METALYSER HM5100 BENCHTOP

Laboratory Heavy Metals Analyser

CONTENTS

1. INTRODUCTION

The Metalyser HM5100 Benchtop heavy metals analyser is the laboratory-based heavy metal analysis product in Trace2o's popular Metalyser range. The instrument is a compact yet powerful benchtop voltammetric analyser, capable of running a variety of the most commonly used anodic and cathodic stripping techniques. Bespoke advanced PC-based software has been specifically designed to provide a simple yet comprehensive user interface, providing the analyst with more detailed control over the precise operation of the instrument, enabling optimisation of the performance of each individual method to suit the sample type. The following instructions explain how to install, set up and use your analyser.

The HM5100 performs potentiometric analysis where the voltage is controlled and current is measured. Typically a method parameter file is loaded which sets up the instrument. The sample is prepared and the analysis is performed. Usually the analysis will consist of a deposition phase, followed by a stripping phase for the element of interest. This will produce a graphical (voltammogram) of the current output from the cell. The voltammogram will feature peaks, the heights of which are proportionally related to the element(s) being analysed and can be measured in order to calculate the sample concentration.

Trace2o's expert team of Research and Development scientists are continually working on developing new methods for heavy metals analysis, and enhancing and improving existing methods. The latest application notes for these methods are available to registered customers on the members-only section of our website, trace2o.com.

