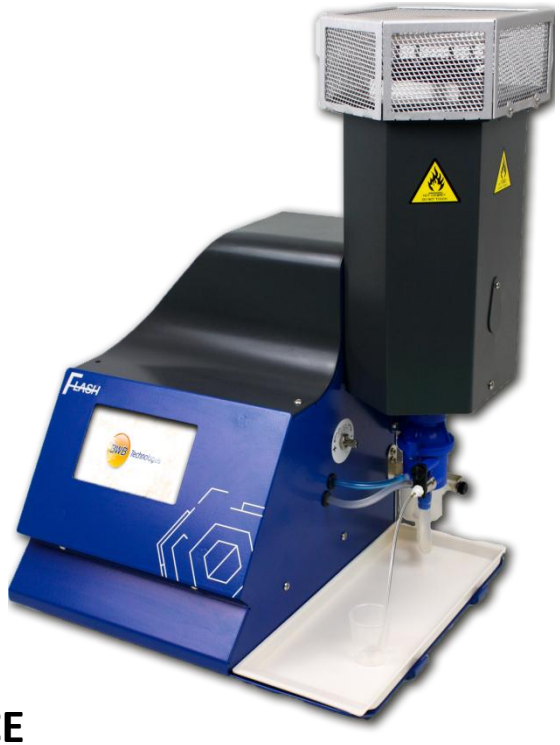


BWB FLASH PHOTOMETER RANGE
FLAME PHOTOMETER

INSTALLATION, OPERATION & MAINTENANCE MANUAL

BWB FL-2 BWB FL-3 BWB FL-4 BWB FL-C BWB FL-K BWB FL-L BWB FL-N

Li 3 Na 11 K 19 Ca 20

Firmware 4.54F42 on

Version 1.0

Why have we made this guide horizontal?
Protecting the environment is a key concern for us here at BWB. This manual was created with the intention of being read on modern PC monitors to prevent the need to print onto paper. Paper copies are available on request for a small charge.

Making our blue
more green

The BWB customer portal gives you access 24/7 to our digital document collection.
Download material safety data sheets, user manuals and hints & tips sheets.

www.bwbcustomerportal.com

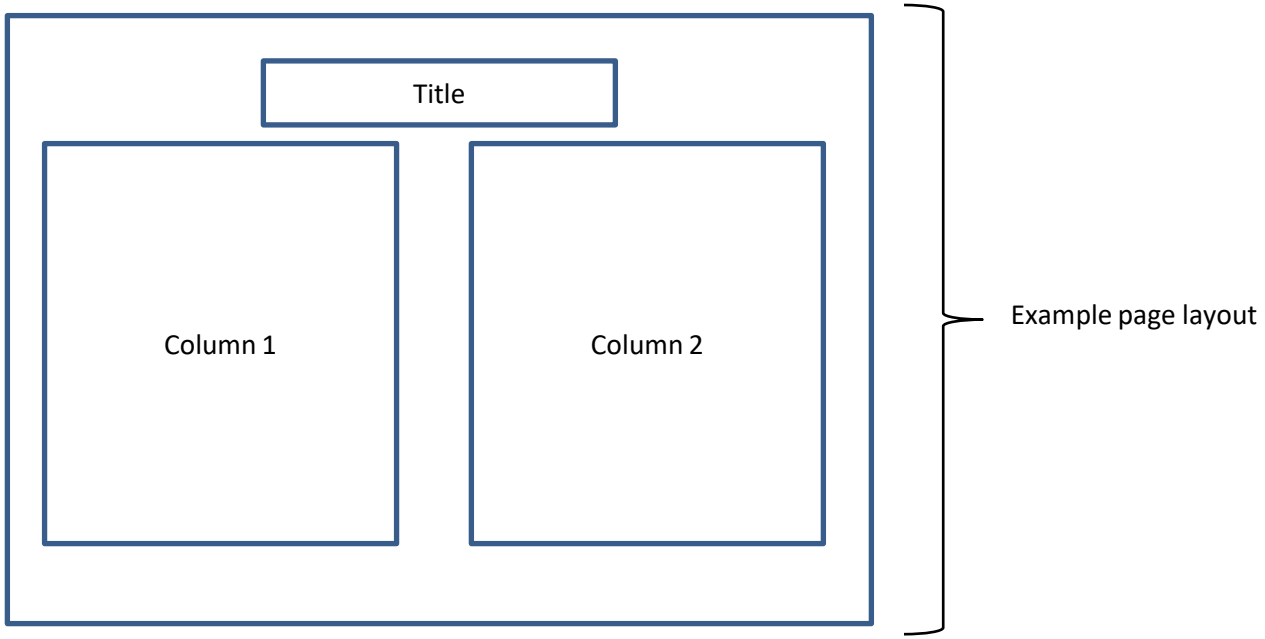
BWB Technologies

Ensure you read this manual cover to cover before attempting to use the instrument. Analytical instrumentation is very sensitive and BWB Technologies Ltd will not be held responsible for operators failing to follow correct processes.

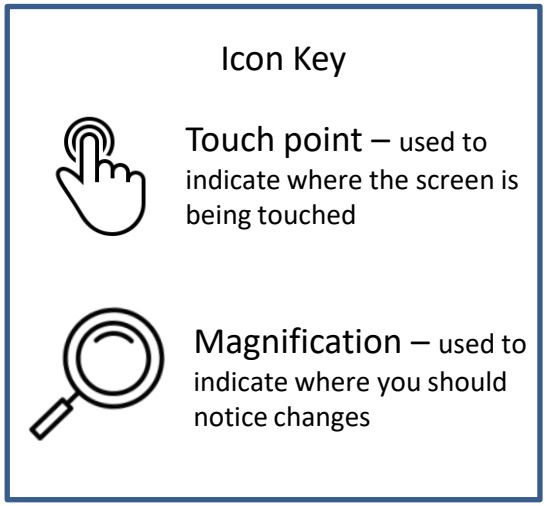
This manual has been written in English, any translations have been conducted at the discretion of the distributor or importer. The English version will always take precedence where required.

How to use this manual

This manual has been constructed in a similar manner to a newspaper with up to 2 columns per page.



Example page layout



Where required a hyperlink is indicated by blue underlined text. The link can be clicked to take you to an appropriate section within the manual.

Page numbers are found in the bottom corner.

CONTENTS

Safety statements

For full risk assessment information please refer to the separate Risk Assessment Document in Annex A.

Please ensure you read this information carefully prior to installing or using a BWB Flame Photometer

The instrument is designed to be operated only by trained laboratory competent operators over the age of 18. For educational purposes, where operators are under 18 years old, you should conduct an independent risk assessment and ensure suitable measures are implemented to prevent accidental burns from the top of the chimney.
Any adjustments, maintenance and repair must be carried out as defined in the operator manual by a person who is aware of the hazards involved

Operating and service personnel should always employ a safe system of work in addition to the detailed instructions provided in this manual.

MSDS Sheets have been supplied for the Calibration Standards, Diluent & Cleaning Solutions supplied in the Starter Pack. If any other chemicals are used the appropriate MSDS should be obtained from the supplier. All Health and Safety data should be adhered to with these and any other chemicals used with the instrument.

It is the operators responsibility to ensure spills are wiped away in a safe and efficient manner carrying out appropriate decontamination if hazardous material is spilt on or inside the instrument.

In the event of a problem where the possibility of safety protection has been impaired, the instrument must be made inoperative, disconnected from service supplies and the fault must be reported immediately. (*Serial number and the Hour Meter reading will be required*).

Under no circumstances should the instrument covers be removed. This can only be performed by a trained engineer and could result in a void of warranty.

Laboratory procedures for safe handling of chemicals should be employed at all times

The instrument is intended for use in laboratory environments and tested to Class B electromechanical compatibility.

The instrument should not be operated with a live flame unless the chimney fan is operational.

Before using any cleaning or decontamination methods except those specified by the BWB you should confirm with us that the proposed method will not damage the equipment

For further help and advice please visit www.bwbtech.com or contact BWB Technical Support technicalsupport@bwbtech.com

Safety statements

All electrical equipment is potentially hazardous. **Never remove covers** from the instrument unless specific maintenance procedures are being followed by trained personnel.

Propane, Butane, and mixtures thereof are highly flammable and potentially explosive.
Test all gas hose connections for leakage with a soap solution or proprietary leak detection spray prior to initial start-up. **Never use a naked flame**. Check for bubbles or any signs of leakage when the gas source is opened. *Leakage can result in a dangerous situation! If any odour of gas is detected or leakage discovered, STOP IMMEDIATELY and correct the situation.*

As with all gas fuelled equipment, combustion products are released into the atmosphere when the flame is alight. The instrument must therefore be installed in an area of sufficient volume and with ventilation adequate to ensure these combustion products do not build-up to hazardous levels. The application and type of sample should also be considered during the evaluation of a fume extraction system to ensure that hazardous fumes are not created from the sample composition. Specialist advice should be sought if any doubt exists regarding the suitability of the proposed location.

Under no circumstances leave the instrument unattended when the flame is alight.

Cylinders of fuel gas should be stored and used in accordance with the supplier's recommendations and local regulations.

The gas hose supplied with the instrument conforms to current UK legislation. If using an alternative gas hose ensure it conforms to your local and national regulations.

Ensure that the connections used within the gas supply pipework from the gas bottle or other source conform to applicable national requirements.

Under no circumstances should the instrument be installed beneath overhanging cabinets. There must be at least 50cm of clear space above the chimney.

Consideration should be undertaken for the appropriate filtering or other systems which may be necessary to trap hazardous sample residues present in the exhaust gas stream.

Use of fuel gases other than Propane, Butane or Natural Gas can result in a dangerous situation and cause severe damage to the instrument, which will void the warranty.

If legislated in your region, connecting the unit to a gas supply should only be carried out by a suitably qualified and certificated installer.

Do not attempt to look down into the Chimney when the flame photometer is in use. Always use the Inspection Port to view the flame

Necessary provisions for collection of waste from the mixing chamber U-Tube/ Waste cup should be considered when supplying a suitable waste receptacle to ensure that hazardous waste material does not pose a risk to other people or the environment. Hazardous waste fluid should be disposed of in accordance to local or national regulations.

The instrument must be located such that it does not impede access around the work area, taking care that both the instrument and service connections cannot be accidentally disturbed or damaged by personnel undertaking other tasks.

Operational recommendations

- The Flame Photometer must be installed in a clean, draught-free environment, where a stable temperature can be maintained. The instrument should also be sited away from bright sunlight and other intense light sources, (away from doors, windows, fans A/C units, etc.). The atmosphere must be free of airborne contaminants such as cigarette smoke, vapour, dust and solvents. Failure to observe these precautions may lead to inaccurate and/or unstable results.

- Ensure there is a clear drain to waste. Check that the drain tubing is free from kinks and that the end is kept above the level in the waste container (if used). The T-piece supplied should be fitted to avoid any possibility of a partial syphon being formed.
  NOTE: An air lock preventing drainage will occur if the waste tube falls below the water level in a waste bucket or waste receptacle.

- Always use the same batch of diluent. It is recommended that diluent concentrate (019-015) is added to all standards and samples at a ratio of 1:100.

- Users should ensure they have access to adequate quantities of deionised (019-051) or distilled water. It is important to ensure the quality and purity of the water is consistent and appropriate to the types of samples being analysed.

- For optimum performance and accuracy always use the same techniques and apparatus when performing calibrations and taking readings.

- The samples should not be highly viscous or non-homogeneous. If possible, samples likely to contain sediment should first be filtered.

- Avoid handling samples, or touching any item in contact with samples, with unprotected fingers. Doing so could lead to serious contamination and significantly impair the accuracy of results.

- Solutions should always be stored away from direct sunlight, and preferably at temperatures below 25˚C. Glass containers should not be used for storage as these may lead to contamination through sodium leaching into the solution. Standards should be prepared and stored in plastic vessels, in high concentrations (i.e. 1000ppm or greater). Dilutions should be prepared as required and discarded at the end of each working day.

- The flame photometer must be allowed to fully warm-up prior to calibration and sample analysis. After the flame has been lit, aspirate diluent or deionised water for a minimum of 45 minutes prior to use. A warm-up period of more than an hour will ensure the accuracy and consistency of results are maximised.

- After ‘ignition slow start’, open the inspection flap to visually check, and if necessary, optimise flame height. The inner cone should be 10-12mm above the top of the burner. Adjust by SLOWLY turning the Fuel control as required. Do not re-adjust the flame height after calibration. Once completed, close the inspection flap to avoid stray light entering the optical system.

- Samples should always be drawn from the top half of the sample cup to avoid sediment or particulate matter being drawn into the aspiration tube. Do not allow the sample cup to become fully drained and never allow the aspiration tube to draw dust or debris from the surface of the sample tray.

- It is essential that the Nebuliser, Mixing Chamber and Burner are maintained in a clean condition to avoid contamination and analysis inaccuracies in the future. Always aspirate deionised water for at least ten minutes after all samples have been analysed, prior to shut down. If high salt content samples have been analysed or contamination is suspected, extend the period over which deionised water is aspirated.

Operational recommendations

- Any slight blockage in the Nebuliser will cause readings to show a downward trend. Aspirating deionised water at all times that standards and samples are not being analysed, and for at least ten minutes after use, will minimise this risk. However, the syringe provided may be used to force diluent through the aspiration tube and nebuliser while the instrument is aspirating if problems with blockage are experienced.

- Ensure there is no evidence of grease or other deposits on the outside of the Aspiration Tube, since this can pick up small droplets of diluent/sample and cause cross contamination. If this occurs, clean the outside of the tube with IPA or a similar de-greasing agent.

- Always use genuine BWB Technologies Ltd replacement parts and qualified personnel to carry out any work on the instrument.

- Always carry out maintenance when indicated or in line with your organisations standard operating procedures (SOPs)

- The front panel is impervious to many chemicals. However, some chemicals may attack it. Immediately wipe up all spills. Clean with a mild soap or detergent and wipe with a soft cloth.

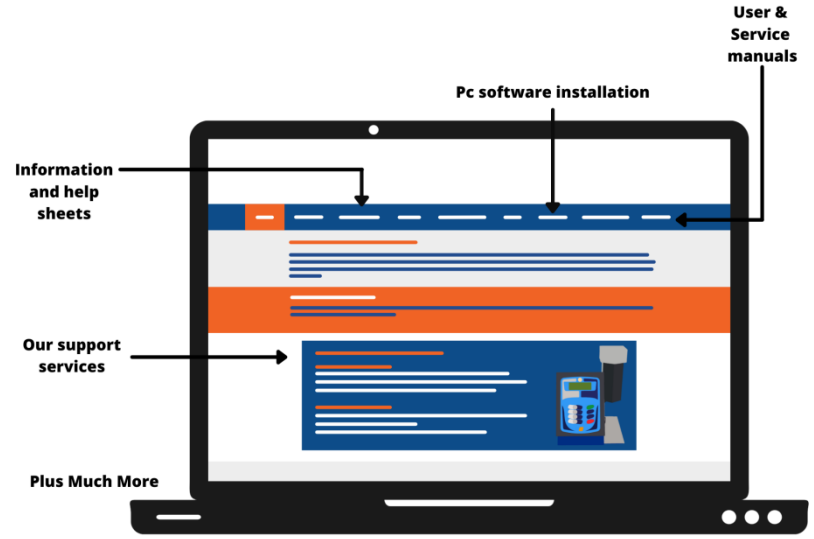
- A plastic based paint is used to protect the enclosure from harsh environments, however, some chemicals will still cause damage, immediately wipe up all spills on the drip tray. Clean with a mild soap or detergent and wipe with a soft cloth.

- To maintain a consistent sample head, it is recommended that samples and standards are taken from low volume, larger diameter beakers. If tall, narrow sample cups are used, the sample head will vary considerably and this will affect the rate of aspiration and thus the stability of results.

- Information on decontaminants their use, dilution and potential application is contained in the laboratory biosafety manual published by the world health organisation and the biosafety in microbiological and biomedical laboratories, published by centres for disease control and prevention and national institutes of health Washington. There are also national guidelines that cover these areas.

Our New Customer Portal

The BWB Customer portal gives you access 24/7 to our digital documentation collection. Download material safety data sheets, user manuals and hints and tip sheets.



Introduction

This manual contains complete instructions for setting up, operation and maintenance of the instrument. Service information for use by qualified personnel is available in the separate Service Manual.

The Model range is intended for use by persons knowledgeable in safe laboratory practices. If the instrument is not used in accordance with these instructions, the protection provided by the equipment may be impaired.

The BWB Flash Photometer model range are multi-channel, low temperature Flame Photometers for the simultaneous* measurement of Na, K, Li & Ca in a variety of samples and applications. The instrument is designed for ease of use and reliable, trouble-free operation. With built-in air compressor, diagnostic indications, touchscreen interface, automatic gas shut off, choice of Single Point, Multi-Point and Multi Ion calibrations and internal data handling the BWB range provides a simple, yet fully capable, instrument for the modern laboratory.

