



Personal Air Sampling Pump

User Manual HB4058-00.09



Thank you for purchasing the Casella Apex2 personal sampling pump. We hope that you will be pleased with the unit and the service that you receive from us. If you do have any queries, concerns or problems, please don't hesitate to contact us at: info@casellasolutions.com

Casella prides itself on providing precision instrumentation since 1799, supplying eminent figures including Darwin and Livingstone. A lot has changed in our 200 year history but what does remain is our commitment to reliable, trustworthy and credible solutions.

For more information or to find out more about Casella and our products, please visit our website at:

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1.0 Introduction

The Apex2 is the new generation of the personal sampling pump – combining class beating performance with wearer acceptance and now with the addition of Bluetooth® Smart giving an extra dimension of connectivity. Monitor the pump from your mobile phone or tablet without having to disturb the wearer.

These are just some of the features of the Apex2

- Bluetooth® 4.0 (Low Energy) Wireless Connectivity
- Airwave App
- Clear full colour OLED display
- Motion sensor to track wearer activity and compliance
- Slim ergonomic design, smooth finish and protective rubber boot
- IP65 rated
- Inlet pressure sensing to establish filter loading and aid diagnostics
- Li Ion Batteries
- Impressive back pressure capability
- Gas Bag outlet

The Apex2 (Plus and Pro models) has the addition of Bluetooth® 4.0 wireless connectivity and the Airwave App for your mobile device which enables you to control and monitor the pump remotely. If you're not using the App, then the colour display gives all the run parameters 'dashboard style' and the use of colour makes the interface more intuitive.

We have included a motion sensor which confirms that the pump is being worn and its slim ergonomic design means that it's less obtrusive to the wearer. The pump is IP65 rated meaning greater protection against dust and water ingress and its smooth finish means that it is easier to decontaminate. A protective rubber boot provides added protection in a hostile working environment.

The Li Ion battery technology used in the Apex2 is low maintenance with no memory effects and has very low self-discharge. Scheduled cycling is not required to prolong the battery's life. An accurate fuel gauge always shows the batteries state of charge and remaining run time (*in Pro and Plus models*).

The Apex2 has a maximum flow rate of 5l/min and offers impressive back pressure capability which ensures it operates reliably across a wide range of filter media. The Apex2 includes a gas bag outlet to enable grab sampling.

Different models of the Apex2 provide features to address the requirements of different applications. The supported functionality is illustrated in the following table with the Standard, Plus and Pro models. All the Apex2 models offer the same flow performance: The Standard Apex2 is the basic pump and the Plus and the Pro offer greater functionality; the Pro version offering advanced programmability.

| | Motion Sensor | Bag Outlet | Bluetooth® | PC Download | Inlet Pressure Sensing | Run Duration Timer | Fully Programmable Timers |
|-------------|---------------|------------|------------|-------------|------------------------|--------------------|---------------------------|
| Apex 2 | ✓ | ✓ | | | | | |
| Apex 2 Plus | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Apex 2 Pro | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

2.0 Safety and Warnings

2.1 For all Apex2 Models

- ⚠ The Apex2 series of air sampling pumps are designed to be robust; however they should not be dropped or subjected to mechanical shock.
- ⚠ Take care not to suck in water, solid materials or highly saturated or corrosive gases into the pump as this may damage the pump and will invalidate the warranty.
- ⚠ The Apex2 pump contains no user serviceable parts and if a fault is suspected, the pump must be returned to Casella or a Casella approved service centre.
- ⚠ The warranty DOES NOT extend to cleaning or general servicing of the instrument.

2.2 Disposal



WEEE Notice: At the end of the instrument's life please do not throw away with the unsorted municipal waste. Please recycle with a registered WEEE handler.

2.3 Disclaimer

Do not attempt to use this equipment until you have thoroughly read the manual or have been instructed by a Casella Engineer.

At the time of writing, this manual was completely up to date but due to continual improvements the final operating procedures may differ slightly from those in the manual. If there are any questions you are encouraged to contact Casella for clarification.

Casella seek continual advancement in their products and services. We reserve the right to make changes and improvements to any information contained within this manual.

Whilst every care is taken to ensure that the information in this manual is correct, Casella will assume no responsibility for loss, damage or injury caused by any errors in or omissions from the information given.

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4.0 Getting to know your Apex2



