

Trace<sub>2</sub>o

# METALYSER PORTABLE HM1000

Portable Field Heavy Metals Analyser



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## 1. INTRODUCTION

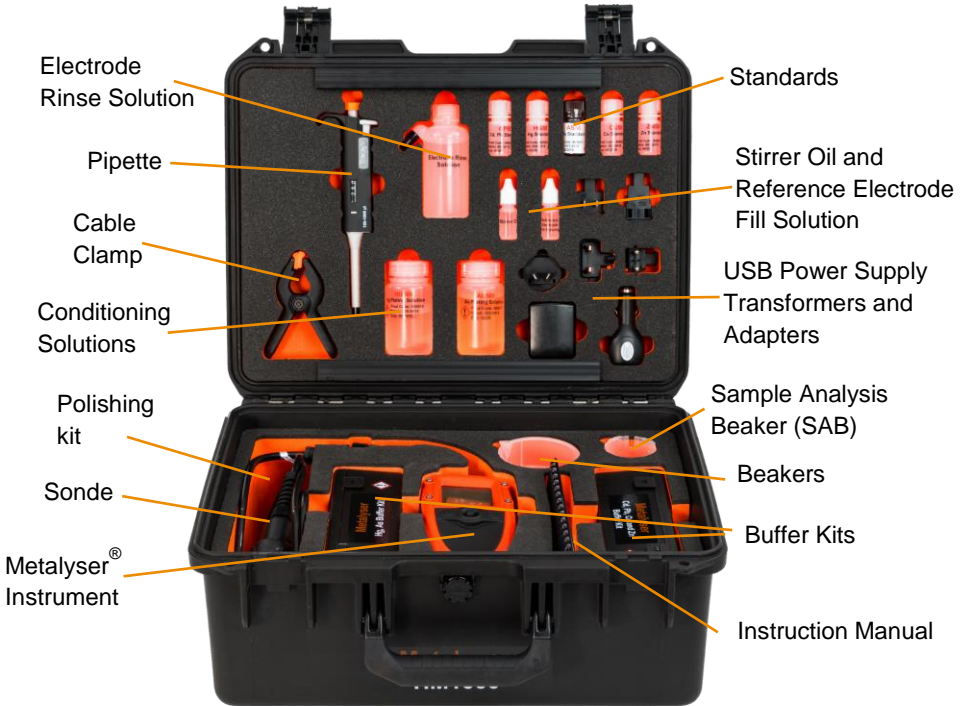
The Metalyser® Portable HM1000 instrument is ideal for testing of very low heavy metal concentrations in natural water courses, for example lakes and rivers. The HM1000 is a rugged field kit that tests for a range of 9 heavy metals and can be used both as a collection and measurement device for at-site analysis. It is very portable using a battery as its power source and can provide results to <10ppb rapidly.

The Metalyser® HM1000 utilises a voltammetric technique to detect heavy metal ions in solution. The technique is not new - it was first proposed in the 1920s - but recent advances in electronics and software have provided a means to make the instrument portable. The instrument takes a complex idea but makes it easy to understand and is therefore usable for a competent person not trained in voltammetry. No complex chemical techniques need to be employed during the course of the analysis.

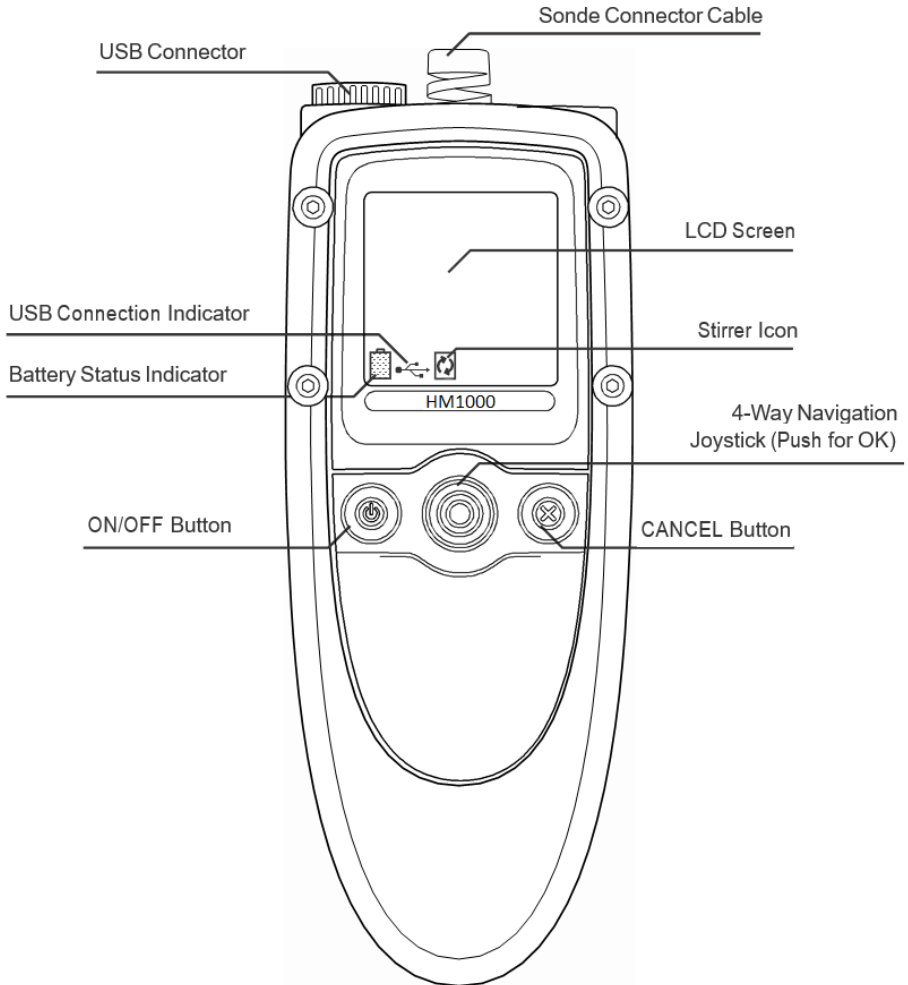
The Metalyser® HM1000 is very robust and has been designed to be virtually maintenance free. The instrument is sealed against water ingress and is housed in a waterproof case, making it suitable for use onsite for carrying out field screening analysis.