The Instrument employs a low temperature flame using air and propane, butane, or a combination of the two (as in LPG). Diagnostic indications of several parameters are displayed on the display during operation. Safety cut off of the gas supply is provided through constant monitoring of the flame and air pressure. If the flame should extinguish for any reason, the gas will automatically stop flowing and the screen reset alerting the user. The instrument is fitted with an internal gas sensor and will shut off the gas supply if gas is detected; The shut down procedure will operate and a warning message will be displayed. Turn off the power to the instrument and stop the leak before re-attempting to light the instrument.

*within model parameters

The Instrument employs microprocessor technology to generate and store calibration curves, thus eliminating the need to manually graph and calculate the results.
In *Single Point* mode a Blank solution and one Standard are used when the samples lie within the linear range. For samples that are higher in concentration the *Multi-Mode* uses a Blank and up to 10 Standard solutions to effect the curve.

Embedded in the instrument enclosure is a built-in air compressor. A unique electronic control system automatically regulates the air pressure/flow to the optimum levels. No user adjustments are necessary to achieve maximum performance. Adjustments, if required, can be carried out in *Service* mode.

A Starter Pack is included as standard with the model range. It comprises Standard solutions, volumetric ware, sample cups, and some initial consumables. Everything needed to begin immediate testing.

The instrument can be used with or without our FP-PC software. The software allows reporting and data storage over and above that possible running the instrument independently.

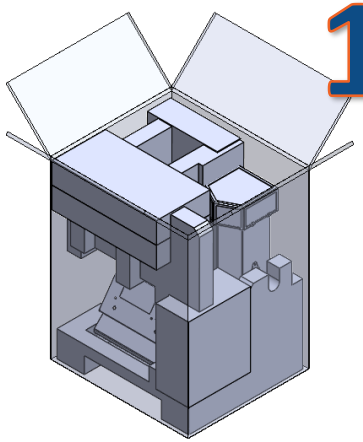
The information contained in this document was correct at the time of publishing. However, BWB Technologies Ltd reserves the right to change specifications, equipment, and procedures at any time, without notice. To obtain a current version contact your local agent or go to bwbtech.com or visit the BWB customer portal.

Unboxing

Please note, for clarity the outer cardboard box is shown in a transparent state.

Use a safe box knife to open the tape holding the carton closed.

1



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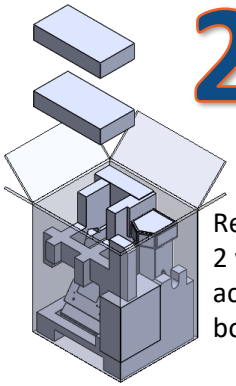
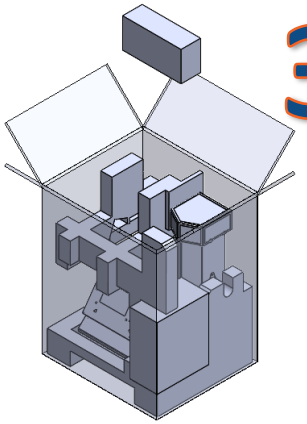


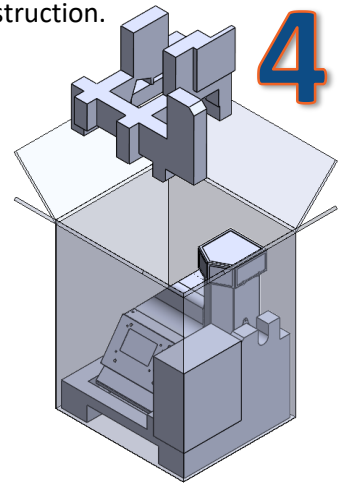
Remove the 2 white accessory boxes

3



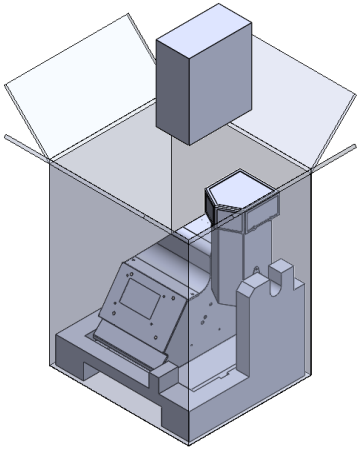
Remove the white fluid box – this contains your calibration fluids*.

4



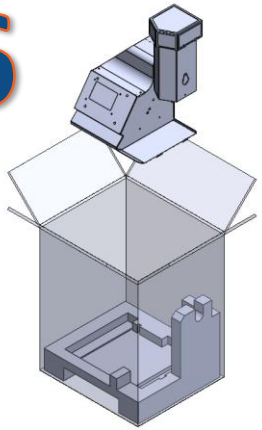
Remove the white foam holding the instrument in place, this is a single piece construction.

5



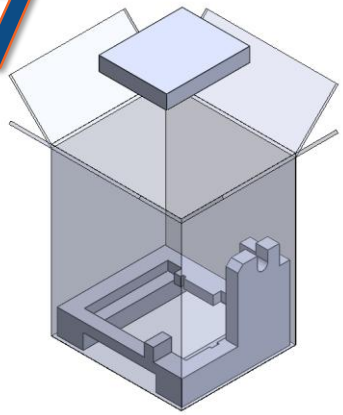
Remove the second fluid box – this contains DI water and Diluent Concentrate.

6



Remove the flame photometer

7

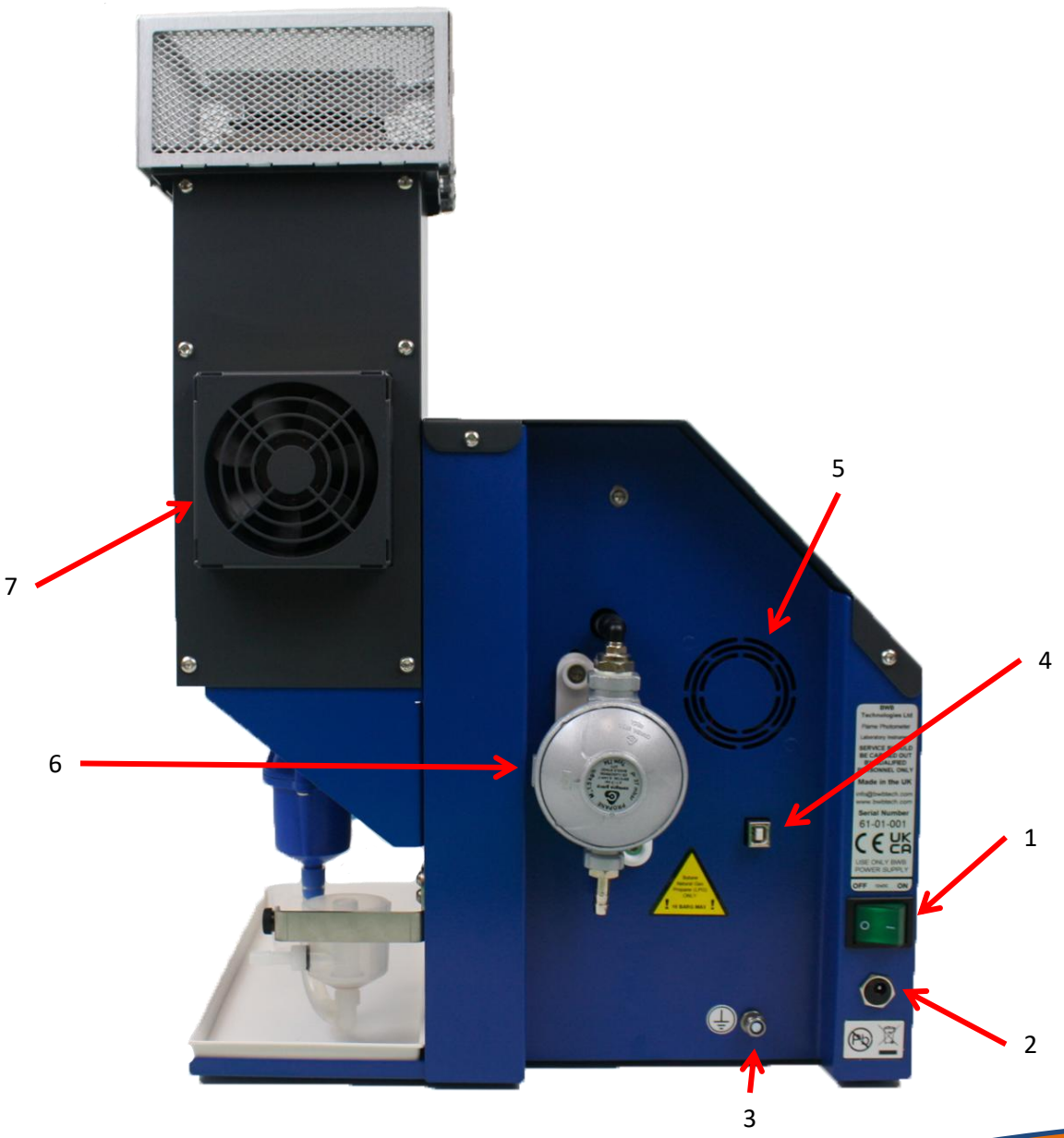


Finally remove the document box from the bottom

! We strongly recommended you retain the packaging. Damage caused from returning the instrument in non-BWB packaging is billed at the normal rate.

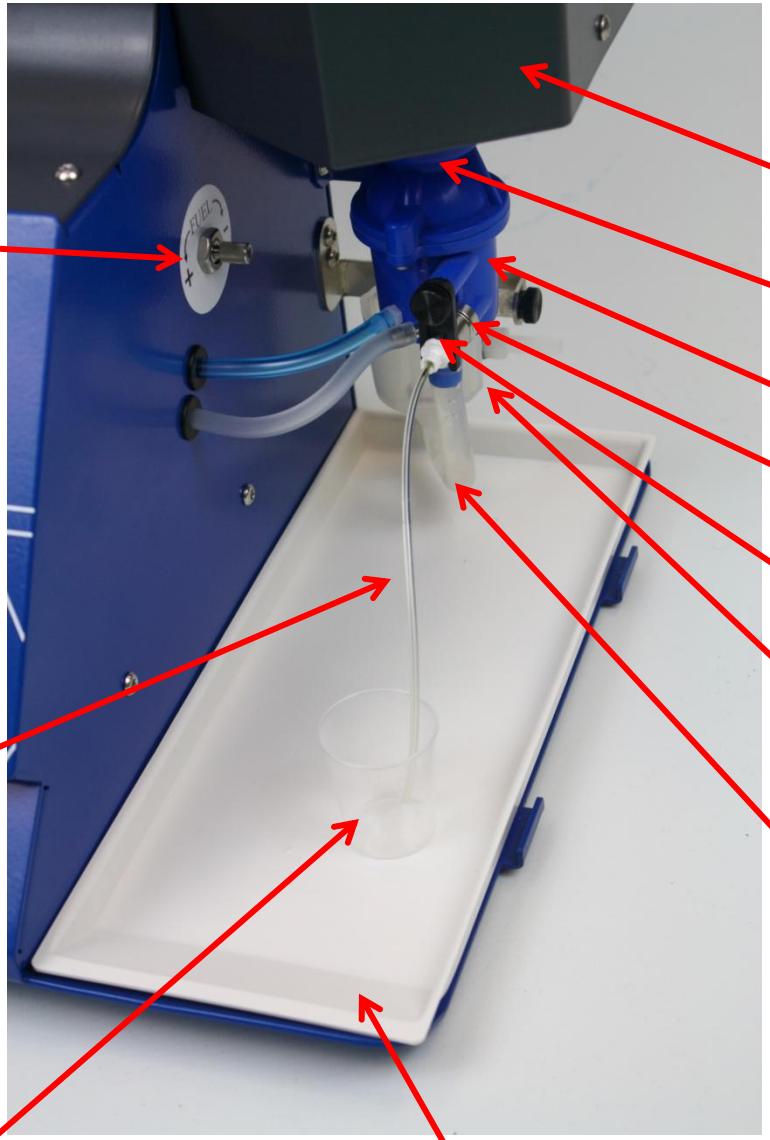
Rear panel controls and connections

1. **Power Switch:** Turns the power On/Off.
2. **Power Inlet Socket:** Receives the power cord from the BWB PSU.
3. **Earth Stud**
4. **Comms:** USB for computer connection.
5. **Cooling Fan:** Maintains temperature inside enclosure.
6. **Fuel gas Regulator:** For propane, Butane or Propane/Butane mixture or natural gas
7. **Chimney Fan:** Maintains chimney temperature.



Do not block any vents or fan grills

Sample area & chimney



Installation

Please ensure you have familiarised yourself with the safety statements before installing this equipment.

For optimum performance, the instrument should be installed according to the following conditions:
The environment must be clean and free of dust and airborne contaminants.

- The instrument should not be stored beneath overhanging cupboards. Allow a minimum of 50cm of clear space above the chimney.
- The instrument must be placed on a sturdy worktop. The BWB model range requires approximately 50cm deep by 60cm wide by 100cm high of bench space.
- Avoid sites that expose the instrument to direct sunlight or draughts.
- To meet the specification, the ambient temperature must be within the range +10°C to +35°C and a maximum relative humidity of 85%, non-condensing.

An AC supply of 100V to 250V, at 50 or 60Hz, is required for the BWB model range. The power supply automatically detects the mains voltage and provides the correct power to the various components of the instrument. The maximum current drawn is 2 amps. **Only the BWB supplied DC power adaptor should be used**. Any other DC supplies may invalidate the warranty or void the CE testing and certification. The instrument can be run from a 12vDC battery (such as those found in a car) with a suitable adapter cable available from BWB. Please contact us should this be required.

A gas fuel supply of Propane, Butane, or Propane/Butane mixture (as in LPG) is used on the BWB model range. It should be regulated at the source to no more than 16Bar with a minimum flow rate of 0.4 litres/minute. The use of industrial quality gas is not recommended as impurities can enter, leaving deposits of dirt and oil, which will render the instrument inoperable.
Attach the supplied high-pressure hose* between the gas source and the gas regulator on the rear panel using the clamp provided to ensure a good seal.

*Refer to the safety statements.

It is recommended that a leakage check be performed using a soap solution or a BWB leak detection solution the first time the instrument gas supply is turned on to ensure the integrity of the connections.

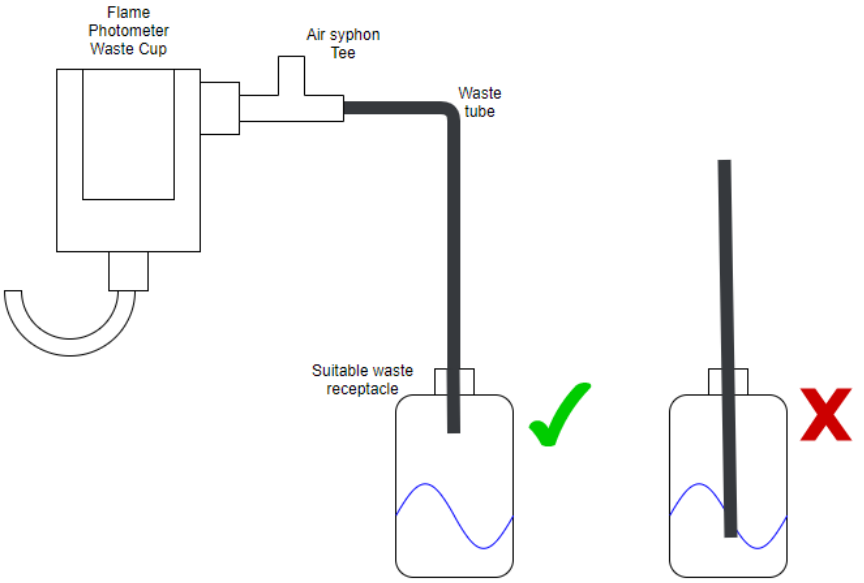
Installation

Embedded in the instrument enclosure is a built-in air compressor. A unique electronic control system automatically regulates the air pressure/flow to the optimum levels. No user adjustments are necessary to achieve maximum performance. Adjustments, if required, can be carried out in *Service* mode.

A sink or suitable container should be sited near the instrument to dispose of the waste overflow from the Drain Cup. If a waste container is used it should be situated so that the sides are below the bottom of the Drain Cup. Attach the supplied silicone tubing to the side port of the Drain Cup and route the other end to the sink or waste container.

There should be a clear drain to waste without kinks or U-sections and the end of the waste tube should be kept above the water level in the waste bucket. The use of a T-piece just after the drain cup is recommended to avoid the possibility of forming a partial siphon.

NOTE: The end of the waste tube must never be submerged below the waste liquid level as this may prevent the natural draining of the beaker. This can cause erratic readings and potentially flood the bench.



IQ OQ PQ

Our novel IQ OQ PQ programme enables a user to successfully validate the installation of the new flame photometer and operator functionality. Submission of the report document to BWB results in certification for performance and operation validation.