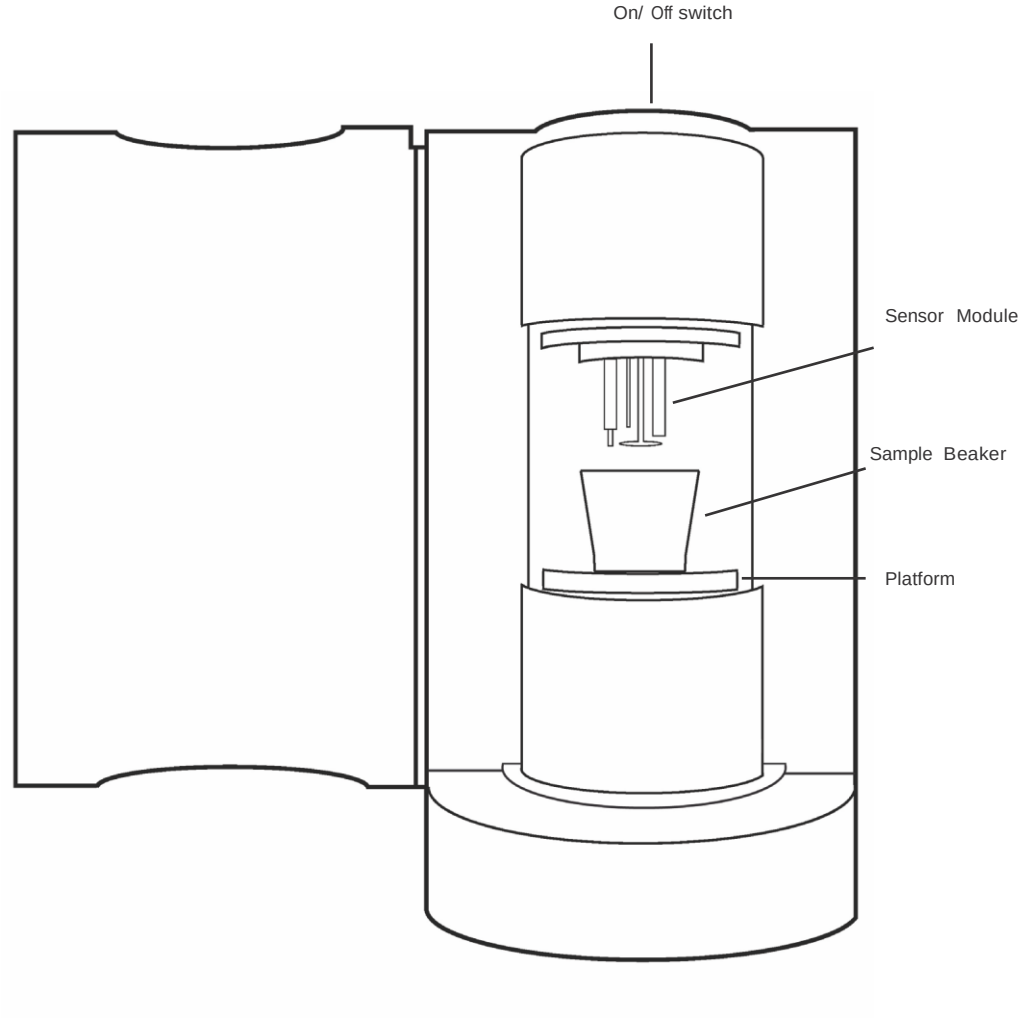
2. BOX CONTENTS

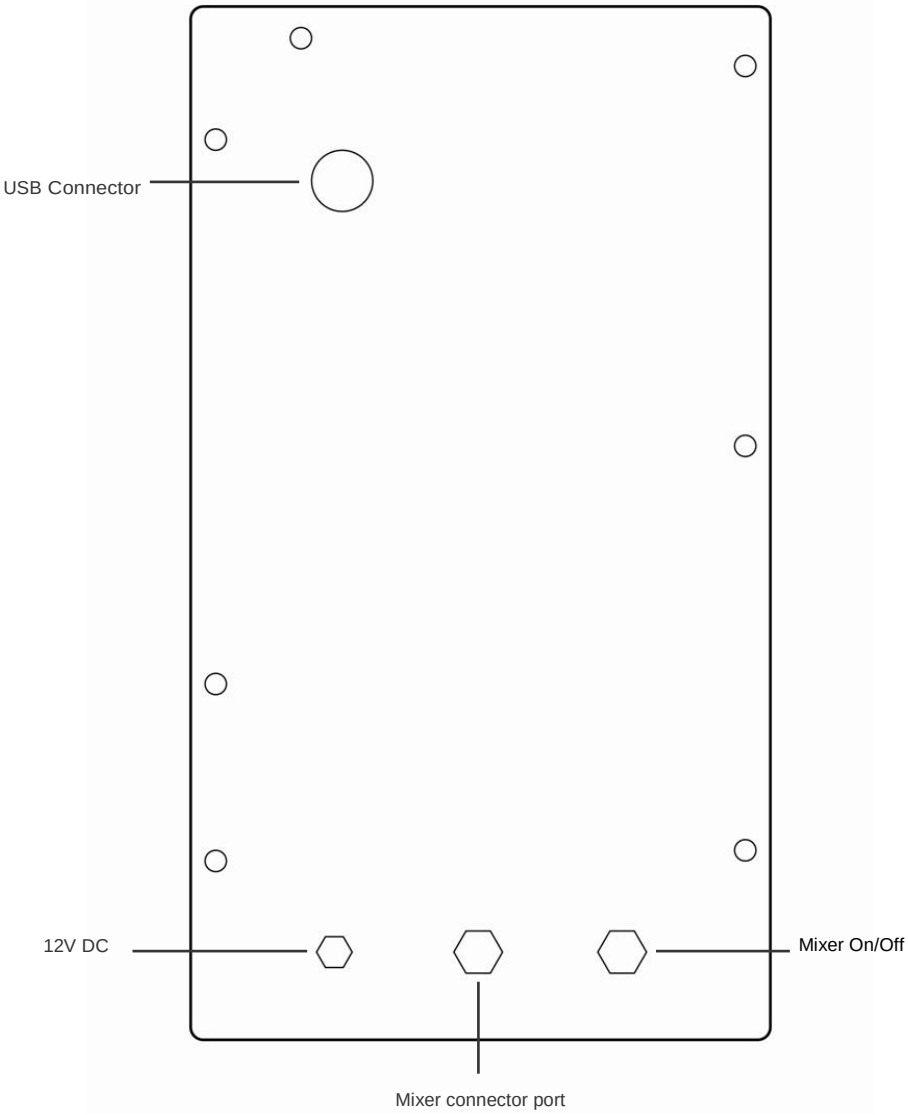
1 x Metalyser HM5100 Benchtop analyser
2 x GC working electrode
1 x Counter electrode
1 x Reference electrode
1 x Polishing platen
5 x Polishing cloth
1 x Bottle of polishing slurry
1 x Reference electrode fill solution bottle

1 x Bluetooth USB dongle
1 x USB lead
5 x Graduated sample analysis beaker
1 x Mains power adapter

In the unlikely event that any of these items are missing, contact Trace2o or your local distributor at your first opportunity.

3. GETTING TO KNOW YOUR METALYSER




USB Connector
12V DC
Mixer On/Off
Mixer connector port

4. INSTRUMENT INSTALLATION

Remove all of the packaging from the HM5100 instrument and ensure that all of the contents are present. If any items appear to be missing, please contact your local distributor or Trace2o.

Set the instrument on a firm level surface.

Connect the lead of the mains adapter to the socket marked 12V DC on the back of the instrument, and plug into a wall socket.

5. SENSOR MODULE

Introducing the sensor module

The sensor module is covered with a protective cardboard sheath for transportation. Remove this sheath before use.

The sensor module comprises three removable electrodes:

Working electrode (W) 

Counter electrode (C) 

Reference electrode (R) 

The working electrodes and reference electrode are supplied with protective rubber caps. These are intended to protect the electrode surfaces. They should be removed during analysis, and replaced when the instrument is not in use.

Trace2o recommends removing the reference electrode from the sensor module for storage. When replacing the protective cap for the reference electrode, fill with deionised water, as this will prevent the reference electrode from drying out.

The sensor module also includes:

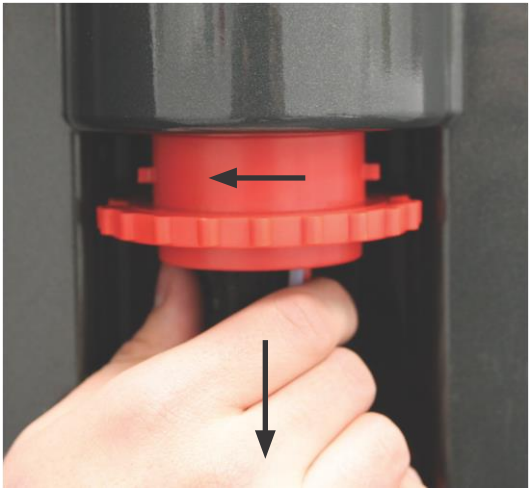
Stirrer

Temperature probe

Connecting/disconnecting the sensor module

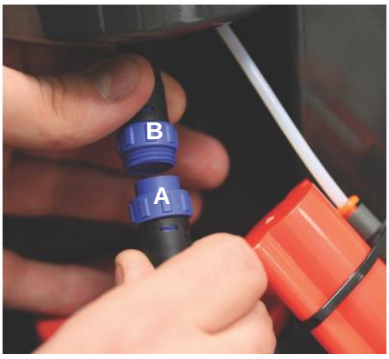
The sensor module can be disconnected and removed if necessary to facilitate cleaning of the HM5100 instrument.

To disconnect the sensor module from the body of the instrument, turn the sensor module cogwheel counter-clockwise to unlock, and carefully pull gently downwards.



To remove the sensor module, unscrew the blue cable connector. The sensor module may now be completely removed.

To reconnect the sensor module, Connect plug A to socket B of the blue cable connector and tighten the locking ring.



Ensure that the working electrode socket is located towards the front of the sensor module, then align the twist-lock pins with the slots on the instrument, slide the sensor module into place, and twist clockwise to lock.

Connecting/disconnecting the electrodes

The electrodes are all pre-fitted, but may need to be removed during the course of analysis, for example when switching between the two working electrodes.

To fit the electrodes, simply align the white arrow on the black connector shroud with the arrow on the socket and gently push the electrode. 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 on the black connector shroud and the connector will pull off.

Avoid knocking the stirrer whilst attaching or removing electrodes.

Insert the electrode into the appropriate sockets as indicated by the electrode letters printed on the sensor module.

The working electrode has a 6-pin connector and will only fit into the W position. The counter and reference electrodes both have 3-pin connectors.
The instrument requires all three electrodes in the correct positions to function correctly. Do not mix up the counter and reference electrodes.

Working electrode usage

The HM5100 is supplied with two working electrodes to prevent cross-contamination of samples.

Working electrodes should be properly cleaned between analyses. Cleaning instructions are provided at the back of the manual.

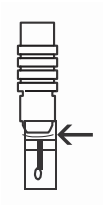
The working electrode comprises a disc of glassy carbon. Although supplied in a polished, ready-to-use state, gradual fouling of the electrode surface will occur by adsorption of buffers, analytes, or organic surfactants, which will reduce the sensitivity
of the analysis. The electrode should therefore be regularly polished to ensure a smooth mirror-like surface using the supplied glass platen, polishing cloth and polishing solution.

