

BACHARACH

Instruction 23-9613
Rev. No. 1
September, 1982

INSTRUCTION MANUAL TLV SNIFFER



MCD 000017797



Bacharach Instruments
301 Alpha Drive
Pittsburgh, PA 15238
(412) 782-3500

CONTENTS

	<u>PAGE</u>
<u>SECTION 1</u>	<u>1-1</u>
DESCRIPTION	
PURPOSE AND FUNCTIONS.	1-1
Toxicity Warning Function	1-1
PPM Meter	1-1
Search Function	1-1
Continuous Self-Monitoring.	1-1
PRINCIPLE OF OPERATION	1-1
SENSITIVITY RANGES	1-2
ACCURACY AND RELIABILITY	1-2
PHYSICAL DESCRIPTION	1-3
Instrument and Case	1-3
Air Sampling Mechanisms	1-3
Combustible Gas Detector.	1-4
AUXILIARY EQUIPMENT.	1-4
Probe and Hose.	1-4
Earphone.	1-4
Batteries	1-4
Battery Charger	1-5
Recorder.	1-5
CONTROLS	1-5
Mode Selector	1-5
ADJUSTMENTS.	1-5
Meter Zero Mechanical Adjustment Screw.	1-5
Meter Zero Coarse Adjustment Screw.	1-6
Meter Zero Fine Adjustment Knob	1-6
Gain Potentiometer Adjustment Screws.	1-6
Alarm Level Potentiometer Adjustment Screw.	1-6
Recorder Level Potentiometer Adjustment Screw	1-6
<u>SECTION 2</u>	<u>2-1</u>
PRE-OPERATION CALIBRATIONS AND ADJUSTMENTS	
BATTERY TEST	2-1
SETTING METER POINTER TO ZERO.	2-1
SETTING METER POINTER DEFLECTION (GAIN CALIBRATION).	2-2-5
RESETTING ALARM RESPONSE	2-6
SETTING RECORDING LEVEL.	2-7
<u>SECTION 3</u>	<u>3-1</u>
MCD 000017798	
OPERATION	
MONITORING TOXICITY.	3-1
Direct Readings and Alarm	3-1
Converting Hexane-calibrated Meter ppm Readings to ppm	
Readings for Other Gases.	3-1
Converting ppm Readings to Percent Lower Explosive Limit.	3-3
LOCATING GAS LEAK SOURCES.	3-4

SECTION 1

DESCRIPTION

PURPOSE AND FUNCTIONS

Toxicity Warning Function

The portable TLV Sniffer is an extremely sensitive combustible gas and vapor sensing instrument with an overall detecting sensitivity range of from 1 to 10,000 parts of gas or volatile flammable vapor per million parts of air (by volume). The instrument is equipped with an audible (beep) alarm that can be set to sound at any desired level of gas concentration to warn automatically of toxic concentrations of gas. Connections are provided for an auxiliary earphone for use in noisy areas to assure that audible warnings will be heard.

PPM Meter

A meter reading directly in parts per million (ppm) allows instant visual determination of toxicity danger as readings are compared to published standard Threshold Limit Values. The instrument can be calibrated to read directly in parts per million for any one of many kinds of combustible gases. Factory calibration is for hexane unless otherwise specified, though readings from other gases and vapors may be interpreted easily by means of reading conversion curves (in OPERATION Section, this manual).

Search Function

In addition to its primary function of indicating ppm combustible vapor concentrations and toxicity levels, an ultrasensitive "search" range of from 1 to 100 ppm makes the TLV Sniffer especially useful for locating hard-to-find gas leaks. A hand-held probe attached to the instrument can be moved in the direction indicated by rising meter readings to point out quickly the source of escaping gas.

Continuous Self-Monitoring

Other functions provided in the TLV Sniffer circuitry for continuous self-monitoring purposes include a continuous, audible note of warning in response to failing batteries and to excessive negative drift in signal voltage due to malfunctioning detector circuit components. A 45-second time delay circuit is incorporated to prevent the sounding of a false alarm due to temporary voltage imbalances during the brief warmup period after the instrument mode selector switch has been set to operate the instrument.

PRINCIPLE OF OPERATION

MCD 000017799

To detect and measure concentrations of combustible gas in the air, the TLV Sniffer catalytically oxidizes gas in a pumped-in sample of air by means of a catalyst-coated resistance element. The resistance of this element changes with changes in heat that are proportional to the amount of oxidized gas, thereby altering the electrical balance of the catalytic element as

Calibrated for hexane gas (a relatively high-energy gas) at the factory, the TLV Sniffer should also provide accurate ppm readings for benzene, toluene, and other gases of similar combustion rates. Conversion curves aid in correctly interpreting readings from combustible gases that release energy at different rates.