The Metalyser® HM1000 is ready out-of-the-box and can be used after charging the built-in battery. After a period of non-use, the Metalyser® is ready to operate very quickly after putting the sonde head into the water sample.

## 2. KIT CONTENT



### 3. GETTING TO KNOW YOUR METALYSER®



### **USB Connector**

The USB connector can be used to charge the battery using the supplied car or mains charger, and also for download/upload and charging via a PC or laptop.

### **LCD Screen**

The LCD screen tells you what is happening as you go along. It will continually display the current date and time as well as other useful indicators such as battery and connection status. The screen is also backlit, enabling use of the instrument under poor lighting conditions.

### **ON/OFF Button**

The ON/OFF is used to turn the instrument on and off, there is also an optional ten minute auto shutdown feature should you leave the instrument unattended.

### **Navigation Joystick**

The joystick allows you to quickly and easily navigate your way through the menus and features of the Metalysers®. The joystick provides five controls; Up, Down, Left, Right and OK. To navigate up, down, left and right simply push the joystick in the required direction. To select an option or 'OK' a choice press the joystick in the centre.

### **Cancel Button**

Pressing the cancel button will return you to the previous menu or screen.

### On Screen Indicators

At the bottom of the screen these symbols will appear periodically to provide information about the instrument's status.



Battery fast charge indicator



Battery trickle charge indicator



Battery fault/overheat indicator



Battery full



Battery  $\frac{3}{4}$  full



Battery  $\frac{1}{2}$  full



Battery  $\frac{1}{4}$  full



Battery empty



USB connection to PC established

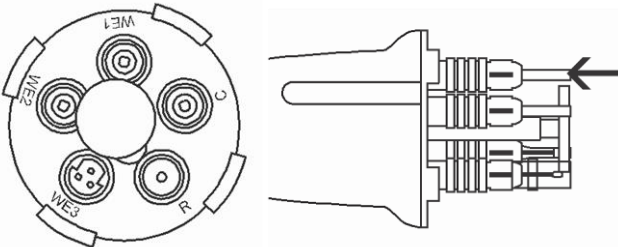


Stirrer on indicator

## Components and care of components

### The Sonde

The sonde head contains the electrodes and stirrer to carry out analysis. It comes pre-assembled with the 4 electrodes and a Sample Analysis Beaker (SAB). The electrodes are the WE1 (Working Electrode 1), WE2 (Working Electrode 2), R (Reference Electrode) and C (Counter Electrode). The sonde has the electrode letter references embossed onto it to ensure they are connected in the correct positions.



To fit an electrode, simply align the arrow on the electrode with the arrow on the sonde head and push the electrode onto its socket. A quiet double click should be heard. Gently pull on the top of the black holder of the electrode to ensure it is fully connected.

To remove the electrodes pull back the connector shroud with the arrow on and the connector will pull off.

**When attaching or removing electrodes be careful to avoid touching the stirrer.**

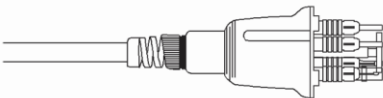
The different Working Electrodes can be identified by the number of connecting pins and are not interchangeable.

Electrode WE1 (6 pins) is to be fitted in position WE1.

Electrode WE2 (3 pins) is to be fitted in position WE2.

**Do not mix up the electrodes as this can cause damage to the instrument.**

The sonde can be assembled in one of two ways. Firstly, the short cable attached to the Sonde can be connected directly to the instrument. It can then be attached to the clamp and stand included in the kit and fitted inside the box. The second option is to fit the extension cable between the Sonde and the instrument. This allows the instrument to be used to collect samples as well as analyse them.