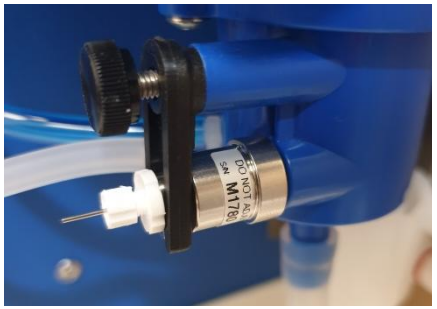
Find out more:
https://www.bwbtech.com/iq-oq-pq

Fitting the nebuliser

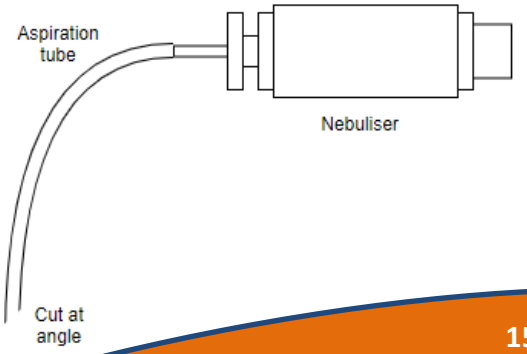
Each nebuliser is calibrated and adjusted under strict QC processes for optimum performance. This adjustment is critical and under no circumstances should you attempt to readjust or dismantle the assembly. If adjustments are made to the nebuliser we shall not accept responsibility for poor performance from your flame photometer. To keep your nebuliser at optimum performance the cleaning and maintenance instructions from the manual must be followed.

1 Remove the Nebuliser Assembly (018-536) from the box, taking care not to touch or damage the needle. Ensure the O-Ring is fitted to the rear extrusion and has not come loose in transit. Fit the air tube to the nebuliser inlet as shown.

2 Unscrew the nebuliser locating screw and gently insert the nebuliser into the mixing chamber recess, taking care to secure correctly, see below. Secure into place using finger tight pressure only.

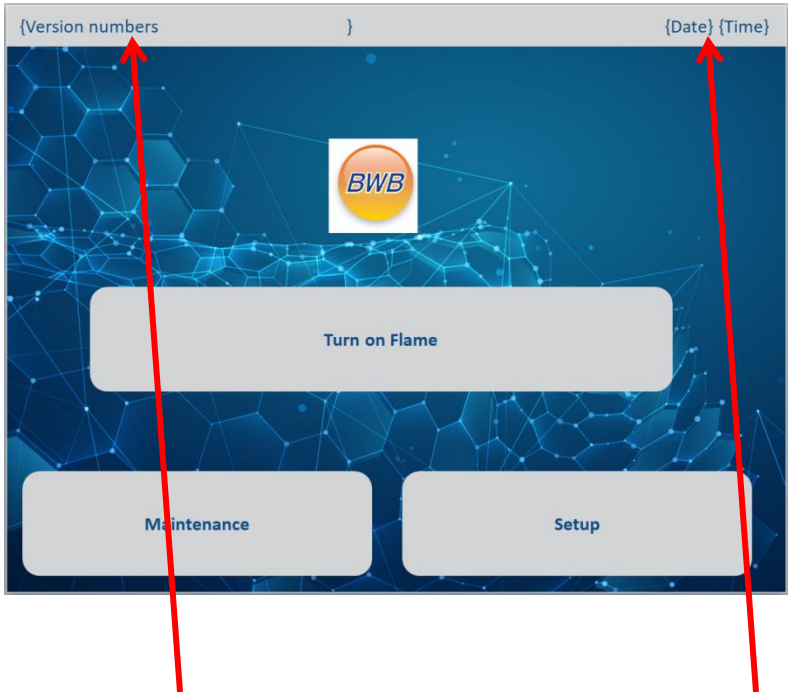


3 Cut a new length of aspiration tube (provided in the aspiration kit) to a maximum of 160mm (for every 1cm over our recommendation the aspiration rate drops by up to 0.5ml/min). Push one end of the aspiration tube onto the needle of the nebuliser taking care not to bend the needle. Snip the free end to a sharp point (this helps prevent it 'sticking' to the bottom of sample cups).



Operation

Touchscreen controls



Version numbers or screen title

Date and time

The touchscreen interface is controlled by the touch of your finger, just like the majority of modern smartphones the touchscreen is capacitive based technology, this means you must make contact with the pad of your finger and not the tip of your nail.
The touchscreen works with the majority of disposable laboratory gloves.

Throughout this manual, the following icon will be used to show a button selection on the touchscreen.

The upper grey bar includes useful information about the status of the instrument. Through different menus this bar will display either the relevant version numbers for the variety of components within this instrument or the screen name in addition to the time and date.

When contacting technical support please have your version numbers to hand as these will be required.

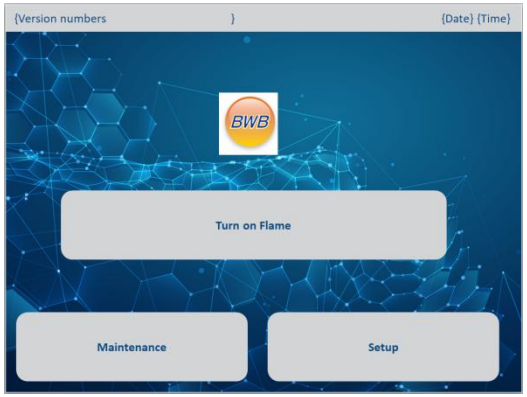
Start Up

Before attempting to start up the instrument make sure all the Installation instructions have been followed and the safety statements have been understood.

1 Initial checklist:

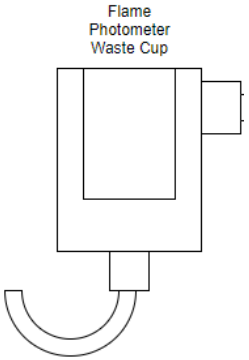
- ❑ Ensure the power lead is connected and the supply is switched on.
- ❑ Check the gas hose is connected and has been leak tested. Open the cylinder valve.
- ❑ Switch on the instrument using the rear panel power switch.

2 Once the system has undergone self diagnostics the *welcome screen* is displayed.

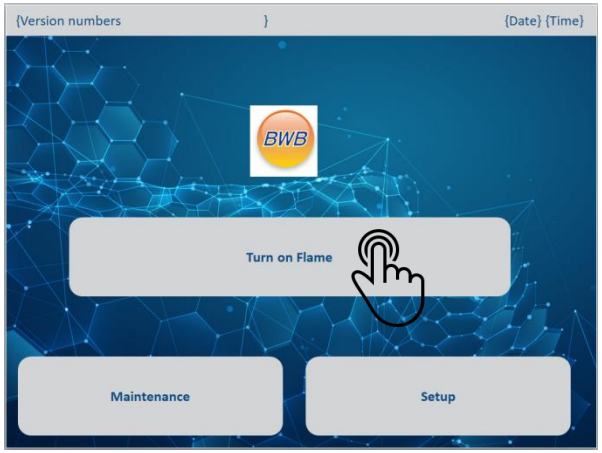


3 Ensure the internal chamber of the waste cup is filled with water. It is vital that this is checked prior to the ignition of the flame. Failure to fill this chamber with water will result in gas leaking from the mixing chamber into the room.

It is also good practice to squeeze the tubing between the waste cup and the mixing chamber in your fingers several times to help remove any trapped air bubbles within the cone of the mixing chamber (not visible). Air bubbles within this area during operation can prevent adequate drainage and will, in time, extinguish the flame.



4 The gas adjustment valve will be in an approximate optimised setting, either from initial BWB factory testing or from your previous period of testing. Adjustment can be made during ignition if required.

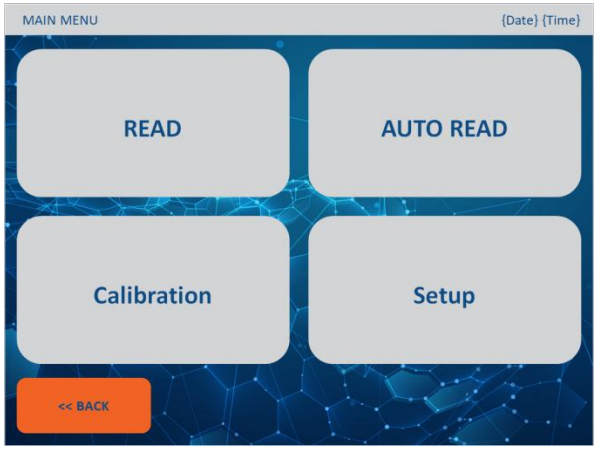


Press *Turn on Flame* and confirm that the waste cup is filled with fluid.

The ignition sequence will start, a spark should be noticed through the chimney inspection flap.
If required, increase the gas flow using the valve to aid ignition.

Please note that if adjusting the valve, it does not have an 'end stop'; it is possible to remove the needle from the valve and cause gas leakage into the room. Ensure the instructions for opening the valve are adhered to.

With successful ignition, the *Main* menu will be displayed:



At this point in the Start Up procedure, open the Flame Inspection Port and make sure the flame has ignited. If not, turn off the power immediately! Allow the unit 30 seconds for capacitors to discharge and then re-attempt lighting the flame. If multiple attempts are unsuccessful, refer to Troubleshooting or contact your local agent.

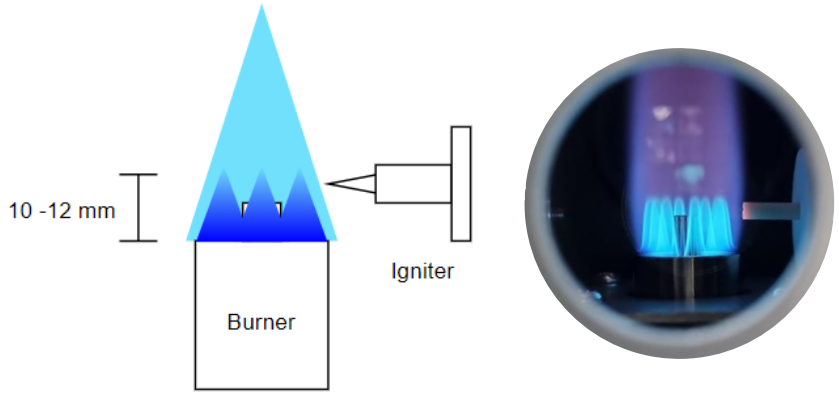
Start Up

Flame optimisation

After the initial 2 minutes of start-up, once the internal pump has turned to operating speed; while viewing the flame through the inspection port, slowly adjust the gas flow with the Fuel-Adjustment valve located on the side panel allowing the flame to respond.

The correct height of the flame is achieved when the small inner cones of the flame are 10-12mm high.

If the gas flow is too low the flame will start but “lift off” the flame spreader and the flame will extinguish. It is recommended to start off with a slightly larger flame and reduce it once the flame has stabilised.



Be aware that opening the gas adjustment valve by too great an increment could result in flames occurring outside the chimney housing, leading to injury and damage.

Aspiration

Aspirate deionised water through the aspiration tube connected to the nebuliser. The tube should be fully immersed in the solution and aspirated continuously at all times, other than when standards and samples are being measured. This ensures no air is drawn into the system and stable burner temperature is maintained for consistency of results.

Warm up

Once the instrument has been through the start-up routine and the flame is lit, it will be necessary to perform a warm-up period of 45 minutes to 1 hour. During this time deionised water should be aspirated continuously to allow the instrument to stabilise its temperature and to clean out any deposits from previous use which may have built up in the needle, nebuliser and mixing chamber.

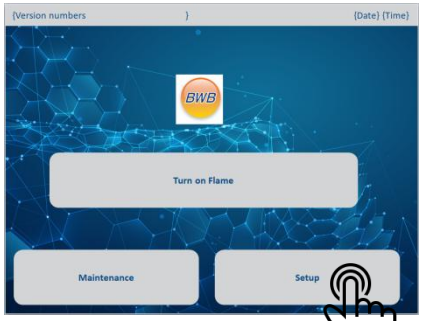
NOTE: Deionised water should be aspirated at all times during warm-up and when the unit is between sampling to ensure the temperature remains stable, ensuring accuracy of results when testing recommences.

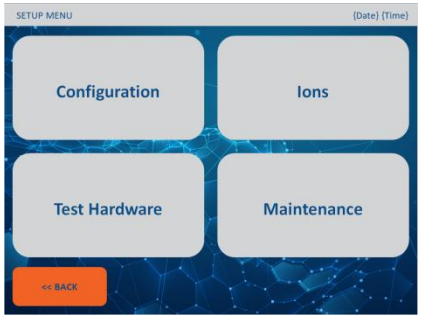
The recommended warm-up times, based on testing in a controlled environment are detailed below:

Ambient	Recommended warm-up
16˚C	45 minutes
21˚C	40 minutes
25˚C	30 minutes

The setup menu

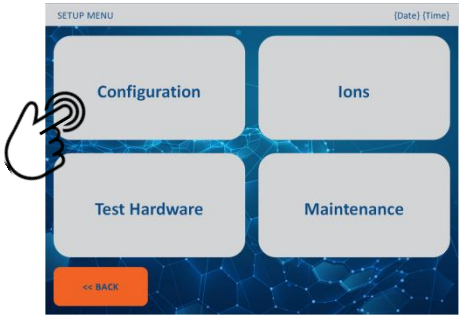
The *Set Up* menu is available from both the *Welcome* menu and the *Main* menu.





The following parameters may be reviewed and adjusted during instrument warm-up or at any other convenient time. It is recommended that all changes to set-up parameters are completed prior to calibration and undertaking sample analysis.

We will first touch upon the ***Configuration menu***



Clock- sets time and date. The clock is factory set to GMT (Greenwich mean time) or BST (British Summer Time).

Auto Read Parameters – Enables the configuration of the maximum amount of AutoRead results stored on the system (1-200) before deletion is required to continue.
Allows the configuration of the Time To Lock – the signal stability time for an AutoRead result to be captured by the system. This can be configured 3-10 seconds but the factory default of 7 seconds is most recommended.

Compressor level – Enables the adjustment of the running speed of the compressor, numerical value 120-250, the larger the number the faster the compressor runs and therefore the greater the air throughput. The factory default is 165, this parameter should only be adjusted when conducting diagnosis or when particularly viscous samples are analysed.

Dwell secs (12-50) – Enables the lengthening or shortening of the flushing time during sample and calibration tests. The factory standard is 20.

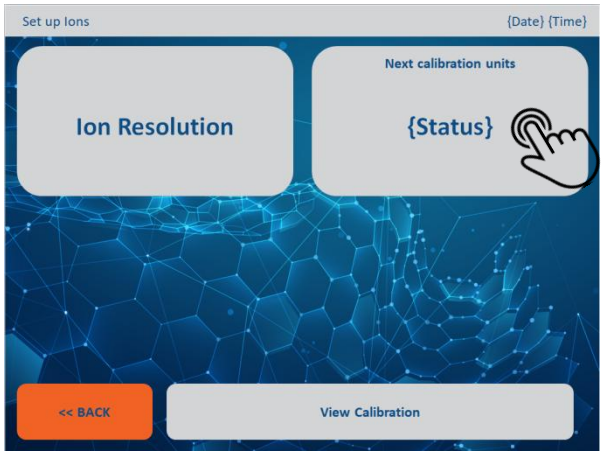
Reset Calib- erases all existing calibration data. A confirmation message prevents accidental deletion.

The setup menu

The ***Ion menu***

Ion Resolution:

This mode changes the amount of decimal places that will be shown on the Ion Readings. The factory default is 1 decimal place. This is optimum for most applications. Increasing the decimal places will make the readings appear to be less stable. Tapping on the relevant button will cycle the decimal places by 1 from 0-3.



Next Calib:

Enables the operator to set the units of measure. Any change takes place on the next calibration. Existing calibrations are not changed and will remain in their calibrated units. Tapping the button toggles the variable options between:

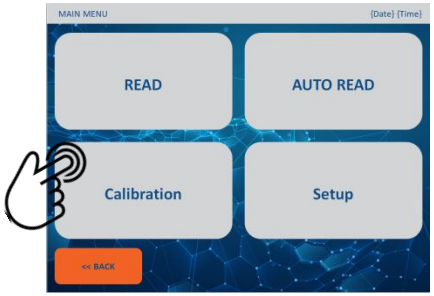
- ppm
- mg/l
- meq/l
- mmol/l
- %
- mg/kg

View Calibration:

This functionality is discussed later in this manual.

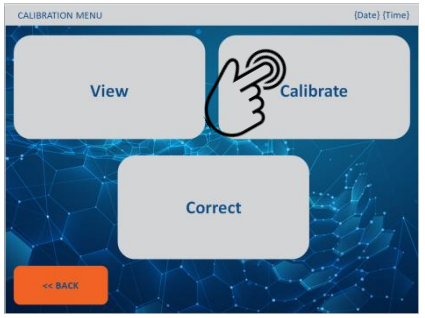
Calibration – Single Element

- It is recommended that calibrations be performed frequently for optimum accuracy, particularly if the instrument has been unused for a lengthy period of time. Factors such as change in room temperature, humidity and ambient air pressure can affect calibration and impair the accuracy of results.
- Do not attempt to calibrate the instrument until the warm-up period has elapsed.
- The display will show the remaining warm-up period based on a nominal 45 minute interval.
- The flame inspection port must not be opened during calibration or measurement.
- A calibration must be performed prior to any sample measurements being undertaken.
- The display will prompt the operator during many of the procedures. At any time if an error is made, press the *back/STOP* key to return to the previous step.



