

USER MANUAL



Digital Flow Meter

HB4087-04

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Casella Holdings Limited
Regent House
Wolseley Road
Kempston, Bedford
MK42 7JY, UK

Phone: +44 1234 844100
E-mail: info@casellasolutions.com
Web: www.casellasolutions.com

TSI Incorporated
500 Cardigan Road
Shoreview MN, 55126
USA

Phone: +1 800 366 2966
Email: info-us@casellasolutions.com
Web: www.casellasolutions.com

TSI Instruments India Pvt Ltd
Office No. 1203, 12th Floor,
Eros Corporate Park, IMT, Manesar,
Sector 2, Gurugram, Haryana 122050,
India

Phone: +91 124 4495100
Email: rajeshjoshi@casellasolutions.com
Website: www.casellasolutions.com

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Flow Detective

Safety and warnings

The Flow Detective does not present a safety risk when you use it as instructed in this User Manual. However, it is possible that the environment where you use the instrument may present a safety risk. For this reason, always follow correct, safe working practices.



CAUTION

The Flow Detective is designed to be robust, however please use the unit as follows:

- Do not drop the flow meter or subject it to mechanical shock.
- Avoid letting the flow meter suck in water, solid materials or corrosive gases as this may cause damage and will invalidate the warranty.
- The Flow Detective contains no user serviceable parts. If a fault is suspected, return the unit to Casella or a Casella approved service centre.



CAUTION

If the equipment is likely to come into contact with aggressive substances, take precautions to prevent the instrument from being adversely affected, so that the type of protection is not compromised. Aggressive substances such as solvents may affect polymeric materials. Regular checks should be carried out to ensure no damage has occurred.



CAUTION

Repair of this equipment shall only be carried out by the manufacturer or an authorised representative in accordance with the applicable code of practice.



CAUTION

When Bluetooth® is enabled, care must be taken to avoid interference with sensitive equipment such as in medical, aviation or safety critical environments.

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.

Flow Detective

Disclaimer

Do not use the Flow Detective until you have thoroughly read this manual or have been instructed by a Casella engineer.

At the time of writing, this manual was 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 please contact Casella for clarification.

Casella makes continual advancements in its products and services. We therefore 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.

Flow Detective

Introduction

The Flow Detective is the latest generation of digital flow meters for the accurate calibration of personal sampling pumps and other equivalent devices.

The Flow Detective is small and robust with no moving parts and with the inbuilt Li ion battery the unit will run for 70 hours between charges.

The Flow Detective has two separate models, the Standard model is a flow meter for medium flow air sampling pumps (0.5 – 5L/min). This can be used to calibrate pumps by noting the values from the display accordingly. The Plus model has Bluetooth connectivity to the Airwave App. After calibration, the App will allow calibration data to be sent via email for easy record keeping. When used to calibrate the Apex2 pump, this has the further benefit that Airwave will control both the Apex2 and Flow Detective and automatically calibrate to selected flow rates, making calibration very quick.

Flow Detective Plus models will also allow calibration at lower flows (20mL – 0.5L/min) used for gas and vapour sampling for sorbent tubes.

A unique feature of the Flow Detective is pulsation detection. This is important because in ISO13137, the international standard for air sampling pumps, it stipulates that pulsation must be below 10%. Pulsation is important for stable flow, especially when using cyclone sampling heads to ensure an accurate size cut. The Flow Detective is the only flow meter on the market to detect pulsation and display if levels are over 10%.

The following table summarises the features and capabilities of the Flow Detective models.

| Feature | Flow Detective | Flow Detective Plus |
|--|----------------|---------------------|
| Standard or Actual flow | ✓ | ✓ |
| Pulsation detection | ✓ | ✓ |
| Flow rate to 5L/min | ✓ | ✓ |
| Low flow calibration (<0.5L/min) | | ✓ |
| Bluetooth connectivity® | | ✓ |
| Closed loop calibration with Apex2 pumps | | ✓ |