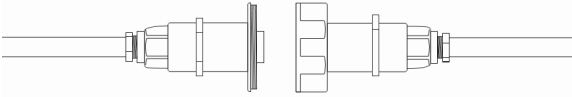


The sonde (electrodes x 4)



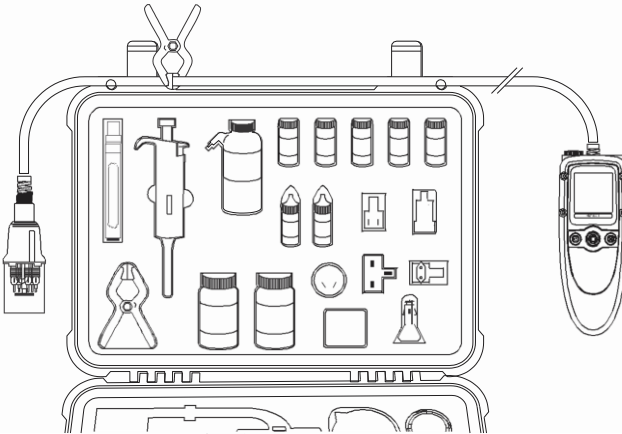
SAB (Sample Analysis Beaker)





In-line waterproof cable connector

**Warning:** Sonde head is designed for submersion up to 1 metre in water. Lowering the head deeper than this may result in water ingress which will require sonde head replacement.



**Note:** The sonde cable may be fixed to the lid of the Metalysers® box, using the box closure tabs and the supplied cable clamp. Alternatively, the user may attach the cable to a suitable fixture at the sample site, e.g. branch, rope, fence, barrier.

## Electrodes



**Counter electrode** – this electrode needs the least maintenance of all. A quick visual inspection to ensure the electrode has no physical damage.



**Reference Electrode** – this electrode contains a liquid filled tube, the liquid can be replenished by using the **Reference Electrode Fill Solution** provided in the kit. Perform a visual inspection to ensure it has no physical damage and ensure there is enough liquid in the outer tube and that there are no bubbles in the inner tube. **For best performance, the Reference Electrode tip should be kept wet. Please remove cap before use, and replace after use.** Always place a few drops of deionised water in the cap before replacing it on the electrode.



**Working Electrode** – the electrode surface should be examined for cracks and imperfections that will affect analysis. The electrode should be regularly polished to remove contaminants and ensure a smooth mirror-like surface using the supplied glass platen, polishing cloth and polishing slurry (see below). Ensure that the protective rubber cap is replaced during storage of the electrode to prevent damage to the electrode surface. After polishing, conditioning steps need to be undertaken before analysis. The different Working Electrodes can be identified by the number of connecting pins and are not interchangeable. Electrode WE1 (6 pins) is to be fitted in position WE1.

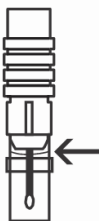
Electrode WE2 (3 pins) is to be fitted in position WE2.

**Do not mix up the electrodes.**

## Refilling Reference Electrode

The Reference Electrode cap needs to be removed prior to analysis and replaced when the electrode is going to be stored. It is best practice not to let the tip of the Reference Electrode dry out. To ensure this, always add a few drops of deionised water into the cap before replacing on the electrode.

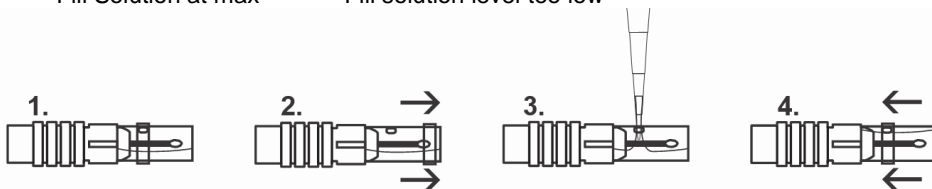
The Reference Electrode must contain **Reference Electrode Fill Solution** to operate. Ensure the Reference Electrode is held vertically with the connector upwards and determine that there is enough solution in the Reference Electrode.



Fill Solution at max



Fill solution level too low



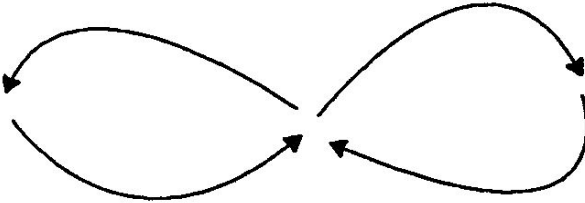
The outer tube needs to be at least 1/3rd full. To top up the **Reference Electrode Fill Solution**:

1. Place the reference electrode horizontal with the hole facing up
2. Slide the band down from the hole
3. Use the pipette to drop enough solution into the Reference Electrode to fill it up.
4. Once topped up, replace the band to prevent the electrode fill solution escaping.

**Note: Only use the supplied Reference Electrode Fill Solution.**

### **Polishing technique for Working Electrode**

To polish the electrode, firstly make sure the glass platen and holder are clean and free of dust or dirt which may cause scratching. Place a clean cloth on the platen and dampen the cloth with the polishing slurry provided. Hold the electrode perpendicular to the platen and use a smooth figure of eight motion as indicated.



Polish until the surface has a mirror finish and no scratches or imperfections are seen.

