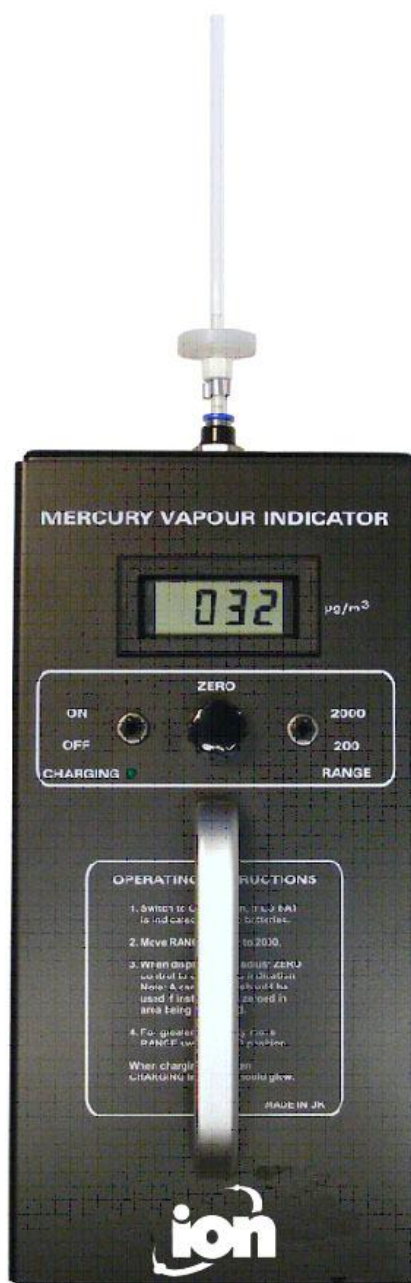


# MVI - Mercury Vapour Indicator Instrument User Manual V1.0



MVI – Mercury Vapour Indicator Instrument User Manual Part Number: 26002

## **Declaration of Conformity**

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**Manufacturer:** Shawcity Limited, Pioneer Road, Faringdon, Oxon., SN7 7BU

**Product:** MVI Mercury Vapour Indicator

**Product Description:** Hand held detector comprising dual beam UV absorption module for the detection of Mercury vapour

**EMC Directives:** 83/336/EEC  
91/263/EEC  
92/31/EEC

**Standards Applicable:** EN 55022: 1987 Class B  
EN 50082-1: 1992 Table 1

**Date of Issue:** 8<sup>th</sup> January 1996

On behalf of Shawcity Limited, I hereby certify that the listed apparatus conforms to the protection requirements of the EMC Standards listed above.



David Hughes  
Technical Manager

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## **Statements**

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### **Warranty**

The warranty period on this product is 12 months from date of sale.

We guarantee to repair or replace faulty goods supplied by Ion Science Limited or, at our option, to refund the purchase price subject to a claim being made in writing to us within 12 months after sale.

Any goods which are in subject of a guarantee claim must be returned to us, carriage paid, and accompanied by the customer's advice note which should state the date of purchase of the goods in question and the nature of the fault.

### **Safety Notes**

Mercury amalgamates with gold, silver, stainless steel and copper alloys. Accidental trapping of Mercury can cause serious damage to vital parts of electronic equipment and delicate instruments. Mercury is also toxic if inhaled, ingested or absorbed through the skin or eyes. Care must always be exercised when handling Mercury.

The MVI employs an internal Ultra-Violet light source operating in the 254nm region. Ultra-Violet radiation is dangerous and if for any reason the lamp is operated whilst exposed, UV protective glasses must be worn.

High voltages are used in this instrument and the cover should only be removed by qualified technicians.

Ion Science Limited can accept no responsibility for the incorrect use of the instrument that cause harm or damage to persons or property. It is the user's responsibility to appropriately respond to the readings given.

### **Quality Assurance**

Ion Science Limited is an ISO 9001:2008 accredited company.

### **Disposal**

Please dispose of the MVI, its components and any used batteries in accordance with all local and national safety and environmental requirements. This includes the European WEEE (Waste Electrical and Electronic Equipment) Directive. Ion Science Limited offers a take back service. Please contact us for more information.

## **Statements**

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### **Calibration and Repair Facility**

Ion Science Limited offer a repair and calibration service. Please contact us for more information

### **Training**

Ion Science Limited would be happy to provide training in the operation and maintenance of the MVI. Please contact us should this be of interest.

### **Contact Ion Science Ltd**

#### **UK Head Office**

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## **Introduction**

The Mercury Vapour Indicator (MVI) is primarily used to monitor environments where Mercury or any of the Mercury compounds are produced, processed or stored and applications where Mercury vapours may pose a health hazard to personnel.

