USER MANUAL

FlowDetective

Digital Flow Meter

HB4087-02

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Casella
Regent House,
Wolseley Road,
Kempston,
Bedford.
MK42 7JY
T:+44(0) 1234 844 100
F:+44(0) 1234 841 490
E: info@casellasolutions.com

www.casellasolutions.com

Contents

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.

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.

Introduction

The Flow Detective is the latest generation of digital flow meter 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%.
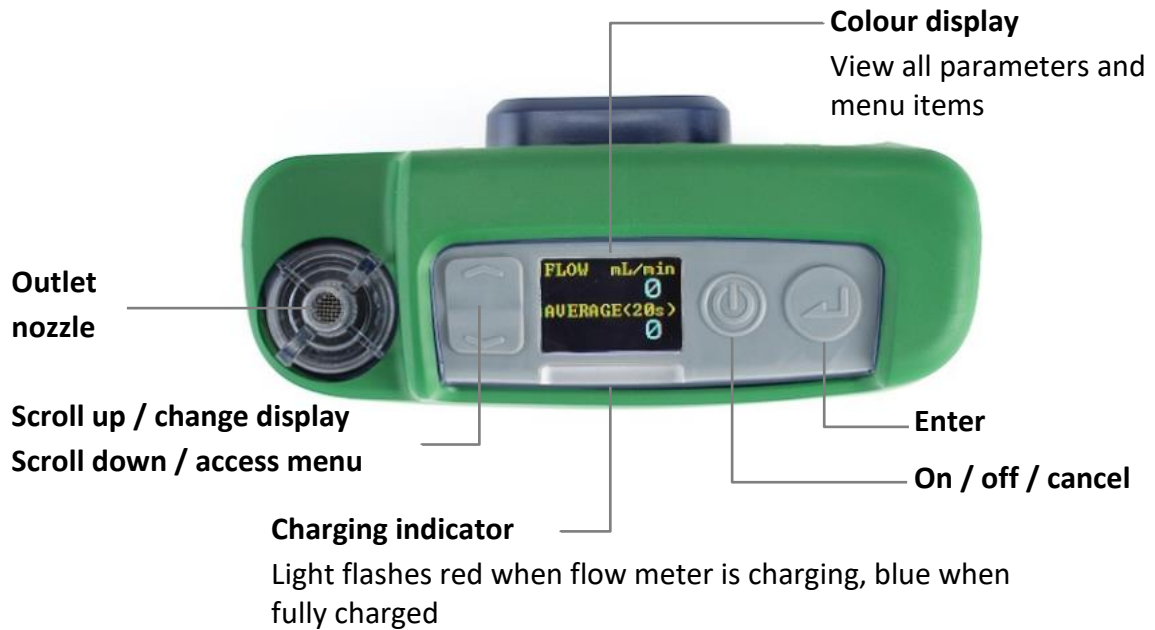
The following table summarises the features and capabilities of the Flow Detective models.

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		✔

Controls and fittings

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

Controls and menu structure

Colour display
View all parameters and menu items

Outlet nozzle

FLOW mL/min
0
AVERAGE<20s>
0

Scroll up / change display
Scroll down / access menu

Enter

On / off / cancel

Charging indicator
Light flashes red when flow meter is charging, blue when fully charged

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.

FLOW mL/min
0
AVERAGE<20s>
0
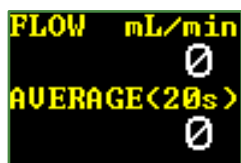
This is the flow dashboard screen that displays after you turn on the flow meter.

MENU
AVG TIME
FLOW MODE
FLOW RANGE
LANGUAGE

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

CASELLA

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.

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:
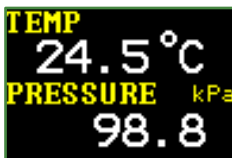
On the top of the flow meter, press ⏻.