The instrument also consists of:

**Stirrer** – the stirrer is crucial to the operation of the instrument so it needs to be checked to ensure it is working properly. It has been designed to minimise turbulence thus ensuring increased repeatability. During a run, look through the translucent beaker or lightly touch the bottom of the SAB to determine that the stirrer is rotating when indicated on the handset. If the stirrer fails to rotate, turn the sonde head upside down, add a few drops of the **Stirrer Oil (do not use any other oil)** down the stirrer shaft at the base near the sonde head (near where it enters the sonde) and rotate gently to ensure the lubricant coats the bottom of the shaft.

**Sample Analysis Beaker (SAB)** – the SAB has a fixed volume, so that when full and removed from the water course, excess sample water will empty out of the holes, levelling off at a constant volume.

**Instrument** – the instrument is waterproof and robust. A periodic visual inspection to ensure it is not damaged and that the screen is readable will suffice.

**Buffers** – the buffers should be stored in a dark, cool, dry environment. If stored correctly, the powder buffers have a shelf life of 3 years, liquid buffers have a shelf life of one year. Refer to individual buffers for expiry dates.

**Standards** - The standards should be stored in a dark, cool place and have a shelf life of 12 months. Refer to standards for expiry dates. Should any contaminant come into contact with the standards, they should be discarded.

**Plating Solutions** – The plating solutions should be stored in a dark, cool place and have a shelf life of one year. Refer to solutions for expiry dates. Should the efficacy of the plating solution deteriorate before this during use, they should be discarded and replaced.

**Menu System**

The Metalysers® instrument is controlled via a system of on-screen menus. The structure of these menus is illustrated below to assist you in navigating them.

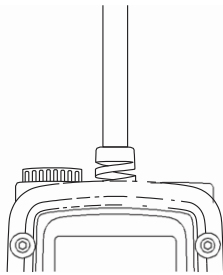
**Main Menu**

Test Methods	→	Condition Electrode	Used to condition the working electrode with Conditioning solution. When used as part of a test it is used to prime the electrode to increase sensitivity
	→	Analyse Sample	Used with Calibrate function. Calibration must be undertaken before analyse sample can be used
	→	Standard Addition	Used to analyse samples and calculate the unknown concentration by the addition of a known standard
	→	Calibrate	Used with analyse sample. Calibration must be performed before analyse sample is used
	→	Blank subtraction	Used to set or replace a baseline if contaminants are suspected in the buffer.
Data Log	→	View Log	Data Log viewing options
	→	Last Result	Displays latest result and graph
System	→	Backlight	Backlight control options
	→	Set date/time	Used to set the instrument date and time
	→	Language	Used to select the display language
	→	Charge	Battery charging options
	→	Auto switch off	Auto off select
	→	Program P/STAT	Program internal hardware (Not used in normal operation)

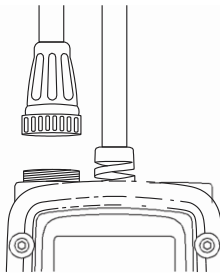
## 4. GETTING STARTED

### Charging the battery

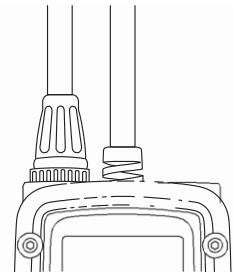
When you first receive your Metalyser® kit, it is advisable to fully charge the battery. The handheld instrument can be charged using the supplied USB cable and the chargers provided in the kit. Connect to the device as shown below, then connect to the chosen charging system (mains/12V). If a computer is used, the software drivers may need to be installed to perform a fast charge.



Unscrew the blue cap



Insert mini USB lead



Tighten the screw cap

Connect to chosen charge system (Computer/ Mains/ 12V)

The Metalyser® is capable of charging at a fast rate taking approximately 7 hours to fully charge the battery, or a trickle charge rate which should be used for overnight top up charge if the instrument is only used once or twice a day.

From the System Menu, select Charge and you will be given three options:

100mA	Trickle charge rate
500mA	Fast charge rate
AUTO	The instrument will automatically select the best charge rate

To select the charge rate follow these steps:

- From the main menu, select **System**
- From the system menu, select **Charge**
- Highlight required charge rate and press **<OK>**
- Press **<cancel>** to return to main menu

**Note:** The fast charge option is only available when the instrument is switched on. The instrument will also charge at a trickle rate if the instrument is connected for charging but not switched on

## **Driver Installation**

Your Metalyser® is compatible with most computers with a USB socket, but first the USB drivers may need to be installed. The drivers are located on the Software USB stick provided for all versions of Windows post Windows 95.

- Insert the USB memory stick into an available USB port on your PC
- Connect the USB cable supplied to the Metalyser® instrument as described for battery charging. Connect the other end to an available USB port on your PC
- Windows will run the 'install new hardware wizard'
- When asked if Windows can connect to Windows update to search for software. Select 'No, not this time'
- Select 'Install from a list or specific location', navigate to USB memory drive
- Windows should install the drivers
- Once complete, the wizard will run again. Use the same settings as before
- Once Windows has installed the drivers, reboot the computer and your Metalyser® should be installed
- To verify correct installation select fast charge on the instrument and check that the fast charge icon (see page 7) is displayed on the Metalyser®'s screen

## **Setting the Date and Time**

The Metalyser® contains a calendar and clock which is used to date stamp the results log. The clock may be set to UTC when you receive the instrument so may need re-setting. It will also need re-setting if the battery is disconnected. To set the clock follow these steps.