Select *Calibration* from the *main menu*

Select *Calibrate* from the *Calibrations Menu*



Select the elements you wish to calibrate, for the purpose of this demo we will conduct a single element calibration for Sodium (Na).

Indicates the UoM for the calibration

Indicates if a calibration already exists for that elements and how many points it is composed of.

Tap on the element button to toggle the icon to include or exclude it from the calibration. A green tick indicates the element will be included whilst a red cross indicates it will not.

Indicates the selected ion is included within the calibration

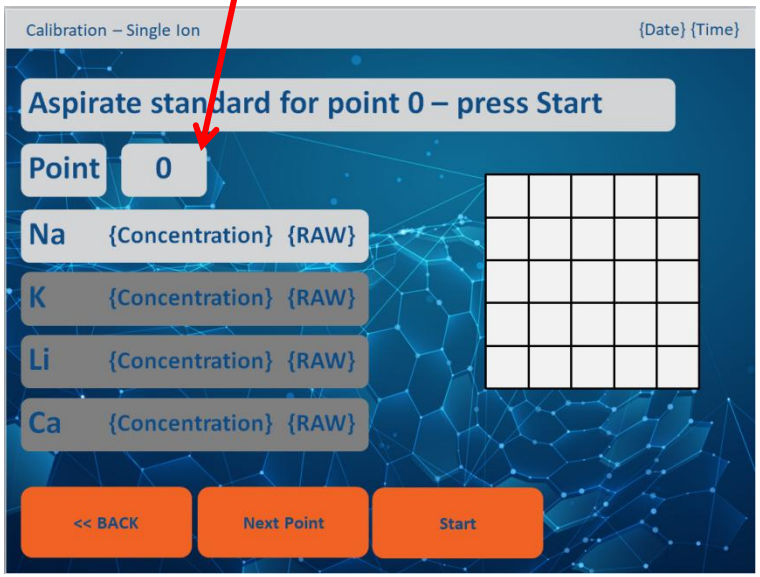
Indicates the selected ion is not included within the calibration

Once the appropriate elements are selected, press NEXT

Calibration – Single Element

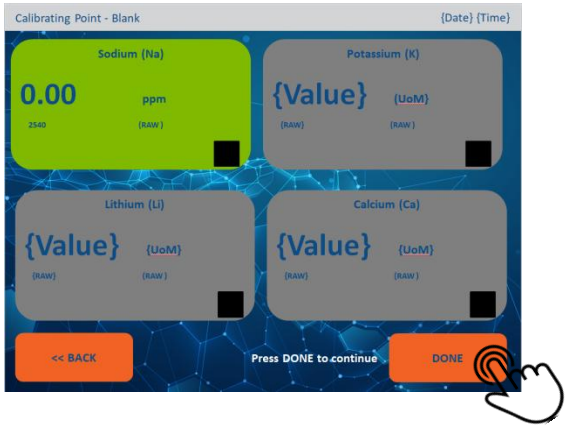
The calibration screen will display any pre-existing calibration data for the concentration and raw values.
The inactive elements (those not be calibrated) will appear in a darker grey box and it will not be possible to select them.

The Blank calibration is always performed first and is not counted as 1 of the 10 points that an element can be calibrated by, this is referenced by Point 0.

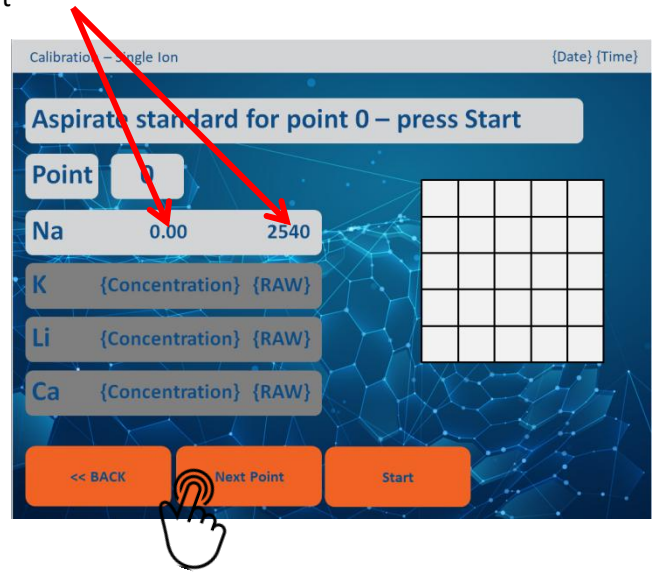


Ensure that the sample tube is aspirating your Blank calibration standard and press Start.

The screen will display the elements and begin acquiring a stable value. Once a stable value is stored, the DONE button will appear, press this to proceed.



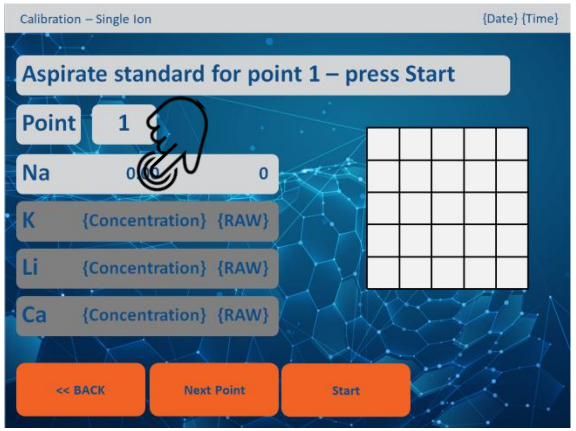
The screen returns you to the Calibration display and you'll see the new RAW saved result for your recent calibration point

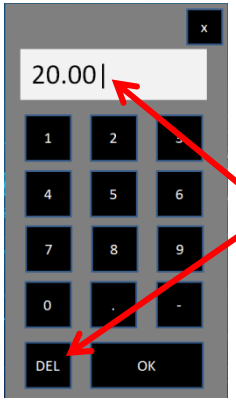


Press Next Point to proceed with the calibration

Calibration – Single Element

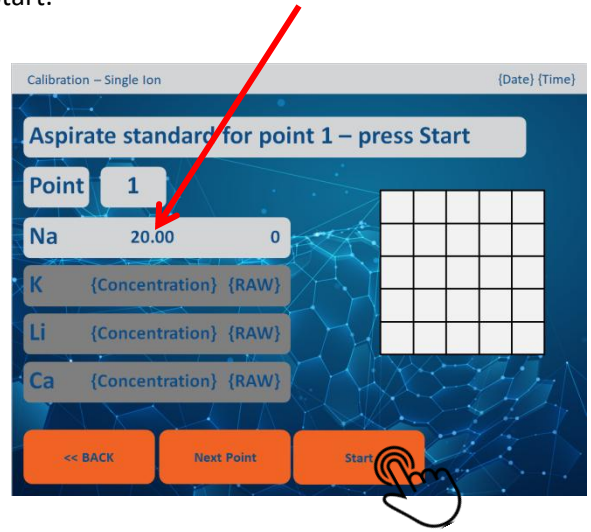
The display is updated and indicates that calibration point 1 is now ‘active’.
The calibration concentration value must first be programmed. Tap the screen on the relevant element where the concentration is displayed to reveal a keypad .



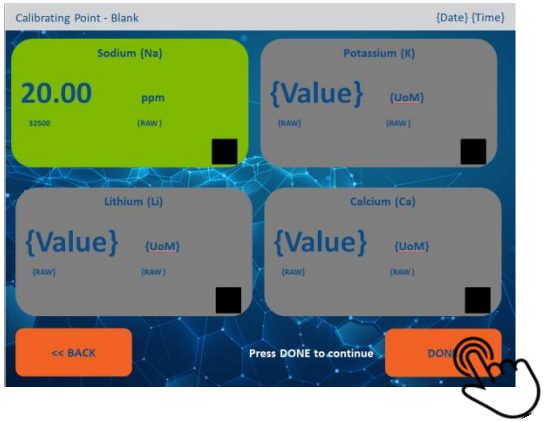


Use the keypad to enter the concentration of your Point 1 Calibration standard. In this example we are using 20.00 ppm. Please note it may be necessary to delete any existing value in the keypad, use the DEL button and the cursor to delete values before entering a new value. Press OK.

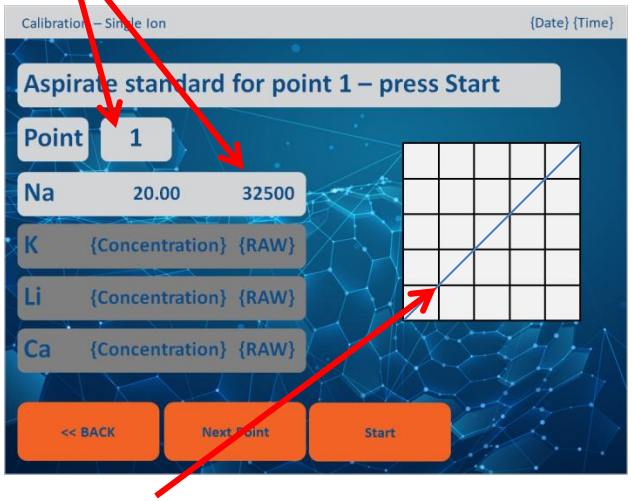
The display is now updated to reflect your configured concentration for calibration Point 1. Ensure that the instrument is aspirating your Point 1 Calibration standard and press Start.



The instrument will acquire a stable value and the DONE button will appear once a result has been saved. Press DONE to continue.



The screen returns you to the Calibration display and you'll see the new RAW saved result for your recent calibration point



The calibration graph is also updated and will display your trend line with some statistical data (R2 value). Please note the graph is produced using Concentration data on the X axis and RAW values on the Y axis.

In order to continue calibrating additional points (up to a maximum of 10) press Next Point to proceed to the sequential calibration point and conduct configuration and calibration in the same manner.

If you have finished your calibration process, press << BACK to return to a previous menu.

The process can be repeated for other elements in order to calibrate each individually, however, where multi-element samples are analysed it is strongly recommended that a multi-ion calibration is performed.

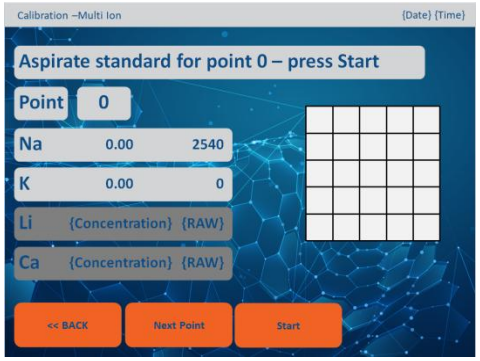
Calibration – Multi Element

Operators should first be familiar with the process of conducting a single element calibration.

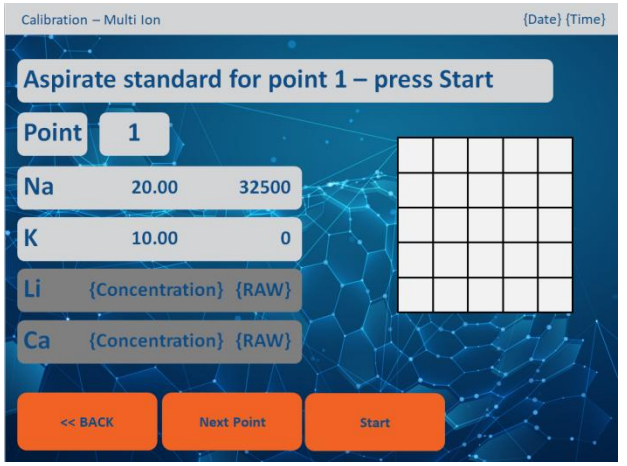
When configuring the elements for calibration, ensure green ticks appear for all those that you wish to calibrate. In our example we'll conduct a Na & K multi-element calibration.

The process for conducting the calibration is exactly the same as the single element, only each element must now be configured with its respective concentration.

Calibrate the Blank first as normal.



Now configure your element concentrations for the first calibration point. In our example we have configured Na at 20ppm and K at 10ppm. Ensure you are aspirating the correct calibration standard and press Start.



Continue calibrating your multi element calibration curve to the required amount of points (up to 10). Use the << BACK button to return to a previous menu once complete.

As with any calibration, the standards should be made so each ion will start with its lowest value and increasing up from that. For example:

Incorrect X

Calibration point	Na	K
1	100	10
2	50	50
3	10	100

Correct ✓

Calibration point	Na	K
1	10	10
2	50	50
3	100	100

BWB Technologies Calibration Kit

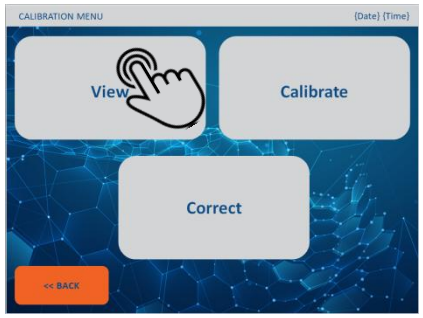
The BWB Technologies Calibration Kit can be used to help your Flame Photometer instrumentation to complete its calibration, the BWB Tech Calibration Kit is available now from your nearest distributor.

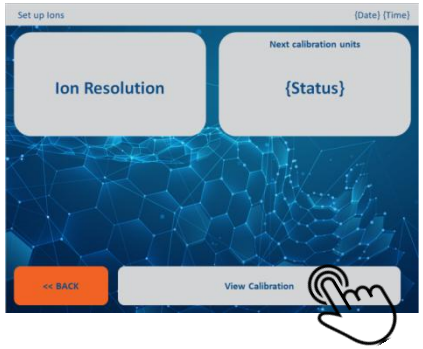
BWB Technologies

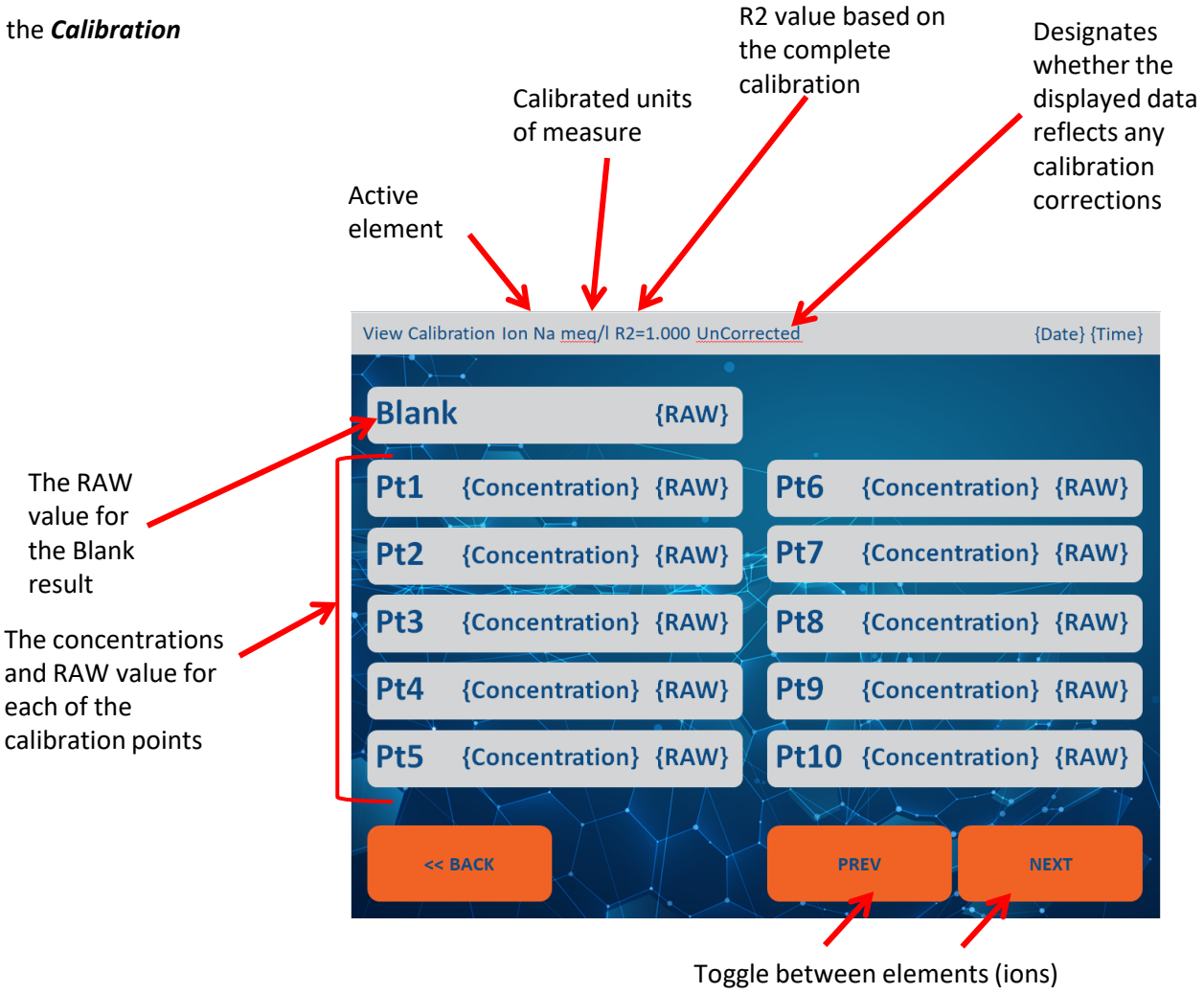
Calibration – View Calibration

The View Calibration menu can be used to display the current calibration values for each of the active channels.