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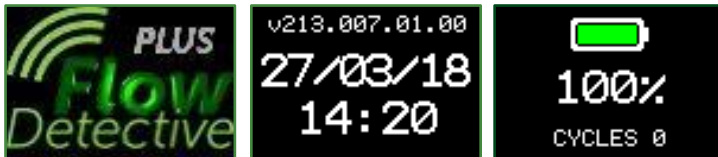
This is followed by the dashboard screen, showing instant and average flow. From this point when air is run through the flowmeter it will display instantaneous and average flow as shown on the dashboard screen below.

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.
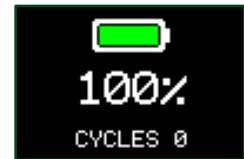

Charge the Flow Detective battery

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 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.

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.
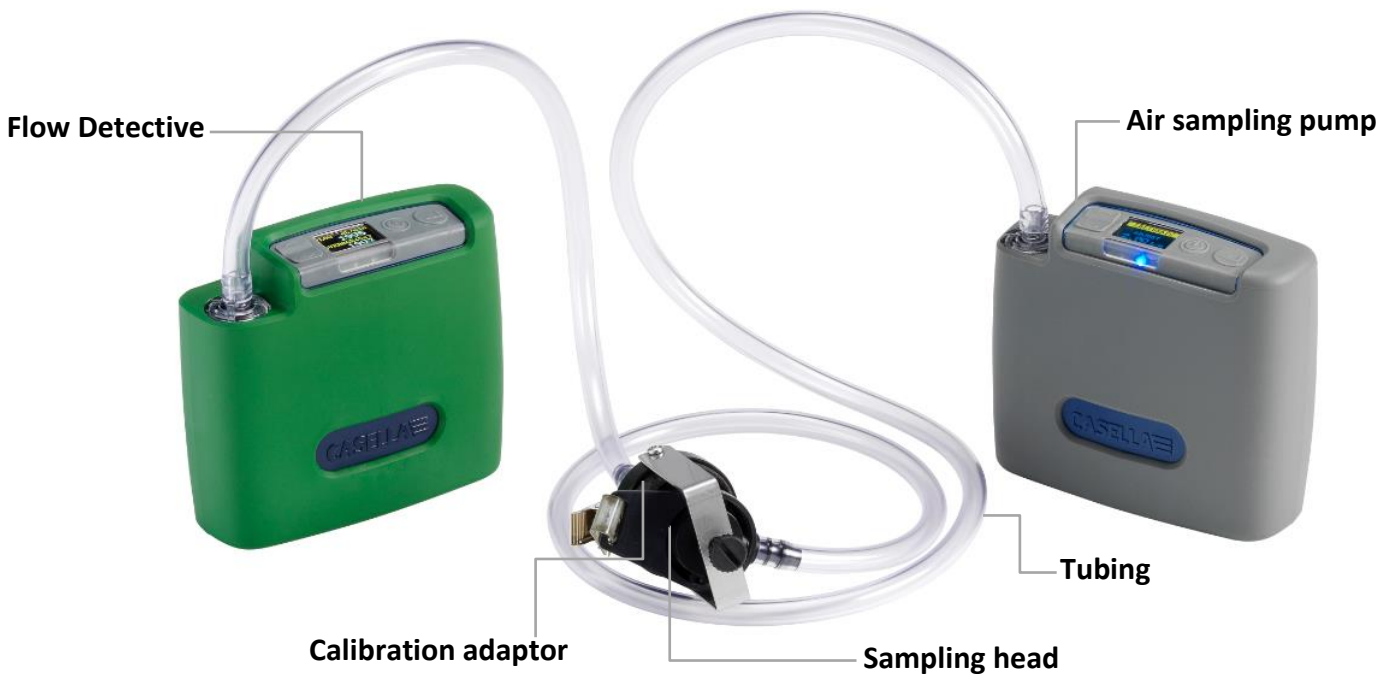
Manual pump calibration

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 ↵.
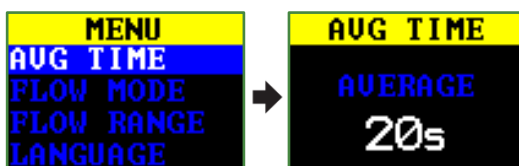
3. Press ⌄ or ⌃ to change the averaging time as desired, and then press ↵. Press ⏻ to return to the flow display.