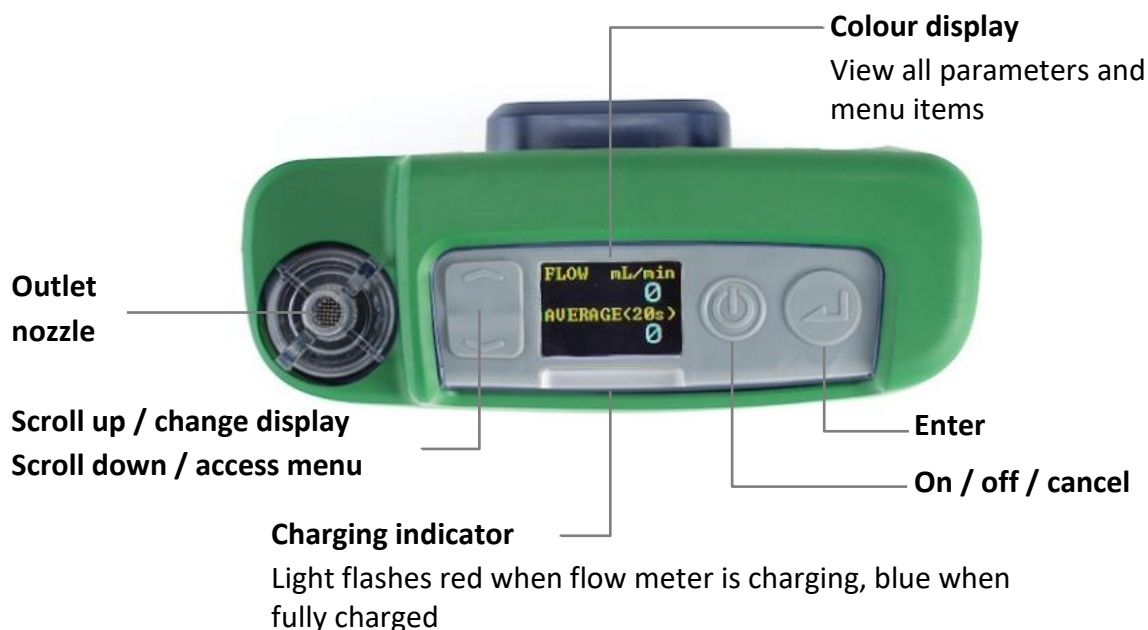


Flow Detective

Controls and fittings

The Flow Detective has a limited number of easy to use controls which are summarised below.

Controls and menu structure



Note: The air inlet is located on the back of the Flow Detective under the clip. Ensure the inlet is not blocked.



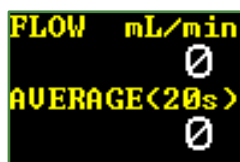
The up / down arrows, which are used to scroll through menu and setting items and also to change values.



The On / Off button, which is used to turn the flow meter on and off, and to return to a previous screen.



The enter key, which is used to enter sub-menu items and to save changed values.



This is the flow dashboard screen that displays after you turn on the flow meter.

Please note that the instantaneous flow does not display in low flow mode.



This is the menu that you use on a regular basis to change settings.

Protective boot

Ensure the protective boot (green in colour) is fitted at all times as it helps to guard against knocks.

If you need to decontaminate the flow meter, remove the boot temporarily.



Note: The green rubber boot must not be fitted to intrinsically safe (I.S.) Apex2 units as this will invalidate the I.S. certification of the Apex2.

Flow Detective

Operation

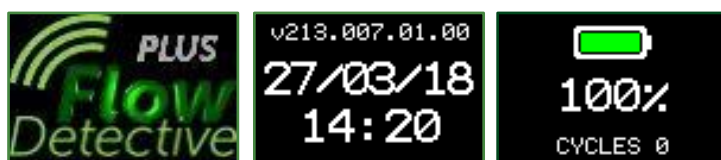
This section describes how to use the flow meter using the minimum of settings. The Flow Detective has many other menu and settings options and these are described in a later chapter.

Turn the Flow Detective on/off

To turn on the Flow Detective:

On the top of the flow meter, press .


The following sequence is displayed. The second display shows the currently set time and date as well as the firmware version. The battery charge state is then shown.

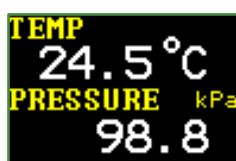


This is followed by the dashboard screen, showing instant and average flow. From this point when air is run through the flowmeter it will display instantaneous and average flow as shown on the dashboard screen below.