The menu is available from both the ***Ions*** menu and the ***Calibration*** menu

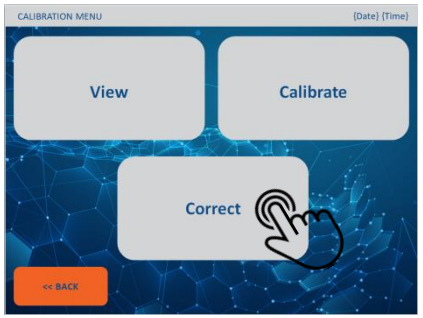




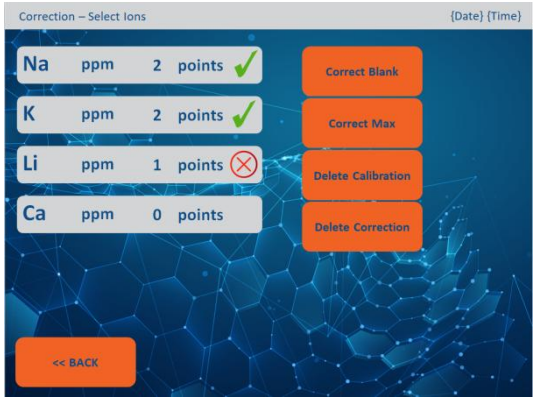


Calibration - Correction

The BWB model range enables the calibration of any or all Ions to be corrected to eliminate the effects of drift in the Ion readings. This option is available only after an Ion has been calibrated.



Toggle on/off the elements you wish to conduct a correction on. Only elements that have a calibration are able to be toggled, as you can see in this example, Ca has a 0 point calibration (none) and therefore cannot be selected. It is also important to remember that if you've conducted a multi-element calibration, then corrections are performed to the same range of elements.

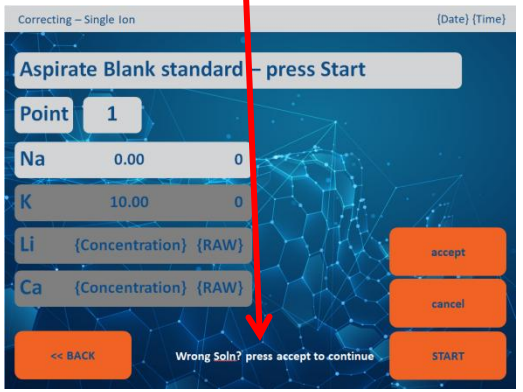


Several options are available once elements have been selected:

- **Correct Blank** press this button to perform a Blank correction.
- **Correct Max** press this button to perform a maximum point correction.
- **Delete Calibration** will delete the calibration of the selected elements.
- **Delete correction** will delete any applied calibration corrections to the elements selected.

All options will trigger a confirmation button or screen before performing the action. For both modes of correction the display will prompt you to aspirate the required calibration standard (or blank) and await you to press Start to being the data acquisition process.

Note: If during either Blank or Calibration correction the signal value is outside the acceptable range for the solution being aspirated, a warning message will be displayed.



Use ***START*** or ***cancel*** to return and attempt the calibration correction again, alternatively, if you are confident the correction solution has been presented press ***accept.***

Calibration – Spectral Interferences

Spectral Cross-Sensitivity
Due to the proximity of the spectral lines used to detect some ions there are issues with spectral cross-sensitivity when samples contain mixtures of ions.
There are also a significant number of potential chemical interferences which must be counteracted in addition to taking the precautions outlined.

Determining Ca when Na is present
Since the Na signal is very strong in comparison with Ca the effects of cross-sensitivity on Na is very small and can generally be ignored. However, the influence of Na on Ca can be substantial.
To enable the determination of Ca in the presence of Na, the instrument applies a correction factor to take account of the overlapping spectra.
During Ca measurement a value is deducted from the Ca signal dependent on the Na signal. The scale of this adjustment is determined and stored as an internal parameter during a correction procedure.

Testing Na & K
It should be noted that Na readings are not truly linear even at low concentrations.
When testing Na and K it is better to look at the correlation number for K rather than Na. For Serum testing the R^2 number for K should be very close to 1 (>=0.98) –if it is not, then the calibration should be repeated.
Better accuracy will be achieved by using small calibration ranges close to the point of interest.
If a large range needs to be available at all times then additional calibration points should be used and a full calibration may be required at frequent intervals.

Calibration – Correction – Ca/Na

For determination of Ca in the presence of Na some corrections are carried out by the BWB-Flame Photometer firmware to take account of the overlapping spectra.

Firstly carry out a single or multi-point calibration as defined previously containing all the ions of interest in approximately the same ratios as expected in the samples, as per good laboratory practice.

During the calibration routine for Ca the corresponding Na raw values are automatically stored by the instrument.

A parameter named ***Ca_Na_correct*** must be configured to give the system the knowledge of the extent of spectral overlap, as this can vary per instrument. Navigate *to Calibrations->Correct->Select Ca->Correct for Na* and have prepared a solution containing only Na close to the expected mid-range in the samples, this will be sampled by the system.
The ***Ca_Na_correct*** parameter will be calculated and stored in just the same way as performing a correction for other channels.

Example: The following calibration points and concentrations have been configured/ calibrated

Element	Calibration points and concentrations			
	1	2	3	4
Sodium (Na)	10	25	50	70
Potassium (K)	5	10	15	20
Calcium (Ca)	20	40	60	80

After calibration a ***Ca_Na_correct*** will need to be performed. Based on the example data a sample of Na with concentration 35 should be used as this is approximately the mid range of the samples.

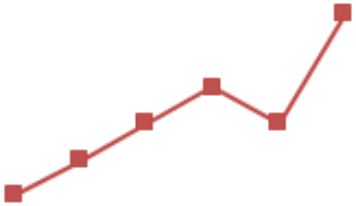
Follow the on screen prompts and conduct the Correction in the same manner as the other routine Corrections or Calibrations.

Calibration – Adjustment

The calibration adjustment feature allows the user to make adjustments to a single calibration point within a calibration curve without having to complete the entire calibration process. This is particularly useful if the user notices an error on the R2 value of the calibration curve or if the wrong calibration standard was accidentally aspirated during a multipoint calibration.

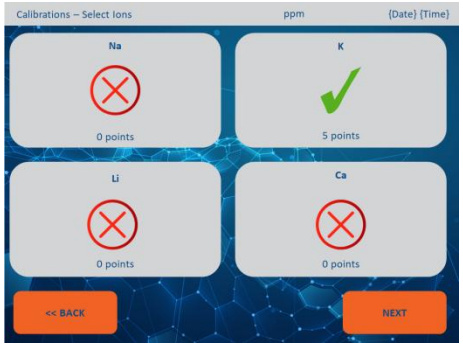
The user should be familiar with the single and multi point calibration process.

For this example we have reviewed the calibration data for our 5 point calibration and notice that we calibrated position 4 incorrectly.

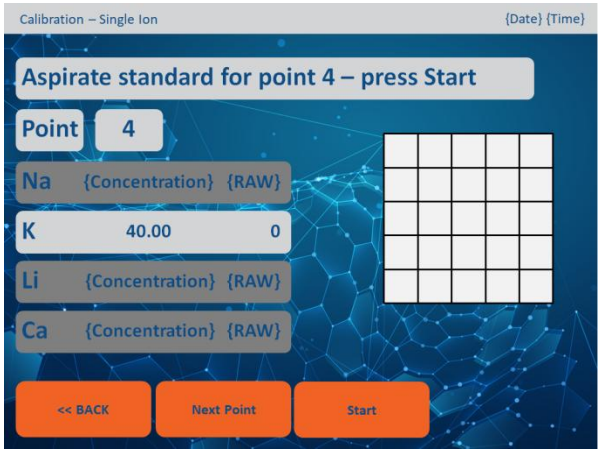


We can re-calibrate this single point without having to complete an entire re-calibration.

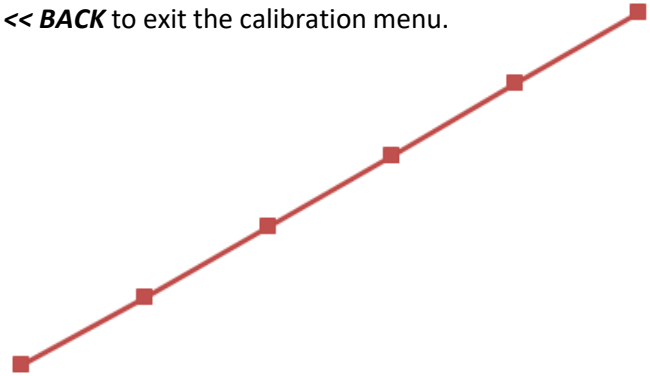
Navigate to *Calibrations* > *Calib* and select the same parameters as you had previously (multi or single element). In this example we conducted a 5 point Potassium (single ion) calibration.



Use the ***Next Point*** button to toggle to the calibration point that is incorrect. In this example Point 4.



Press ***Start*** and perform the calibration of Point 4 in the normal manner. Once the result is saved the graph will update and will reflect your new calibration curve.
Press ***<< BACK*** to exit the calibration menu.



We can now see that the calibration curve is as expected and sampling can begin.

Sampling modes – READ mode

The instrumentation offers 2 modes for sample analysis. AutoRead will automatically calculate and log a stable sample concentration. It is recommended this mode is used for routine sample analysis.
READ mode monitors the flame on a continual basis. As a sample is adjusted the readings will display the change in sample. This mode requires the operator to determine and record stable values. It is recommended this mode is used for process flow / monitoring applications. For all other applications we suggest using AutoRead.

Read mode

Select ***READ***
Aspirate the unknown sample.

The concentration readings for the calibrated ions will be displayed simultaneously and continue to be updated until the ***<< BACK*** key is pressed.

The display indicates the RAW for all channels available on the model but will only display a concentration for those that have been calibrated.

When concentration readings are displayed the Stability Indication Lines to the right bottom of the Ion data box should be observed.

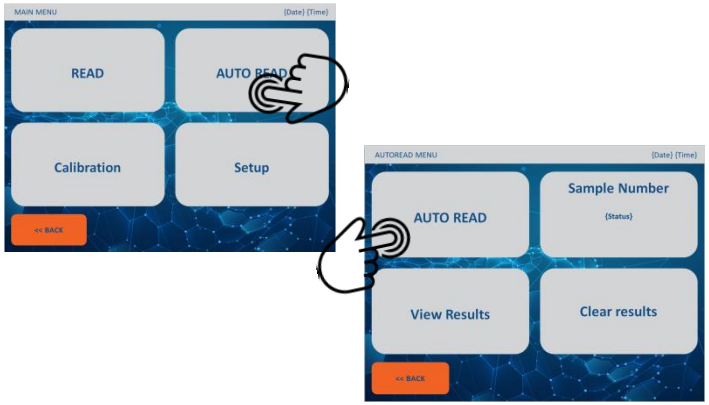
These stability indication lines indicate signal trend, i.e. whether the reading is increasing, steady or decreasing, and the degree of noise present in the signal.

A flat black line with a white background indicates no noise and stable signal, a dense black line indicates a very noisy signal. The line may also appear to be rising or declining, depicting the signal.

Concentration readings should only be taken when the trend line is flat (i.e. reading is steady), and noise is at a minimum (i.e. thin line shown). If the concentration reading is seen to be falling; check that the sample has not been fully aspirated.

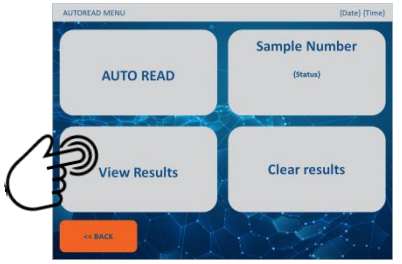
Sampling modes – AutoRead mode

The instrumentation offers 2 modes for sample analysis, AutoRead will automatically calculate and log a stable sample concentration. It is recommended this mode is used for routine sample analysis.

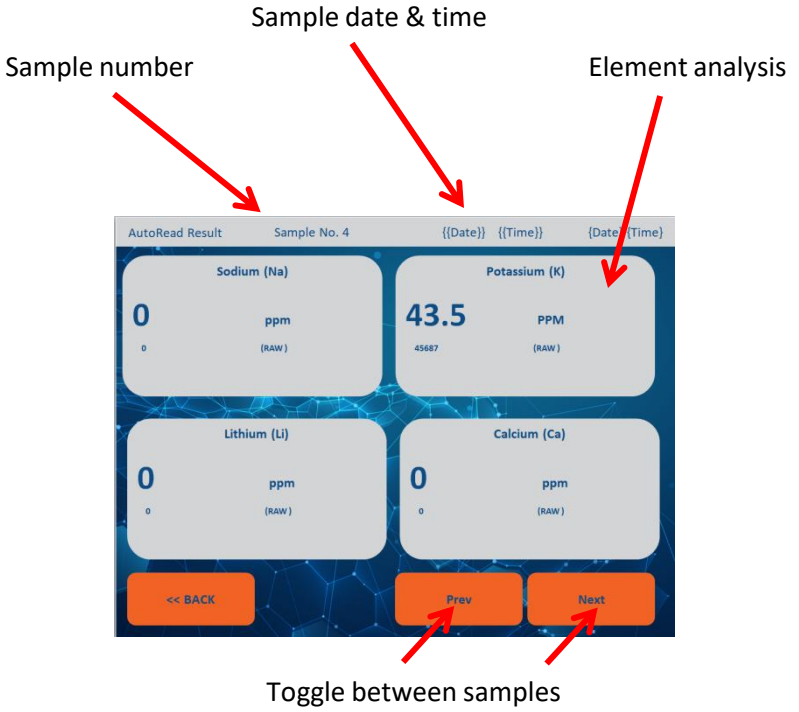


This mode monitors the readings and determines when each ion is stable. The reading is then locked. This display is similar to READ only the calibrated channels are displayed in green and those without a calibration are darkened.

Once a result has been acquired use the NEXT button to move onto the next sample.



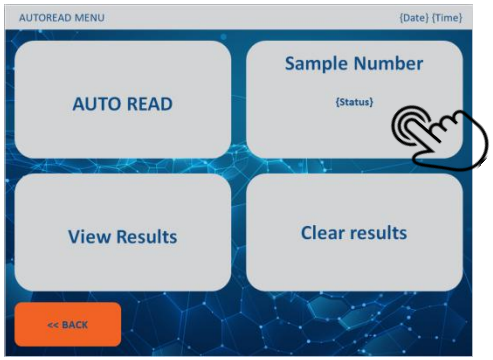
View results – displays the saved results from AutoRead analysis. Toggle through the appropriate windows with the Prev and Next button.

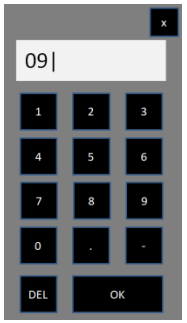


Sampling modes – AutoRead mode

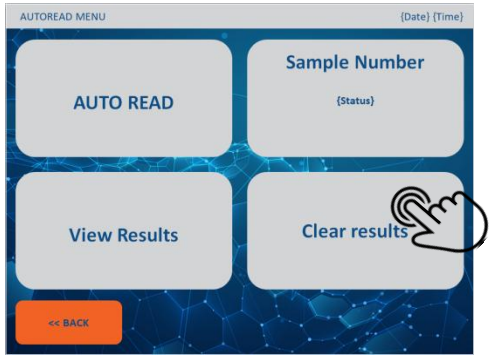
Sample number depicts the next sample number in sequence to be analysed. You may configure your own sample ID number or allow the system to proceed to the next sequential number. Please note that it is possible for a user to configure all samples with the same ID if so required.