Fig 1

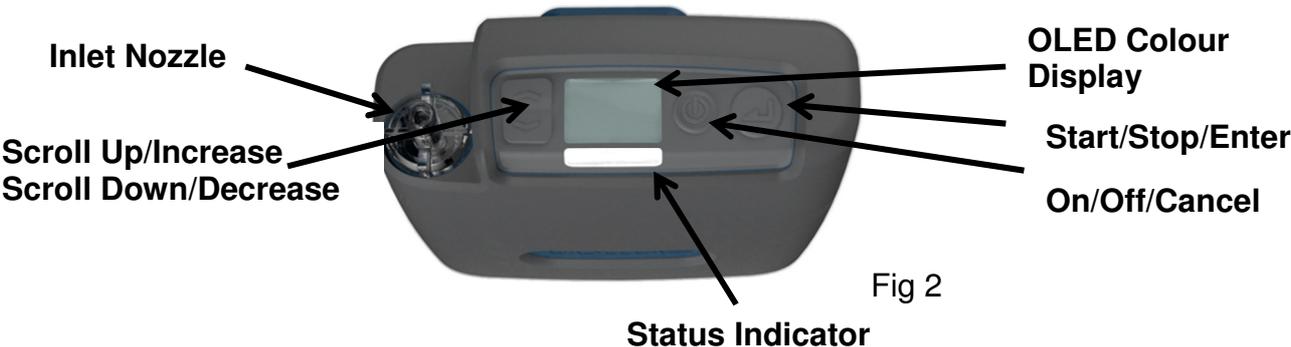


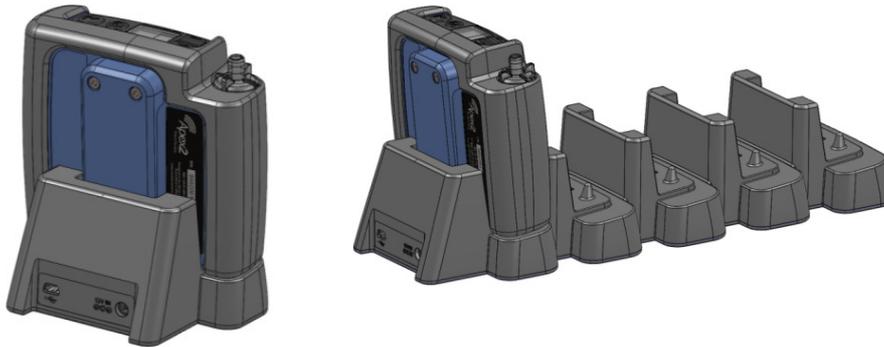
Fig 2



Fig 3

5.0 Charging the Apex 2

An intelligent combined docking station and charger, either single or 5-way is required to charge the Apex2. Sampling history data from the Apex2 Plus and Pro models is downloaded via USB using the same docking station. On the 5-way charger, the 'docking' pocket with the  USB symbol is the only pocket specifically for downloading data, but ALL pockets can charge the Apex2. **For downloading data, the docking station must be powered.**



The single way charger is powered using a PC18 universal power supply (2.1mm power connector) and the 5 way version uses a PC28 adapter (2.5mm power connector). A red LED will illuminate on the docking station to show that the power is on.

If an Apex2 is switched off or is in 'Stop' mode and is placed in the docking station, a 'fast charge' will automatically start. During charge the Apex2 will display the battery charging icon plus the batteries' percentage state of charge. The Red LED will continue to flash during the entire charging cycle.



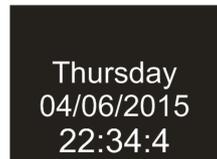
The charging display will blank after the defined display timeout period. Pressing the Power button will 'wake' the display for a further interval until timeout. Once fully charged a solid blue LED will be shown for 10 minutes, after which time, the pump will power off.

The charge time from empty to full is approximately 6 hours. Shorter charge times will result in a reduced pro-rata run time.

If the pump is placed in the docking station whilst in Run mode, the pump will continue to sample as normal and can be powered from the docking station for an extended period of time. Batteries will not charge in this mode. Ensure the pump is stopped before placing in the charger.

6.0 Switching the Apex2 On and Off

To power on the Apex2 simply press and release the On/Off < ⏻ > key. At power up the pump will display the following screens;-



It then defaults to the Stop mode (Red Title bar) dashboard screens detailing data from the last run;-



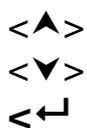
Tilt the pump forwards or backwards to automatically change the viewing angle of the display. This means you can view the display from the front whilst it is in operation and being worn by the user, or from the reverse, if you are wearing it yourself.

To power off the Apex2 from any Stop mode screen, press and hold the On/Off < ⏻ > key for 3 seconds. Please note that the pump will not power off whilst a sampling run or programme timer is active. If the button is released before the shutdown sequence is complete, the pump will not power off.

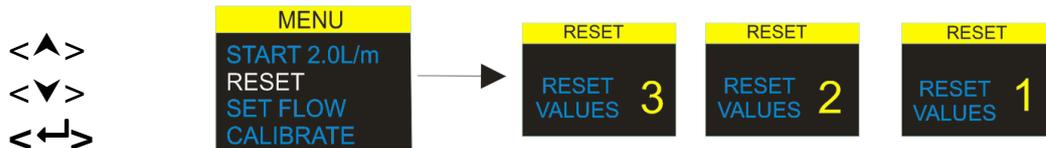


7.0 The Main Menu

To access the main menu press the Down key < ▼ > once from the main dashboard screen



Select this option to resume a run with the current flow rate and accumulated run data. You may exit at any point in the countdown. To clear the run data choose 'RESET' and return to 'START'.



Select this option to reset the accumulated run time and volume to zero. You may exit at any time during the countdown.



Select this option to change the flow rate. Use the arrow keys to change the flow and the enter key to accept.



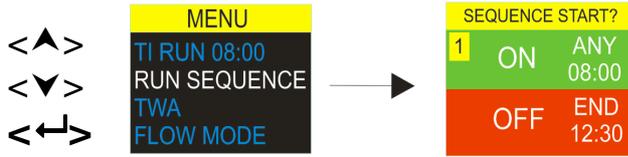
To perform a single point calibration, attach a sampling head or flow tube or other flow-measuring device to the pump's inlet nozzle then select this option to calibrate.

8.0 Timer Programmes (Plus and Pro Models Only)

Note – The duration and programmed sequence timer functions are only available when 'Advance' mode has been enabled in the power-up configuration menu.