See care and maintenance section for further details.

Reference electrode usage

The HM5100 has a custom-built reference electrode that has been designed to eliminate the need to drain and refill the reference chamber on a regular basis. The only maintenance required is to top up the fill solution in the reference chamber from time to time. The reference chamber should be kept at least 1/3rd full.

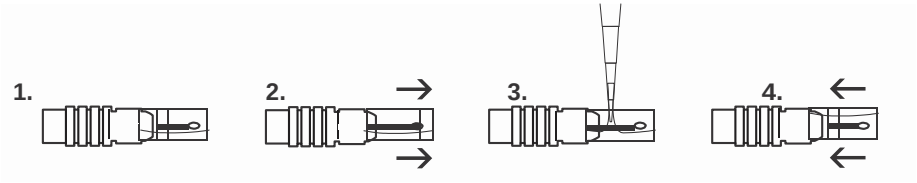
When necessary, replenish from the Reference Electrode Fill Solution bottle supplied with the unit. Slide the band down from the hole and use a micropipette to add fill solution to the reference chamber. Once topped up, replace the band to prevent the electrode fill solution escaping. Following addition of fill solution to the reference chamber, the reference electrode should be allowed to equilibrate for 24 hours before use.



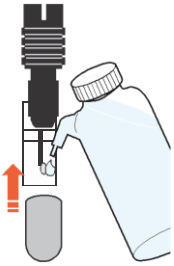
Fill solution level at max

Fill solution level too low

Only use the supplied reference electrode fill solution.



Remember to remove the protective rubber cap before use, and to replace the cap after use to prevent the reference electrode from drying out. Add a few drops of deionised water to the cap before placing on the reference electrode.



Cleaning and maintaining the instrument, sensor module, and electrodes

Cleaning and maintenance instructions for the instrument, sensor module and all of the electrodes are provided at the back of this manual.

6. CONNECTION SETUP

Connecting a PC to the Metalyser HM5100

The Metalyser HM5100 can connect to a PC via either USB or Bluetooth. If, after initial setup the user later decides to connect via another method, initial setup will need to be repeated to re-establish the connection.

Initial Setup

USB Driver Installation

Your HM5100 instrument 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 HM5100 CD ROM and are available for all versions of Windows post-95. Follow the procedure to ensure that the USB drivers are correctly installed.

- Insert the CD ROM into the CD drive.
- Ensure that the HM5100 instrument is connected to a power supply using the 12V DC adapter.
- Unscrew the blue protector cap on the rear of the HM5100, connect the waterproof USB cable to the HM5100 instrument, and tighten the screw cap.
- Connect the other end of the USB cable to an available USB port on your PC.
- Turn on the HM5100 by depressing the green power switch on the top of the instrument. The green indicator LED should turn on.
- 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 (Advanced)'
- Check 'Include this location in search if applicable, and navigate to the CD ROM 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.

Bluetooth Installation

Your HM5100 instrument is able to communicate with a PC through Bluetooth. Most newer laptops and some desktops will have built-in Bluetooth connectivity; however, a Bluetooth adapter dongle is supplied with the instrument. Follow the procedure to correctly establish a connection to the instrument via Bluetooth.

- If use of the Bluetooth dongle is required, insert the Bluetooth dongle installation CD and follow the on-screen instructions to correctly install the Bluetooth software and drivers.
- Turn on built-in Bluetooth, or plug the supplied Bluetooth dongle into an available USB port on your PC.
- Turn on the HM5100 instrument by depressing the green power switch on the top of the instrument. The green indicator LED should turn on.
- Double-click the Bluetooth icon, found in the system tray.
- Depending on previous use of Bluetooth, the configuration wizard may load. Follow the on-screen instructions.
- Select 'Add device'.
- 'Metalyser 5XX-XX-XXX' should be displayed in the window, where the X values correspond to the serial number of your instrument. If it is not, turn the instrument off, wait five seconds, then turn the instrument on again.
- Select 'Metalyser 5XX-XX-XXX' and click 'Next'.
- 'Installing device driver software' may be displayed.
- You may be asked to enter the PIN for the instrument. This is pre-set as 1234.
- 'Your device is now ready to use' will be displayed.
- A Bluetooth connection between the Metalyser and the computer has now been established.

Software Installation

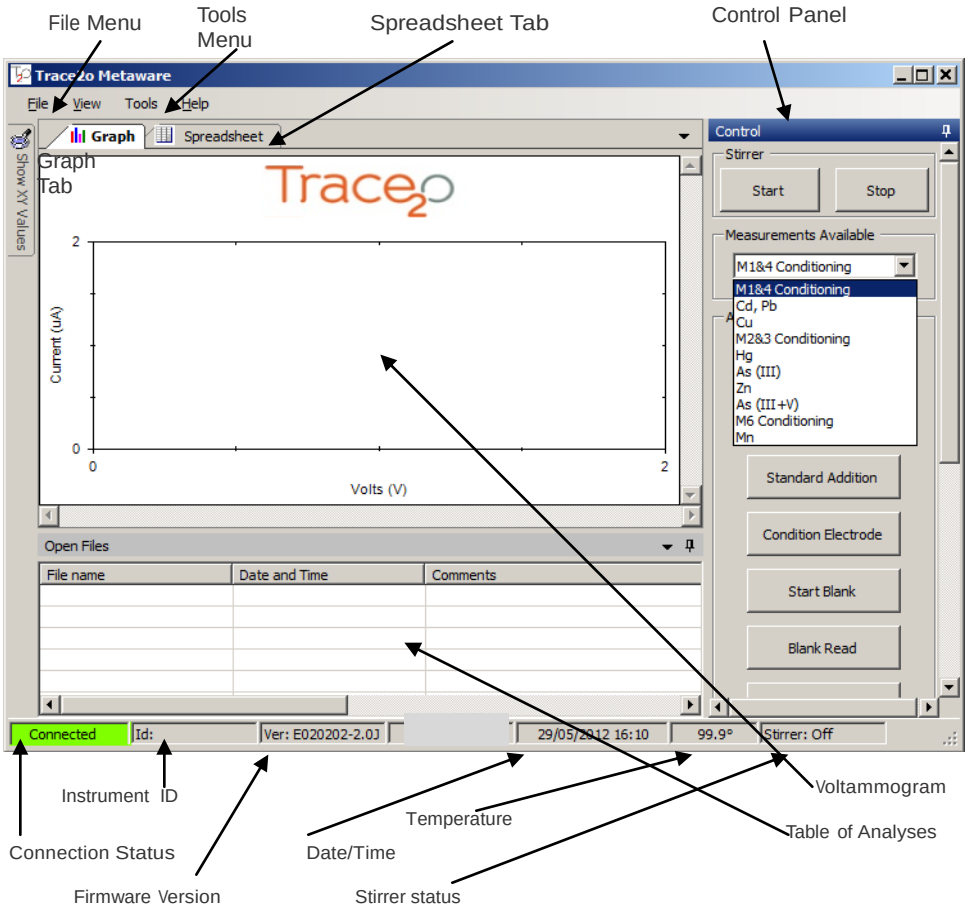
The HM5100 instrument is controlled through theTrace2o Metaware Benchtop software, which is provided on the HM5100 USB stick.