Units of measurement used for detecting Mercury vapour are micrograms/cubic metre expressed as  $\mu\text{g}/\text{m}^3$ .

The MVI has two manually switched ranges of measurement:

0-200  $\mu\text{g}/\text{m}^3$  with a resolution of 0.1  $\mu\text{g}/\text{m}^3$

0-2000  $\mu\text{g}/\text{m}^3$  with a resolution of 1  $\mu\text{g}/\text{m}^3$

## **Principle of Operation**

A sample of the immediate atmosphere under investigation is drawn by the pump into a glass sampling cell where a Ultra-Violet light source is absorbed by the sample. Photodiode detectors are used to measure the intensity of radiation passing through the sample chamber. The optical system is designed specifically to detect Mercury in the Ultra-Violet region of 254nm.

The presence of Mercury vapour will reduce the radiation energy reaching the photodiode detector in proportion to the vapour concentration. This change is then converted into an electrical signal and conditioned to provide a linear reading on the front LCD as  $\mu\text{g}/\text{m}^3$ .

An audible alarm is fitted which gives warnings when preset conditions are achieved.



## Specification

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|                          |  |
|--------------------------|--|
| <b>Function</b>          | Surveying atmospheres for Mercury (Hg) concentrations below and above the accepted exposure limit        |
| <b>Detector</b>          | Dual beam Ultra-Violet absorption module   |
| <b>Measuring Ranges</b>  | 0.1-199.9 and 1.0-1999 $\mu\text{g}/\text{m}^3$ (user controlled)  |
| <b>Sensitivity</b>       | 0.1 $\mu\text{g}/\text{m}^3$ and 1.0 $\mu\text{g}/\text{m}^3$  |
| <b>Accuracy</b>          | $\pm 5$ micrograms or $\pm 10\%$ of reading  |
| <b>Repeatability</b>     | $\pm 5\%$ FSD  |
| <b>Response Time</b>     | Approximately 3 seconds  |
| <b>Temperature Range</b> | +10°C to +50°C   |
| <b>Battery Type</b>      | 15 Volt Ni-Cad rechargeable  |
| <b>Battery Life</b>      | Greater than 6 hours after full charge   |
| <b>Dimensions</b>        | 145 x 295 x 80 mm (120 mm with handle)   |
| <b>Weight</b>            | 6 lb 10 oz (3 kg)  |
| <b>Linearity</b>         | Higher than 5% from 0 to 500 $\mu\text{g}/\text{m}^3$  |
| <b>Zero Drift</b>        | Less than 5 $\mu\text{g}/\text{hour}$  |
| <b>Alarms</b>            | Audible alarm factory preset to 25 $\mu\text{g}/\text{m}^3$  |
| <b>Datalogger</b>        | 0-2 volt for use with a datalogger (not supplied)  |
| <b>Operation</b>         | After a short warm up the MVI gives real time indication of Mercury vapour levels through the PTFE probe |

**Packing List**

The MVI is sent to you packaged in a lightweight, waterproof structural resin instrument case with foam insert.

Contents should be carefully removed and checked against the packing list. Any discrepancies between the contents and packing list must be reported to Shawcity Limited within 10 days of receipt of shipment. Shawcity cannot be held responsible for shortages not reported within that period.

| <u>Item</u> | <u>Description</u>  | <u>Quantity</u> |
|-------------|---|-----------------|
| 1           | MVI instrument  | 1               |
| 2           | MVI battery charger   | 1               |
| 3           | Charcoal in line filter   | 1               |
| 4           | PTFE probe and filter assembly<br>(including 10 water trap filters) | 1               |
| 5           | MVI operation manual  | 1               |
| 6           | Peli case with foam inserts   | 1               |





## **Description**

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The Mercury Vapour Indicator (MVI) is a compact, self contained and completely portable instrument which indicates the amounts of Mercury in micrograms/cubic metre.

The indicating digital display and carrying handle are mounted on the top cover. A female luer connector is provided at the end of the instrument to accommodate a dust and water trap filter with PTFE extension probe. In addition, a length of flexible tubing may be connected to the filter for greater convenience when checking floor areas or gratings.

The internal Nickel Cadmium battery is rechargeable using a plug-in battery charger. The operating time when fully charged is greater than 6 hours. Warm up time is approximately 10 minutes and direct readings are indicated on an easy to read LCD display.

The audible alarm provides warning of three pre-defined conditions:

| <u>Condition</u>  | <u>Audible Signal</u> |
|---|-----------------------|
| 1. High Mercury vapour concentration greater than 25 $\mu\text{g}/\text{m}^3$ | Slow pulse (1/sec)    |
| 2. Negative reading from -24 $\mu\text{g}/\text{m}^3$ and lower               | Continuous tone       |
| 3. Low battery  | Fast pulse (3/sec)    |

The audible alarm is inhibited during the first 5 minutes of operation.