Instantaneous flow is not displayed when utilising low flow mode.



Press  to switch between the flow display and the environmental display shown below:



To turn off the flow meter:

On the top of the flow meter, press and hold  until the countdown has finished and the screen goes blank.



Charge the Flow Detective battery

Before using the Flow Detective, check the battery level icon or battery gauge to ensure there is enough charge for the intended measurements. The flow detective will run for 70

Flow Detective

hours from a single charge so charging is not required on a regular basis. If the Flow Detective is not used for extended periods of time, such as several months, it is recommended that the unit is still charged periodically.

To check the battery level:

1. Turn on the Flow Detective as described above.
2. Check the battery level, which will show as a percentage during the start-up screens.
3. Turn off the Flow Detective as necessary.




The Flow Detective is supplied with a single charger station and power supply. A USB cable for upgrading firmware of the unit is also supplied.

Note: A fully charged battery will last in excess of 70 hours of continuous operation.

To charge the flow meter battery:

1. Ensure that the Flow Detective is switched off.
2. Place the flowmeter on a charging station.

The red light on the top of the Flow Detective flashes during the whole of the charging time and the charge state is displayed for a user defined period.

3. To see the amount of charge at any time press .

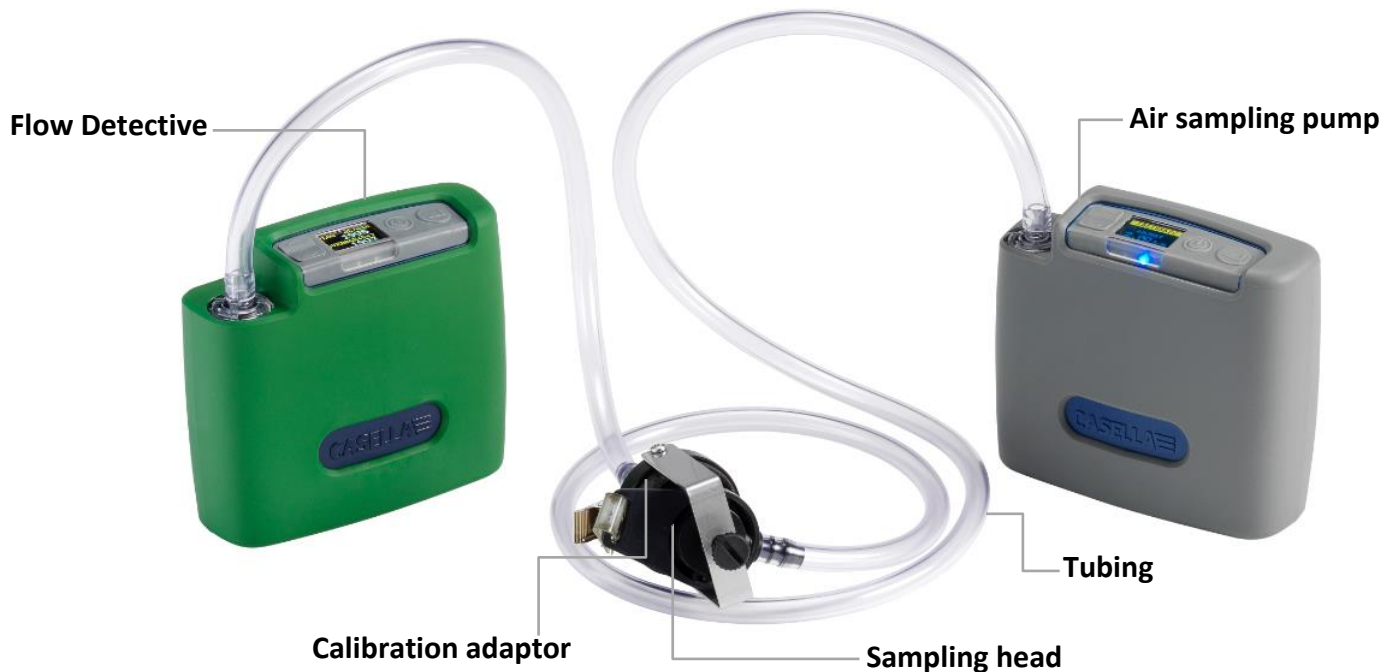
Once fully charged the blue light turns on for 10 minutes, after which time the flowmeter turns off.