- Connect the USB stick to a free USB slot on the computer.
- Browse to the 'Metaware Benchtop Install' folder.
- Double click setup.exe
- Follow on-screen instructions.

7. INTRODUCING METAWARE

Loading Metaware

- Go to **Start Menu**
- Select **Programs**
- Select **Trace2o**
- Click **Trace2o Metaware HM5100**.



Connecting to HM5100

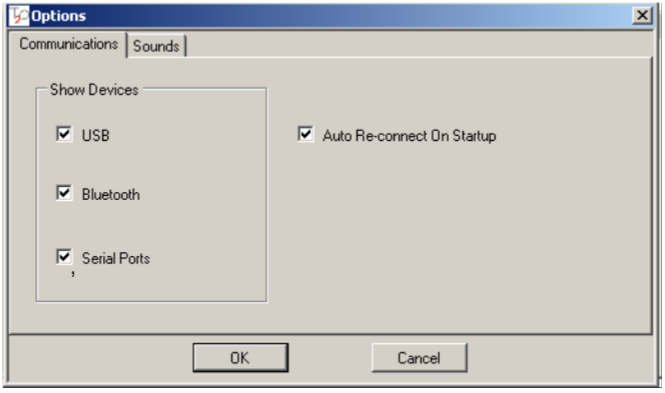
If connecting via the USB cable:

Select **Tools**, then **Communications**, then **Metalyser HM5100.** The connection status panel on the info pane at the bottom of the screen will change from 'Disconnected' to 'Connecting.....'

When a connection has been successfully established, the connection status panel will read 'Connected'

And the serial number of the instrument will be displayed on the instrument ID panel.

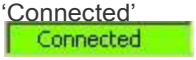
If the Metalyser cannot be seen in the Connections sub-menu, then select Tools then Option and check the Serial Ports checkbox on the dialog box. Click OK then look for Metalyser HM5100 (COMX) (where X is the numerical value of the COM port to which your Metalyser is connected) in the Communications sub-menu.



If connecting via Bluetooth

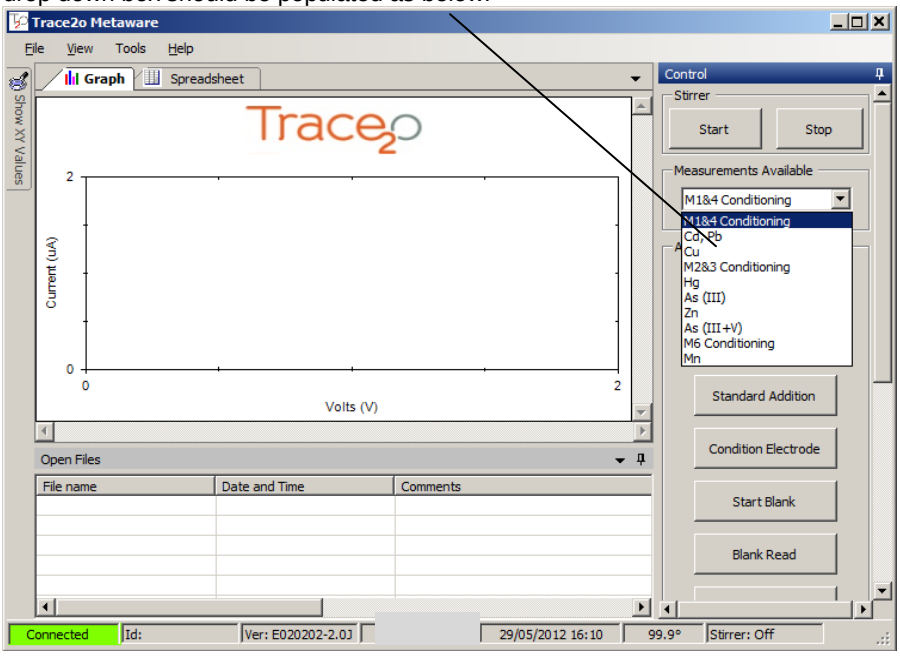
Select **Tools**, then **Communications**, then **Metalyser 5XX-XX-XXX** (where the X values correspond to the serial number of your instrument).
The connection status panel on the info pane will change from 'Disconnected' to 'Connecting.....'

When a connection has been successfully established, the connection status panel will display 'Connected'



and the serial number of the instrument will be displayed on the instrument ID panel.

A 'Read configuration' box should pop up and ask if you wish to 'Read all definitions from the unit'. It is recommended to select Yes. No can be selected if the instrument has been recently connected and a connection is being re-established after a short period of in-operation for example travelling between sites.
When the test methods have been read, the 'Measurements available' drop down box should be populated as below.



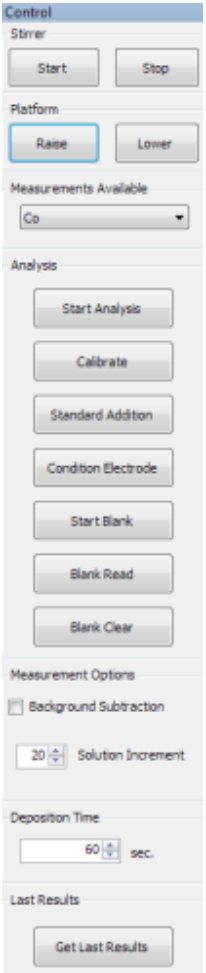
Language Selection

The Metaware software comes with pre-installed language packs. To select the language pack select ‘Tools’ and then ‘Language’ and select the language of choice.

Setting the Date and Time

The instrument has an internal 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. The clock can be set through the Metaware. To set via Metaware right click on the time pane at the bottom of the Metaware window and click ‘set to PC time’.