The **Run Duration timer** allows the pump to sample for a fixed period and then automatically switch off when that time has elapsed. (Plus and Pro



The **Programmable Sequence timer** allows 9 'on' and 'off' events to be set in sequence. These may be used to define daily or weekly sampling sequences. For instance sampling may start in the morning then automatically pause for a workers lunch or rest breaks. (*Pro Model Only*)



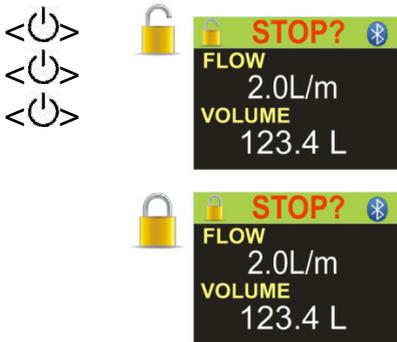
Time weighted average (TWA) mode allows the pump to sample for a fixed proportion of time over a specified total run time. The instrument calculates the required ON/OFF cycle to automatically spread the total sample time evenly over the entire run time (*Pro Model Only*). In this example the pump will sample for 1 minute and then pause for one minute (50:50 on off ratio) this pattern will continue for the total run duration of 8 hours.

9.0 Stopping and Pausing a Sampling Run



To Stop or Pause a sampling run press and hold the Enter key  and the countdown screens display. To exit the STOP operation release the Enter  key any time during the countdown. The Dashboard display will be shown.

10.0 Locking and Unlocking the Apex2



Whilst pressing and holding the up key, press the <↔> key 3 times within quick succession to toggle between the 'LOCK' options.

The **Full lock** can only be set during 'Run' mode and is denoted by a closed padlock icon. In this mode the keypad is fully de-activated until it is unlocked again. The wearer cannot stop or disturb the pump by any key presses.

Partial Lock mode is denoted by a half open padlock icon and can be set in 'Run' or 'Stop' modes. In this mode the wearer may stop and start the sampling pump but has no access to the Menu or other functions.

11.0 Motion Sensing



The Apex2 includes a Motion Sensor which reports a motion index expressed as the amount of time that the pump was moving. This ensures wearer compliance and confidence in the validity of the sample.

12.0 Bag Fill Mode

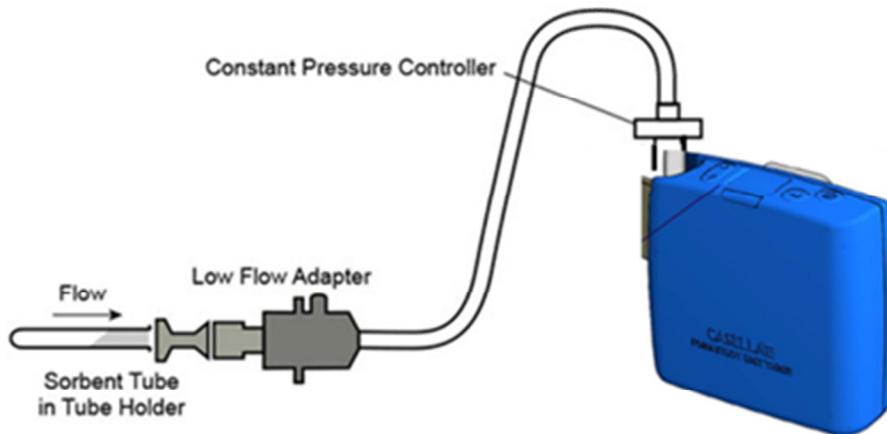


This allows the Apex2 to fill a gas bag and stop automatically when it is full.

Use a suitable length of 5mm (nominal internal diameter) tubing to connect the gas bag to the Apex2 outlet using the Luer type fitting.

Bag fill mode is automatically set by adjusting the flow to <1l/min and starting the pump. It will automatically stop filling the bag when the outlet flow sensor pressure reaches 15mBar.

13.0 Low Flow Mode



This enables the instrument to be used with sorbent tubes at flows down to 5ml/min.

Connect the inlet of the Apex2 unit to a flow meter and calibrate to a flow rate of 1.5L/min. Stop the pump and disconnect the flow meter.

Connect the constant pressure regulator, the low flow adaptor and the sorbent tube holder to the Apex2 pump. Connect this to your flowmeter. Break off both ends of the sorbent tube and fit it in the holder with the arrow pointing towards the pump. Start the pump and adjust the flow to the required rate, as indicated on the flow meter, using the screw adjustment on the low flow adaptor. This set up is now calibrated to your low flow rate.

Remove the sorbent tube and replace with a fresh one for the sampling operation.

14.0 Configuring the Apex2

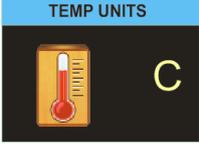
The Settings Menu is accessed by pressing and holding the <▲> and <↔> keys immediately after powering up the pump. Scroll through the items until the desired function is highlighted. Confirm with the Enter <↵> key.