Thus, purity of the air sample used for meter pointer zero settings is by far the most important factor in obtaining accurate ppm readings. Ideally, the pointer should be zeroed in the PPM X 1 mode of operation, where deviations from zero would be more apparent because of maximum deflection. In this range, however, extreme sensitivity causes the instrument to respond to the slightest traces of gas. Wisps of cigarette smoke, fumes from passing autos, and subtle air contaminations from many other sources may affect the zero setting. The extent to which zero readings are biased because of air sample impurities will be reflected in less accurate readings of actual gas concentration ppm. Frequently, an apparent negative drift of the meter pointer may be caused by carrying the instrument to an area of fresher air after zeroing the meter inadvertently on air that was not as pure.

PHYSICAL DESCRIPTION

Instrument and Case

The TLV Sniffer is housed in a sturdy, brushed-aluminum and blue, wrinkle-finished plastic case. An attractively designed carrying handle serves also as an adjustable support stand and shoulder strap holder. Weighing 5-1/2 lbs., the compact 8-x6-1/2-x3-1/4-inch instrument is as convenient to carry as a transistor radio. A front panel, easily visible with the instrument in carrying position, contains a meter reading directly in ppm, and control knob for range selection and zero setting of the indicating meter pointer. The side panels of the instrument provide plugs and connectors for an air sample probe, earphones, battery charger, and recorder. Removal of ten screws holding the rugged plastic cover to the rigid aluminum case gives access to batteries and calibration adjustment controls located within the interior of the case.

TLV Sniffer Models

The TLV Sniffer is available as a standard model 0023-7350, for use in areas known to be free of combustible gases and vapors, or as an intrinsically safe model 0023-7356, for use in hazardous areas designated Class I, Divisions 1 or 2 by the National Electrical Code. Model 0023-7356 has been certified to be intrinsically safe by the Factory Mutual Laboratories.

Air Sampling Mechanisms

The TLV Sniffer air sampling system consists of a short intake connection leading directly into an interior aluminum air chamber holding the detector, a six-inch length of tubing connecting the chamber and a miniature sample-drawing pump, and a three-inch length of tubing to an exhaust port on the left side of the instrument case.

For intrinsically safe model: The Intrinsically Safe battery pack is similar to above, but the battery consists of six nickel-cadmium cells connected by welded links to prevent arcing. The cell assembly is enclosed in a rivet-sealed, high-impact, plastic housing with protective fuses and wire-wound resistors that limit current capacity even under short-circuit conditions to levels below that which would ignite the worst possible mixtures of combustible gas and air.

Battery Charger

A compact battery charger (230 VAC: #0023-7353; 115 VAC: #0023-7230) with a plug-in connector may be attached to a jack provided in the right side of the instrument case. For stationary testing, the TLV Sniffer may be operated with the charger connected. For portable operations, the charger may be used to rejuvenate batteries within the instrument overnight. The intrinsically safe battery pack may be recharged either in or outside the instrument.

Recorder

A recorder (range: 0-100 mv; impedance: 10,000 ohms or greater) may be connected to the TLV Sniffer for use if variations in combustible gas levels are to be recorded for study or legal data. Recording is more suitable for the PPM X 100 and PPM X 10 mode ranges. The ultrasensitive PPM X 1 "search" range, responsive from 1 to 100 ppm of gas, is not as suitable for an accessory recorder because of the small magnitude of the signal and the potentially rapid fluctuations of the signal within the range in response to small changes in detected quantities of combustible gas.

CONTROLS

MCD 000017801

Mode Selector

The MODE SELECTOR control knob at lower right on the instrument panel operates a rotating gang switch with an OFF position, a battery test switch, and three range-selector switch positions that allow a choice among three sensitivity ranges for readings of 0 - 100 ppm, 0 - 1000 ppm, or 0 - 10,000 ppm on the meter scale.

ADJUSTMENTS

Meter Zero Mechanical Adjustment Screw

The meter pointer mechanical adjustment screw is located within the instrument on the back side of the meter barrel near the - terminal. This adjustment screw is factory set, and does not ordinarily require subsequent attention. Any adjustment of this screw should be done with the MODE SELECTOR knob turned to the OFF position.