- From the main menu, select **System**
- From the system menu, select **Set date/time** and press **<OK>**
- Use the navigation key to alter the date and time
- Press **<OK>** when finished to save settings



## Backlight

Your Metalyser® is equipped with a backlight to aid viewing in poor lighting conditions.

To change the backlight settings follow the steps below:

- From the main menu, select **System**
- From the system menu, select **Backlight**

ON	The backlight will be on at all times <sup>1</sup>
OFF	The backlight will be off at all times
AUTO	The backlight will switch on when a key is pressed or the screen refreshes. It will turn off after five seconds of inactivity

<sup>1</sup> The battery life will be shortened in this mode.

- Highlight required setting and press **<OK>**
- Press **<cancel>** to return to main menu

## Language Selection

The Metalyser® comes with English, French and Spanish languages pre-installed. To Change the language follow the steps below:

- From the main menu, select **System**
- From the system menu, select **Language**
- Highlight required language and press **<OK>**
- Press **<cancel>** to return to main menu

## Auto switch off

The Metalyser® can be set to automatically switch off after ten minutes of inactivity. This is recommended to extend battery life. To change this setting follow the steps below:

- From the main menu select System
- From the system menu select Auto **switch off**
- Highlight required setting and press **<OK>**
- Press **<cancel>** to return to main menu

## 5. OPERATING PROCEDURE

### 5.1. METHODS

The Metalysers® operating procedure consists of two main steps – plating (conditioning) and analysis. The plating step forms a plate on the surface of the Working Electrode which can be seen as either a grey or yellow/gold layer on the tip of the electrode. The quality of this plate is essential to achieving reliable results and therefore a secondary conditioning step is included.

The following table illustrates which electrode to use for each element:

<b>Elements Analysed</b>	<b>Working Electrode Used</b>	<b>Colour of Working Electrode after Plating</b>
Cd, Pb	WE1	Grey
Hg	WE2	Yellow / Gold
As	WE2	Yellow / Gold
Cu	WE1	Grey
Zn	WE1	Grey
Mn*	WE1	Grey
Cr (VI)*	Chromium Electrode	Yellow/Gold
Ni*	WE3	Black (no plating required)

\*Not available as standard

If WE1 is to be used in the analysis, then WE2 is not part of the circuit and has no role in the analysis. Likewise for WE1 during analyses using WE2.

When switching between different analyses, the unused electrode needs to be removed otherwise results may be affected.

Procedures for each parameter are detailed in the relevant application notes.

## 5.2. PLATING

This is a process used to form a very thin plate on the surface of the working electrode and only takes a few minutes to complete. The plating step is necessary prior to the analysis of each element, however it is possible to analyse elements consecutively if they share a common plating solution (e.g. Cd, Pb, and Zn all use HG500 Hg Plating Solution). Before carrying out the plating step, the Working Electrode surface must be polished to remove any scratches and imperfections (see page 12).

There are two preliminary steps needed for any analysis with the Metalyser®. The plating step uses either the HG500 Hg Plating Solution or AU500 Au Plating Solution, added to the SAB, to form a plate on the working electrode. After plating, the mirror-finish black tip is covered with a plate that is either grey (HG500 Plating Solution) or yellow/gold (AU500 Plating Solution) in colour.

The element being tested determined the plating solution required:

HG500 Hg Plating Solution – Cd, Pb, Cu, Zn

AU500 Au Plating Solution – Hg and As

HG1000 Thick Hg Plating Solution – Mn

AU1000 Thick Au Plating Solution – Cr(VI)

WE1 is used for Cd, Pb, Cu, Zn and Mn analysis

WE2 is used for Hg and As analysis

WE3 is used for Ni analysis

Chromium Electrode is used for Cr(VI) analysis only

It is necessary to perform the plating and conditioning before an analysis session or if the sensitivity of the analysis decreases. This is because, over time, the plate will reduce in thickness and eventually come off. Typically this would be after 20+ consecutive samples or a period of 2-3 hours. It is therefore suggested to regularly re-plate the electrode; if analysing a lot of samples, it is recommended to plate in the morning and again at the beginning of the afternoon session.