<▲>
<▼>
<↔>




Language: Supported languages include English, Portuguese, Brazilian, Spanish, Italian, German and French

<▲>
<▼>
<↔>

Temperature Units

<▲>
<▼>
<↔>




Pressure Units

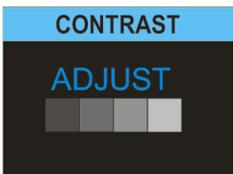
<▲>
<▼>
<↔>





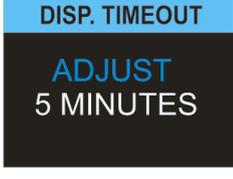
Time and Date

<▲>
<▼>
<↔>

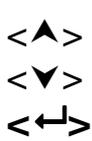
Display Contrast

<▲>
<▼>
<↔>

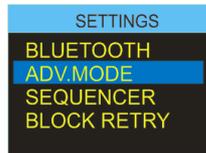



Display Timeout Period

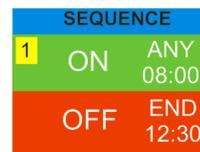
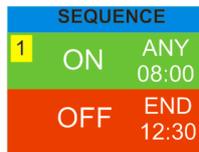
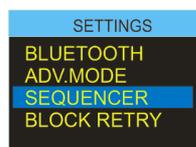
As a power saving measure, it is recommended that while the pump is running, the display does not need to be on. It may 'go to sleep' after a user specified time-out interval and will automatically 'wake up' following any key press. Set the time in this screen here.



Bluetooth Menu: It is possible to turn the Bluetooth Radio On or Off



Advanced Mode: When enabled, advanced programming options (Duration and Sequence timers) will be available within the main menu. Disabling advanced mode keeps the user interface simple and quicker to use.



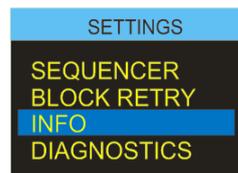
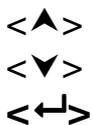
Sequencer

It is possible to specify up to 9 On/Off times and days enabling the Apex2 to follow an automatic start and stop sampling regime.

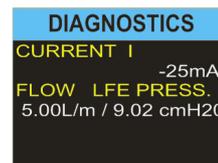


Blockage Retry

If the pump experiences an inlet blockage for more than 20 seconds it will automatically halt sampling. After one minute the pump may re-start. The number of restart attempts before the pump ends the current run is defined here.



Information: Access details of your Apex2 here: serial number and the firmware version loaded.

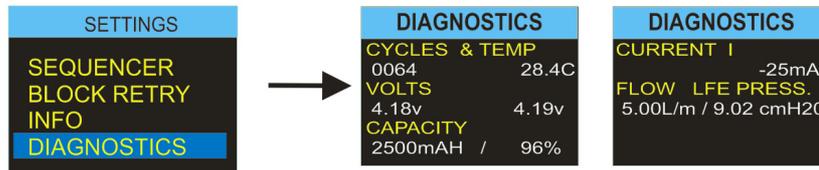


Diagnostics

These screens show a range of engineering parameters. Press $\leftarrow \rightarrow$ to toggle between the screens. This information is intended for routine maintenance and to aid speedy fault diagnosis. **See section 15 below**

15.0 Diagnostic Screens

The diagnostic screens provide information relating to the internal pump operation and battery management.

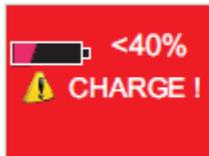


The data includes:

- Cycles** – The total number of charge cycles for the internal battery pack. Lithium Ion battery technology is a robust and high performance battery technology but like all batteries, the cells storage capacity will deteriorate with use and time. Typically, Lithium Ion cell technology specifies 350 to 600 full charge and discharge cycles based upon high charge and discharge rates. However, if the cells are not fully (deep) discharged during normal usage and are not subjected to extremes of temperature, a significantly greater cycle life should be achieved. Typically this is the region of 800 plus cycles. The battery technology and life is similar to that of a modern laptop P.C.
- Temp** – Battery pack temperature. This should remain within a 0 to 45C range during normal operation and charging.
- Volts** – Voltage of the battery cells – both cells should be in range of 3 to 4.2v and should remain within approximately 0.4 volts of each other.
- Capacity** – Battery storage capacity: This is the fuel gauge’s most recent estimation of the batteries storage capacity.
- Percentage** – Represents the batteries storage capacity relative to a brand new pack (2600mAH). <65% suggests battery aging or deterioration. Always fully cycle the battery before considering the capacity and percentage values.
- Current I** – Shows the present battery current. Typically 25mA at mid screen brightness.
- Flow / Pressure** – Shows the pumps current set flow rate and target control pressure. Typically if the pump is set to 5L/m the pressure should report 8 to 12cmH20

16.0 Warning Messages

The following warning messages are shown at power up. Any key press clears.



The following error messages may be displayed for other faults during normal sampling applications:-



Blockage Retry: If the pump cannot maintain the target flow rate within 5% for more than 20 seconds (due to say a kinked tube or inlet blockage) then it will automatically halt sampling. After one minute the pump will attempt to re-start. If the specified number of retry attempts are unsuccessful, the pump will terminate the current sampling run.

17.0 The Airwave App for Mobile Devices

The Airwave Application allows an instrument's status and measurement progress to be checked discretely without having to disturb the worker who may be performing a critical task or be inaccessible.

It must be installed on a suitable mobile device which supports Bluetooth® 4.0 connectivity and running Android operating systems version 4.3 or higher.

Please download the latest version of the Airwave App from the downloads section of the Apex2 web page <http://www.casellasolutions.com/productblahdeblah> (Correct link)

It is recommended that the Apex2 is placed in Lock Mode to discourage the wearer from tampering

Tap the  icon on your mobile device to open the Airwave App.