Flow Detective


Assemble the sample train

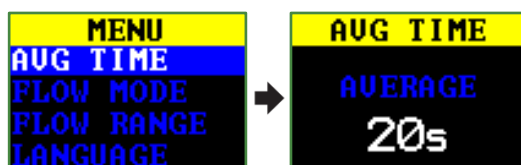
The sample train consists of the air sampling pump, air sampling head with a filter as well as the necessary tubing. The pump should not be calibrated by itself, the sample train as a whole is used to ensure the whole system is sound and leak free, including having the filter already inserted in the sampling head. This all needs connecting to the flowmeter as shown below.







Manual pump calibration

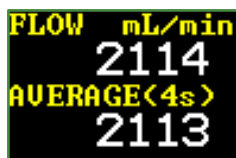
Manual pump calibration is to use the Flow Detective with a standard pump from any manufacturer and uses the display of the Flow Detective to view the flow.

1. Switch the pump on and navigate the correct location for calibration on the pump – see the instructions for the air sampling pump for more information.
2. Navigate to **AVG TIME** by pressing  from the measurement screen, and then press




Flow Detective

- Press  or  to change the averaging time as desired, and then press . Press  to return to the flow display.
- With the sampling pump running adjust the flow on the pump until the desired flow is shown on the Flow Detective.



FLOW mL/min
2114
AVERAGE<4s>
2113

- Once the flow is stable and at the desired flow, make a note of the average flow value.
- Average flow levels can be reset at any time by holding .

Pulsation indicator

As pumps generally use a moving diaphragm, this creates fluctuations in the flow rate on a pump. As sampling heads like cyclones rely on a steady flow to maintain a specific size cut, it is important for pulsation to be as small as possible. The Flow Detective displays a red indicator if pulsation is above 10% as shown below.



FLOW  mL/min
863
AVERAGE<1s>
886

It is a requirement for medium flow pumps to maintain pulsation below 11% under ISO13137, where medium flow ('P' type) pumps have a flow rate of 1 - 5L/min.

For low flow pumps ('G' type) used for low flow sampling of gases and vapour, there is no requirement to keep pulsation below 11%. However, the pulsation indicator still provides indication that flow may be unstable which would indicate if the Flow Detective is displaying accurately.

For this reason, instantaneous flow is not displayed on low flow mode, only the averaging value.

It is always essential to calibrate with the sampling media as part of the sample train. This is particularly important at low flow, where an adsorbent tube is required, which is designed to smooth the flow rate, preventing pulsation and allowing for an accurate average flow measurement by the Flow Detective.

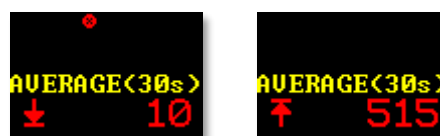
Note: Pulsation must be below 11% with the full sample train in place and does NOT need to be below 11% if the flow meter is connected directly to the pump.

Over/Under Range Indication

The flow detective indicates clearly when the average flow rate measurement is outside of the selected range (low flow or normal flow).

Low flow range:

The low flow range accommodates for a flow of between 20ml/min and 500ml/min. As shown below, if the average flow is below 10ml/min it will show a static average value in red with an arrow that signifies it is under range. If the average flow measurement is above 515ml/min then it will display a static value in red with an up facing arrow to show it is over the selected range.



Normal flow range:

The normal flow range accommodates for a flow of between 500ml/min and 5000ml/min. As shown below, if the average flow is below 490ml/min it will show a static average value in red with an arrow that signifies it is under range. If the average flow measurement is above 5100ml/min then it will display a static value in red with an up facing arrow to show it is over the selected range.



Flow Detective

Wireless calibration using Airwave App

The Airwave App can wirelessly connect to the Flow Detective (Plus model), which allows any manufacturers pump to be calibrated and the calibration data sent via the email client of the mobile device. Airwave is a free to download App for iOS and Android and is available from Google Play and Apple App Store. Firstly, assemble the sample train as per the section above and ensure your pump and the Flow Detective are switched on.

Note: To perform wireless calibration Bluetooth will need to be connected, see [Bluetooth](#)

When using Airwave the calibration is separated into two methods, 'calibration' and 'post check'.