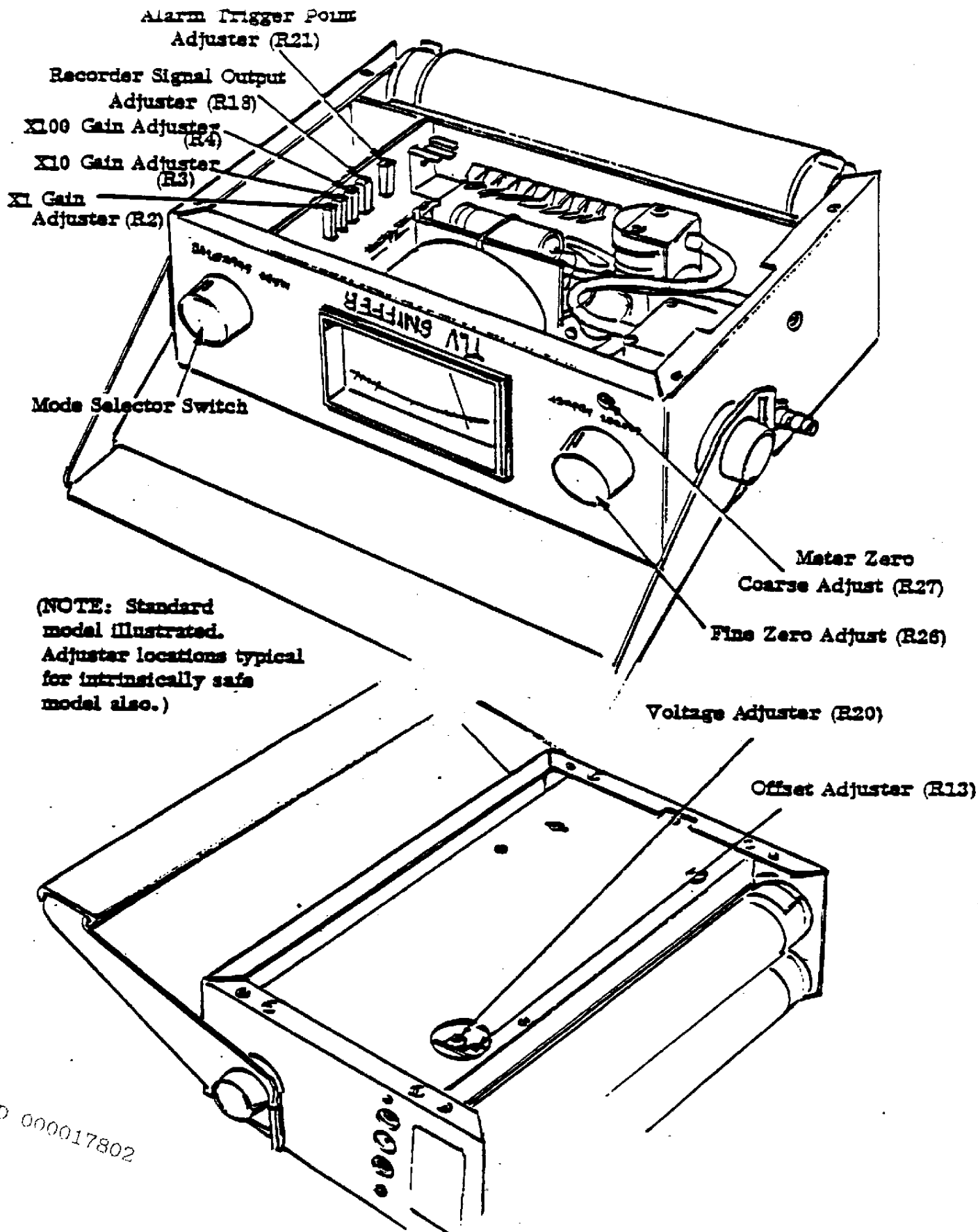


Figure 1-1. TLV Circuitry Adjustment Potentiometer Locations.

SECTION 2

PRE-OPERATION CALIBRATIONS AND ADJUSTMENTS

Prepare the TLV Sniffer Combustible Gas Detector for operation in accordance with the following steps:

BATTERY TEST

Test battery as follows: Turn MODE SELECTOR knob from OFF position to BATT TEST position. Meter pointer should come to rest in BATTERY GOOD range of meter scale. (Both a meter reading below BATTERY GOOD range and an audible signal warn of batteries too weak to sustain normal operation.)

SETTING METER POINTER TO ZERO

Set pointer to meter zero as follows: MCD 000017803

1. Attach air sampling probe connector to instrument intake on left side of case by pulling back spring collar of connector, pressing connector over intake, and releasing spring collar.
2. Place TLV Sniffer in position in which meter indications will be read (usually in meter-up position).

NOTE: Heat distribution from active and reference filaments of the detector sensor changes from vertical to horizontal position. The resulting change in electrical balance between elements causes a shift in pointer zero from one position to the other.

3. Set MODE SELECTOR switch to PPM X 100 and operate instrument for 10 minutes to allow circuits to stabilize.
4. In fresh air, set ZERO ADJUST knob at midpoint (five full turns from either extreme position). If fresh air is not available, use Bacharach Kit #51-7199 to apply known pure air to the Sniffer intake (instructions in kit).
5. Turn coarse adjustment screw, located under ZERO ADJUST knob, to move meter pointer to zero on the meter scale.
6. Turn MODE SELECTOR to PPM X 10 position and turn ZERO ADJUST knob to set pointer to zero.
7. Turn MODE SELECTOR to PPM X 1 position and turn ZERO ADJUST knob to set pointer to zero.

NOTE: The TLV Sniffer is extremely sensitive in the PPM X 1 range. CO₂ from breath too close to the intake, cigarette smoke, auto fumes, etc., can interfere with accurate setting of the pointer to meter zero.