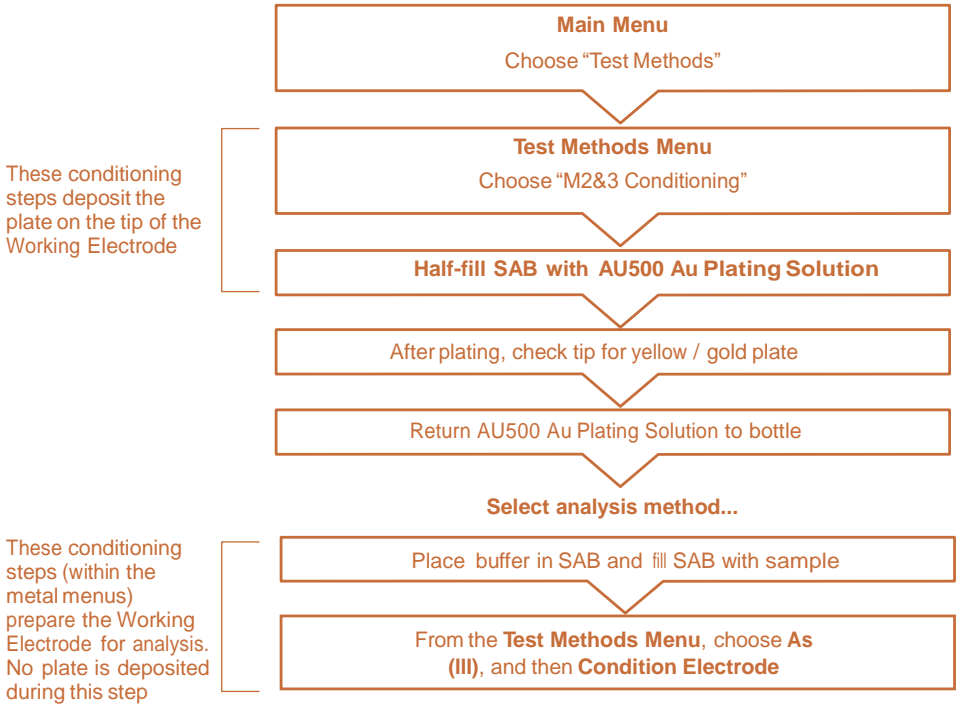
If in doubt, remove the old plate by wiping the surface, polishing the tip of the Working Electrode to a mirror-finish (with the polishing kit provided), rinse with the wash bottle and perform a new plating.

When analysing for elements requiring a plate different to the one currently being used, the electrode not in use will need to be removed from the sonde to prevent interference. It is advised to group together analyses using the sample plate to save switching between them.

The conditioning of the electrode occurs when the element of interest is selected in the **Test Methods** menu, then choosing condition electrode, which is at the top of the list for the selected electrode. The conditioning step should be carried out in sample water, and undertakes a run which sensitises the Working Electrode.

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**Example:** Overview of As (III) conditioning procedure, after polishing, to first plate then sensitise the electrode:



Refer to Application notes for operating procedures for each parameter.

### 5.3. ANALYSIS

Before performing a test using the Metalyser®, ensure that the working electrode has been successfully plated and conditioned first for the metal of interest.

(See section 5.2. Plating and the relevant application notes)

There are two ways to analyse a sample, either via the Standard Addition method or by an in-field calibration of the instrument.

1. **Standard Addition:** This is the recommended method of analysis, where the used adds a known amount of standard to the solution, producing a known peak height. The Metalyser will first run a scan of the sample, to determine if the metals are present and measure the response. A prompt will be given to add a standard to the sample; this is done using the pipette provided. A fixed volume of standard is added to the SAB which will produce the increase in peak height from which the initial sample concentration can be calculated.
2. The in-field calibration method establishes a calibration curve first before analysing a number of samples rapidly. The Metalyser® firstly needs to establish the calibration curve using the Calibrate option in the menu of each metal of interest. Once this has been successfully completed an **Analyse Sample** can be undertaken. (Note: using **Analyse Sample** without establishing a new calibration curve, the previous calibration will be used which may not be correct for the current analysis).

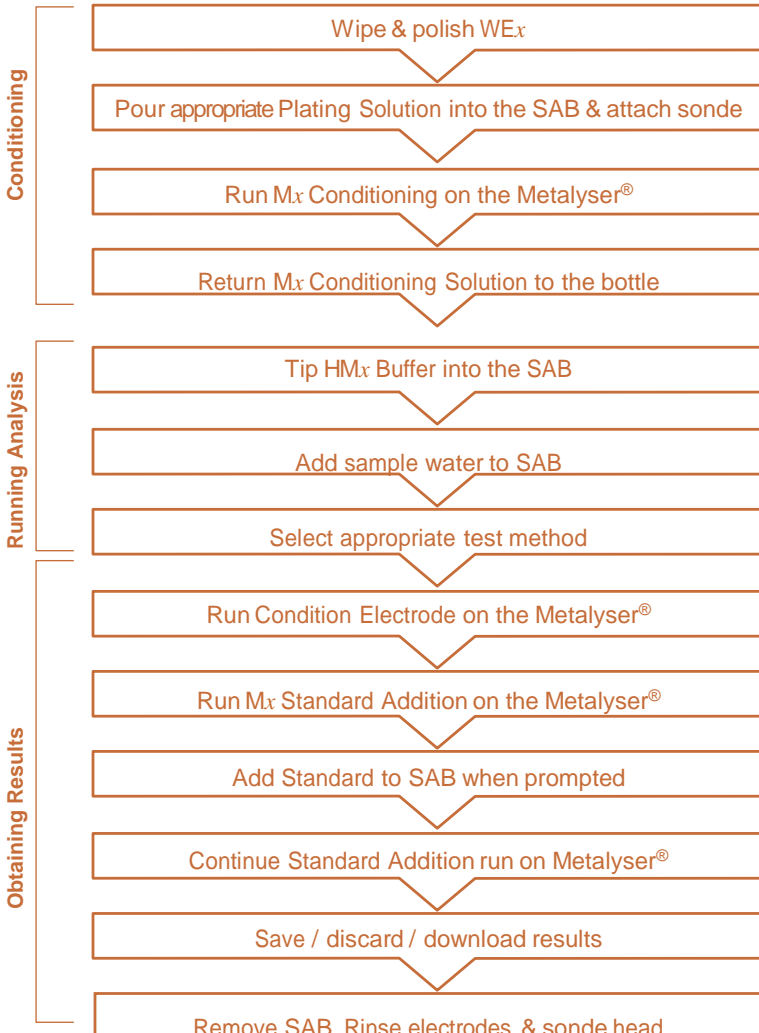
The calibration needs to be established **just prior** to analysis and also after a new plate has been applied to the tip of the working electrode. Many factors affect the calibration curve and the greater the time the analysis occurs after the calibration curve was established the greater the chance that there will be a decrease in accuracy. This is due to a number of factors including variability with the plate over time and even the components of the solution changing. It is important when calibrating the instrument that it is calibrated on a similar type of water to that being analysed, i.e. if a river sample from a particular river is being analysed then the Metalyser® needs to be calibrated using that river water, if a new river is to be analysed then recalibrate using a new river sample from the new location.