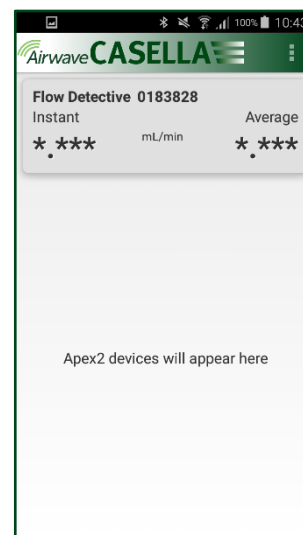
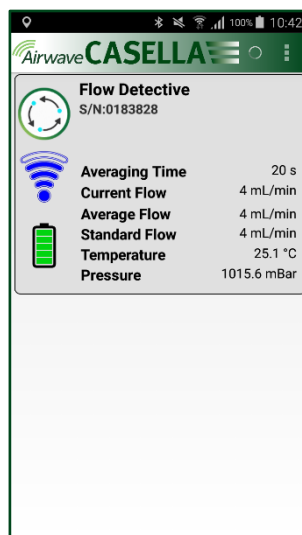
Calibration:

This option should be checked prior if you are calibrating the pump prior to doing the air sampling measurement. The pump should be adjusted to the desired flow rate and the **Calibration** option checked in Step 2 below. When emailing from Airwave data will be tagged that it is a 'Calibration' so it can be identified as being prior to the measurement.

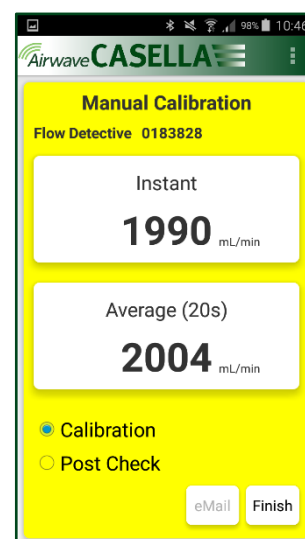
Post Check:

This option is to be checked after the measurement run, to check the deviation of the flow compared to the 'calibration' before the measurement. Select **Post Check** in Step 2 below, do not adjust the flow of the pump but wait until the flow from the pump is steady. Standards stipulate that the flow after sampling (i.e. at 'Post Check') should be within 5% of the flow before the measurement (i.e. at 'Calibration').

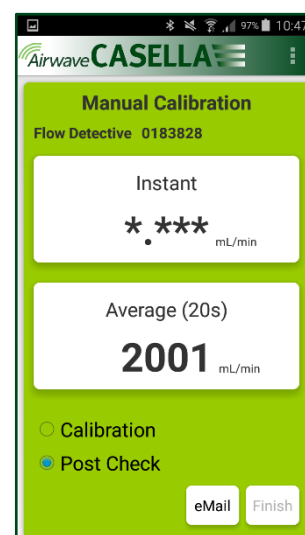
1. Open Airwave on your mobile device. Any Flow Detective (Plus model) in range that is switched on will be displayed. Select the Flow Detective on both displays shown to enter manual calibration mode.



- The manual calibration screen will then be displayed. If the calibration required is before sampling select **Calibration**, then adjust the flow on the pump until the desired steady level is reached. Press **Finish** to stop calibration. If you are checking to see the deviation of flow after your measurement, select **Post Check**. With the pump running wait until the average flow has stabilised but do not adjust the flow rate of the pump. Press **Finish** to stop the post run check.



- The background on the Airwave screen will go green to show calibration is complete. Press **eMail** to email calibration data using your mobile device's email client. The content of the email will reflect if is a 'calibration' or a 'post check'. Before the email is sent, details of the pump, its serial number and sample information can be entered.
- To calibrate another pump, connect the sample train and repeat from step 2.



Flow Detective


Wireless calibration of Casella Pumps using Airwave App

The Airwave App can wirelessly connect to the Flow Detective and Casella's personal sampling pumps (Apex2 and VAPex) simultaneously. This will allow calibration of the pumps without having to access the menus on the pump at all, saving time in calibration. Firstly, assemble the sample train as per the section above and ensure both the pump (VAPex or Apex2) and the Flow Detective units are switched on.