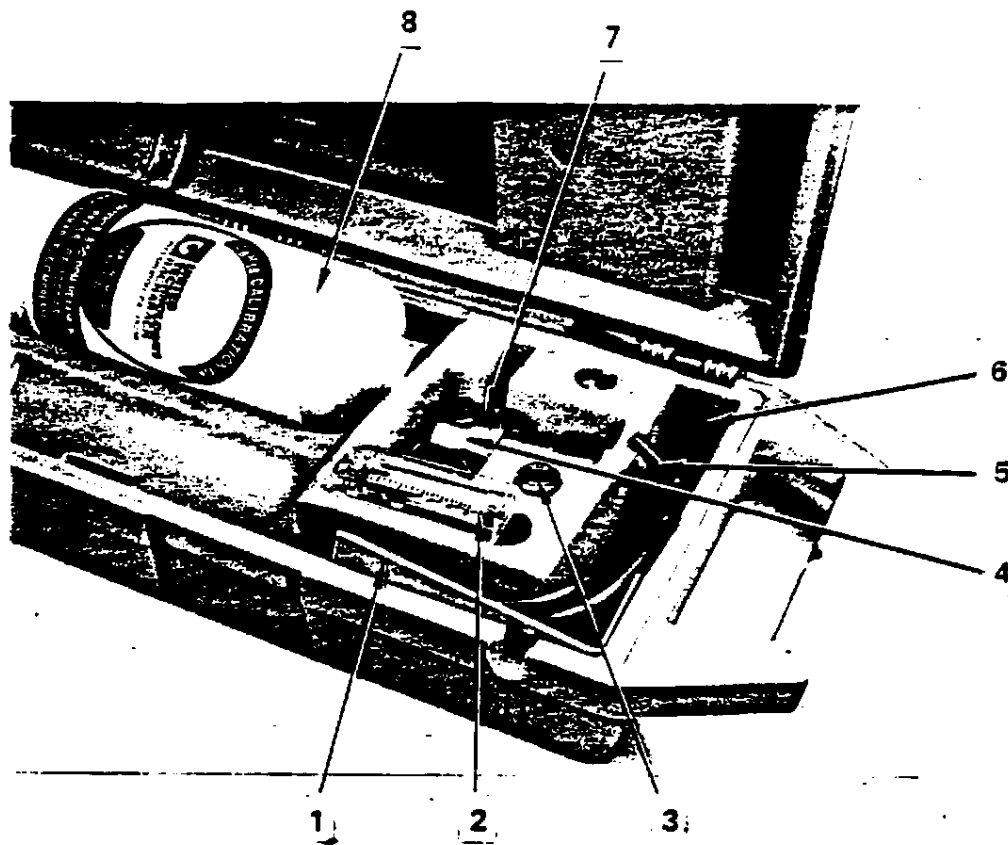


Figure 2-1. Bacharach Code 51-7199 Gas Calibration Kit

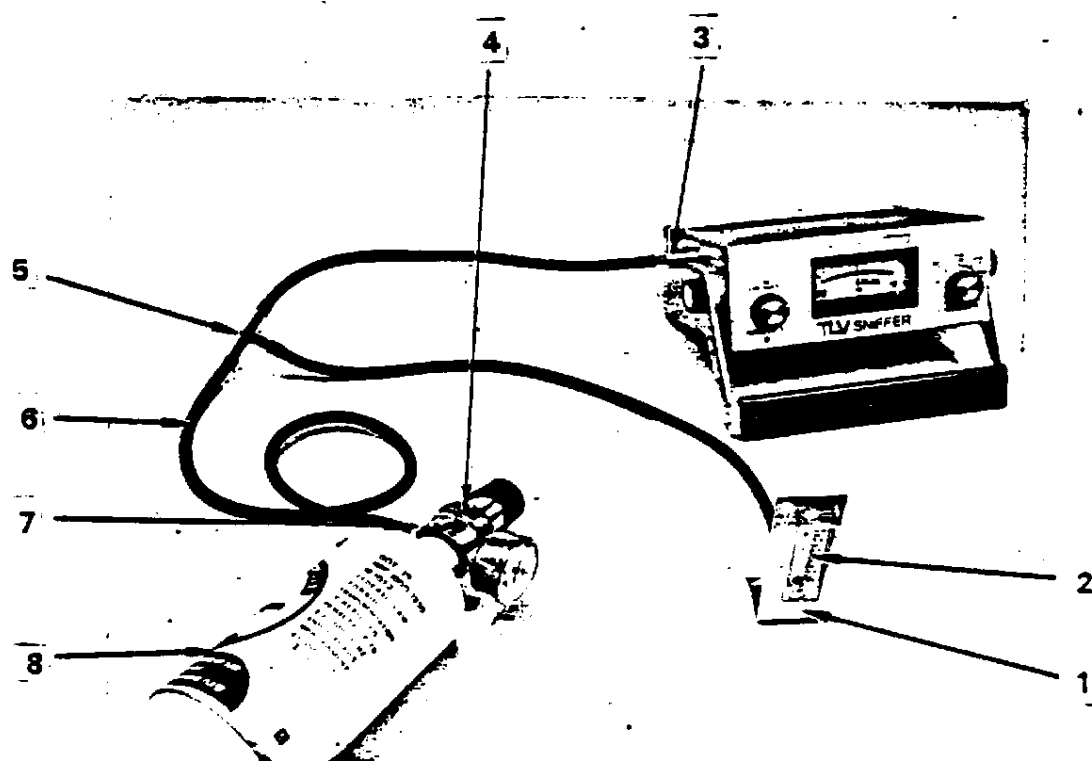
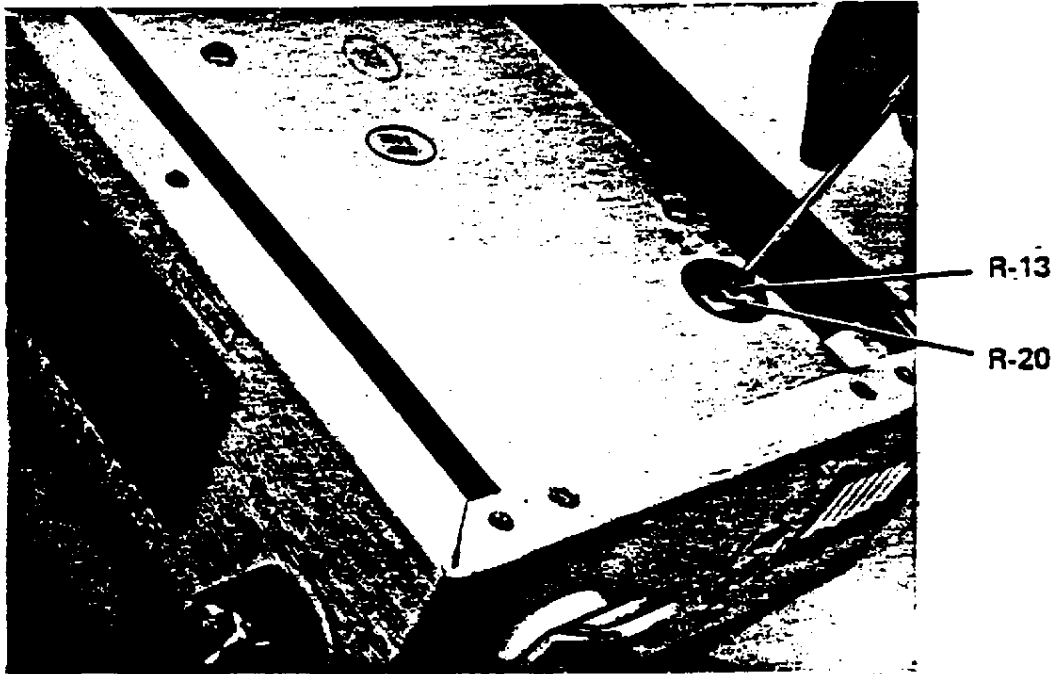


Figure 2-2. Calibration Gas Transfer Assembly Properly Hooked Up.



MCD 000017805

Figure 2-3. Locating and adjusting R-13 on PPMX100 position for meter pointer indication of scale zero.

- 7) Turn MODE SELECT switch to PPMX10 position. Then turn the FINE ZERO ADJUST until meter pointer indicates full scale 1000 ppm. Turn MODE SELECT switch to PPMX100 position and adjust R4 the X100 Span Adjuster until meter pointer indicates (10) or 1000 ppm. Turn FINE ZERO ADJUST until meter pointer indicates scale zero.
- 8) Turn MODE SELECT switch to PPMX10 position, then turn FINE ZERO ADJUST until meter pointer indicates 10 on the scale or 100 ppm.
- 9) Turn MODE SELECT switch to PPMX1 position and adjust the X1 Span Adjuster until meter pointer indicates 100 (full scale) or 100 ppm.
- 10) Turn FINE ZERO ADJUST until meter pointer indicates scale zero. The TLV is now calibrated and ready for use on the low range 0-100 ppm as a gas leak detector.

SETTING RECORDING LEVEL

If recorder (range: 0-100 mv; impedance: 10,000 ohms or greater) is to be used, attach accessory recorder jack to RECORDER plug in right side of instrument case and set recording level as follows:

1. Set MODE SELECTOR knob to PPM X 100 or PPM X 10 as desired and apply combustible gas to instrument intake.
2. Turn RECORDER potentiometer adjustment screw until accessory recorder response corresponds with meter readings as desired.