## Operating Controls

The MVI indicating display and all operating controls are mounted on the front panel where they are readily accessible when the unit is held in the operating position.

1. The **ON/OFF** switch is located immediately below the display and to the left. In the **ON** position the MVI will operate and display. In the **OFF** position power to the MVI is disconnected. The instrument **MUST** also be switched **OFF** to enable charging.
2. The **Zero Adjust** control is located at centre of the panel between the handle and display. A ten turn potentiometer is used to manually set the display to zero, provided that the instrument is in a Mercury free atmosphere. The MVI is designed to show both positive and negative readings and can be adjusted between  $\pm 240 \mu\text{g}/\text{m}^3$  by use of the zero control. Zero drift shown on the display is normal and is caused by changes in temperature or humidity. The zero control is used to cancel out any negative or positive change on the display prior to taking a reading.
3. **Range Switch**
  - a) **2000** in this range the instrument will measure over a range of 0-2000  $\mu\text{g}/\text{m}^3$  in steps of 1  $\mu\text{g}/\text{m}^3$ .
  - b) **200** in this range the instrument will measure over a range of 0-200  $\mu\text{g}/\text{m}^3$  in steps of 0.1  $\mu\text{g}/\text{m}^3$ .

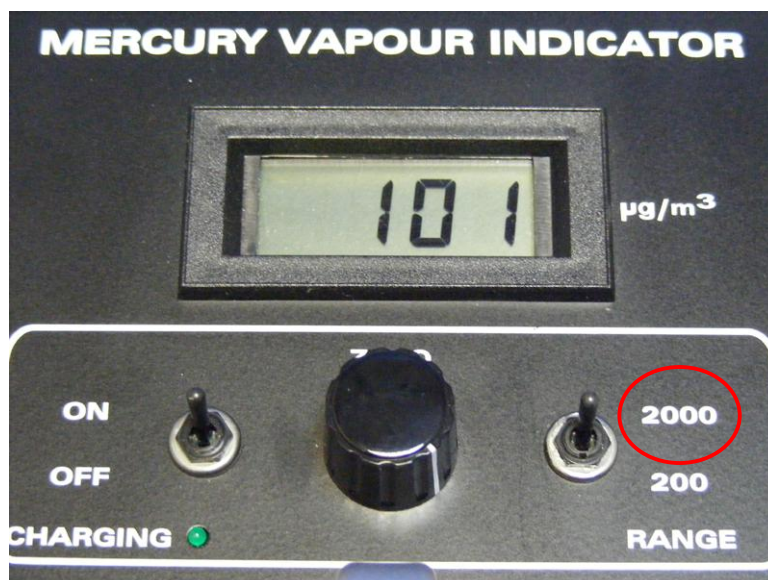


## Operating Controls

### 4. Indicating Display

This shows the Mercury concentration in the monitored environment.

**Range: 0-2000  $\mu\text{g}/\text{m}^3$**



**Range: 0-200  $\mu\text{g}/\text{m}^3$**



## **Operating Controls**

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### **Important Note**

The display will indicate **LO BAT** when batteries require charging.



**Battery Charging**

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USA  
Charger  
(201-033)

EUROPEAN  
Charger  
(201-038)

UK  
Charger  
(201-031)



## **Battery Charging**

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The MVI incorporates a Ni-Cad battery with a continuous duty cycle of greater than 6 hours' operation. The full charge cycle for the battery is 16 hours.

### **Recharging**

Switch the instrument off. Connect the MVI battery charger to the instrument. Use only the MVI charger supplied with the instrument. Use of an alternative charger may damage the instrument and will void the warranty. The green charging LED lamp located immediately below the ON/OFF switch will light indicating the batteries are accepting charge.



If the instrument is not regularly used, then once a month it should be fully discharged by running it until the **LO BAT** appears. The instrument must then be fully recharged for 16 hours.

Only store the unit in a fully charged state.

### **Battery Charger Part Numbers**

|                  |         |
|------------------|---------|
| USA Charger      | 201-033 |
| European Charger | 201-038 |
| UK Charger       | 201-031 |

### **IMPORTANT NOTE**

**Only use the Shawcity battery charger provided with your instrument.**



## **Preparing the MVI for Use**

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1. Turn the instrument **ON** and ensure the **LO BAT** indication does not appear. If **LO BAT** does appear then charge the unit for 16 hours before proceeding to next step (refer to Battery Charging Section of this manual for further information).
2. Allow the instrument to warm up (approximately 5 minutes). The MVI is ready to use when it displays a stable reading.
3. Fit the charcoal filter in line.