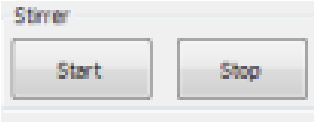
8. USING THE METAWARE



The control panel

The control panel is used for controlling the stirrer and the height of the adjustable platform, as well as setting the number of repeats, and starting the analysis.

Stirrer



The stirrer will run automatically throughout the conditioning, deposition and equilibrium steps of an analysis. It can also run independently of the potentiostat. To start the stirrer, cick the **Start** button. To stop the stirrer, click the **Stop** button.

If you are not sure whether the stirrer is running, the 'Stirrer' panel of the info pane at the bottom of the Metaware window will display 'On' or 'Off', dependent on the current status of the stirrer.

Platform

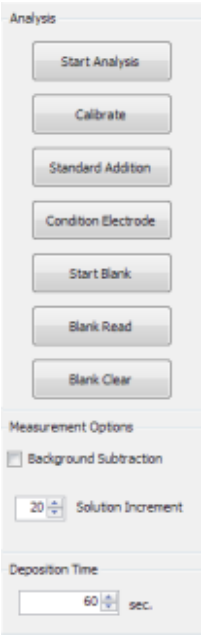
The sample elevation platform must be lowered to facilitate insertion or removal of a sample, or addition of a standard. The platform must be raised during analysis so that the electrodes are submerged in the sample.

To raise the sample platform, click the **Raise** button. To lower the sample platform, click the **Lower** button.

The HM5100 cannot run analyses with the sample platform in the down position.

If the 'Start Analysis' button is clicked and the sample platform is in the 'Down' position, the Metaware will inform the user by displaying the message: Platform not raised. Raise platform and continue? If **Yes** is clicked, the platform will be raised and the analysis will commence. If **No** is clicked, the analysis will be cancelled.

Analysis



There are a number of options available for performing an analysis using the HM5100. These are detailed below. For quick analysis, **Standard Addition** may be used. For the best accuracy, **Start Analysis** should be used in conjunction with the **Spreadsheet** tab to carry out a multi-point standard addition as detailed below. The analysis may take a few seconds to start whilst the commands are sent to the instrument.

The deposition time can be set independently of that specified for the method parameter using the **Deposition Time** box.

For more information on appropriate usage of the deposition time box, consult the relevant Trace2o application note for the analysis.

The **Background Subtraction** checkbox is intended for use when using the potentiostat for analyses that require non-stripping voltammetric analysis - for example, the Cr (VI) test (M7). By default, the box is checked. If background subtraction is not required, uncheck the box. Consult the application note for more information.

9. OPERATING PROCEDURE

For simplicity the metals are grouped into M groups. For each analysis the same M group number is used for all of the Conditioning Solutions, Buffers and Standards. For example, if Hg were to be analysed then M2 would be used, requiring the use of M2&M3 Conditioning Solution, M2 Buffer and M2 Standard.

The Metalyser operating procedure consists of three main steps – Conditioning, Analysis and Results.

An application note has been included with each of the buffer kits which provides the complete instructions for carrying out each analysis, however, it is recommended the manual is read fully before commencing a test.

Conditioning

This is a process used to form a very thin plate on the surface of the working electrode. Before the conditioning step, the electrodes are typically black and should be a mirror finish. A conditioning solution is added to the SAB and a conditioning step is run. After the conditioning step the surface will change colour. For example the electrode surface will look grey after M1 conditioning. It is necessary to carry out a conditioning step prior to the analysis of each M group, however it is possible to analyse M groups consecutively using the same plate if they use a common conditioning solution. Eg, both M1 and M4 use the same M1,M4,M5 conditioning solution.
Over time the plate will reduce in thickness and eventually come off, typically this would be after 20+ consecutive samples or a period of 2-3hours but if there is any doubt about the quality of the plate it should be cleaned off, the electrode re-polished and the plate re-applied by repeating the conditioning step.

Analysis

Once the Conditioning step has been carried out an analysis step can be performed for the metal of interest. The complete instructions for each Metal are included within each of the buffer kits.

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

1. **Standard Addition (Single Point):** This is the recommended method of analysis for the Metalyser. The Metalyser will first run a scan on the sample, 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 give an increase in peak height from which the sample concentration can be calculated.

2. **Calibration:** The in-field calibration method establishes a calibration curve first before analysing a number of samples rapidly. The Metalyser first 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** is not advised without first establishing a new calibration curve, otherwise 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 later 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 sample from the new location.

3. **Multi-point Standard Addition:** For more advanced analysis, the analyse sample option can be selected. This will run an analysis and plot the results. The peak heights can be measured manually and the results tabulated using the spreadsheet function. Once the data has been entered the calculate function can be used to generate a linear regression curve and determine the result for the original sample concentration.

Adding a standard addition

When prompted a 20ppb Standard Addition needs to be added to the SAB. This is achieved by using a pipette. The 20ppb default setting can be changed prior to commencing analysis by using the up/down selector under **Solution Increment** in the Metaware. Each 140µl increase on the pipette is equivalent to 10ppb.

Variable volume standard additions

The standard addition added to the sample must be a concentration of the metal that matches what is programmed into the instrument. The default set-up is to use 280ul addition of a 5ppm standard which equates to 20ppb in the SAB where the SAB holds 70ml of sample.
To calculate the final concentration of standard in the SAB in ppb, use the equation

$$\frac{\text{Addition volume(ul)}}{\text{SAB volume(ml)}} \times \text{Standard Concentration(ppm)}$$

To achieve higher accuracy, the standard addition should be matched closely to the expected sample concentration. For higher concentrations the volume of the addition could be excessive, leading to errors due to the increase in volume of the SAB especially with multiple additions. To reduce the volume smaller additions can be made using higher concentration of the standards. If the standard addition is changed the final concentration in the SAB needs to be calculated and entered into the Solution increment box under Measurement options in the control panel.

