



# MVI

## Instrument User Manual V2.4



Register your instrument online to receive your extended Warranty.

## **Register your instrument online for extended warranty**

Thank you for purchasing your Ion Science instrument.

The standard warranty of your instrument can be extended to up to five years on PhoCheck Tiger and two years on other Ion Science instruments.

To receive your extended warranty, you must register your instrument online within one month of purchase (terms and conditions apply.)

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## Declaration of Conformity

The EU Authorised Representative of the manufacturer Ion Science limited has sole responsibility, on the date this product accompanied by this declaration is placed on the market, the product conforms to all technical and regulatory requirements of the listed directives

**Authorised Representative:** ISM Deutschland GmbH · Laubach 30 · D-40822 Mettmann, Germany  
**Product:** MVI Mercury Vapour Indicator  
**Product Description:** Handheld detector comprising dual beam UV absorption module for the detection of Mercury vapour  
**Directives:** EMC Directive (2014/30/EU)  
LVD Directive (2014/35/EU)

**Standards:**  
**EN IEC 61010-1:2010** Safety requirements for electrical equipment for measurement, Control and laboratory use – Part 1: General requirements  
**EN ISO/IEC 9001:2015** Quality management systems – Requirements  
**EN 61326-1:2013** Electrical Equipment for measurement, control and laboratory use EMC Requirements (Class B and General Immunity)

**Name:** Clemens A. Verley

**Position:** Chief Executive Officer



**Signature:**

**Date:** 31<sup>st</sup> December 2020

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## Statements

### Responsibility for Use

Inadequate performance of the gas detection equipment described in this manual may not necessarily be self-evident and consequently equipment must be regularly inspected and maintained. Ion Science recommends that personnel responsible for equipment use institute a regime of regular checks to ensure it performs within calibration limits, and that a record be maintained which logs calibration check data. The equipment should be used in accordance with this manual, and in compliance with local safety standards.

### Warnings

Mercury amalgamates with gold, silver, stainless steel, aluminium 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 254 nm 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

MVI instruments are manufactured by Ion Science Limited within an ISO 9001:2015 compliant quality system, which ensures that the equipment supplied to our customers has been designed and assembled reproducibly, and from traceable components.

### 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.

### Calibration and Repair Facility

Ion Science Limited offer a repair and calibration service. Please contact us for more information:  
[info@ionscience.com](mailto:info@ionscience.com)

### Training

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

## Legal Notice

Whilst every attempt is made to ensure the accuracy of the information contained in this manual, Ion Science accepts no liability for errors or omissions, or any consequences deriving from the use of information contained herein. It is provided "as is" and without any representation, term, condition or warranty of any kind, either express or implied. To the extent permitted by law, Ion Science shall not be liable to any person or entity for any loss or damage which may arise from the use of this manual. We reserve the right at any time and without any notice to remove, amend or vary any of the content which appears herein.

## Warranty

Standard Warranty can be extended to up to 2 years on the MVI when registering your instrument via our website: [www.ionscience.com](http://www.ionscience.com)

To receive your Extended Warranty, you need to register within one month of purchase (Terms and Conditions apply). You will then receive a confirmation email that your Extended Warranty Period has been activated and processed.

Full details, along with a copy of our Warranty Statement can be found by visiting: [www.ionscience.com](http://www.ionscience.com)

## 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:

0-199  $\mu\text{g}/\text{m}^3$  with a resolution of 0.1  $\mu\text{g}/\text{m}^3$

0-1999  $\mu\text{g}/\text{m}^3$  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 an 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 254 nm.

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 pre-set conditions are achieved.