4. Adjust the zero control to indicate zero '000' on the display.



5. Remove the charcoal filter.
6. Fit the PTFE probe and filter.



## **The MVI is now ready for use**

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During use it may be necessary for steps 4 to 8 to be repeated.



When using the instrument it is important to remember that Mercury is heavier than air and therefore measurement should be taken at approx 1 foot (30 cm) from ground.

After use switch the instrument **OFF** and recharge the batteries if necessary



## **Interferences**

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The MVI detector operates on the principle of UV light absorption. There are substances other than Mercury which also cause light absorption and these substances are known as interference vapours.

Some of the interference vapours encountered are various hydrocarbons, water vapour, Sulphur compounds and particles such as smoke. There is no measurable interference from Carbon Monoxide, Carbon Dioxide or Ammonia. High concentrations of water vapour will give readings of between 5 to 10  $\mu\text{g}/\text{m}^3$ , however if the MVI is zeroed at a similar humidity, this will not be seen.

### **Table of some interferences at 100 ppm concentration:**

| <u>Compound</u> | <u>Reading in <math>\mu\text{g}/\text{m}^3</math></u> |
|-----------------|---|
| Benzene         | 20  |
| Toluene         | 3.5   |
| Acetone         | 3.0   |
| Ethyl Alcohol   | 6.0   |
| Ethyl Acetate   | 3.0   |

## **User Maintenance**

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### **Filter Replacement**

#### Charcoal (Zero) Filter

The Mercury zero filter will become saturated after extensive use. It is therefore necessary to check the condition of the filter using the following procedure:

- a) Turn the instrument **ON** and ensure that the **LO BAT** indicator does not appear.
- b) Allow the instrument to warm up for 10 minutes. Zero the instrument in fresh air.
- c) Connect the charcoal filter to the MVI. The reading should not increase by more than 4 µg. If the reading increases by more than 4 µg then the filter must be replaced.



#### PTFE Probe and Filter Assembly

The MVI is supplied with a PTFE probe and luer filter. This can become contaminated or loaded with dust in regular use. Typical symptoms of contamination are a sluggish response to Mercury and an unstable zero. If either of these symptoms occurs then the filter must be replaced.

Replacing the filter:

- a) Unlock the luer filter and discard
- b) Replace with a new filter



## **User Maintenance**

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### **Audible Alarm Level**

The Mercury alarm level is factory set at 25 µg/m<sup>3</sup>. If a different alarm level is required please contact Shawcity for adjustment information.

### **MVI Health Check**

Over time the internal filter and tubing can become contaminated. We, therefore, recommend carrying out an occasional health check to ensure that the instrument is clean and not giving slow or false readings. There are 4 simple tests as detailed below which can be carried out by the user.

Prior to testing switch on the MVI and select the 2000 range. Leave the instrument to stabilise for 10 minutes before proceeding.

Test 1: Can the MVI be zeroed?

Zero the MVI in clean air (do not use the charcoal filter). Can the MVI be zeroed? If not, then a service is required. If yes, then continue.

Test 2: Check for internal contamination

Using a clean piece of flat card or plastic, block the air flow to the luer connector. This will force air to be drawn from the internal parts and any contamination will show on the display. If the reading increases by a value greater than 5 µg/m<sup>3</sup> then the MVI internal parts are contaminated and service is required.

Test 3: Check for case contamination

Use a clean, dry cotton bud and scrub the lid top where dirty. Offer the bud to the luer inlet and note any reading changes. A change of greater than 5 µg/m<sup>3</sup> indicates the case requires some cleaning.

Test 4: Does the MVI detect Mercury?

Obtain a sample of mercury and offer this to the inlet. Check that the MVI responds accordingly. If the instrument does not detect any Mercury then the MVI will require servicing.

**Consumable Items**

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| <u>Description</u>                | <u>Part Number</u> |
|-----------------------------------|--------------------|
| Zero Filter                       | 26006              |
| PTFE Probe and pack of 10 filters | 26007              |
| Manual                            | 26002              |
| 230 VAC Charger (UK)              | 26003              |
| 220 VAC Charger (European)        | 26004              |
| 110 VAC Charger (USA)             | 26005              |

## Calibration and Repair

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The MVI requires annual calibration to maintain the best accuracy. Shawcity Limited will calibrate the instrument against a near Primary Standard and issue a certificate of calibration. If any calibration or repair work is required please return the instrument to the Service Department at Shawcity Ltd. A written estimate will be provided for all work.

For further information please contact our Service Department on + 44 (0) 1367 241675 or via email on [service@shawcity.co.uk](mailto:service@shawcity.co.uk) and they will be pleased to assist you.



Shawcity Calibration Room