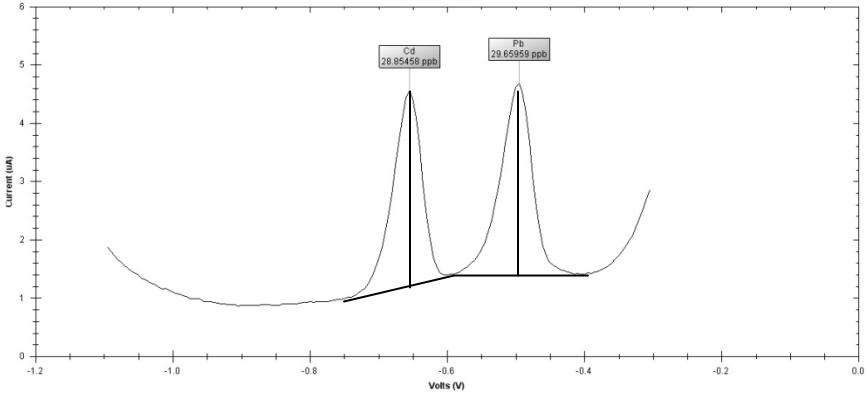
The following table gives some guidance as to what values to use:

Final concentration in SAB	Metals standard	Standard Addition volume
1 ppb	5ppm	14ul
5 ppb	5ppm	70ul
20ppb	5ppm	280ul
100ppb	50ppm*	140ul
500ppb	50ppm*	700ul

Results

Following the analysis a graph known as a voltammogram will be displayed. This is a plot of output current vs applied potential. If the metals of interest are present in the sample, peaks will be seen in the data. The peaks will automatically be labelled with the metal name and the concentration value calculated and displayed.

The **voltammogram below shows a typical result for an M1 analysis. The two peaks displayed are for cadmium and lead**



Basic graph functions:

Right clicking the mouse whilst hovering over the graph will show the following options:

- **Copy:** Copies the graph to the Windows clip board.
- **Save Image As:** Saves the image as a graphics file.
- **Page Setup:** Setup the printing options.
- **Print:** Prints the graph to a selected printer.
- **Zoom Out:** Zooms back out one zoom step.
- **Reset Zoom:** Restores the viewing window to the default setting.
- **Set Scale to Default:** Restores the axis to the default values.

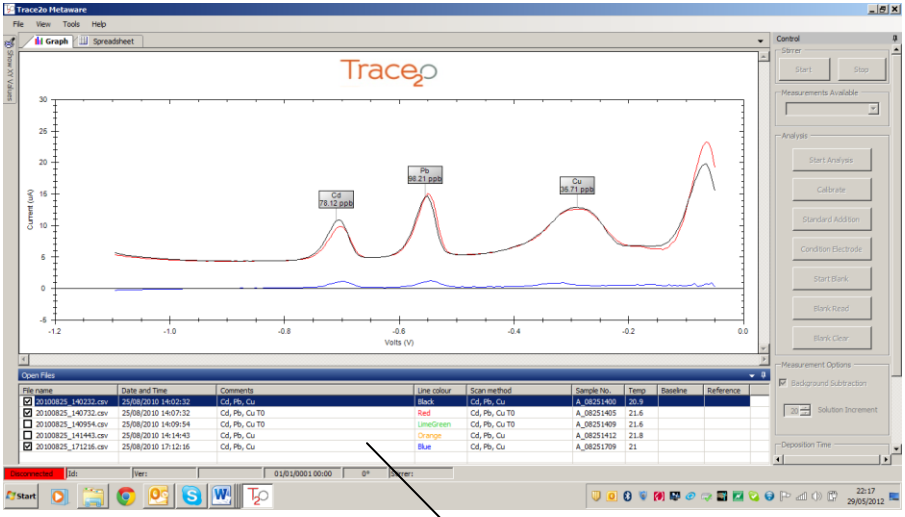
Advanced graph functions

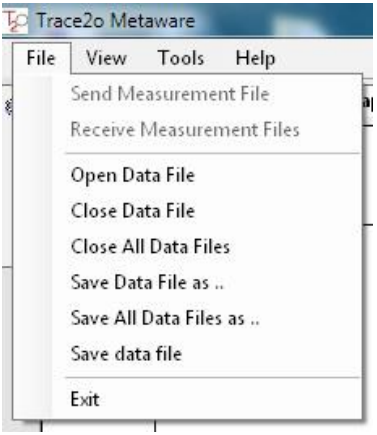
It is possible to measure the peak heights manually to provide raw current data which can facilitate more accurate data analysis by providing data for use in the linear regression table.

- **Calculate Peak:** To calculate a peak, first position the cursor over the data-point you wish to use as the right hand side of the peak then right click the mouse and click 'calculate peak'. If a valid point is not found, this function will be greyed out. Move the mouse to the left hand side of the peak and left click the mouse. The baseline will be drawn in and the peak height shown, reported as a current (µA).
- **Abort Peak Calculation:** If an error is made during the selection of data points the calculation can be aborted.
- **Remove all peak data:** Removes all of the peak data from the graph.
- **Remove this peak data:** Used to remove result readings from voltammogram. Move the cursor over the peak result box and then select this option which will remove the peak data.

Show Data Points:

For more detailed information the data points can be displayed on the graph. Click the Tools option from the top menu and select the 'Show Data Points' option to toggle them off and on.





File Menu while using the Graph tab

The table of analyses (open files) at the bottom of the screen displays all of the data currently loaded. The graphs can be toggled on and off using the tick box on the left for each individual graph.
Files can be saved using “Save Data File As” from the File menu and later opened or closed using several standard Windows options (as shown left).

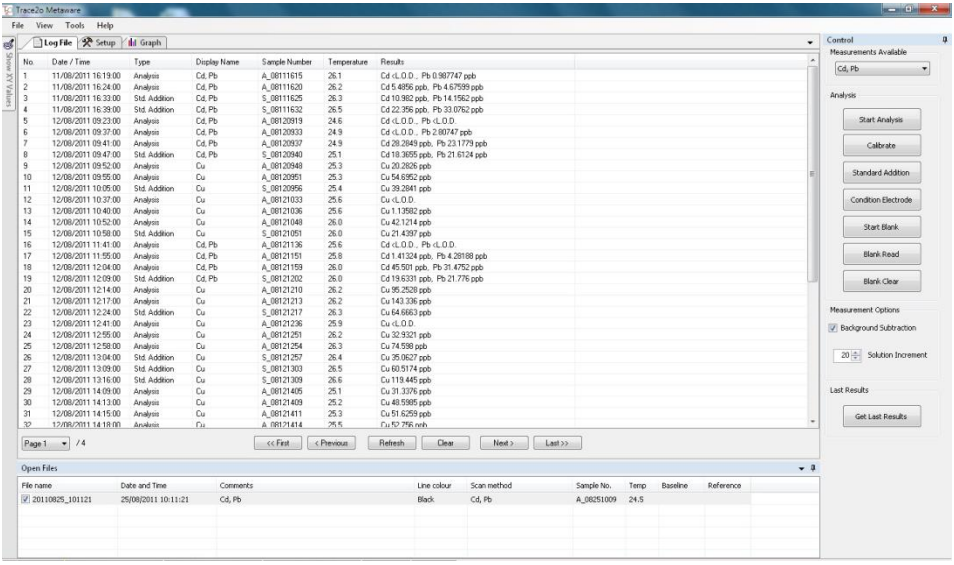
If a file is saved with a different name, the updated filename will not be displayed until the file is re-loaded.

