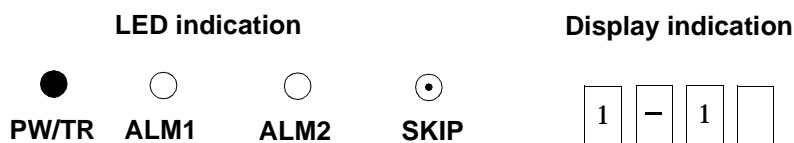


- Press the TEST/SET switch to display the sensor bias voltage on the screen. The bias voltage is displayed in mV (millivolts).
- Press the MODE switch to return the unit to Maintenance Mode 2.
- Press and hold the MODE switch until the Skip lamp shuts off; this action will return the unit to Detection Mode.

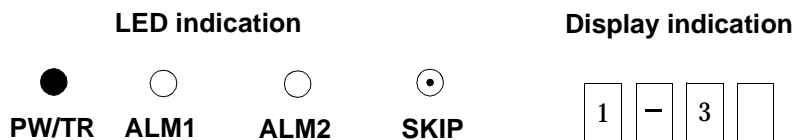
Setting a Sensor's Start-up Time

This procedure performs internal setup in the GD-K77D specific to the new sensor so that the unit will be able to determine when the sensor's output becomes too low to operate properly.

- Turn on the power to the Model GD-K77D. See “Start Up” for more information.
- Activate Maintenance Mode 1 by removing the Model GD-K77D's cover, then pressing and holding the Mode switch for three (3) seconds until 1-1 appears on the display and the SKIP lamp flashes.

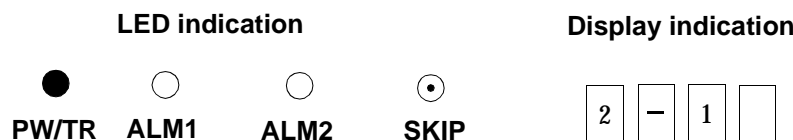


- Use the FLOW ADJ switch to show 1-3 on the display.



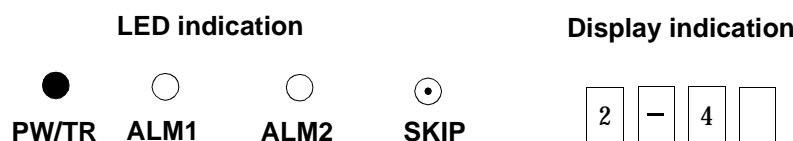
- Press the TEST/SET switch. The display will show “ADJ.”

- Press and hold the TEST/SET switch until 2-1 appears on the display. The unit is now



in Maintenance Mode 2.

- Use the FLOW ADJ switch to show 2-4 on the display.



- Press the TEST/SET switch to show S.SET on the display.
- To set the initial value of the sensor, press the TEST/SET switch.
- Press the MODE switch to return the unit to Maintenance Mode 2.
- Press and hold the MODE switch until the Skip lamp shuts off; this action will return the unit to Detection Mode.

Storage

If you need to store the Model GD-K77D temporarily or for long periods of time, make sure that the unit is oriented upright with the display facing forward. This orientation will help minimize the normal aging of the sensor and keep the sensor membrane from drying out.

Store the Model GD-K77D in a sturdy, water resistant container at normal room temperature away from gas, solvents, and vapors. The storage temperature must be between 32 o F (0 o C) to 104 o F (40 o C) and relative humidity should be between 30% and 85%.

CAUTION: *When the Model GD-K77D is not used for long periods of time, the lithium battery may lose power. The lithium battery, under normal operating conditions, has a life expectancy of about three (3) years from the date of manufacturing. When the lithium battery is replaced, put the unit into maintenance mode before replacing the battery by pressing the Mode switch for 3 seconds. Then calibrate the unit as described in the Calibration section. If the Model GD-K77D has been stored for a long time, calibrate the Model GD-K77D when the unit is put back into service.*

WARNING: **Do not discard, disassemble, mutilate, or burn the sensor. It uses a dilute acid electrolyte that damages clothing or other materials, and it can cause skin burns or blindness should the electrolyte come in contact with the eyes. If the electrolyte makes contact with the skin or eyes, wash the affected area very thoroughly with water. With eye contact, seek medical attention immediately.**

Do not recharge, burn, mutilate, or expose the lithium battery to temperatures greater the 212° F (100° C) because it may leak or explode. Do not immerse the battery in water.

Replacing Components of the GD-K77D

This section describes how to change the sensor, pump, and fuse.

Replacing the Sensor

1. Turn off the GD-K77D power switch. Also verify that the power to the unit is off.
2. Loosen the thumbscrew on the front of the cover and pull the cover away.
3. Loosen the detector unit set screw and carefully pull the detector unit away from the wall mounting bracket.
4. Disconnect the sensor cable on the right side of the sensor from the sensor. Gently pull on the connector to disconnect it.
5. A metal snap-in bracket holds the sensor in place. Push this bracket to the left until it releases the sensor.
6. Gently push the sensor back, away from the sample cup, and slide it out of the right side of the detector unit.
7. Install the new sensor into the sample cup.
8. Reconnect the sensor cable to the sensor.
9. Reinstall the sensor retaining bracket.
10. Reinstall the detector unit and cover.
11. Turn power on and turn on the GD-K77D.
12. Set the sensor start time. See the Setting a Sensor's Start Time section on p.38.
13. Allow the unit to warm-up for 2 hours.
14. Calibrate the sensor as described in the Calibration section.