The **Blank Subtraction** method is used for creating a new baseline for the instrument for the analysis. It is to be used only when a suspected contaminant is present in the buffers being used. Performing this will replace the previous blank.

**After each analysis the sonde head and the electrodes are to be washed thoroughly. This is in order to minimise carry-over and to clean off all traces of the previous analysis. This can be achieved by using the deionised water or by washing the sonde head (without the SAB) in the sample water. This is particularly important following an arsenic analysis.**

## 5.4. STANDARD ADDITION ANALYSES OVERVIEW

Performing a Standard Addition method analysis consists of Plating running Analysis and obtaining a result. The following main steps will assist you in understanding how to perform a Standard Addition based test.



Where 'WE<sub>x</sub>', use WE1 or WE2 for your required analysis  
Where 'M<sub>x</sub>', use M1, 2, 3, 4 or 5 for your required analysis

## 6. ADDING A STANDARD ADDITION

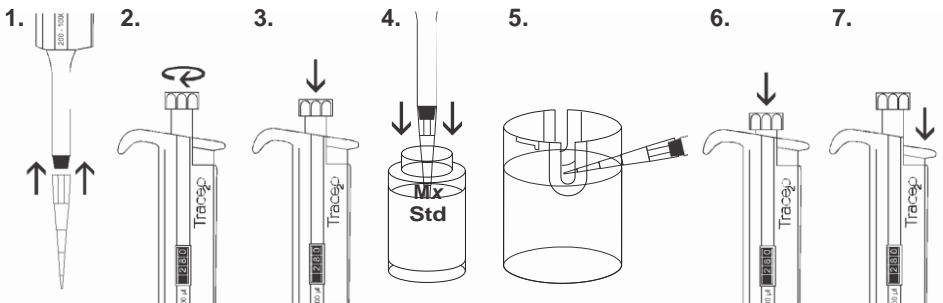
When prompted, a 20ppb Standard Addition needs to be added to the SAB. This is achieved by using the pipette (which is set to 280µl). The 20ppb default setting can be changed by pushing the joystick left and right. Each 140µl increase on the pipette is equivalent to 10ppb.

On the handheld, when prompted to add 20ppb of a particular element(s) then the highlighted value of 20ppb can be altered by pushing the joystick to the left and to the right. If the user wants to measure higher levels then a higher value closer to the concentration level will be required. The accuracy will increase the closer the Standard Addition is to the actual concentration. For example, an unknown sample is expected to be around 15ppb then a 20ppb standard in this case is sufficient. If the user expects the analysis to be 100ppb then, for example, a 120ppb standard would be suitable.

### How to use a pipette

1. Place a clean pipette tip on the pipette
2. Select the volume required by twisting the dial at the top of the pipette
3. Hold the pipette vertically with the hand wrapped around it and the thumb on the button at the top; press the button down gently to the first stop.
4. Place the pipette tip in the standard bottle just underneath the top of the liquid and slowly release the plunger
5. Move the pipette to the SAB and locate the pipette tip through the hole in the SAB
6. Push the plunger all the way down to the second stop and hold then slowly withdraw the pipette tip from the SAB
7. To release the pipette tip after use, push the white button at the side of the pipette

**Before carrying out testing, become familiar using the pipette and the two different stops on the plunger to ensure the correct volume of standard is added.**



### **Altering deposition times**

The standard default deposition time of 60 seconds is suitable for all analysis down to 5ppb for most elements, 10ppb for arsenic. To increase accuracy for the lower levels, an increased deposition time is recommended. If the user expects the analysis to be higher, then a shorter deposition time should be used. This can be adjusted when prompted to choose a deposition time at the beginning of the test methods.

30, 60 or 120 seconds can be selected by moving the joystick to the right and to the left on this screen and then pushing the centre of the joystick to accept it.