Note: To perform wireless calibration, Bluetooth will need to be available and enabled on your pumps and on the Flow Detective. Not all Casella models provide bluetooth functionality. The bluetooth functionality is available on Apex2 (Plus and Pro only), VAPex (Pro only) and Flow Detective (Plus only).

When using Airwave the calibration is separated into two methods, 'calibration' and 'post check'.

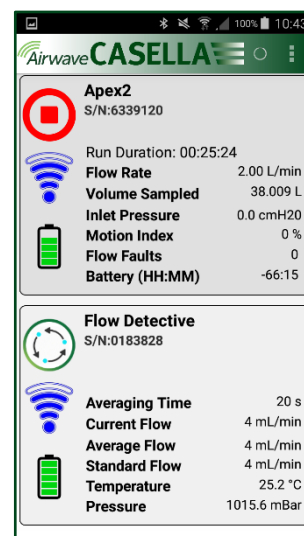
Calibration:

This option should be checked prior if you are calibrating the pump prior to doing the air sampling measurement. Airwave will automatically adjust the flow rate of the pump to the desired flow rate when the  **Calibration** option is checked in Step 2 below. When emailing data from Airwave, data will be tagged that it is a 'Calibration' so it can be identified as being prior to the measurement.


Post Check:

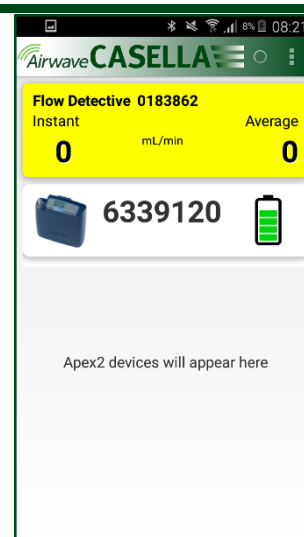
This option is to be checked after the measurement run, to check the deviation of the flow compared to the 'calibration' before the measurement. When using 'Post Check' in Step 2 below, Airwave will measure the flow level without adjusting it. Standards stipulate that the flow after sampling (i.e. at 'Post Check') should be within 5% of the flow before the measurement (i.e. at 'Calibration').

1. The Flow Detective and any available Casella pumps will be shown on the dashboard screen. Select the Flow Detective.

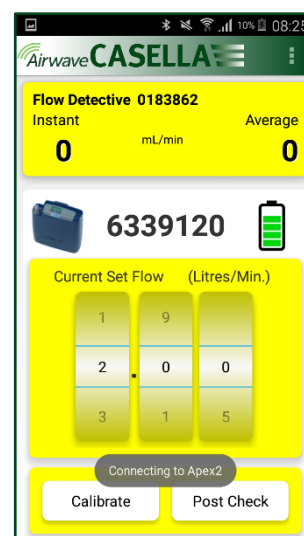


Flow Detective

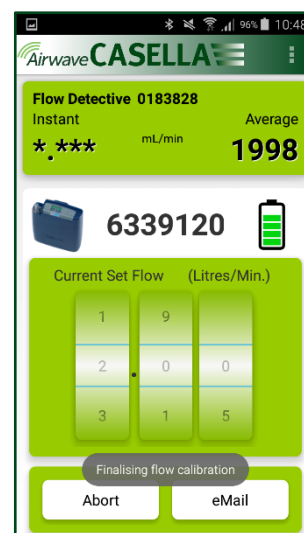
2. A list of available Casella pumps will be shown, identifiable by its serial number. Select the Apex2 in this instance. If the correct Apex2 is not shown, ensure the pump is switched on, with Bluetooth enabled and click 'scan' from the menu . Any newly discovered Apex2s will then be displayed in the list.



3. Once connected to the Apex2, the area around the flow adjustment turns yellow. Then set the flow rate by rotating the scroll wheels as shown right. This will change the flow rate set on the pump. Then press **Calibrate** to begin calibration. Click 'Abort' to stop the calibration.



4. The Apex2 will now be automatically calibrated by the Flow Detective. Airwave will determine once the flow is steady and automatically complete the calibration. Once complete the screen background will turn green. Calibration data can then be emailed as necessary by pressing **eMail**.