Replacing the Pump

1. Turn off the GD-K77D power switch. Also verify that the power to the unit is off.
2. Loosen the thumbscrew on the front of the cover and pull the cover away.
3. Loosen the detector unit set screw and carefully pull the detector unit away from the wall mounting bracket.
4. A metal snap-in bracket holds the pump in place. A tab from the bracket is accessible on the right side of the detector unit. Push the bracket tab back until the bracket snaps back and releases the pump.
5. Gently pull the pump away from the detector unit.
6. Disconnect the pump cable from the pump connector on the circuit board in the top of the detector unit and remove the cable from the cable retainer near the connector.
7. Connect the new pump's cable to the pump connector and route the cable through the cable retainer like the old pump's cable.
8. Install the new pump into the detector unit and snap the retaining bracket back on.
9. Reinstall the detector unit and cover.
10. Turn power on and turn on the GD-K77D.
11. Verify that the flowmeter ball is between the red lines. Adjust the flow if necessary.

Troubleshooting

Trouble Alarm: Flickering PW/TR Lamp

When the PW/TR lamp is flashing, this indicates a trouble condition. The following are typical trouble conditions:

Table 4: Trouble Alarm: Condition, Cause, and Remedies

LED	Condition	Cause	Remedy
E-00	System Fault	Memory Problem in the Detector	Call RKI Instruments, Inc. for assistance.
E-01	Sensor Fault	Connector Contact Failure or Sensor Cable is Disconnected	Check the sensor cable to make sure that it is properly connected to the sensor and to the amplifier board. For further assistance, contact RKI Instruments, Inc.
E-04	Zero Follower Fault	Usually High Zero Drift	Calibrate the Unit. Replace the Sensor.
E-05	Low Flow	Clogged Filter or Deteriorated Pump	Check the flowmeter to make sure the flow ball is between the two red flow lines. Adjust the flow rate if required. The dust filter may be clogged. Examine the dust filter; clean or replace it as required. Check that the Model GD-K77D is mounted firmly or that the fixing screw is fastened securely. The tubing on the gas-in or gas-out side of the Model GD-K77D may be clogged or broken. Check and repair the pipes as required. The Model GD-K77D's pump may need to be replaced.

Prevention

A trouble alarm may result from disconnected wiring or short circuits between the Model GD-K77D and devices connected to it. To reduce the possibility of a trouble alarm, do the following:

- Check the wiring on the Model GD-K77D as well as the wiring on all peripheral equipment.
- Check the wiring on the detection system.
- Check all tube connections.

PW/TR Lamp Off

- Check the power switch. Is it turned on?
- Check power connection and re-connect if necessary.
- Check fuse for proper connection and replace fuse if burned out.
- Check the power voltage to the Model GD-K77D. Is the voltage normal?

Abnormal Performance

A sudden surge of line noise may be the source of the problem. Try turning off the Model GD-K77D, then turning the unit back on.

Prevention and Remedies

- Do not power the Model GD-K77D with a circuit that has a load or with high frequency noise.
- Do not install the Model GD-K77D in areas with high levels of radio interference or electronic noise. This electronic interference may cause abnormal readings.
- In some circumstances, the Model GD-K77D may be affected by static electricity or electromagnetic interference. If the environment in which the Model GD-K77D is to be placed has these electrical hazards, take appropriate steps to shield the Model GD-K77D properly.
- Do not place the Model GD-K77D near electrical wiring or other electrical devices, such as industrial motors.
- If the noise problem persists, try moving the Model GD-K77D to a new location, away from electrical devices and cables, and use a line filter to eliminate any line noise.
- Also note that noise can be caused by lightning.

Unable to Calibrate

- Is the calibration gas concentration appropriate?
- The sensor sensitivity may be too low because of age. You may need to replace the gas sensor.

Slow Response

- Check the flowmeter to make sure the flow ball is between the two red flow lines. The flow rate of the Model GD-K77D is 500 L/min. If the flow ball is not between the red flow lines, adjust the flow rate. When the flow ball is above the top flow line, press the FLOW ADJ switch down to reduce the flow rate. When the flow ball is below the bottom flow line, press the FLOW ADJ switch up to increase the flow rate. When the flow ball drops below the bottom flow line, the Model GD-K77D cannot accurately detect the target gas.
- The dust filter may be clogged. If the flow ball in the flowmeter drops below the bottom flow line, and increasing the flow rate by pressing up on the flow toggle switch does not raise the flow ball, the filter may be clogged and requires replacement. Examine the dust filter; clean or replace it as required.

- Check that the Model GD-K77D is mounted firmly or that the fixing screw is fastened securely.
- The tubing on the gas-in or gas-out side of the Model GD-K77D may be clogged or broken. Check and repair the pipes as required.

Disconnected Fuse

- If the Model GD-K77D's fuse is disconnected or is burned out, the unit will not operate.
- If the fuse has burned out, replace the fuse. When replacing the fuse, turn off the power to the Model GD-K77D. Use only replacement fuses that have the correct current and voltage ratings. Do not use any fuse other than the one specified for the Model GD-K77D. Using a non-specified fuse will cause a short and damage the Model GD-K77D.
- If an electrical fault has occurred, do not attempt to operate the Model GD-K77D. Before re-starting the unit, you must correct the electrical fault.
- If the fuse continues to blow out and the problem cannot be attributed to a source outside the Model GD-K77D, contact RKI Instruments, Inc. for assistance. The Model GD-K77D may be faulty and needs to be repaired.

Parts List

Table 6 lists replacement parts and accessories for the Eclipse Detector Head.

Table 5: Parts List

Part Number	Description
06-1272RK	Sample tubing for inlet and exhaust fittings, 4 mm ID x 6 mm OD (specify length in feet when ordering)
43-4155RK	Fuse, 2A, 5 x 20 mm