Note: The contents of the “File” menu will change according to which tab is currently in use.

Results log

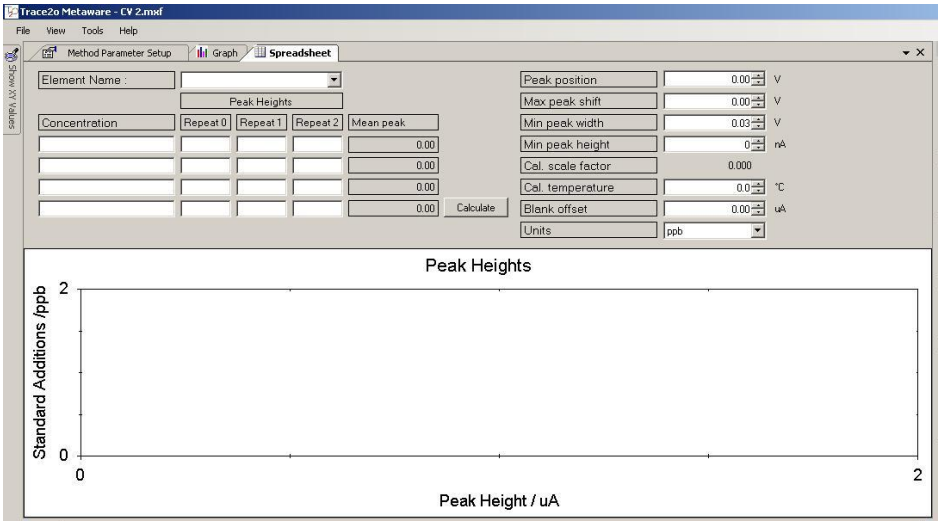
The results summary for each analysis will be stored in the instrument's memory. Select the log file tab and then refresh to display the log file. These results only contain numerical information but each analysis run by Metaware can be saved complete with the graphical data.

The log file can be saved in .CSV format which can be then loaded into a spreadsheet for record keeping.

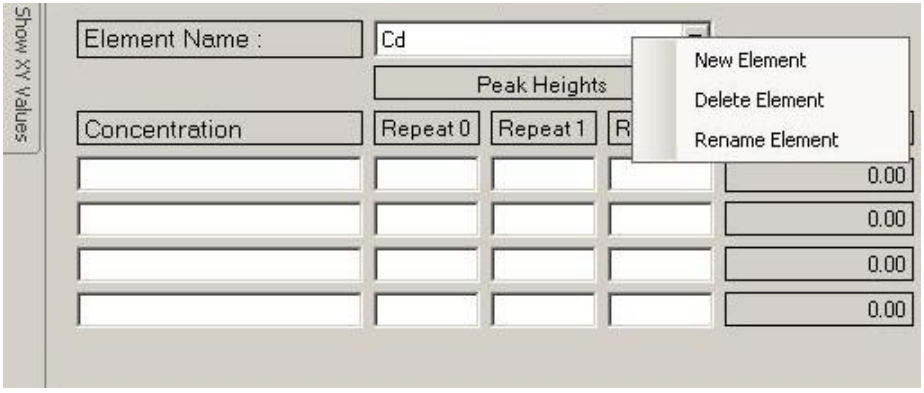


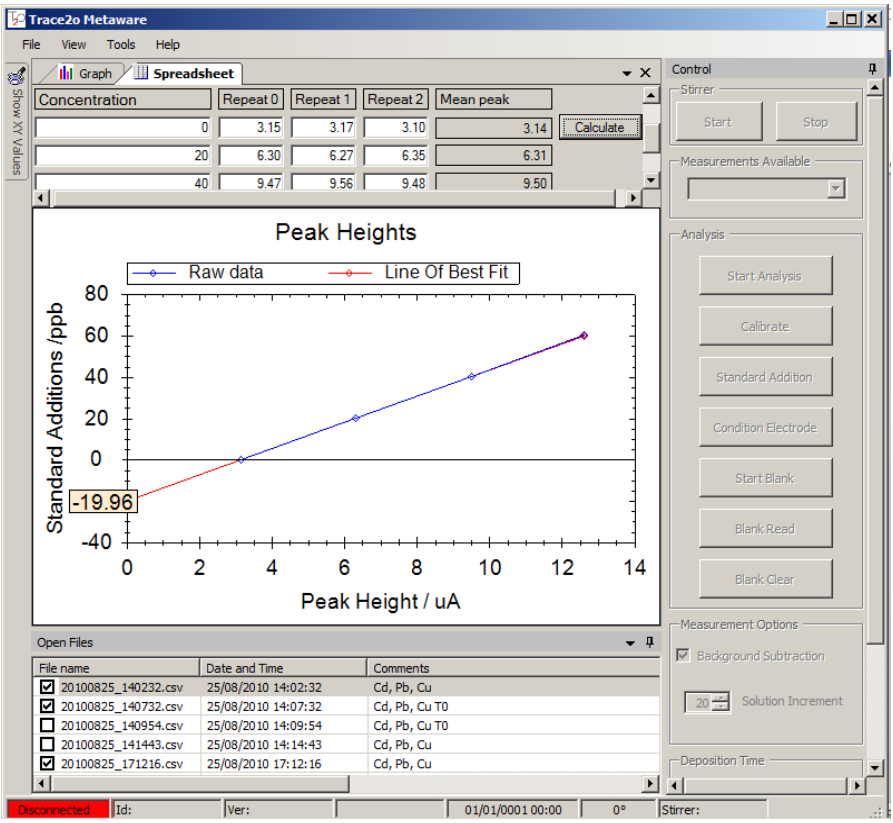
10. LINEAR REGRESSION

The HM5100 has a built-in spreadsheet function enabling the user to perform linear regression on the analysis data.



To create a spreadsheet, right-click on the drop-down menu and select **New Element**. Input an element name. Multiple spreadsheets can be created. Right-clicking on an existing element name offers the option to rename, or delete the spreadsheet as required.