5. Press 'Back' once calibration is complete to select another pump for calibration.
6. Follow the same above steps if you wish to calibrate VAPex using Flow Detective.

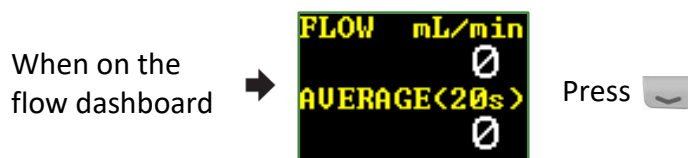
Note: If a 'post check' has been performed on an Apex2 that has previously been through 'calibration', emailed data will be shown with calculated Flow Deviation (%) and Corrected Flow values.

Flow Detective

Settings menu



This section describes the settings you may wish, or need, to alter and it describes how to access system information you may be asked for by a service or support technician.



To access the **SETTINGS** menu:



The menu will then be shown:



Press  or  to scroll to any of the following settings options.

Press  to enter/save a setting or move between values, and press  to go back without saving changes.

Note: If no buttons are pressed when in the settings menu for a certain amount of time, the unit will exit the settings menu and default back to the flow dashboard screen.

Averaging time

Set the averaging time of the measurement. This can be set from 1s to 60s.



Flow mode

Switches between standard or actual flow. Note: Standard flow mode states all flows to atmospheric conditions at the point the Flow Detective was calibrated. See calibration certificate for temperature and pressure values.



Note: For normal operation and pump calibration for air sampling, use actual flow.

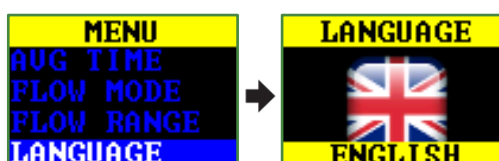
Flow range

Set the flow range accordingly, Normal (0.5 – 5L/min) or Low (20 – 500mL/min). Low flow range is in Plus model only.



Language

Supported languages include English, Brazilian Portuguese, Spanish, Italian, German, French and Chinese.



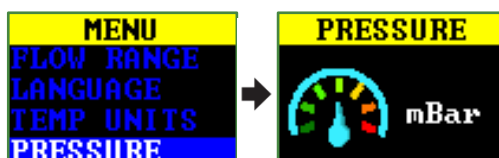
Temperature units

Change temperature units from Celsius (C), Fahrenheit (F) or Kelvin (K).



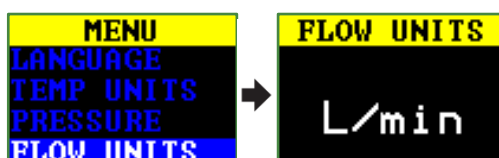
Pressure units

Pressure unit scan be changed between mBar, psi, kPa, mmHg, "H₂O or cmH₂O.



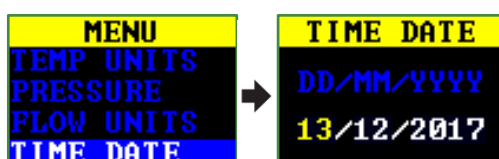
Flow units

Allows flow to be displayed in L/min, mL/min, cF/min or cc/min as necessary.



Time and date

Changes the date and then time using the scroll up/down and enter key.



Contrast

You may want to adjust the screen contrast for low light conditions.



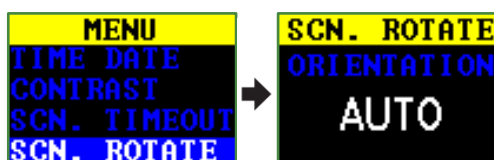
Screen timeout

Use a screen timeout if you want to save power. Once the screen is off, press any key to turn it on again.



Screen rotation

Allows the screen to rotate 180° when the unit is held horizontally and rotated.



Bluetooth

Enable or disable Bluetooth (Plus model only. You need to enable Bluetooth when using the Airwave App)



Information

Use this to see the instrument serial number as well as the firmware version.



Diagnostics

This information is intended for routine maintenance and fault diagnosis. A second diagnostics screen is available to display further information on current and flow by pressing enter.