## Specification

<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 $\mu\text{g}/\text{m}^3$
<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 0 to 100% RH (non-condensing)
<b>Battery Type</b>	15 Volt NiMH rechargeable
<b>Battery Life</b>	Greater than >4.5 hours after full charge
<b>Dimensions</b>	145 x 295 x 80 mm (120 mm with handle)
<b>Weight</b>	5 lb 3 oz (2.35 kg)
<b>Linearity</b>	Within 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 20 $\mu\text{g}/\text{m}^3$
<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 Ion Science Limited within 10 days of receipt of shipment. Ion Science 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 (including 10 water trap filters)	1
5	MVI Calibration Certificate & Checklist	1
6	Premium case with foam inserts	1





## Description

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 Metal Hydride battery is rechargeable using a plug-in battery charger. The operating time when fully charged is greater than >4.5 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. Mercury vapour concentration greater than $20 \mu\text{g}/\text{m}^3$	Slow pulse (1/sec)
2. Negative reading from $-20$ to $-25 \mu\text{g}/\text{m}^3$ 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.

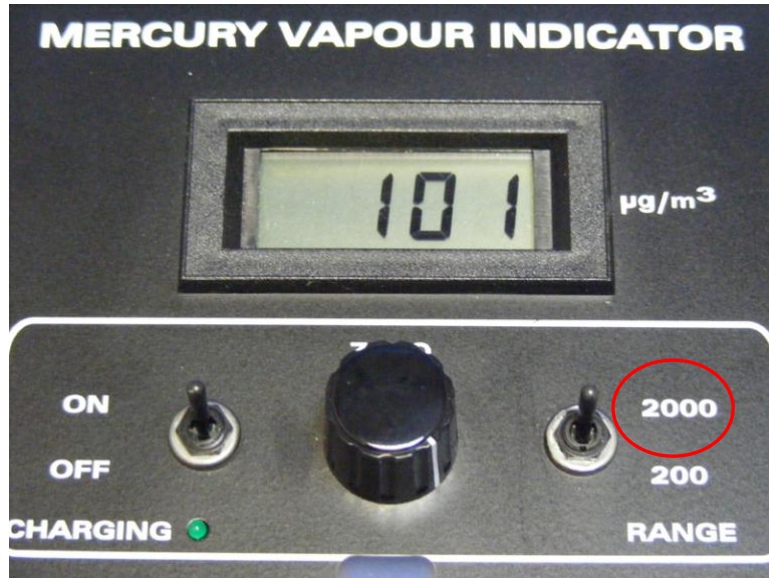
1. The **ON/OFF** switch is located immediately below the display and to the left. In the **ON** position the MVI will operate and display. In the **OFF** position, battery power to the MVI is disconnected. The instrument **MUST** also be switched **OFF** to enable charging.
2. The **Zero Adjust** control 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 0-1999  $\mu\text{g}/\text{m}^3$  in steps of 1  $\mu\text{g}/\text{m}^3$ .
  - b) **200** in this range the instrument will measure over a range of 0-199  $\mu\text{g}/\text{m}^3$  in steps of 0.1  $\mu\text{g}/\text{m}^3$ .



4. Indicating Display

This shows the mercury concentration in the monitored environment.

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



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



**NOTE:** The display will indicate **LO BAT** when batteries require charging. *Please note the instrument does not operate reliably when LO BAT is indicated.*



## Battery charging

Universal Battery Charger (A-26220)

The MVI incorporates a NiMH battery with a continuous duty cycle of greater than >4.5 hours' operation. The full charge cycle for the battery is 16 hours.

**NOTE:** If the units are charged from a flat battery the unit should not be charged for more than 16 hours continuously. If the unit requires a top up charge then 2 – 8 hours charging should be sufficient.



## 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.



**IMPORTANT NOTES:**

- Only use the Ion Science universal battery charger (Part Number: A-26220) provided with your instrument.
- When received as new or after Service by Ion Science or an approved Ion Science Service Centre, your Instrument will arrive fully charged. Do NOT recharge until the “LO BAT” symbol appears. Do not leave connected to the AC power supply unless charging and certainly no more than 16 hours from a low battery message.
- Excessive charging will dramatically reduce your battery life and will mean the batteries require replacing frequently.
- Only store the unit in a fully charged state.

**Preparing the MVI for use**

It is recommended that you zero your instrument in a known ‘clean environment’ using fresh air.