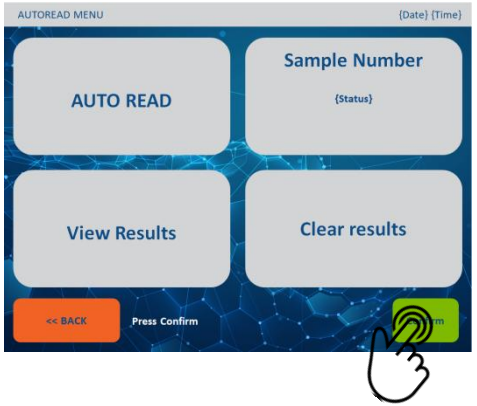
Note: It is recommended that this parameter is not modified to enable the system to offer the next sequential number during AutoRead sampling.





To delete your saved AutoRead results use the Clear Results button. This will toggle a confirmation message before wiping all results from the system.





NOTE: The required number of saved results (up to 200) can be selected in the *Setup – Config –AutoRead* menu (*Max Results*). Enter the required number of results and press *accept* to confirm.

When the buffer is full there will be a prompt to delete the results. Once deleted, the buffer will recommence from Sample 1.

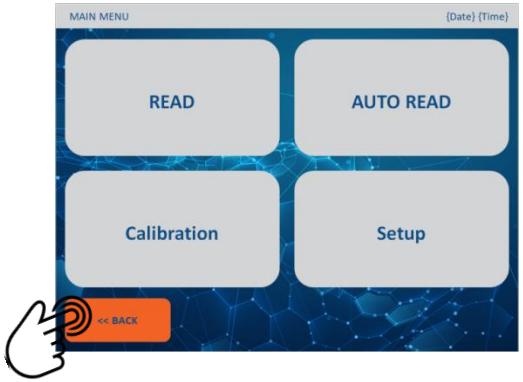
It is recommended that a batch of samples be deleted once they have been viewed and/or printed. A permanent storage can be achieved by up loading the results using the FP-PC software. Refer to the separate FP-PC Manual.

Shut down procedure

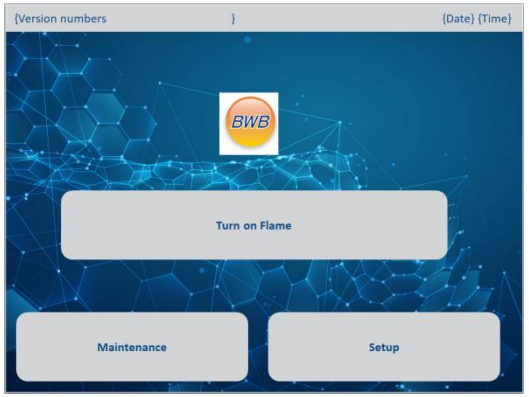
When analysis of all samples has been completed, it is necessary to aspirate deionised water for a period of not less than 10-15 minutes depending on the concentration and type of samples under test. This will ensure the mixing chamber and nebuliser are clean and ready for future use.

Once the cleaning protocol has been completed, the flame should be extinguished.

From the *Main* menu press ***<< BACK*** and then the ***CONFIRM*** button to extinguish the flame.



The instrument will return to the *Welcome* menu.

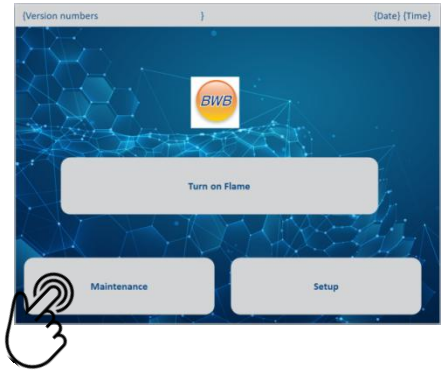


Turn off the gas supply.
Check the flame has extinguished via the Chimney Inspection Port.
Turn off the external air supply (if being used) ONLY when the flame is extinguished.

Do not turn off the power to the instrument until the fan on the rear of the chimney has stopped spinning. Serious heat damage to internal components can occur if the instrument is turned off before a sufficient cool down has been permitted.

Maintenance – The Maintenance Menu

To ensure optimum performance, periodic maintenance should be carried out according to this section. Maintenance consists of cleaning on a regular basis and occasional replacement of certain parts. There are no maintenance items inside the main enclosure. It is not recommended that the user enter the main enclosure unless servicing is necessary. In this instance, contact your distributor or technicalsupport@bwbtech.com



Run Compressor
Toggle on/off the running of the compressor. If toggled on, the compressor will continue to operate until it is turned off again.

FDet (Flame Detection)
The flame detection option alters the sensitivity of the flame detector. The instrument will leave the factory with the optimum value pre-set. This varies from unit to unit but is generally either 80 or 60.

NOTE: This setting should not be altered without prior consultation with your local agent or BWB for advice.

Gas Detect Alarm Level
The limit of signal at which the gas detection alarm built inside the instrument will cause an error. This can be toggled between 0.1-0.9 and is factory set to 0.5. Refer to the troubleshooting for further assistance on this feature.

Fan
This enables the temperature to which the unit is controlled to be changed. The instrument will leave the factory with the Fan option set to 32. This is to ensure the instrument electronics maintain a constant temperature to maximise stability. This option has a minimum setting of 20 and a maximum setting of 50. It has been determined that in an ambient temperature of 20-25°C; 32 will provide the best degree of stability.

NOTE: This setting should not be altered unless the instrument is being used in abnormal ambient temperatures. Consult your local agent or BWB for advice.

Show Info
The instrument incorporates a timer that records the elapsed time (in hours) that the instrument has been alight. It can be used as a reminder of when to perform maintenance.
Also shown are the instrument serial number and the main firmware version, hardware version and OTA firmware. (This information will be required if contacting your local agent or BWB).

Maintenance

The following are recommended intervals only. Every application and type of sample varies and it is the overall responsibility of the operator to determine the frequency of maintenance required based on the requirements or company SOPs.

Daily or 8 hours:

- Empty waste container, if used.
- Check U-tube is filled with water.
- Clean Aspiration Needle and Aspiration tubing, review replacing the aspiration tubing. (160mm length recommended).
- Clean any spills in tray.

Weekly or 40 hours:

- Carry out daily maintenance procedure.
- Check the operation of the Nebuliser.
- Check the Drain Cup, Burner, U-tube, Nebuliser, and waste tube. Clean as needed.
- Clean the Mixing Chamber and flush the nebuliser, using a good quality de-proteinizing solution such as Decon® 90 (2-5% mix with deionised water).
- Replace the aspiration tubing (160mm length recommended).

Monthly or 200 hours:

- Carry out weekly maintenance procedures.
- Check the fuel gas tubing (external to the instrument) and connections for leaks, using a soap solution or proprietary leak detection spray.
- Check the gas supply tubing (external to the instrument) for signs of stress cracking. Replace as needed.
- Clean the Burner, Nebuliser, and Drain Cup using a good quality de-proteinizing solution such as Decon® 90 (2-5% mix with deionised water).

Semi-annually or 1000 hours:

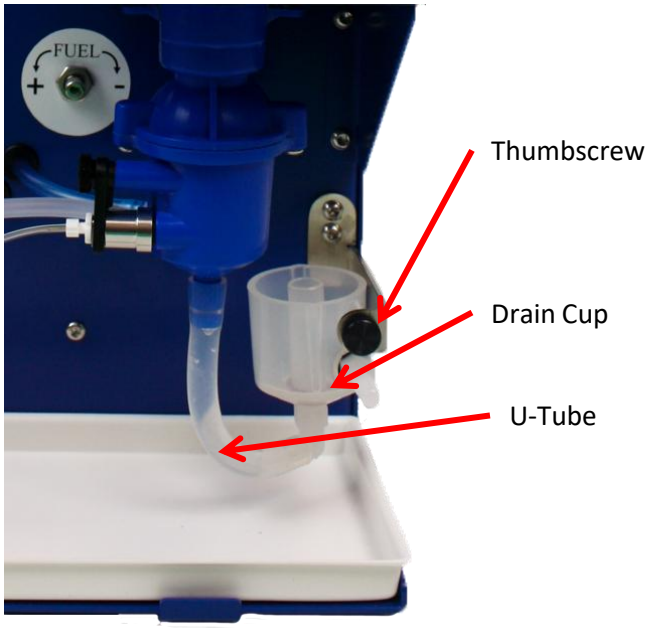
- Carry out the monthly maintenance procedures.
- Using the chimney inspection flap, inspect the clarity of the windows in view (inner chimney and optic) to ensure clarity remains. If in doubt, remove the inner chimney and clean both windows and the optic window.
- Replace U-tube and waste tubing.

Annually or 2000 hours:

- Carry out the semi-annual maintenance procedure.
- Replace gas sensing module
- Replace at a minimum:
    - Pump inlet filter,
    - Air filter,
    - Gas filter,
    - Igniter,
    - O-Rings.

BWB now offers an Annual Service Kit, containing all the parts you need to keep your Flame Photometer running at peak performance. It includes the parts listed above in addition to the mixing chamber.

Maintenance



U-Tube
The U-tube must be as supplied and remain free of obstructions or 'kinking' that might inhibit waste flow out of the Mixing Chamber. For safety reasons, the U-tube must be filled to overflowing with water.

NOTE: To clean, use a detergent solution (Decon50™) with subsequent thorough rinsing with tap water. Do not use organic solvents or alcohol based cleaners. They may cause the tubing material to expand and lead to permanent damage.

Drain Cup Cleaning
The only maintenance needed is occasional cleaning.

1. Unplug the mains power cord.
2. Remove the U-tube and waste tube, taking care not to spill water.
3. Undo the thumbscrew and carefully drop the drain cup from the bracket.
4. Clean with a detergent solution, mild acid, or Decon 90® (2-5% mix with deionised water). Rinse thoroughly with water.
5. Move the drain cup back into position and secure with the thumbscrew.
6. Reattach the U-tube and waste tube.

Maintenance

No attempt should be made to remove (or adjust) the Aspiration Needle from the nebuliser body.

Aspiration Needle and Aspiration Tubing

The heart of nebuliser function, the Aspiration Needle, should be cleaned daily or whenever the stability or accuracy of the instrument is in question. Cleaning periodically during the period of use usually keeps blockages to a minimum and may be conveniently carried out by gently forcing deionised water from the syringe through the aspiration tube.
More severe blockages can often be removed by running Nebuliser Cleaning Rod through the inside of the needle and/or replacement of the aspiration tubing. Refer to the Nebuliser Cleaning instructions detailed below for thorough cleaning in the case of stubborn blockages

Nebuliser

The Nebuliser should be checked according to the maintenance schedule, or more frequently if results are erratic or an obstruction is suspected.

No attempt should be made to adjust the Nebuliser needle.

Prior to carrying out this procedure ensure the flame is extinguished.

Checking the Nebuliser:

1. Ensure both the Needle and Aspiration Tube (max 160mm) used for the test are clean and free of obstructions.
2. Unscrew the Nebuliser Retaining Clip and remove the Nebuliser from the Mixing Chamber.
3. Switch on the power to the instrument.
4. From the *Welcome* menu, choose *Maintenance* menu.
5. From the *Maintenance* menu, choose *Run Compressor* to start the air compressor.
6. Aspirate deionised water.
7. Measure the aspiration rate by timing how long it takes to aspirate a known amount of water. The aspiration rate should be within 2.8-4.5 millilitres/minute.
8. Observe the mist. It should consist of fine droplets extending about 15-20 cm. Larger droplets may also be emitted intermittently. This is normal. However, a constant stream of larger droplets could indicate a problem with the Nebuliser. Alternatively, if the aspiration rate is too low or there is no fine mist, the Nebuliser needs cleaning.
9. If the Nebuliser performance is satisfactory refit into the instrument and secure with the retaining clip.

No attempt should be made to remove (or adjust) the Aspiration Needle from the nebuliser body.

Prior to carrying out this procedure ensure the flame is extinguished.

Nebuliser Cleaning:

1. If necessary, unscrew the Nebuliser Retaining Clip and remove the Nebuliser from the Mixing Chamber.
2. Remove the air supply tube and aspiration tubes.
3. Use the Syringe filled with deionised water and a small length of clean aspiration tube to gently force the deionised water through the aspiration needle to remove any obstructing materials from the centre.
4. Gently run the Nebuliser Cleaning Rod through the inside of the needle taking care not to abrade the inside surface. This should remove any stubborn deposits.
5. Soak the Nebuliser in a good detergent solution such as the BWB cleaning agent.
6. When fully clean, rinse the Nebuliser thoroughly with deionised water. Allow to dry.
7. Re-fit the Nebuliser to the air line.
8. Test the cleaned Nebuliser as above.
9. If problems persist, remove the nebuliser from the instrument and soak in a detergent solution, de-proteinizing solution, and/or Decon 90® (2-5% mix with deionised water) overnight.

DO NOT soak the nebuliser in organic solvents or alcohol.

Never attempt to adjust the Nebuliser.

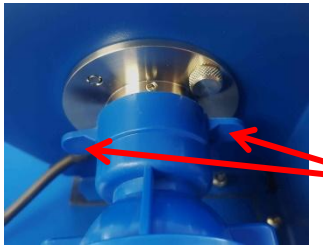
*image not depictive of service kit

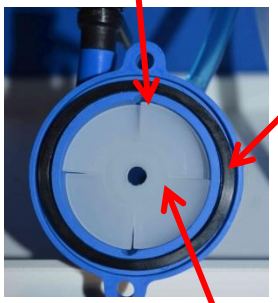
Maintenance

Mixing Chamber Cleaning

The Burner must be completely cool before proceeding further.

1. Remove the Nebuliser from Mixing Chamber.
2. Disconnect the U-tube from Mixing Chamber.
3. Disconnect the blue gas tube from the mixing chamber (this can be a stubborn fit, be careful to pull in a straight direction and do not twist to prevent snapping the barb)
4. Gently spread the Release Tabs on the upper part of the mixing chamber just enough to clear the groove they are in and pull the Mixing Chamber down away from the burner.
5. Separate the Mixing Chamber halves by undoing the two screws that hold them together using a T20 Torx driver.
6. Note the orientation of the baffle in the lower half of the mixing chamber and carefully remove the baffle. (it is essential the baffle is replaced after maintenance in the same orientation – grooves located).
7. Remove the gasket from the groove in the lower half of the mixing chamber.
8. Clean all parts with a detergent solution, de-proteinizing solution, and/or Decon 90® (2-5% mix with deionised water). **DO NOT** use organic solvents or alcohol as they may damage the mixing chamber body.
9. Rinse all parts well with deionised water.
10. Inspect the gasket for any signs of deterioration or compression. Replace if necessary. Do not lubricate the o-ring in any media apart from DI water.
11. Make sure the Baffle is pushed securely and squarely into the lower half of the Mixing Chamber. it is essential the baffle is replaced after maintenance in the same orientation – grooves located.
12. Refit the Gasket into the groove on the lower half of the mixing chamber.
13. Inspect the gauze for any signs of deterioration and replace if necessary (018-104).
14. Place the gauze in the top of the mixing chamber.
15. Locate the top and bottom of the mixing chamber sections together and secure with the two screws removed earlier. Do not overtighten.
16. Refit the Mixing Chamber into position on the Burner Tube, ensuring the tabs locate securely into the retaining groove.
17. Refit the U-tube and Nebuliser assembly.





Burner Cleaning

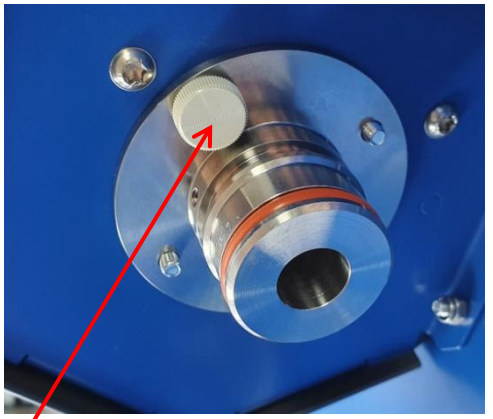
The Burner must be completely cool before proceeding further.

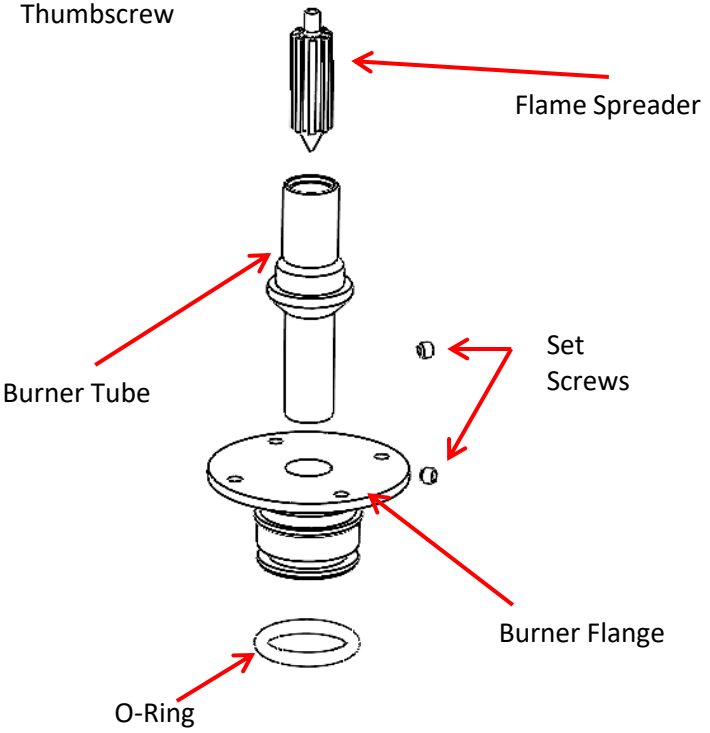
The Burner Assembly should be cleaned according to the maintenance schedule; or more frequently if the signal becomes erratic when aspirating deionised water.