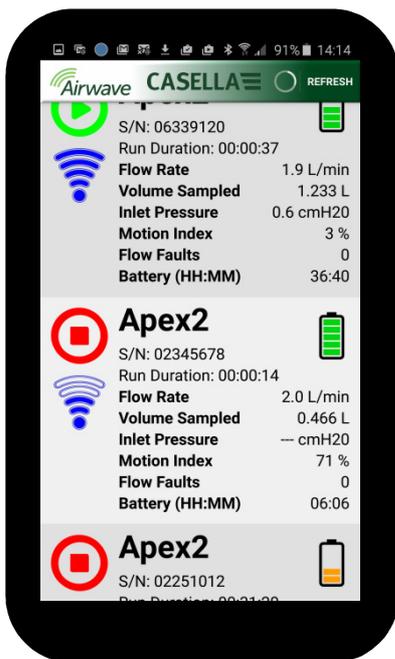
17.1 Bluetooth® Connection and Security

With Bluetooth® enabled, Airwave compatible products will always broadcast their basic status and dashboard data and will be visible on any number of local mobile devices running the Airwave App.

However, it should be noted that Airwave compatible instruments such as the Apex2 will only accept connection and control request from a single known or 'paired' mobile device. This prevents an 'unknown' mobile device making a connection and then interrupting an active measurement run.

To 'pair' a mobile device with a specific instrument, the Airwave App must be activated on that mobile device and then used to connect to an Apex2 pump whilst it is in 'Stop' mode. The identity of that last mobile device to connect during stop mode is saved within the Apex2 and only this mobile device can connect to the instrument whilst a run is active.

17.2 The Dashboard View



When the Airwave App is first opened it will automatically scan for any Casella Airwave compatible products within range (typically 25m line of sight with no solid obstructions in the path). For an instrument to appear in the list it must have the Bluetooth® feature enabled.

The dashboard provides a condensed 'snap shot' of the vital measurement data and status from all Airwave compatible instruments in range. Each instrument will update and broadcast its dashboard data approximately every 3 seconds.

To save power, the Airwave App stops scanning once all instruments within range have been detected. Press 'SCAN' in the top right of the mobile device display to rescan for new instruments.

17.3 The Control Panel Data



From the Dashboard view, 'tap' a specific instrument to initiate a direct connection with that instrument.

Whilst connected to an instrument a comprehensive set of measurement results will be displayed. It may be necessary to scroll up and down to view all the available data.

From the Control Panel it is also possible to Start, Stop or Pause a measurement run. Touch and hold the appropriate icon in the lower part of the mobile device's display for 3 seconds during which time a countdown will be displayed. Release at any time during the countdown to abort the operation.

17.4 Connection Menu



The MENU contains a number of options to facilitate the convenient transfer of the measurement results via the device's email or clipboard services.

18.0 The P.C Data Download Utility

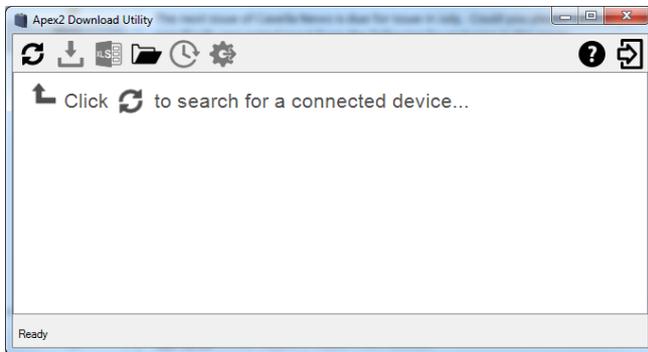
The Apex 2 data download utility application is freely available on our website at: <http://www.casellasolutions.com/support/software>

After downloading, run the setup.exe file to install the application.

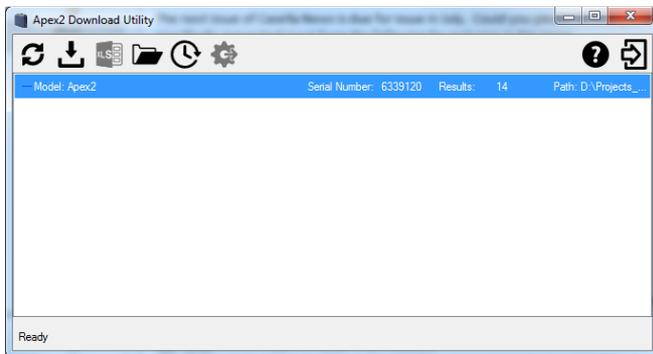
This utility is used to download Apex2 run data into an Excel compatible file format to allow you to collate data for your reports.

For downloading data from the Apex2 via the docking station, please refer also to Section 4

With the download application open, the docking station powered and connected to a USB port on your P.C, place a pump in the download pocket of the docking station.

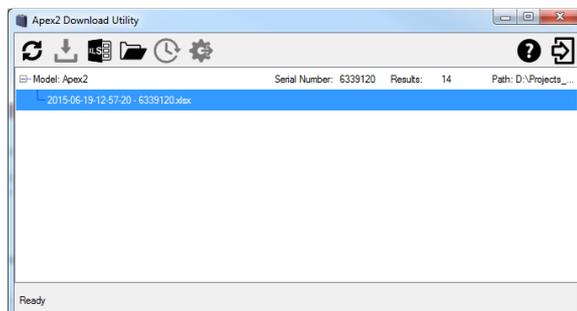
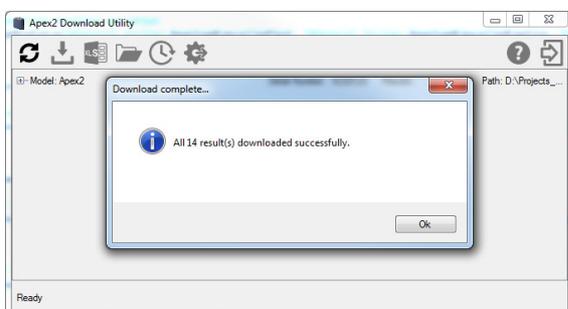


With the download application open, the docking station powered and connected to a USB port on your P.C, place a pump in the download pocket of the docking station. Click  to scan for the connected pump



 Select a destination folder to download your data file to.