The table has four possible entries for the sample concentration. The first entry would normally be zero, as this is the unknown concentration of the sample that is trying to be established. The second, third, and fourth entries would be the sample concentration after each standard addition. In the above example three standard additions are performed each of 20ppb. The peak heights are calculated for each of the additions and entered in the table. To achieve greater accuracy, repeat analysis can be run after each addition to give an average over three readings although it is not necessary to fill the table. When all the data is entered, click **Calculate**. The mean peak heights will be calculated and a graph of concentration vs peak height plotted. A line of best fit will be drawn through the data and the y-intercept shown, which corresponds to the unknown sample concentration for the metal of interest. The value is shown as a negative because this indicates the amount which needs to be added to each of the data points to make the line of best fit go through the origin which in this case is 19.96ppb.

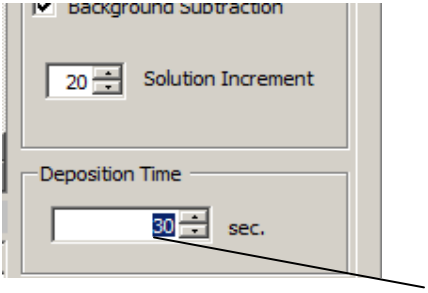
11. ADVANCED OPERATIONS

Blank Subtraction

The **Blank Subtraction** method is used to create a new baseline for the analysis. Some of the buffers used may contain small amounts of metals and the blank subtraction can be used to measure this and offset it against the results. Performing this will replace the previous blank. The blank offsets can also be cleared if required.
After each analysis the Sonde head and the electrodes should be washed thoroughly. This is in order to minimise carry-over and to clean off all traces of the previous analysis. The Sonde head can be washed in the sample water and then given a final rinse with the rinse solution in the kit.

Variable Deposition time

The sensitivity of the analysis is controlled by the deposition time which is the time for which metals are deposited onto the electrode during the analysis. The relationship between deposition time and sensitivity is linear so doubling the deposition time will double the amount of metal deposited.



To adjust the deposition time, alter the value in the measurement options box. If using the standard addition function or calibration the results given in ppb will be automatically corrected and no calculation is required, although if the calibration is performed the deposition time must be the same as that for the consequent analyses.
If using the spreadsheet function it is important to ensure that the deposition time is kept the same for all analyses.

12. 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.

13. CARE AND MAINTENANCE

With careful use, the maintenance requirements of the HM5100 instrument should be minimal. However, to ensure the continued operation of the instrument and minimise the potential for sample contamination, the instrument should be carefully cleaned at the end of every session

Instrument cleaning

Trace2o strongly recommends the use of IPA wipes for routine cleaning of the Metalyser HM5100 Benchtop instrument, sensor module, and electrodes. Other polar protic solvents (i.e. methanol, water) are also suitable for cleaning the instrument. Acetone and other polar aprotic solvents (DCM,THF) will damage
the surface of the instrument and void the manufacturer's warranty.

Sensor module cleaning

The sensor module should be thoroughly rinsed with deionised water at the start and end of use, and whenever changing between samples. It is recommended to hold a sample cup as close to the electrodes as possible and squirt the electrodes using a wash bottle.

For in-situ deeper cleaning of the sensor module, use dilute hydrochloric or nitric acid (0.1M) in a sample beaker and run the stirrer for several minutes.

Care of your electrodes

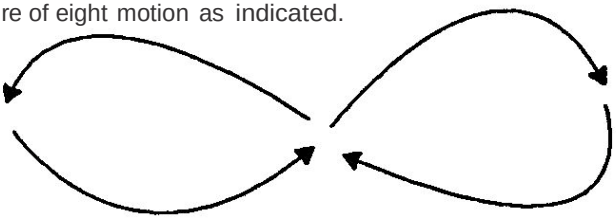
Counter electrode – an occasional quick visual inspection is required to ensure that the electrode has no physical damage.

Reference electrode –regularly perform a visual inspection to ensure that the electrode has no physical damage, and that there is sufficient liquid (at least 1/3rd full) in the reference chamber, and no bubbles in the inner tube. The fill solution in the reference chamber should be kept replenished using the Reference Electrode Fill Solution provided in the kit. For best performance, the reference electrode tip should be kept wet. This can be accomplished by adding a few drops of deionised water to the protective cap when storing the electrode.

Working electrode – the electrode surface should be examined for cracks and imperfections that will affect analysis. The glassy carbon should be regularly polished to remove contaminants and ensure a smooth mirror-like surface using the supplied glass platen, polishing cloth and polishing solution. Ensure that the protective rubber cap is replaced during storage of the electrode to prevent damage to the electrode surface.

Polishing technique

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 solution 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.

Maintenance and warranty

With normal usage, the HM5100 should only require minimal maintenance – however if your instrument develops a fault, contact Trace2o Technical Support or your distributor in the first instance. Trace2o products are provided with a full one year warranty. It is recommended that your HM5100 is returned to your local dealer for an annual service to keep the instrument in good condition. For more information, please contact Trace2o.

Firmware and software updates for the HM5100 are available, free of charge, via the Trace2o website or through your local distributor.

NB: The HM5100 is shipped with tamper-proof labels. Any attempt to disassemble the instrument without authorisation from Trace2o will damage the tamper-proof labels and void the manufacturer's warranty. Trace2o will not accept any returns of items disassembled without authorisation, and Trace2o warranty department will not repair items without an intact label.

14. SPECIFICATIONS

Metalyser HM5100 Benchtop Unit

Power supply: 12V DC, 1.5A, 2.1mm DC Jack

Materials: ABS-ESD, PC, PEEK, PTFE

Communications:

USB: Virtual Comm port 57600 Baud
Bluetooth: V2.0 2.4Ghz

Potentiostat:

DC Potential range: ±2V
DC Potential resolution: 0.001V
Output current range: ±10mA
Input current range: 1nA – 1mA (7 ranges)
Resolution: 0.1% of current range **AC Potential Range:** 0 – 0.25V **AC Potential Resolution:** 0.001V

Electrodes:

Working electrodes: 3mm Glassy Carbon disc. Impedance < 1.5 ohm **Counter (Auxiliary) Electrode:** Platinum foil. Impedance < 0.2 ohm **Reference Electrode:** Silver/Silver Chloride double junction. 3M KCL filled

Metalyser HM5100 Benchtop Instruction Manual v1.0

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