1. Remove the Mixing Chamber as previously described.
2. Remove the 2 thumbscrews and withdraw the Burner Assembly.
3. The burner can be cleaned as a complete assembly by submerging the component into a bath of de-proteinizing solution, and/or Decon 90® (2-5% mix with deionised water). DO NOT use organic solvents or alcohol as they may damage the O-ring.

Alternatively, for stubborn contamination further disassembly is possible:

1. Undo the set screw on the Chimney Mount using a 2.1mm AF Allen Key. Carefully remove the Burner Tube.
2. Remove the Flame Spreader by undoing the set screw using a 2.1mm AF Allen Key.
3. Clean the Burner Tube and Flame Spreader with a detergent solution, de-proteinizing solution, and/or Decon 90® (2-5% mix with deionised water). DO NOT use organic solvents or alcohol as they may damage the O-ring.
4. Inspect the O-ring for signs of deterioration or splitting. Replace if necessary.
5. Re-assemble ensuring the Flame Spreader pointed end is downwards and that the set screw is aligned with one of the ridges in the flame spreader, NOT with a groove.
6. Offer the Burner Assembly up to the Chimney Assembly and refit the 2 retaining thumbscrews.
7. Replace the Mixing Chamber.





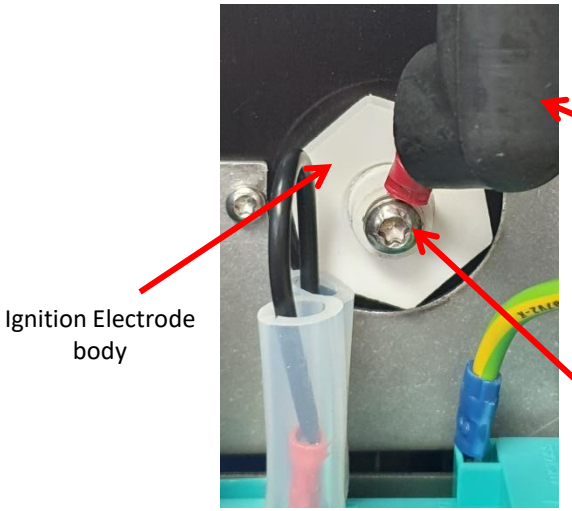
Maintenance

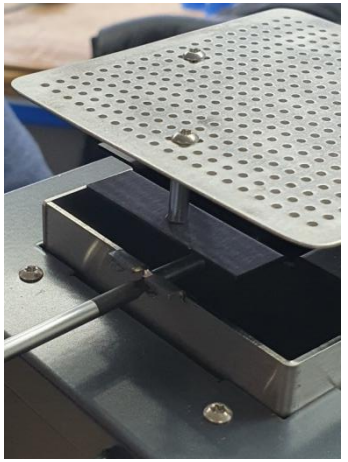
Inner Chimney/Ignition Electrode cleaning

The Chimney Assembly and Burner must be completely cool before proceeding further.

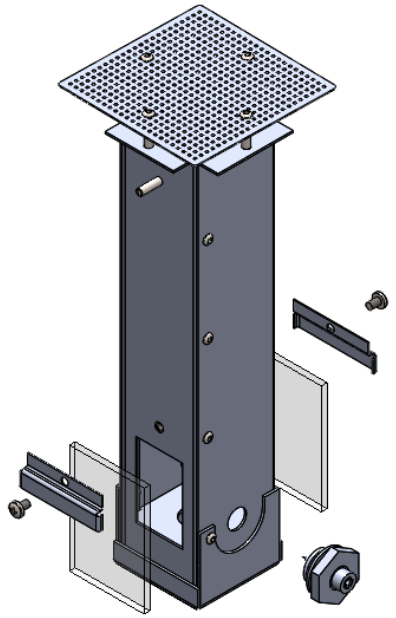
The Inner Chimney and Igniter should be cleaned according to the maintenance schedule; or more frequently if ignition is unreliable or the signal becomes erratic.
It is advised to ensure the optical glass is kept clean and free from finger grease and other such contaminants.

1. Unplug the mains power cord.
2. Remove the six Chimney Back Piece retaining screws using a T20 Torx driver.
3. Note the location of the chimney fan power cable and then disconnect this from the socket.
4. Carefully place Chimney Back Piece and screws to one side.
5. Identify the Ignition Electrode connection. Slide back the insulating boot and disconnect the wire using a T20 Torx driver.
6. Using a T10 Torx driver, remove the four screws holding the chimney top 'guard' to the outer chimney, place the guard to one side. Remove the 2 screws holding the Inner Chimney to the Top Cover after removing the 4 screws holding the mesh chimney top in place.
7. Lift the Inner Chimney Assembly up slowly and remove the air tube connection on the bottom of the chimney.
8. Continue raising the Inner Chimney in a vertical motion out of the Outer Chimney, being careful not to damage the Ignition Electrode.
    1. *If the user intends to clean or replace the Ignition Electrode during this procedure, undo the 25.4 (1") AF hexagonal Retaining Nut on the igniter.*
    2. *Remove one widow by loosening the clamping bracket using a T20 Torx driver.*
    3. *Replace the igniter and fit a new nut. Retighten.*





7. Remove the Inner Chimney Windows from the Inner Chimney by removing the screws from the window retainers.
8. Clean the glass windows and chimney pieces using a non-abrasive cleaner or mild detergent solution, taking care not to scratch any of the surfaces.
9. Reach into the Outer Chimney and clean the optic window very gently using a very soft cloth or cotton swab
10. If required, the Outer Chimney/Heat Shield Assembly can also be removed for cleaning by removing the 4 screws on the top of the chimney housing using a T10 Torx driver.
11. Re-assemble in reverse order, taking care not to damage or place finger grease on the windows.
12. Replace the Inner Chimney into the Outer Chimney. Reconnect the air tubing, the wire to the Ignition Electrode and replace the Rubber Boot.
13. Reconnect the chimney fan connection and ensure the cable is tucked between the ignition module and the space below the socket (this is critical).
14. Refit the Chimney Back Piece and all six retaining screws.
15. Refit the chimney top ‘guard’.



Troubleshooting

The following is intended to address common situations encountered when operating the BWB flame photometer range. For additional information, log on to www.bwbtech.com and check under Applications Tab and/or FAQ Tab for common questions and answers.

Note: If service is required this should only be performed by qualified service engineers. If you attempt to carry out the work you may void the warranty.

Further assistance is available at technicalsupport@bwbtech.com when emailing us, please provide the Serial Number, Hour Meter reading and describe the situation and the fault symptoms in as much detail as possible.

No display on power up:
Check power cord is plugged in to the rear panel and mains supply is turned on.
Check the mains supply conforms to proper standards.
Ensure you are using a BWB 12vDC power supply, only BWB supplies should be used.

Instrument fails to stabilise after Start Up:
Check the instrument is sited in a draught free location.
Ensure the ambient air is clean and free of airborne particles.
Check the mains supply conforms to proper standards.
Check the gas supply is not fluctuating or almost exhausted and all hoses and connections are not leaking. Repair/replace as required.
Check the nebuliser performance. If unsatisfactory, clean nebuliser as instructed or replace.
If using an External air supply, check this is not fluctuating.

No flame ignition on Start Up:

Gas Supply
Check the gas supply is turned on at source and it is not exhausted.
Ensure the gas source is properly regulated to no more than 20bar.
Test hoses and connections for leakage and repair as needed.
Air supply
From the *Start Up* menu, select the *Maintenance* menu and *Run Compressor*.
Check the compressor is running. Remove the tubing from the air inlet and ensure air is flowing out of the tube. If not consult your local agent or BWB regarding compressor service.
U-Tube
Check the centre of the drain cup is filled with water.
Spark
During *Start Up* visually check, through the Inspection Port, that a spark is generated to the centre of the flame spreader, indicating the ignition system is working.
If no spark is seen, unplug the power cord, remove the Outer Chimney Rear Plate and check that the lead connection to the Spark Igniter is properly attached.
Fuel Gas Pre-set
Perform the fuel gas pre-set adjustment.

Troubleshooting

Instrument does not stabilise during calibration or reading:

Check the instrument is sited in a draught free location.
Ensure the ambient air is clean and free of airborne particles.
Allow the recommended warm up time.
Ensure all solutions are properly prepared.
Check the gas supply is not fluctuating and all hoses and connections are not leaking. Repair/replace as needed.
Check the nebuliser performance. If unsatisfactory, clean nebuliser as instructed or replace.
Check that liquid is freely overflowing from the U-tube in the drain cup and out of the drain tube. If not, check for pinching and leakage and replace as required.
Check the Aspiration tube is not blocked with particulates. Clean or replace as needed.
Clean Mixing Chamber.
Clean Burner Tube and Flame Spreader.

Flame goes out during use:

Check the fuel gas supply is providing gas. Correct as needed.
Check the fuel gas hoses and connections for leakage and repair/replace as needed.

Flame does not auto- extinguish on shut down:

Turn off power and gas supplies.
Contact your local agent or BWB for advice.

No computer communication:

Check the USB connection on the rear panel.
Refer to the Software Manual.
A **"**Serial BallPoint**"** issue may be encountered whereby the Microsoft serial port enumerator fails to identify incoming data correctly. Recent versions of the Microsoft Operating System no longer support an earlier registry fix. To disable the "Serial BallPoint" and enable the instrument to connect to the FP-PC software, navigate to the "Device Manager" and expand the subfolder labelled "*Mice and other pointing devices*". Right click on "*Microsoft Serial BallPoint*" and select "*Disable*". A warning message will be displayed, select "*Yes*". Re-selecting the USB port in the FP-PC software should enable connection to the instrument. Contact your IT support desk or BWB if you require further assistance.

Glossary

Na	Sodium
K	Potassium
Li	Lithium
Ca	Calcium
ppm	parts per million
mg/L	milligrams per litre
meq/L	milliequivalents per litre
mmol/L	millimoles per litre
L/Min	Litres per minute
Bar	Unit of measure
˚C	Degrees Centigrade
CM	Centimetres
Temp	Temperature
LPG	Liquid Propane Gas
LED	Light Emitting Diode
LCD	Liquid Crystal Display

HT	High Tension
Config	Configuration
Maint	Maintenance
Pt	Point (calibration)
Auto Rd/Auto R	Auto Read
Calib	Calibration
Multi	Multiple
V+T	Voltages and Temperatures
Comms	Communications
SN	Serial Number
USB	Universal Bus
FP-PC	BWB's Computer Software
OTA	Optical Train Assembly
e.g	Example
config	Configuration
SOPs	Standard operating procedures

Use this space to make your own notes

Annex A

Generic Risk Assessment for BWB Flame Photometer Instrument Range

Assessor: Hozan Edwards for BWB Technologies Ltd **Date of Assessment:** 07.01.2023 **Planned Review Date:** Contact for a later copy

Important Note:

This document is a general risk assessment for the use of BWB Flame Photometer Range. This risk assessment should be reviewed fully by users of the instrument prior to use for the first time and in the event that it is not sufficient to control the risk posed by the model in question then the user should include additional risk control measures and more specific information on the particular application, it is the responsibility of the organisation to ensure the risks identified by BWB and/or your own assessment are mitigated and employees or operators of the system are sufficiently protected from harm. Risk Assessments require review and in some cases revision to ensure the assessment continues to reflect current working practices. A review should be conducted in response to significant changes to the area / application or if an accident or incident has occurred.
The following assessment has been carried out to UK legislation and working practices, these may differ in your country or region.

Recommendations to reduce risk:

Persons using the instrument must wear clothing suited for the environment and application or as defined by your company's documentation.
Long hair must be tied back and if possible cosmetic products (hair gels for example) should not be worn in the hair.
Ensure other laboratory users are made aware when the flame photometer is turned on.

Description of Activity:

Use of the BWB Flame Photometer (all variants) which requires bottles or pipe fed propane, butane or natural gas to fuel an enclosed naked flame.
Consideration of other ongoing activities and workers in the vicinity of the flame photometer.
Use of electrical equipment (Flame photometer).

Key comments:

Operators must be trained sufficiently by either the manufacturer or distributor, supporting documentation is supplied in digital format with the BWB USB stick, accessible online through the customer portal or by request by emailing BWB directly info@bwbtech.com .
Maintenance and safety checks are to be completed by the manufacturer or appointed distributors only. BWB will not take responsibility for damage or accident caused by non-qualified personnel carrying out service or maintenance work.

Significant Hazard	Perceived Nature of Risk	Control Measures	Residual Risk Low (L) / Medium (M) / High (H)
Flammable / Explosive Substances	Gas (propane, butane, natural gas)leak leading to explosion	Local exhaust ventilation covering the region where equipment is to be used. Upon initial connection of gas tube and propane tank, joints are to be checked with a “digital gas sniffer”, leak detection spray or other suitable test. Joints are to be checked for “tightness” prior every ignition of the instrument.	M
Exposure to Hazardous Substances	Some samples / standards may be hazardous	Follow safe working procedures for the correct handling of chemicals, samples or standards based on material safety data sheets. PPE, Gloves and safety glasses are to be worn in the vicinity of the Flame Photometer or sample/ standard preparation area.	L
Burns / Fire	Burns to user from instrument exhaust / chimney. Fire caused exhaust heat to clothing / materials.	Do not reach over the instrument for any reason. Ensure other users are made aware when the instrument is turned on. Do not touch the chimney or place anything in contact with the chimney. Ensure the clearance room above the chimney is to that specified in the manual. Do not use the exhaust gases as a “heating” or “warming” method for any material. Do not insert your finger or any other part of body/ object/ component through the chimney inspection flap.	M

Significant Hazard	Perceived Nature of Risk	Control Measures	Residual Risk Low (L) / Medium (M) / High (H)
Chemical Storage	Flammable organic liquids in vicinity of flame photometer. Storage of propane cylinder.	Flammable materials/ fluids should be stored away from the flame photometer at all times, ideally in protective cabinets. Bottles containing solvents or fluids with flammable vapors to be kept in fume cabinet or stored away from flame photometer. Gas cylinders should be stored in designated areas compliant with local regulations when not in use.	M
Hazardous Waste Disposal	Disposal of harmful samples and or standards	Segregated and well labelled waste containers should be used and disposed of at regular intervals using the correct means based on local regulations.	L
Discharge / Leak	Discharge of propane from cylinder	No attempts should be made to use regulators other than the manufactured supplied regulator. Connections and hoses should conform to local regulations. Should gas be smelt by any user in the lab or vicinity the instrument should be immediately shut down and power turned off. The gas bottle or source should be turned off. Corrective action to find and prevent the leak re-occurring should be taken once the lab or vicinity has been adequately ventilated.	M

Significant Hazard	Perceived Nature of Risk	Control Measures	Residual Risk Low (L) / Medium (M) / High (H)
Electrical Safety	Power to instrument	Carry out regular PAT testing according to company's PAT testing routine and process. Only approved persons, the manufacturer or appointed distributors are to carry out electrical work inside the instrument. Ensure any spills in the vicinity of the instrument or power line are cleared up adequately and immediately and any decontamination is undertaken.	L
Manual Handling	Replacing propane bottles. Moving the instrument from storage to area of use.	Small propane cylinders are recommended. The instrument weighs 11kg, follow correct manual handling lifting technique. Ask for help if required. Refer to your companies manual handling risk assessment.	L
Storage / housekeeping	As Above "Chemical Storage"	As above "Chemical Storage"	M
Pressure/ Vacuum systems	Propane cylinder is at high pressure	Refer to the manufacturers guidelines for the safe storage, location and operation of the gas supply cylinder. Store and use in line with local regulations.	L
Temperature	Hot surfaces on the flame photometer chimney and exhaust region.	Use adequate signage to ensure other workers know the instrument is on and hot. See above "Burns / Fire"	M
Lone Working	All of the above	Ensure you are familiar with your companies "lone working" document and regulations. Assess as appropriate.	L

Annex B

Battery replacement / removal

The European Parliament and EU Council have set the goal of reducing the amount of Waste Electrical and Electronic Equipment (WEEE) going to landfill and reducing the hazardous substance content of Electronic and Electrical Equipment (EEE).