Click the  icon to commence data downloading.



Data files may be opened directly in MS Excel.

19.0 Technical Specifications

| | |
|--------------------------|----------------------------|
| Flow Performance | |
| Flow Range ml/min | 1000-5000 |
| Low Flow Range ml/min | 5-500 |
| Flow Control | < ± 5% at calibrated point |
| Pulsation | <10% @ 2l/min |
| Back Pressure Capability | <i>see separate table</i> |
| Fault Detector | Auto Restart |
| | |
| Operating | |
| Display | Colour OLED |
| Controls | 4 buttons |
| Status Indicators | Red/Green LED |
| Dimensions | 112x37x102mm |
| Weight | 480g |
| | |
| Environmental | |
| Temperature | Operation, 0 - 45 °C |
| | Storage, -10 - 50 °C |
| Humidity | 30-95% RH (non-condensing) |
| Barometric Pressure | Auto-correcting |
| | |
| Electrical | |
| Battery Type | Li ion |
| Battery Level Indicator | Yes |
| Battery Life | >9hours |
| Chargers | <i>Single or 5-way</i> |
| Charge time | Typically <6hrs |
| | |
| Approvals | EN1232 Compliant |
| | ISO 13137 Compliant |
| | Ingress Protections: IP65 |

Flow Performance

| | |
|-----------|---|
| 5.0 l/min | 16" (41cm) H ₂ O for 8 hours |
| | 11" (28cm) H ₂ O for 9.6 hours |
| 4.0 l/min | 25" (64cm) H ₂ O for 8 hours |
| 3.0 l/min | 39" (101cm) H ₂ O for 8 hours |
| 2.0 l/min | 59" (150cm) H ₂ O for 8 hours |
| | 16" (40cm) H ₂ O for 26 hours |
| | 4" (10cm) H ₂ O for 26 hours |
| 1.0 l/min | 96" (240cm) H ₂ O for 8 hours |

20.0 Declarations

WIRELESS BLUETOOTH 4.0 CONNECTIVITY

All models support wireless connection via Bluetooth® 4.0 (Low energy or Smart). This connectivity is compatible with mobile and PC devices that support Bluetooth® 4.0 only.

TX power: 0 dBm to -23 dBm
 Receiver sensitivity: -93 dBm
 Range: Typically >25m line-of-sight and depending on local RF conditions.

The instrument contains a Bluetooth® Low energy wireless transmission module, **BLE113** from Bluegiga technologies. The Bluetooth® Qualified Design IDs for this module are:-

Bluetooth Controller QDID: B021015, **Bluetooth Smart Software:** QDID B018942

Copies of the modules regional approvals certificates may be obtained from Casella or Bluegiga.



This product contains an FCC and Industry Canada certified Bluetooth® Low energy wireless transmission module:-

FCC IDENTIFIER: QOQBLE113
Industry Canada IC:5123A-BGTBLE113(Single)

Producer: BlueGiga Technologies Inc.
 Model: BLE113 Bluetooth smart module
 Modular Type: Single Modular

FCC CONFORMITY STATEMENT

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation

RADIATION EXPOSURE STATEMENT:

The product complies with the FCC portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual.

**CE DECLARATION OF CONFORMITY**

Casella declares that this product is in compliance with the essential requirements and other relevant provisions of applicable EC directives. A copy of the EU Declaration of Conformity for this product may be obtained by clicking on the Product compliance documentation link at www.casellasolutions.com.

**WEEE - INFORMATION FOR EU MEMBER-STATES ONLY**

The use of the WEEE symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about recycling of this product, please contact your local waste disposal service or contact the agent where you purchased the product.

21.0 Frequently Asked Questions

1. What is the difference between the Standard, Plus and Pro models?

We recognise that different users have different requirements and that is why we have created 3 different models. Please see the table below for further details. If you just want a basic version of the pump, i.e. without Bluetooth® and programming BUT with the same GREAT PERFORMANCE the Apex2 standard is the pump you need but if you would like greater functionality including the ability to remotely view the worker, please review the options.

| | Apex2 | Apex2 Plus | Apex2 Pro |
|--------------------------|--------------------|--------------|--------------|
| Flow Range ml/min | 500-5000 | 500-5000 | 500-5000 |
| Back Pressure Capability | See Separate Table | | |
| Battery | Li Ion | Li Ion | Li Ion |
| Battery Life | >9hrs* | >9hrs* | >9hrs* |
| Display Type | Colour | Colour | Colour |
| Motion Sensor | ✓ | ✓ | ✓ |
| Bag Outlet | ✓ | ✓ | ✓ |
| User Lock | ✓ | ✓ | ✓ |
| Pump Status Indicator | ✓ | ✓ | ✓ |
| Fuel Gauge | Battery level icon | **Fuel Gauge | **Fuel Gauge |
| Bluetooth® Wireless | .. | ✓ | ✓ |
| Airwave Mobile App | .. | ✓ | ✓ |
| PC Download | .. | ✓ | ✓ |
| Run Duration Programme | .. | ✓ | ✓ |
| Delay Timer Programme | .. | .. | ✓ |
| Timer Programme | .. | .. | ✓ |
| TWA Mode | .. | .. | ✓ |

* Depending on flow rate and media

**The fuel gauge gives estimated usage based on parameters from the current/last run

The fuel gauge will show estimated run duration based on current mode – ie it will be much longer when stopped.