MCD 000017806

SECTION 3

OPERATION

MONITORING TOXICITY

Monitor combustible gas and vapors to determine concentrations with respect to Threshold Limit Values as follows:

Direct Readings and Alarm

1. Turn MODE SELECTOR control knob to BATT TEST position and read condition of battery on meter dial. Install new or recharged batteries if necessary.
2. Turn MODE SELECTOR control to desired operating range, selected in accordance with the Threshold Limit Value for the toxic gas to be monitored (PPM X 1 for TLV from 0 to 100 ppm; PPM X 10 for TLV from 0 to 1000 ppm; PPM X 100 for TLV from 0 to 10,000 ppm).
3. Allow ten-minute warmup period with instrument in same position as it is to be used in service (meter facing up or meter facing to the side).
4. In fresh air before entering monitoring area, turn ZERO ADJUST control knob until meter pointer resets on zero.
5. For monitoring in noisy areas, insert jack of accessory earphone in plug on right side of instrument case.
6. Enter monitoring area and read ppm gas concentrations on meter. Audible warning sounds if gas concentration causes readings at mid-point of scale or above, or if toxic Threshold Limit Value has been exceeded, provided the alarm has been set for this response.
7. For readings above 10,000 ppm: Replace probe assembly 0023-7243 with dilution probe 0023-7355 and slide dilution probe O-ring to expose dilution holes of probe (extends range 10X to read up to 100,000 ppm). See Figure 3-1. Add in-line filter and trap assembly if sampling in dust- or moisture-laden areas.

Converting Hexane-calibrated Meter ppm Readings to ppm Readings for Other Gases

Hexane gas is commonly used for factory calibration and subsequent in-service recalibrations of the TLV Sniffer. To determine ppm concentrations of gases other than hexane with instruments calibrated for hexane, multiply the ppm meter reading by the factor for the gas detected as listed in the table below. (Note meter range setting in making ppm readings and calculations.)

MCD 000017807

Table 3-1. Multiplying Factors for Converting ppm Meter Readings of Hexane-calibrated Instruments to ppm Concentrations of Other Gases.
(Approximations)

Gas Detected	Factor	Gas Detected	Factor
Acetone	1.50	Hydrogen Sulfide	18.60
Acetylene	1.78	Isopropanol	1.59
Acrylonitrile	1.54	M.E.K.	1.60
Benzene	1.02	Methane	1.58
1,3-Butadiene	1.52	Methanol	3.71
Butane	1.04	Methyl Acrylate	3.37
Butyl Acetate	2.08	Methyl Chloride	4.02
Carbon Disulfide	5.92	Methyl Chloroform	4.44
Carbon Monoxide	5.11	Pentane	1.04
Cyclohexane	1.02	Perchloroethylene	13.66
Ethane	1.36	Propane	1.14
Ethanol	1.90	Propylene	1.30
Ethyl Acetate	2.22	Styrene	2.25
Ethyl Ether	1.30	Tetrahydrofuran	1.41
Ethylene	1.38	Toluene	1.03
Ethylene Oxide	2.05	Trichloroethylene	6.40
Heptane	1.05	Vinyl Acetate	2.00
Hexane	1.00	Vinyl Chloride	2.24
Hydrogen	1.45	o-Xylene	1.64

Converting ppm Readings to Percent Level of Lower Explosive Limit (L.E.L.)

To determine gas concentration levels in terms of percent of lower explosive limit (% L.E.L.) from direct ppm readings for hexane or from calculated ppm concentration levels for other gases:

1. Read ppm on TLV Sniffer indicating meter.
2. On 0-to-10,000 "PPM CONCENTRATION IN SAMPLE" horizontal scale at bottom of % L.E.L. Conversion Chart, Figure 3-2, locate position left-to-right representing ppm reading.
3. On slanted chart line representing kind of gas detected, find the point in vertical alignment over ppm reading point on horizontal scale.
4. On vertical scale at left labeled "% L.E.L. EQUIVALENT," read the percent-of-lower-limit equivalent found in horizontal alignment with the point located on the slanted line.

MCD 000017808

SECTION 4

MAINTENANCE AND REPAIRS

SYMPTOMS AND REMEDIES

Gradual exhaustion of the detector element, eventual wearing of air-sample pump parts, battery recharging or replacement, etc., require an amount of maintenance and repair work over an extended period of time. The following table describes symptoms, possible causes, and remedial actions relating to conditions requiring maintenance and repairs.

TABLE 4-1

TROUBLESHOOTING PROCEDURES

SYMPTOM	POSSIBLE CAUSE	REMEDY
Meter pointer drifts from zero.	Traces of combustible gas in air sample thought to be pure.	Adjust pointer to zero in fresh air. Use Bacharach Kit 51-7199 if fresh air is otherwise unavailable.
	Change of position of instrument from upright to horizontal or vice versa, thus redistributing heat between active and reference elements of the detector.	Keep instrument consistently in either vertical or horizontal position while in use.
	Insufficient warmup period.	Allow 10-minute warmup period before zeroing meter pointer.
	Erratic monolithic chip.	Consult factory or replace circuit board.
	Erratic sensing element.	Replace detector.