4. With the sampling pump running adjust the flow on the pump until the desired flow is shown on the Flow Detective.

5. Once the flow is stable and at the desired flow, make a note of the average flow value.

6. 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.

It is a requirement for medium flow pumps to maintain pulsation below 10% 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 10%. However, the pulsation indicator still provides indication that flow may be unstable which would indicate if the Flow Detective is displaying accurately.

Note: Pulsation must be below 10% with the full sample train in place and does NOT need to be below 10% if the flow meter is connected directly to the pump.

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'.
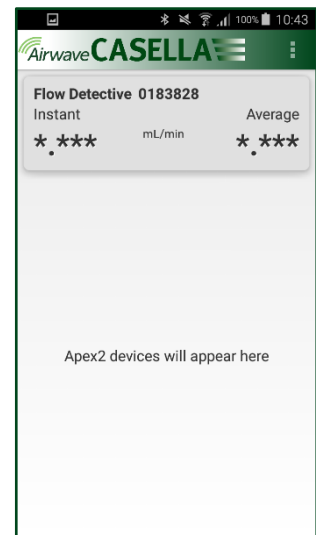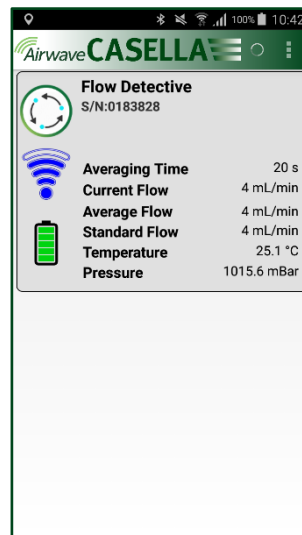
Calibration:

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.

CASELLA

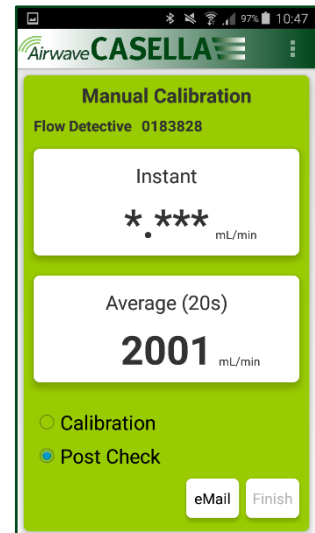2. The manual calibration screen will then be displayed. If the calibration required is before sampling select ⊙ Calibration , then adjust the flow on the pump until the desired steady level is reached. Press Finish to stop calibration. If you are checking to see the deviation of flow after your measurement, 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.

Airwave **CASELLA**

Manual Calibration
Flow Detective 0183828

Instant

1990 mL/min

Average (20s)

2004 mL/min

⊙ Calibration
○ Post Check

eMail   Finish
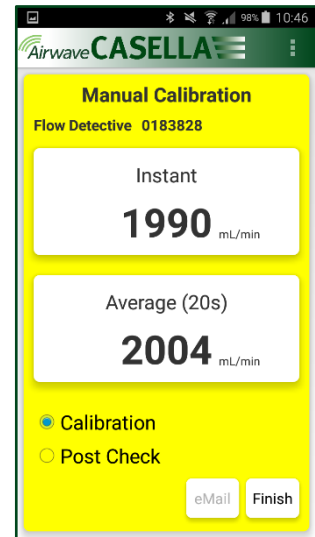
3. The background on the Airwave screen will go green to show calibration is complete. Press eMail to email calibration data using your mobile device's email client. The content of the email will reflect if is a 'calibration' or a 'post check'. Before the email is sent, details of the pump, its serial number and sample information can be entered.