2. I would like to upgrade models is this possible?

If you have bought a Plus Model but would like greater programming and timer capability it is possible to upgrade the firmware. Please contact salesupport@casellasolutions.com. If you have bought the Standard Apex2, this is not possible.

3. What program options are there for the Apex2?

With the Apex2 Plus model you can set 'Run Duration'. This means that the pump will run for the designated time you choose, say 8 hours, from when the pump is started.

The Apex2 Pro has 'Run Duration' and other options. This includes a 'Timer' facility where you indicate a start and a finish time for a particular day. Also there is a 'TWA' mode. This means 'Time Weighted Average' and allows the pump to operate for a fixed percentage of a specified sample time. The Apex2 calculates the required on/off cycle automatically to spread the total exposure time over the entire sample time.

Table showing the programming options for the Apex2

| | Apex2 | Apex2 Plus | Apex2 Pro |
|------------------------|-------|------------|-----------|
| PC Download | .. | ✓ | ✓ |
| Run Duration Programme | .. | ✓ | ✓ |
| Delay Timer Programme | .. | .. | ✓ |
| Timer Programme | .. | .. | ✓ |
| TWA Mode | .. | .. | ✓ |

4. Is there an intrinsically safe version?

Casella has a long history of producing intrinsically safe equipment. The Apex2 is no exception and has been specifically designed to be capable of meeting the very latest revisions of the IEC standard. Certification is expected within 6 months of launch.

5. Will there be a model suitable for the mining industry?

Absolutely! As with the I.S. version, the Apex2 has been specifically designed to meet the latest ATEX standards. Certification is expected within 6 months of launch. The Mining model will have similar functionality to the standard Apex2 but with the addition of a Motion Sensor and the ability to download run data.

6. What is the recommended service interval for the Apex2?

Casella recommends annual factory maintenance and recalibration for accurate and reliable operation. The Apex2 pump logs usage and a reminder will appear after 2500 hours if this comes sooner than 1 year. For further information about servicing, please contact salesupport@casellasolutions.com

7. How do I know what filters and accessories I need for my application?

Filters and accessories do depend very much on your application. Please visit <http://www.airsamplingsolutions.com> or contact info@casellasolutions.com for further information. The website has a hazard search which returns recommended methods and the equipment required.

8. Why include a motion sensor?

Sometimes workers are resistant to being monitored and feel that wearing the pump hampers their work. There have been examples of workers taking the equipment off and leaving it running in a cupboard and picking it up again at the end of a shift to hand it in to the Occupational Hygienist. The motion sensor tracks the amount of movement and gives an index to the Occupational Hygienist who can then tell if the sample is a valid one. If the pump has not been moving all day, it's quite likely it's been taken off.

9. Is wearer acceptance a problem then?

It can be – workers' may not always see the benefit of being monitored and only see that wearing a pump will be an unnecessary encumbrance rather than the long term goal of protecting their health. To try and combat this, the Apex2 has been designed to be less obtrusive to the wearer. It's a smaller, slimmer, lighter design which makes moving around easier: sitting, standing, climbing. The sturdy clip can be fitted to a variety of belts and harnesses and the rubber boot guards against knocks and rough treatment.

10. What is the battery life and charge time and what's the benefit?)

The Apex2 incorporates Li Ion batteries for greater battery life. You can be confident that you can get to the end of the shift without running out of charge. Battery life does depend on the application and factors like the flow rate and the back pressure must be taken into account. It is difficult to give a definitive answer as to 'how long will the charge last' because it does depend on the individual sample. We can only give guidance.

11. What is the pulsation value and why is it so important?

When choosing a pump, you should ensure that the pulsation value given is <10% to ensure confidence in your results. (ISO13137)

Pulsations in air flow can affect the size cut performance of size selective sampling heads such as cyclones. Pulsations can also make the filter vibrate which means there is a potential to lose sample. There is also evidence that pulsation may affect low flow gas/vapour sampling in retention of sample.

With every cycle of the pump air is drawn in and then exhausted. The resulting air flow will not be completely smooth and includes an alternating, or pulsating component due to the pumps rotation. The Pulsation performance is expressed as the ratio of the pulsating components amplitude to the mean (steady) flow rate. A

smaller pulsation ratio percentage indicates a smoother flow of air. The Apex2 incorporates an elastomeric cavity to absorb and minimize these flow pulsations.

12. What is the flow control and why is that so important?

During the sample run a number of factors can slow the pump, e.g. a loaded filter or the voltage across the battery dropping which means that the flow rate would drop also. If this happens you would not know for sure the volume of air drawn through the pump over the sampling period and this would affect the accuracy of your results. The Apex2 has flow control built into the circuitry so that it monitors and maintains flow accuracy meaning that you have confidence in your calculations.

The Apex2 conforms to ISO13137:2013 which states that flow control be $\pm 5\%$ for ambient temperatures $+5$ to 40°C and pressures of 850 to 1255mBar. This is the international standard specifying performance requirements for personal sampling pump and it is vital that your personal sampling pump conforms to this standard.