Please follow the following steps to decommission your flame photometer prior to recycling

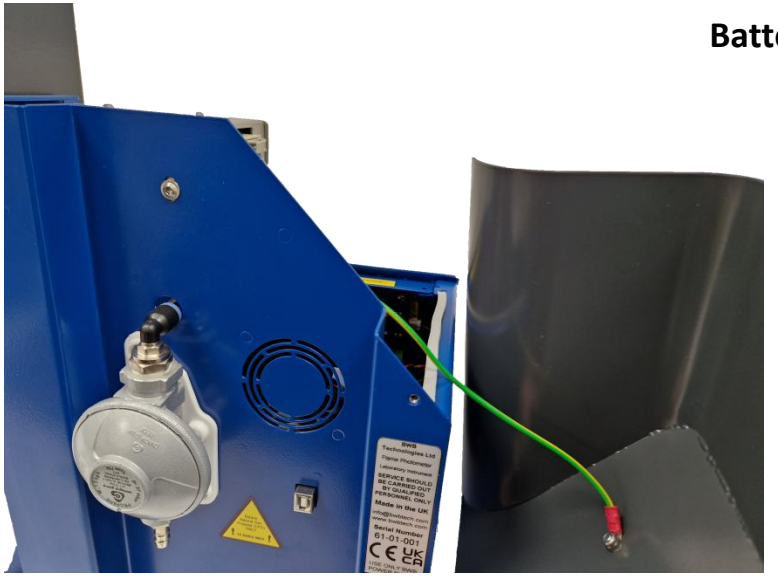
It will first be necessary to access the interior of the instrument enclosure. This should be carried out as follows:-

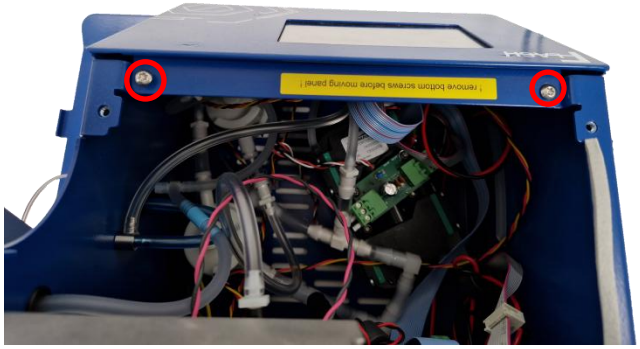
1. Unplug the mains power cord.
2. Turn off the gas supply at source
3. Remove the four screws which secure the instrument top cover and remove the cover.

The cover will also always be attached to the instrument by an earth cable. If the cable is removed it is **essential** that the earth cable be replaced it the same position and the fixing is fully tightened when the cover is replaced.

Annex B

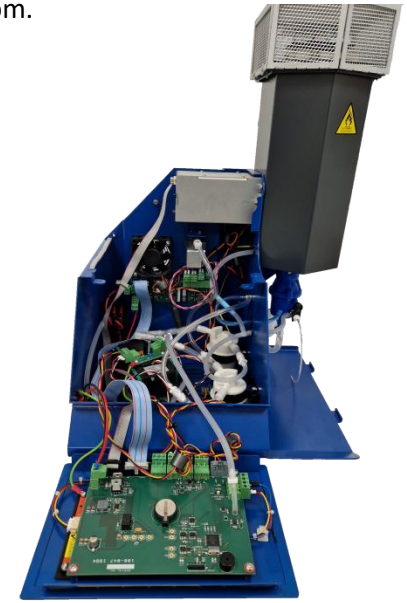
Battery replacement / removal





4. Remove the four screws holding the Front Panel Assembly in place

5. Place bubble wrap or a soft material on the table in front of the front panel to protect the keypad. Carefully lower the Front Panel Assembly down on the table being aware that it is retained to the instrument by cables at the bottom.



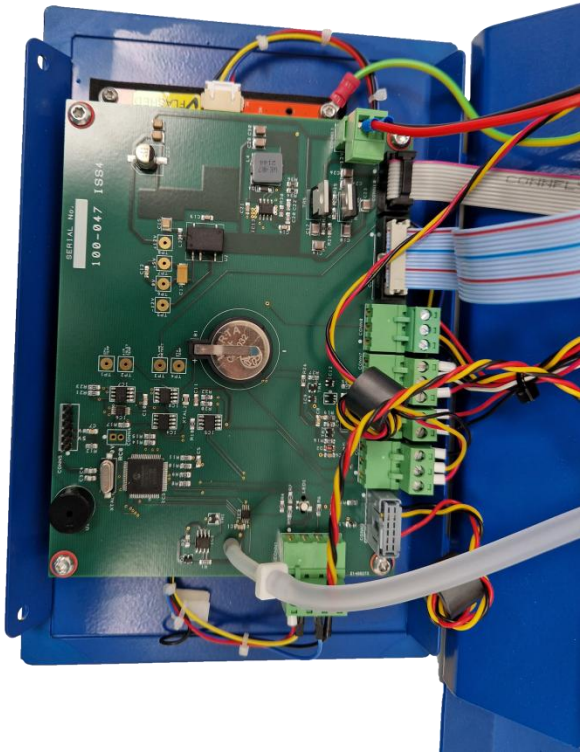
Annex B

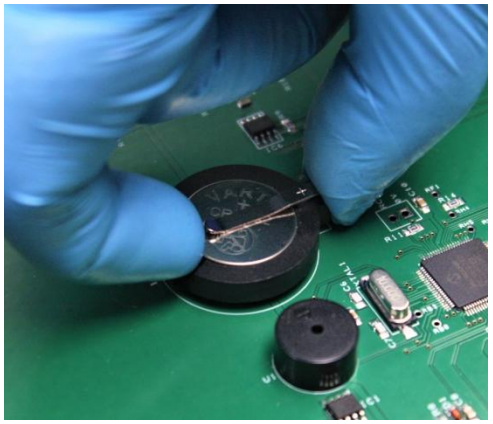
Battery replacement / removal

Locate the battery on the motherboard.

The battery is held in place with a light spring, one edge of the black surrounding ring is open to allow finger access, carefully prise the battery away from the spring and remove it from the black ring.

The battery can now de disposed of in a safe manner or replaced as required.

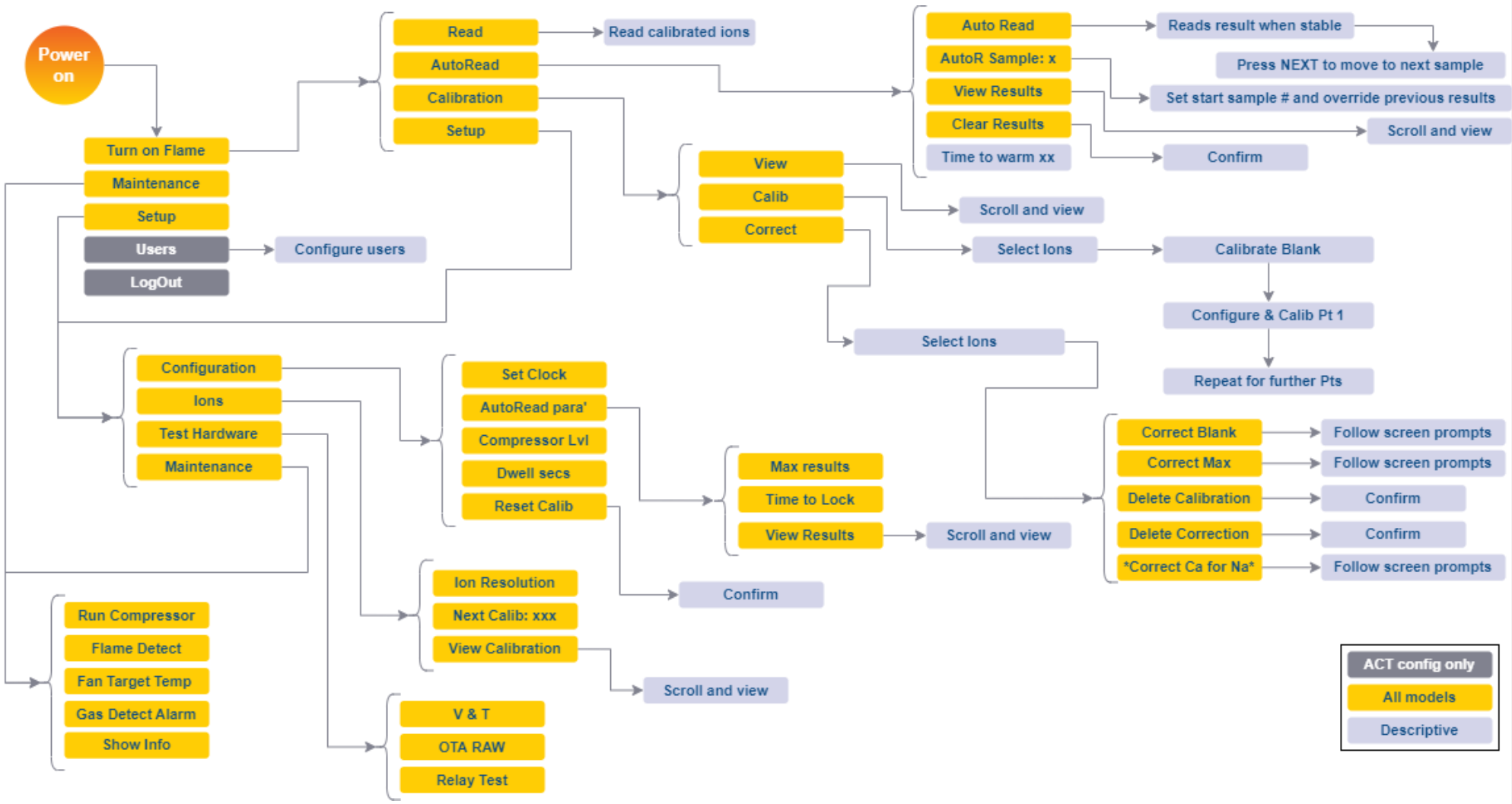




Re-assemble the instrument in reverse order.

Annex C

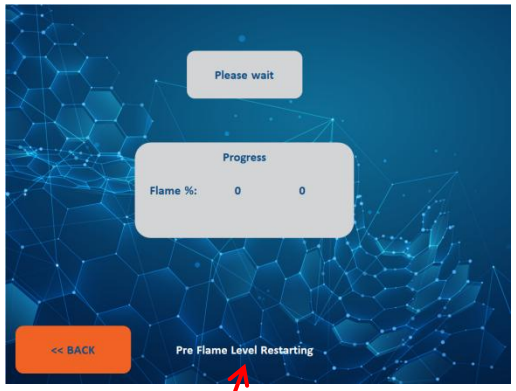
Navigation menu flow diagram



Annex D

LCD error messages

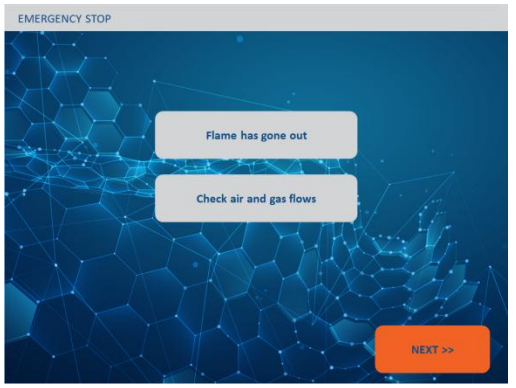
Pre flame Level



Indicates too much ‘stray’ light is entering the device, the sensors consider the flame is already lit.

- Ensure the chimney inspection flap is closed, the instrument is not located near a window (or the blinds are closed) and that exceptionally bright LED lighting is not positioned directly above the instrument.
- Ensure the flame is in fact not lit.

Flame gone out



Indicates the flame has failed. If it is the first occasion during flame start up then repeat the process it can take some time for gas to fill the system. Ensure the flame once lit is set to a sufficient level. Ensure that the flame is not too small during the 2 minute pump warmup phase.

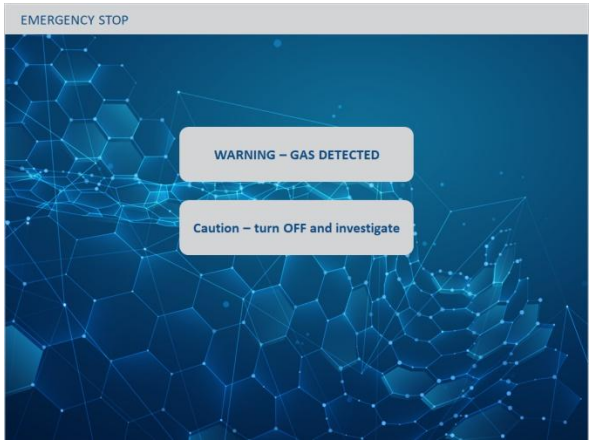
- Ensure the gas supply is not interrupted and that sufficient gas at source is provided.
- Ensure that the air flow is not interrupted and that sufficient air flow is permitted.
- Conduct an aspiration test.

RESET

Indicates the flame has failed. The instrument will attempt to restart itself to a safe recover mode (please note the instrument will never attempt to re-light the flame without user intervention. Wait for the next information screen for further details of the fault.
If the instrument fails to restart itself within 5 minutes, power off the instrument for a minimum of 30 seconds and turn it back on.

Annex D

LCD error messages



Indicates the gas sniffing module has detected a presence of gas (or other substance).

The gas sensors are very sensitive and any background 'smells' or other equipment can raise the bottom end, the same goes for environment and humidity.
The gas sniffers have a tolerance of adjustment to overcome false alarms. It should be noted that you should only increase the level at which the device alarms if you are confident that no leaks within the instrument or vicinity are noted.
The adjacent instructions enable the adjustment the level of 'alarm':

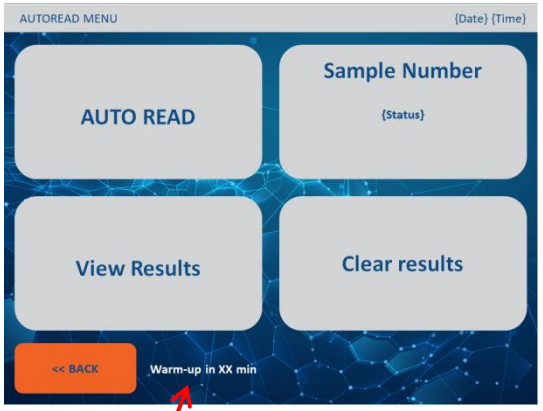
1. Turn on instrument power
2. Select Maintenance
3. Toggle the Gas Detection Alarm setting by tapping on the button. It is set at 0.6 from the factory and can go up to 3.0. A small increase to 1.0 is first recommended before setting the alarm to the maximum value.
4. Turn on flame through the normal routine.
5. With the flame lit navigate to view the reading of the gas sniffing module:
a. (setup)
b. (test hardware)
c. (V&T)
d. The gas sensor feedback is displayed on the bottom line, the setting for the alarm that we've just set to 0.7 is displayed next to it in brackets. As long as the feedback stays under 0.7 then it won't trigger. Watch it for some time 5-10 minutes and see where it settles.
6. If the above steps have failed to overcome the false alarm the steps can be repeated to increase the level or alarm to the maximum value of 3.0.

If after completing the steps, the alarm continues to provide a false result then the environment and aspects undertaken in close proximity of the instrument should first be evaluated. IPA used in relatively close proximity for example will trigger the alarm, as is the same with other organic compounds.
If a false alarm continues then it is possible to disconnect the module and prevent further alarms whilst a new module is requested from BWB.
In order to disconnect the sensor please follow the instructions for module replacement within the service manual, or available upon request.

Annex D

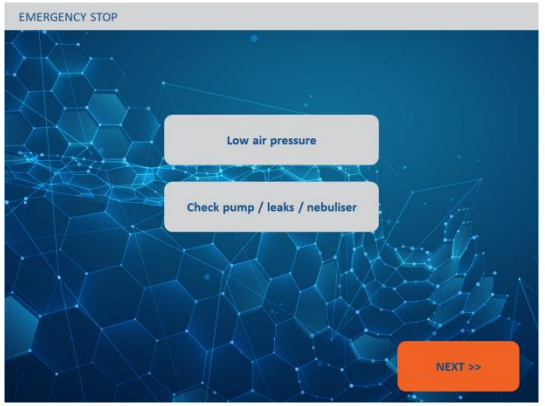
LCD error messages

Warm-up



Indicates that the instrument flame has not been on for a sufficient time to reach optimum warm up. It should be considered to hold off conducting the chosen process until the warm up time message has elapsed. This can be ignored and the process conducted regardless if you wish. Note: the display will not refresh until you navigate away and back to it.

Low air pressure



Indicates that the air pressure detected by the instrument is not sufficient.

- Ensure the compressor is set to 165 in the maintenance menu.
- Ensure the nebuliser is aspirating and bubbles are not forming in the sample pot.
- Check the aspiration rate is approx 2.8 -4.5ml/min
- Gain access to the instrument enclosure and ensure the tube is connected to the pressure sensor and that other tubes are not loose. Refer to the service manual.

Found an error message not listed here? Contact technical support and we'll help out technicalsupport@bwbtech.com