

GP-204  
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INSTRUCTION MANUAL  
FOR  
RIKEN HAND-HELD  
PORTABLE COMBUSTIBLE DETECTOR  
MODEL GP-204

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## 1. GENERAL DESCRIPTION

The model GP-204 HAND-HELD PORTABLE COMBUSTIBLE GAS DETECTOR is a compact battery-operated portable instrument used for taking an air sample and indicating the presence and concentration of combustible gas. Samples of the air under test are drawn by means of a rubber aspirator bulb and analyzed for combustible gas content on a heated platinum filament in a Wheatstone bridge measuring circuit. A built-in meter indicates combustible gas content in units of explosibility. Power for operation of the instrument is provided by built-in dry cells. A probe and extension hose permit withdrawal of samples from remote locations and the instrument fits in a compact leather case with over-the-shoulder carrying strap. The model GP-204 is suitable and recommended for testing tanks, manholes, vessels and other spaces to determine presence or absence of combustible gas in pressure cylinders, pipe lines and other closed systems. It is a valuable aid to safety of operations whenever combustible gases or vapors are handled.

## 2. OPERATION

Before taking instrument on the job, check battery voltage. To check, put switch in VOLT ADJ position. Meter should rise to the "CHECK" position near top of scale. Lift and turn VOLT ADJ. control clockwise to determine maximum voltage setting. If it cannot be set beyond mark, batteries need recharging or replacement for full capacity. Do not attempt to use instrument at all if reading cannot be set up to mark.

If voltage is satisfactory, continue with the next steps of preliminary adjustment as follows:

- 1) Confirm operation of pilot light/meter illuminating lamp.
- 2) With sample inlet in fresh air, squeeze bulb several times to flush out any remaining gas.
- 3) Check zero setting by turning switch to ON position. Meter should read close to zero. Lift and turn ZERO knob to bring reading to exactly 0.
- 4) Couple sampling hose to instrument inlet on left-hand end, and connect probe to end of hose.
- 5) Admit a sample of some combustible gas to end of probe, and confirm that meter rises upscale.

Instrument is new adjusted and ready to use. It may be turned off and carried to the job. To make a gas test, proceed as follows;

- 1) Turn to VOLT ADJ. position, adjust voltage if necessary, then turn to ON.
- 2) Hold probe within space to be tested. Squeeze bulb several times while watching meter, and observe maximum reading.
- 3) After completion of test, remove probe from test space, flush with fresh air for 4 or 5 squeezes of bulb, and turn off.

### 3. INTERPRETATION

Meter readings are taken on a scale graduated 0~100% LEL. The abbreviation L.E.L. stand for Lower Explosive Limit, and represents the lowest concentration which can be ignited by a source of ignition, hence the lowest concentration which can produce an explosion. This quantity is also spoken of as the Lower Flammable Limit (L.F.L.).

The model GP-204 is calibrated before shipment to read directly in percent L.E.L. of iso-butane in air, based on the known L.E.L. for iso-butane of 1.8% by volume. This is, a 1.8% by volume will produce a reading of 100%, and smaller concentration will read in proportion.

Other combustible gases will read approximately correctly in terms of explosibility but for maximum accuracy a calibration curve for the specific substance should be consulted. Typical calibration curves for various gases are shown in Fig. 1. Curves are drawn in terms of percent L.E.L. for both coordinates.

Concentrations may also be interpreted in terms of volume percent by multiplying the percent L.E.L. in the sample (determined from the meter reading and the curve) by the published figure for L.E.L. in volume percent, as noted on the curve.

The maximum concentration allowable in a space where men are working or where welding operations are carried out is primarily a matter of local regulation and of judgement based on knowledge of conditions. A maximum reading of 10% or 20% is usually allowed. If 20% is selected, this is often spoken of as a factor of safety of 5, as the concentration must be increased five times before explosive conditions are reached.

#### 4. MAINTENANCE

##### 1) Calibration and Adjustment

In addition to the normal operating controls found on the top panel, the following auxiliary controls are available.

##### Calibration Potentiometer

This adjustment is used to set the meter reading to the desired level, while sampling a known concentration of combustible gas. In the GP-204, the top plate must be removed by taking out the screws in each corner. The calibration potentiometer is a slotted-shaft control located above right upper corner of meter. Turn clockwise to increase meter reading.

##### 2) Element replacement

The element assembly, consisting of an active filament and a similar but enclosed reference filament, should be replaced if zero cannot be set within range of ZERO ADJ., or if reading cannot be set high enough on a calibration gas, using calibration potentiometer.

- ① Loosen the two panel hold-down screws, remove and invert top panel.
- ② With switch off, loosen (do not remove) the three screws holding the terminals for red, black and white wires. Pull wires from terminals.
- ③ Remove the two Philips-head screws holding cross-shaped element retainer in place. Pull out both filaments and replace with new ones in same position. Check that gaskets are in place on element before installation. Be sure that the active (black wire) filament is in the cavity with the flame arrestor. Install wires on terminals as before.
- ④ Turn instrument on and adjust zero.
- ⑤ If a calibration gas is available, reset span.

##### 3) Batteries

The model GP-204 is furnished with two standard size D dry cells. These dry cells (UM-1/1.5 size D/R 20, Maxell 100) will give 3 hours (Max.) of operating life and are recommended.

When meter cannot be set as high as the "CHECK" line with switch in VOLT ADJ. position and VOLT ADJ. knob all the way clockwise, batteries require replacement or recharging.

To replace batteries, remove instrument from leather case, and loosen the coin-slotted captive screw found in center of bottom plate. Remove plate, exposing batteries in their spring-contact holders. Pull old batteries out, and install new ones in the same position, observing polarity as marked on holder.