MCD 000017809

TABLE 4-1 (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
No audible alarm in presence of strong concentration of combustible gas.	Operation of 45-second delay circuit after turning MODE SELECTOR control to operate instrument.	Wait approximately 45 seconds for delay period to expire.
	Improper setting of alarm response level.	Reset alarm to desired level.
	Faulty monolithic chip.	Consult factory or replace circuit board.
	Faulty alarm circuit.	Replace printed circuit board.
	Loose lead to speaker; damaged speaker.	Inspect for loose leads. Using 0-15V range voltmeter, check for excitation voltage across speaker terminals while meter indicates in alarm zone.
	Dead batteries.	Confirm battery exhaustion at meter with MODE SELECTOR switch in BATT TEST position. Recharge or replace batteries if necessary.

MCD 000017810

Replacing Batteries

Replace batteries, if necessary, as follows:

1. Remove ten screws used to hold cover to case and remove cover.
2. Standard model: Remove two battery assemblies (three batteries in each of two cardboard tubes) from spring clips in back of case.

Intrinsically safe model: Replace entire sealed battery pack. The following steps 3 and 4 do not apply.

3. Standard model: Remove old batteries from tubes and replace with new batteries. Orient plus and minus battery terminals as indicated by arrows with polarity signs on battery mounting panel.
4. Standard model: Snap replacement batteries with tubes into battery holding clips. Spring terminals at one end may be held back with a small screwdriver or similar tool to facilitate insertion of battery assemblies in clips.
5. Replace cover and attach with ten screws.

MCD 000017811

Replacing Detector

Replace detector when necessary as follows:

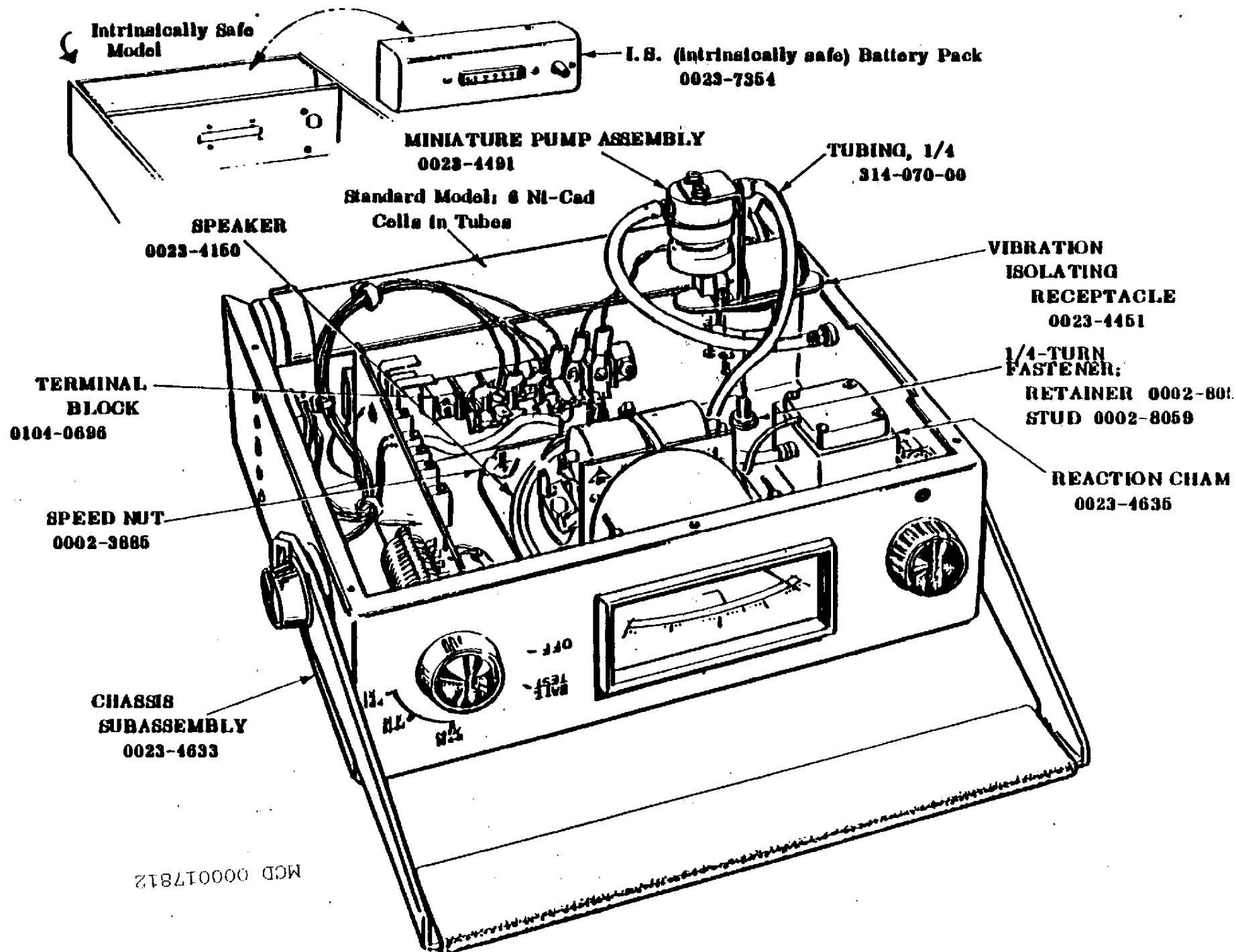
1. Remove instrument case cover to gain access to detector housing.
2. With instrument in speaker-down position, remove four screws used to attach detector socket assembly to cubical aluminum air sample chamber.
3. Lift detector socket assembly from air chamber block.
4. Unplug old detector from socket assembly.
5. Insert new detector in socket. New detector part number should correspond to that listed on label affixed to cover of instrument (#800-080.90).
6. Reinstall socket assembly with new detector in air chamber and replace instrument cover. Tighten screws uniformly and snugly.