4. To calibrate another pump, connect the sample train and repeat from step 2.

Airwave **CASELLA**

Manual Calibration
Flow Detective 0183828

Instant

*.*** mL/min

Average (20s)

2001 mL/min

○ Calibration
⊙ Post Check

eMail   Finish

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.
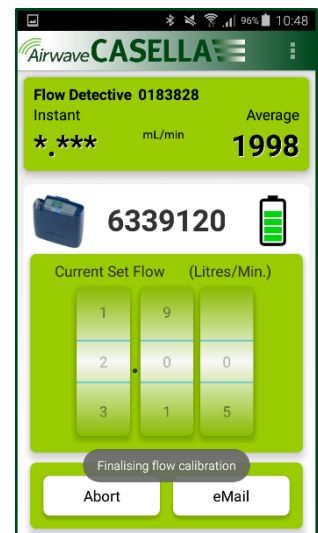
Flow Detective
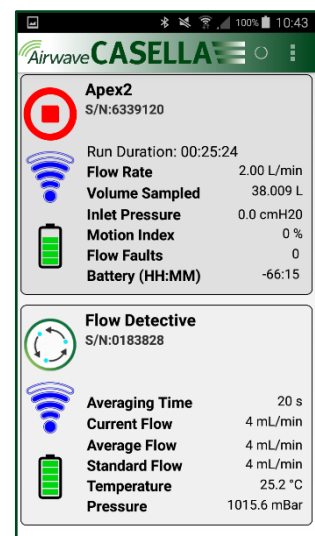
CASELLA

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.
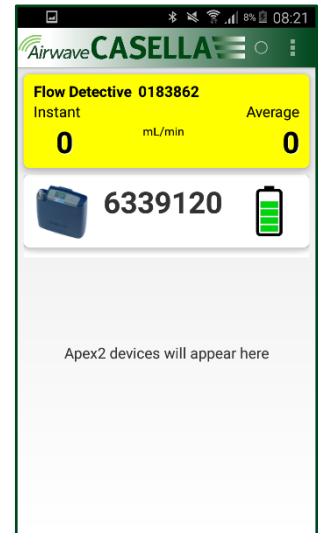
3. Once connected to the Apex2, the area around the flow adjustment turns yellow. Then set the flow rate by rotating the scroll wheels as shown right. This will change the flow rate set on the pump. Then press [Calibrate] to begin calibration. Click 'Abort' to stop the calibration.
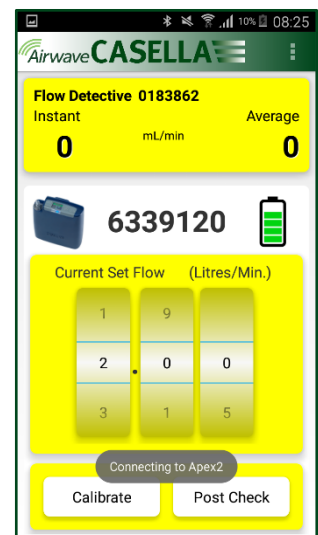
4. The Apex2 will now be automatically calibrated by the Flow Detective. Airwave will determine once the flow is steady and automatically complete the calibration. Once complete the screen background will turn green. Calibration data can then be emailed as necessary by pressing [eMail] .

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 Devaition (%) and Corrected Flow values.

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:

When on the flow dashboard ➡

```
FLOW  mL/min
          0
AVERAGE(20s)
          0
```
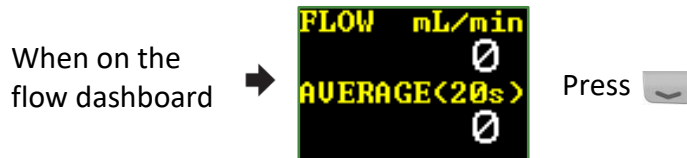
Press 👇

The menu will then be shown:

```
    MENU
AVG TIME
FLOW MODE
FLOW RANGE
LANGUAGE
```