13. What is back pressure?

This is the resistance to flow caused by the filter media as opposed to free flow of air through the pump (like having a sock over your vacuum cleaner, the pump has to work a bit harder!) It is measured in inches or cm of water. The smaller the pore size of your filter, the greater the back pressure and the harder the pump has to work. As well as being a drain on the battery the pump needs to be powerful enough overcome the resistance. Another factor is the flow rate and it is the combination of flow rate and filter media that determines the back pressure.

Having a pump that is capable of dealing with a wide variety of flow rates and filter media is really important and the Apex2 has class beating back pressure capability. Please see the below table for typical back pressures exerted by particular filter media.

| Flow Rate ml/min | 25mm MCE/0.8 | | 25mm MCE/0.45 | | 37mm MCE/0.8 | | 37mm PVC/5.0 | | 37mm polycarb/0.45 | | 37mm ptfe/1.0 | |
|------------------|--------------|-------|---------------|--------|--------------|-------|--------------|-------|--------------------|-------|---------------|-------|
| | inches | cm | inches | cm | inches | cm | inches | cm | inches | cm | inches | cm |
| 1000 | 6 | 15.24 | 14 | 35.56 | 2 | 5.08 | 1 | 2.54 | 4 | 10.16 | 1.5 | 3.81 |
| 1500 | 9 | 22.86 | 22 | 55.88 | 3 | 7.62 | 1 | 2.54 | 6 | 15.24 | 2.5 | 6.35 |
| 2000 | 12 | 30.48 | 28 | 71.12 | 4 | 10.16 | 2 | 5.08 | 8 | 20.32 | 4 | 10.16 |
| 2500 | 15 | 38.1 | 35 | 88.9 | 5 | 12.7 | 2 | 5.08 | 10 | 25.4 | 5.5 | 13.97 |
| 3000 | 18 | 45.72 | 40 | 101.6 | 6 | 15.24 | 2.5 | 6.35 | 12 | 30.48 | 7 | 17.78 |
| 3500 | 21 | 53.34 | 44 | 111.76 | 7 | 17.78 | 3 | 7.62 | 15 | 38.1 | 8 | 20.32 |
| 4000 | 25 | 63.5 | 50 | 127 | 9 | 22.86 | 3 | 7.62 | 17 | 43.18 | 9.5 | 24.13 |
| 5000 | 31 | 78.74 | 63 | 160.02 | 11 | 27.94 | 4 | 10.16 | 21 | 53.34 | 12 | 30.48 |

22.0 Servicing, Maintenance & Support

22.1 Servicing

Casella's in house service department offers a comprehensive range of repair and calibration services designed to maintain a fast and efficient back-up for all our products. The Service Department is operated under the scope of our BSI registration for products manufactured by us. We will however, undertake the repair of other manufacturer's equipment.

For further information please contact our service department at our UK headquarters salesupport@casellasolutions.com or via approved servicing distributors. We will be happy to provide quotations for individual repairs or provide annual maintenance under contract.

22.2 Maintenance

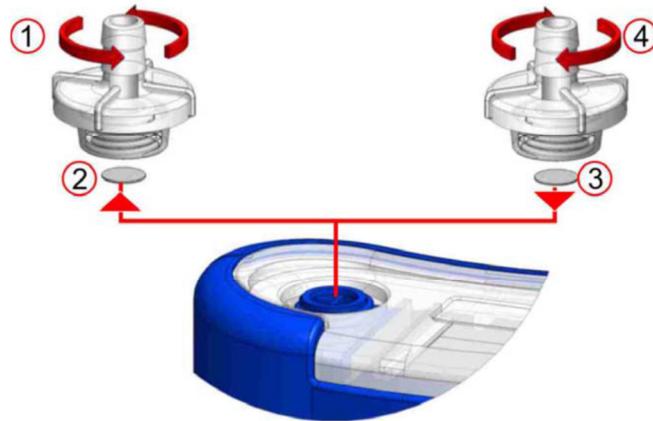
The Apex2 Personal Air Sampling Pump is designed to provide long and reliable service. Routine maintenance should be minimal.

-  Avoid leaving the battery pack in a discharged condition for extended durations
-  Do not operate without an inlet filter. Ingested dirt and dust particles may cause internal damage, malfunction or erratic flow
-  Replace the inlet filters regularly
-  Keep the instrument body clean

22.3 Renewing the Inlet Filter

The filter element should be replaced every 3 months. The pump running time and the operating environment can reduce this time considerably.

- 7.1 Remove the inlet nozzle
- 7.2 Discard the filter element
- 7.3 Fit a new filter element
- 7.4 Fit and tighten the Inlet nozzle, hand tight only.



22.4 Further Support

Please visit our website <http://www.casellasolutions.com> or email us at salesupport@casellasolutions.com

23.0 Part Numbers and Accessories.

| | |
|--------------------------|--|
| Apex2 Models | |
| Apex2 | Apex2 Standard Pump |
| Apex2Plus | Apex2 Plus Pump |
| Apex2Pro | Apex2 Pro Pump |
| Apex2 Accessories | |
| 209055b/KIT | Single Docking Station for Apex2 Pump inc. PSU & USB Cable |
| 209058b/KIT | 5-Way Docking Station for Apex2 Pump inc. PSU & USB Cable |
| 209025C | Protective Rubber Boot |
| Apex2 Kits | |
| APEX2KIT | 5-Way Apex2 Standard Kit |
| APEX2PLUSKIT | 5-Way Apex2 Plus Kit |
| APEX2PROKIT | 5-Way Apex2 Pro Kit |