Replacing Printed Circuit Board

Replace printed circuit board, when necessary, as follows:

1. Remove instrument case cover to gain access to printed circuit board.
2. Using Allen wrench, remove two small setscrews used to hold MODE SELECTOR knob to shaft and remove knob from shaft.
3. Remove hex head nut used to hold MODE SELECTOR switch shaft to instrument panel.

Figure 4-1. TTV Sniffer Chassis Subassembly Showing Miniature Pump Assembly in Disassembled Position.



REPLACEMENT PARTS LIST

TLV SNIFFER (Standard Model 0023-7350; Intrinsically Safe Model 0023-7356)

<u>ITEM</u>	<u>STOCK NO.</u>
Calibration Kit	0051-7199
Connector, Tubing	0003-6152
Cover, Instrument	0023-4454
* Dry Cell (alternate to Ni-Cad Cell; 6 required)	3600-3100
Earphone	0023-0605
Element, Detector	8000-8090
Filter, In-line Dust and Moisture Trap	0023-7341
Filter, Probe (box of 24 refills)	5500-7000
Fuse (for Intrinsically Safe battery pack)	0204-2703
Handle	0023-4445
Hexane Tank (500 ppm)	0051-1120
** I.S. (Intrinsically Safe) Battery Pack	0023-7354
Knob, Control	0023-4443
Knob, Handle	0023-4444
• Ni-Cad Cell (preferred for standard model; 6 required)	0004-0030
* Printed Circuit Board Assembly-Std. Model	0023-4441
** Printed Circuit Board Assembly-Intrinsically Safe	0023-4778
Probe and Hose Assembly	0023-7243
Probe and Hose Assembly, Dilution	0023-7355
Pump Assembly	0023-4773
Pump Bellows (replacement)	0023-0018
Pump Check Valve (replacement; 2 required)	0023-4218
Recorder Plug, Switchcraft #755	---
Screw, Cover Mounting (10 required)	01-3461
Finishing Washer (10 required)	102-4062
Spacer, Handle	0023-4647
Speaker	0023-4150
* Tube, Battery (standard model; 2 required)	23-2313
Tubing, 1/4 O.D. x 1/16 wall	03-6105

MCD 000017813

- * Standard model only
- ** Intrinsically safe model only

WARRANTY

1. Bacharach Instrument Company Division of AMBAC Industries, Incorporated warrants to Buyer that at the time of delivery this product will be free from defects in material and manufacture and will conform substantially to Bacharach's applicable specifications. Bacharach's liability and Buyer's remedy under this warranty are limited to the repair or replacement, at Bacharach's option, of this Product or parts thereof returned to Seller at the factory of manufacture and shown to Bacharach's reasonable satisfaction to have been defective; provided that written notice of the defect shall have been given by Buyer to Bacharach within one (1) year after the date of delivery of this product by Bacharach.
2. Bacharach warrants to Buyer that it will convey good title to this Product. Bacharach's liability and Buyer's remedy under this warranty of title are limited to the removal of any title defects or, at the election of Bacharach, to the replacement of this Product or parts thereof that are defective in title.
3. The warranty set forth in paragraph 1 does not apply to parts the Operating Instructions designate as having a limited shelf-life or as being expended in normal use.
4. THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE GIVEN AND ACCEPTED IN LIEU OF (i) ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE; AND (ii) ANY OBLIGATION, LIABILITY, RIGHT, CLAIM OR REMEDY IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM BACHARACH'S NEGLIGENCE, ACTUAL OR IMPLIED. The remedies of the Buyer shall be limited to those provided herein to the exclusion of any and all other remedies including, without limitation, incidental or consequential damages. No agreement varying or extending the foregoing warranties, remedies or this limitation will be binding upon Bacharach unless in writing, signed by a duly authorized officer of Bacharach.

NOTE: Fuses, batteries, and sensors are expendable items not covered by the warranty.

MCD 000017814

NOTICE

This manual contains proprietary information that shall not be reproduced or copied in whole or in part as the basis for manufacture of items herein described.