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 ammount 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.

```
    MENU                 AVG TIME
AVG TIME
FLOW MODE      ➡        AVERAGE
FLOW RANGE                20s
LANGUAGE
```
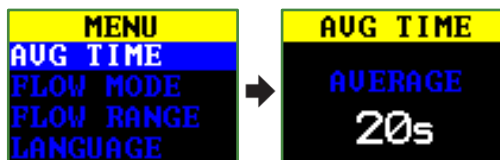
Flow mode

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.

```
    MENU                 FLOW MODE
AVG TIME
FLOW MODE      ➡        STANDARD
FLOW RANGE
LANGUAGE
```

CASELLA

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.

MENU
AVG TIME
FLOW MODE
FLOW RANGE
LANGUAGE

➡ **FLOW RANGE**
NORMAL

Language

Supported languages include English, Brazilian Portuguese, Spanish, Italian, German, French and Chinese.
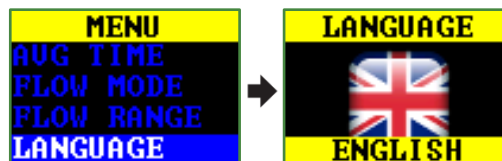
MENU
AVG TIME
FLOW MODE
FLOW RANGE
LANGUAGE

➡ **LANGUAGE**
ENGLISH

Temperature units

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

MENU
FLOW MODE
FLOW RANGE
LANGUAGE
TEMP UNITS

➡ **TEMP UNITS**
°C

Pressure units

Pressure unit scan be changed between mBar, psi, kPa, mmHg, "H$_2$O or cmH$_2$O.

MENU
FLOW RANGE
LANGUAGE
TEMP UNITS
PRESSURE

➡ **PRESSURE**
mBar
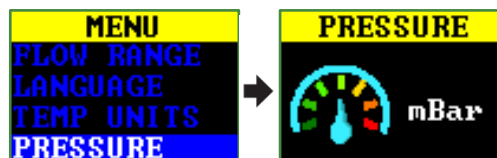
Flow units

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

MENU
LANGUAGE
TEMP UNITS
PRESSURE
FLOW UNITS

➡ **FLOW UNITS**
L/min

Time and date

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

MENU
TEMP UNITS
PRESSURE
FLOW UNITS
TIME DATE

➡ **TIME DATE**
DD/MM/YYYY
13/12/2017

Flow Detective

Contrast

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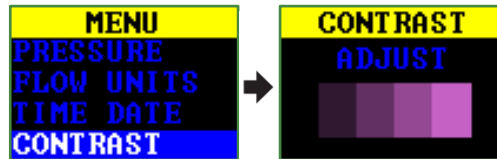
Screen timeout

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
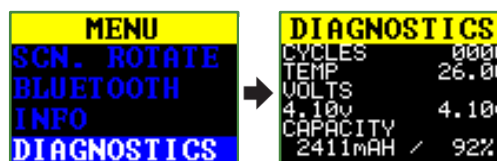
Information

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	< ± 2% from 500 to 5000mL/min ±0.8% of reading ±0.2% FSD from 20mL to 500mL/min
Pulsation Indicator	Flashes when pulsation is >10%
Flow Modes	Standard or Actual Flow
Averaging Time	1 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.

FCC

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

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 (salessupport@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.
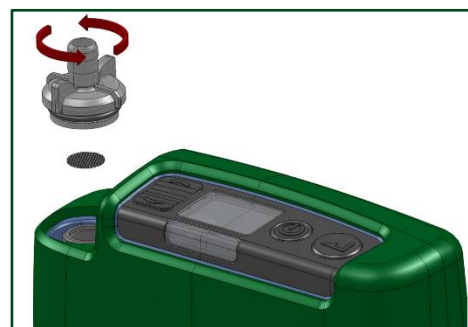
Support

For technical support, please log your query on our online system at: https://helpdesk.casellasolutions.com

CASELLA

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