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 run until you see a stable reading
  - This should happen after 3 to 4 minutes when operating in the 0 to 2000 range
  - Allow 10 minutes before operating in the 0 – 200 range
3. As soon as the reading is stable you can zero the instrument
  - rotate the ‘zero adjust control knob’ until ‘000’ shows on the LCD screen



4. Fit the PTFE probe and filter



If you suspect you are in an area contaminated with mercury, you MUST connect the charcoal filter to the inlet of the MVI before adjusting the zero-control knob.



Due to the nature of the carbon filter case and the materials used, it can give odours which will show as a small negative reading on the MVI when removed.

### Preparing the MVI for use

The MVI is now ready for use.



When using the instrument, it is important to remember that Mercury is heavier than air and therefore samples should be drawn from ~1 foot (30 cm) from ground.

After use, switch the instrument **OFF** and recharge the batteries if necessary. ***Please remember the MVI may not operate correctly when LO BAT is indicated on the display.***

## Interferences

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. A large change in humidity will cause readings of between 5 to 10  $\mu\text{g}/\text{m}^3$ . The MVI is zeroed at the site of measurement away from sources of mercury to avoid this.

### 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

### Filter Replacement

#### Charcoal (Zero) Filter

It is advised that you replace the carbon filter after exposure to contaminants as it will become saturated with use. To check the condition of the filter, use the following procedure:

- Turn the instrument **ON** and ensure that the **LO BAT** indicator does not appear.
- Allow the instrument to warm up for 10 minutes. Zero the instrument in fresh air.
- Connect the charcoal filter to the MVI. The reading should not increase by more than 4  $\mu\text{g}$ . If the reading increases by more than 4  $\mu\text{g}$  then the filter must be replaced.



Always replace end caps to maximise life of filter.

#### 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:

- Unlock the Luer filter and discard
- Replace with a new filter



#### Alarm Level

The mercury alarm level is factory set at 20  $\mu\text{g}/\text{m}^3$ . These values are limited by unit accuracy. The alarm level cannot be set beyond 35  $\mu\text{g}/\text{m}^3$ .

#### 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 0 to 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  $\mu\text{g}/\text{m}^3$  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  $\mu\text{g}/\text{m}^3$  indicates the case requires some cleaning.

### Test 4: Does the MVI detect Mercury?

Using appropriate health & safety measures, present the MVI with a mercury concentration of approx 30  $\mu\text{g}/\text{m}^3$ . Check that the MVI responds accordingly. If the instrument does not detect any mercury, the MVI will require servicing.

## Consumable items

### Description

- Zero Filter
- PTFE Probe and pack of 10 filters
- Manual
- Universal Battery Charger

## Calibration and Repair

The MVI requires annual calibration to maintain the best accuracy. Ion Science Ltd 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 Ion Science Ltd. A written estimate will be provided for all work.

For further information please contact our Service Department on + 44 (0) 1763 208503 or via email on [service@ionscience.com](mailto:service@ionscience.com) and they will be pleased to assist you.

## Manual log

Manual Version	Amendment	Issue Date
MVI Manual V1.8	The audible alarm level information has been updated – page 18	28/06/2011
MVI Manual V1.9	The audible alarm (factory set) info has been updated – page 6 & page 18	22/6/2012
MVI Manual V2.0	Manual format and layout updated Over charging information added (page 13)	07/01/2013
MVI Manual V2.1	Interferences text (Page 18) updated. Address for Ion Science America updated.	02/05/2013
MVI Manual V2.2	Update to Declaration of Conformity Update to Contact Information Specification update Interferences update p17 Test 4 update p19 Battery Capacity Updated Pages 8 & 10 & 15 Disclaimer added – page 23	14/02/2019
MVI Manual V2.3	Put into new format Updated images Ranges changed from 0-200 to 0-199 and 0-2000 to 0-1999	23/03/2020
MVI Manual V2.3R	Declaration of Conformity	09/12/2020
MVI Manual V2.4	Reduced battery life to >4.5 hours	09/12/2020

**Disclaimer:** Information in this [manual, document...] is subject to change without notice and does not represent a commitment on the part of Ion Science. No claims, promises or guarantees are made about the accuracy, completeness, or adequacy of the information contained herein.

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