<b>Deposition time (seconds)</b>	<b>Concentration range (ppb)</b>
30	50 to 500
60	10 to 50
120	<10

Suggested ranged for choosing deposition times

The instrument has been designed to have a maximum reading of 500ppb. Should the user wish to measure higher than this, they will need to dilute the sample. For example, if the user wishes to measure 600ppb dilute the sample by half and then multiply the result by 2.

Always dilute with water that will not contribute to the heavy metals being tested. Deionised water is ideal.

### **Blank subtraction**

Blank subtraction is recommended to be used for all of the analyses and is the default setting. It is particularly important for the analysis of Hg and As.



## 7. TROUBLESHOOTING

Whilst your Metalysers® is designed to be very reliable, problems may occur throughout its working life. The following tables are intended to help you diagnose and resolve these problems simply and quickly. Should you not be able to resolve the problem please contact your supplier and they will be able to assist you.

When troubleshooting your Metalysers® the following steps should be undertaken in this order:

1. Reference Electrode – does the Reference Electrode contain the right level of electrode fill solution? Is it damaged at all? Are there air bubbles in the inner tube?
2. Stirrer – does the stirrer rotate? Does it mix the powder reagents when operating?
  - a. To check this run the stirrer according to the instructions on page 13
3. Working Electrode – is the Working Electrode conditioned correctly?
  - a. Is WE1 grey in colour or is WE2 yellow in colour? Has the grey
  - b. WE1 Conditioning been wiped off before the WE2 plating?
4. Solutions – have the solutions been contaminated? Have the correct buffers been added in the correct order? Has the right amount of standard been added?

The Metalysers® will try and help you with determining the problems. See below.

Displayed Error	Probable Cause
>L.O.D	The metal concentration is above the maximum limit of 500ppb Dilution should be used
<L.O.D	The metal concentration is below the minimum limit of detection for the method being used
Addition error	The increase in metal response was not sufficient enough to determine the addition
Calibration error	The addition was not added or the metals have not been detected

Problem	Possible Cause	Solution
Peak not visible	Conditioning step not completed Plate damaged No heavy metals in solution	Wipe end of Working Electrode, polish and re-condition as per procedure Re-plating required Test with known amount of standard solution
Results lower than expected	Stirrer not rotating Physical mask over the electrode	Ensure stirrer is rotating by looking into the SAB or lighting touching the bottom to determine stirrer is working, if the stirrer is stuck, use stirrer oil as described on page 13 Ensure no debris – for example, leaves – are physically masking the electrode surface, preventing the analysis from occurring
Results increasing with each run	Organics present	Instrument is not designed to deal with strong organics; system is for natural rivers and water courses
Sample >L.O.D	Overrange on instrument	The Metalyser® has been designed for low level ppb analysis in natural water. The instrument will measure high limits by a) choosing a shorter deposition time (i.e. change default from 60 to 30 seconds when prompted in the Set Deposition time menu during the course of the run) b) diluting the sample by a known amount and multiplying the result back to the original solution
Metalyser® not responding to key press	Internal fault Connected via Metaware	First turn off the Metalyser®, wait for a few seconds and then turn it back on. If this does not fix the problem, disconnect the battery and reconnect. If the fault persists, contact the supplier to organise a return Disconnect Metalyser® from Metaware, turn of the Metalyser® and then turn it back on after a few seconds. This should give control back to the Metalyser®.

**Note:** Periodically, it is good practice to check the response of the instrument and hence the quality of the plate during the course of the day by looking at the graph of the last result and looking for peaks. The information on this graph is very informative and tells the operator what is happening with the results.

To see the graph, navigate to main menu, chose **Data Log**, then **Last Result**. The result will appear first; pressing **<OK>** will display the graph. Press **<OK>** again to exit the graph.

## 8. INTERFERENCE EFFECTS

The Metalyser® has been designed to test very low levels of metals in water and as such is very sensitive. Due to the interaction of other metals and organics in the water source, interferences can occur as with any system of this type.

The Metalyser® is designed to function in water sources that might be suitable for drinking. The buffers chosen mean that in many instances interferences are unlikely to occur.

## 9. SPECIFICATIONS

### Metalyser® HM1000 Handheld Unit

Environment	Water Ingress: IP67 Operating temp: -20°C to +70°C Storage temp: -20 °C to + 70 °C
Connections	1 x waterproof Mini USB port, 1 x 12 Way Multipole Connector.
Display	128 x 128 pixel monochrome backlit LCD.
Power supply	4.5 – 5V DC, 700mAh
Battery	3.3V Li-ion 2200mAh rechargeable.

	Parameter	Lower Limit <sup>†</sup>	Upper Limit <sup>*</sup>
Arsenic (III)	As (III)	5	500
Total Arsenic	As (III+V)	10	500
Copper	Cu	5	500
Mercury	Hg	5	500
Cadmium	Cd	3	500
Lead	Pb	5	500
Zinc	Zn	5	500

\*Upper limit fixed at 500ppb. If the user requires values higher than this then a dilution will be needed

†Lower limits achievable using the Handset at 60 seconds deposition.  
Increased accuracy can be achieved by setting the deposition time to 120 seconds

Variability at 20ppb ± 5% with Metaware software, ± 7.5% with handheld

Accuracy dependent on element measured, sample matrix and type

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