#### 4) Sample system

##### ① Hose

The hose used in Teflon-lined, synthetic rubber-jacketed, and immune to absorption or attack by any combustible vapors or solvents. Keep hose clean and be sure that couplings make air-tight contact, checking occasionally by holding finger over hose inlet. Bulb should remain flattened after squeezing if there is no leak. Extension hoses in various lengths are available.

##### ② Flame arrestor

The active filament is installed within a sintered bronze porous metal cup, which acts as a flame arrestor to retain explosions that may occur when sampling explosive gas-air mixtures. The flame arrestor may be removed by taking out the four screws that hold the plate in which the elements are installed. If flame arrestor is dusty, wet, oily, or corroded, it must be washed or replaced. Preferred cleaning method is by washing in detergent solution, rinsing from the inside out, and drying thoroughly in air. Before re-installing flame arrestor in instrument, be sure that the reaction chamber cavity and incoming lines are clean and dry.

#### 5) Meter lamp

The meter lamp is on whenever the instrument is on, and provides illumination to permit reading meter in dark places. If lamp fails, it should be replaced as follows:

Remove four screws holding top plate to top panel. Take off top plate exposing lamp. Loosen set screws which lock lamp wires to terminals, and pull lamp out. Install new lamp in the same position.

## 5. PRECAUTIONS AND NOTES ON OPERATION

### 1) Heated samples

When sampling spaces such as hot tanks that are warmer than the instrument, remember that condensation can occur as the sample passes through the cool sample line. Water vapor condensed in this way can block the flow system and corrode the flame arrestor. A water trap can be used to control this, and is available as an accessory.

If heated hydrocarbon vapors of the heavier hydrocarbons (flash point 90°F or above) are present, they may also condense in the sample line and fail to reach the filament. Thus an erroneous low reading may be obtained.

### 2) Element poisoning

Certain substances have the property of desensitizing the catalytic surface of the platinum filament. These substances are termed "catalyst poison" and can result in reduced sensitivity or in failure to give a reading on samples containing combustible gas. The most commonly encountered catalyst poisons are the silicone vapors, and samples containing such vapors even in small proportions should be avoided.

Occasional calibration checks on known gas samples are necessary, especially if the possibility exists of exposure to silicones. A calibration check on a known iso-butane gas is the most dependable as an indication of normal sensitivity. A convenient calibration accessory is available and described under "Accessories".

### 3) Rich mixtures

When high concentrations of gas are sampled, especially those above the L.E.L., considerable heat is liberated at the filament. This heat may cause damage to the filament or tend to shorten its life, so sustained testing of samples beyond the meter range should be avoided. When sampling rich mixtures, the following instrument action may be expected;

- ① Mixtures up to 100% L.E.L. reading on scale.
- ② Mixtures between L.E.L. and Upper Explosion Limit (U.E.L.) readings at top of meter.
- ③ Mixtures above U.E.L. - As sampling continues the meter first goes to top of scale, then comes back down on scale or below, depending upon concentration. Very rich mixtures will give a zero or negative reading. The alarm circuit thus insures that a very rich sample will not be overlooked, as it could otherwise be with a simple indicating instrument.

#### 4) Oxygen deficient mixtures

Samples which do not have the normal proportion of oxygen may tend to read low, if there is not enough oxygen to react with all combustible gas present in the sample.

As a general rule, samples containing 10% oxygen or more have enough oxygen to give a full reading on any combustible gas sample up to the L.E.L.

#### 5) Oxygen - Enrich mixtures

Sample having more than the normal proportion of oxygen will give a normal reading. However, they should be avoided because the flame arrestor used is not dense enough to arrest flames from combustible gas in oxygen, which can be much more intense than those in air. DO NOT ATTEMPT TO USE THE MODEL GP-204 ON SAMPLES OF COMBUSTIBLE GAS IN OXYGEN. \*

\* Instruments for measurement of oxygen concentration are available from Riken Keiki Co., Ltd.

### 6. ACCESSORIES

#### 1) Extension hoses

Additional lengths of hose may be used, up to approximately, for sampling from deep tanks and manholes. The polyurethane hoses are satisfactory for most samples including natural gas, hydrogen, propane, and gasoline vapors.

#### 2) Water trap (Option)

Where there is danger of water being drawn into instrument, a water trap should be used. This glass-bodied trap with sintered metal filter couples to indicator inlet and will collect water that is drawn into or condensed in sample hose. Inspect trap periodically while in use, and empty or clean bowl and filter whenever visible water or dust accumulate. Regular sample hoses connect to inlet of trap when it is installed on instrument.

## 7. PARTS LIST

The following parts are considered as normal repair or replacement items (Option) and may be ordered separately, by description and number. Always specify model and serial number of instrument for which parts and accessories are required. For problems with parts not listed, write RIKEN KEIKI CO., LTD. for information or request shipping instructions for return of the instrument for repair.

<u>Parts Number</u>	<u>Description</u>
406246	Element (Active and reference) Type HW-6246
# 1	Lamp for meter illuminating
2750-1101-60	Battery, size D
0904-0012-60	Aspirator bulb
0904-0074-50	Sampling probe
	Hose, 1m, Polyurethane, complete with couplings
	Hose, 2m, Polyurethane, complete with couplings
	Hose, 3m, Polyurethane, complete with couplings
	Hose, 5m, Polyurethane, complete with couplings
	Hose, 10m, Polyurethane, complete with couplings
	Hose, 30m, Polyurethane, complete with couplings
# 2	Flame arrestor plate assembly
# 3	Water trap
# 4	Sampling bag ( 2 liters)