Technical specifications

| General | |
|----------------------------------|---|
| Flow Measurement Range mL/min | Normal range: 500 to 5,000 Low flow range: 20 to 500 |
| Flow Accuracy | < $\pm 2\%$ from 500 to 5000mL/min $\pm 0.8\%$ of reading $\pm 0.2\%$ FSD from 20mL to 500mL/min |
| Pulsation Indicator | Flashes when pulsation is >10% |
| Flow Modes | Standard or Actual Flow |
| Averaging Time | 5 to 60 seconds |

| Physical | |
|------------|---|
| Display | Colour OLED |
| Controls | 4 buttons |
| Dimensions | 112 x 37 x 102 mm (4.41 x 1.46 x 4.02 inches) |
| Weight | 372g (including boot) |

| Environmental | |
|---------------------|-------------------------------|
| Temperature | Operation, 0 to 45°C |
| | Storage, -10 to 50°C |
| Humidity | 30 to 95% RH (non-condensing) |
| Barometric Pressure | Auto-correcting |
| Temperature Sensor | Accurate to better than 1% |
| Pressure Sensor | Accurate to better than 3% |

| Electrical | |
|-------------------------|---------------------|
| Battery Type | Rechargeable Li ion |
| Battery Level Indicator | Yes |
| Battery Life | >70 hours |
| Charge Time | <6 hours |
| Battery Cycles | >1000 cycles |

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 support section 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.

Servicing, maintenance and support

Servicing

The Flow Detective contains no user serviceable parts and if a fault is suspected, return to Casella or a Casella approved service centre.

The warranty DOES NOT extend to cleaning or general servicing of the instrument. For details of the warranty, please visit our [Terms and Conditions](#).

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 in accordance with our BSI registration for products manufactured by us.

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

Maintenance

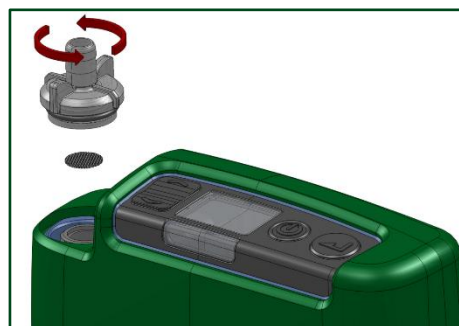
The Flow Detective is designed to provide long and reliable service. Routine maintenance should be minimal.

- Avoid leaving the battery pack in a discharged condition for extended periods.
- Do not operate without an outlet filter. Dirt and dust particles may cause internal damage, malfunction or erratic flow.
- Replace the outlet filter if damage or blocked.
- Keep the instrument body clean.

Replacing the outlet filter

To replace the outlet filter:

1. Unscrew and remove the outlet nozzle.
2. Discard the filter element.
3. Fit a new filter element and ensure it is centrally located to achieve a good seal.
4. Refit and hand-tighten the outlet nozzle. Do not overtighten.



Flow Detective

Support

For technical support, please log your query on our online system at:

<https://helpdesk.casellasolutions.com>

Error messages

There are no common error messages displayed on the Flow Detective. However, under very rare circumstances an electrostatic discharge event can cause the internal sensors to halt (the measured flow rate may appear to freeze). If this occurs, then switch the unit off and back on in order to recover full functionality.

Part numbers and accessories

| Flow Detective Part Numbers | Description |
|-----------------------------|---|
| Flowdetective | Flow Detective Standard Instrument, 1m Tygon tube, protective rubber boot, field guide and calibration certificate. |
| Flowdetectiveplus | Flow Detective Plus Instrument, 1m Tygon tube, protective rubber boot, field guide and calibration certificate. |

| Flow Detective Kit Part Numbers | Description |
|---------------------------------|---|
| Flowdetectivekit | Kit includes Flow Detective, kit case, charger and calibration adaptor |
| Flowdetectivepluskit | Kit includes Flow Detective Plus, kit case, charger and calibration adaptor |

| Accessory Part Numbers | Description |
|------------------------|--|
| 209152B/KIT | Single Charging Station for the Flow Detective including PSU |
| 213026D | Kit case to hold Flow Detective, charger (Inc PSU) and calibration adaptor |
| P109028 | Calibration adaptor for inhalable sampling heads |
| 213018C | Protective Rubber Boot (included with Flow Detective) |
| 213028B | Desktop stand |