APEX SERIES
PERSONAL AIR SAMPLING PUMPS
& PUMP MANAGER SOFTWARE

User Handbook
HB 3294-01

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CONTENTS

WARNINGS !

Apex and Apex Pro air sampling pumps are designed to be robust, however they should not be dropped or subjected to mechanical shock. DO NOT draw in water, or highly saturated or corrosive gasses. Failure to comply will render the warranty invalid.

They contain no user serviceable parts and if a fault is suspected the instrument must be returned immediately to Casella CEL or to a Casella CEL Approved Agency for repair.

The warranty DOES NOT extend to cleaning or general servicing of the instrument.

Improved Features

¤ Small size due to space-saving pump design

¤ Real-time display of flow rate on large LCD

¤ Direct flow control via keypad

¤ Multi language display

¤ Programmable run timer

¤ Data downloading via Infrared link

¤ Set up and data download of Advanced Models controlled by Pump Manager Software

Using the Keypad

Manual control is exercised via a simple four key pad.

Press once to switch the instrument ON,
Press and hold a moment to cancel a command,
Press and hold down to switch OFF.

Scroll up through available options or increase a displayed value.
Hold-down to use repeat function.

Scroll down through available options or decrease a displayed value.
Hold-down to use repeat function.

Press to accept a value or option, for example to start the pump,
Press and hold-down to stop the pump.

1. INTRODUCTION

For many years, the name Casella has been associated with the design and manufacture of personal air sampling pumps for the occupational health and hygiene market. The Apex series of pumps is an improved replacement for models in the highly successful Vortex range.

These instruments use an efficient diaphragm pump whose flow rate is precisely maintained using automatic flow control circuitry (Patent pending). The pump draws contaminated air through a sampling head at a rate determined by the head design or sampling strategy. Two models are available.

Apex (standard model),
Apex Pro (can be downloaded and programmed by a PC).

Please consult Casella CEL for information about upgrading a standard model to an Apex Pro. The instrumentation is available as individual pumps or as complete kits with the appropriate accessories to suit particular applications and is supported by our training and service facility at Bedford. The Casella group also offers consultancy and analysis support services for personal air sampling.

The Apex series has been developed to provide sampling capabilities between 5 millilitres/min and 5 litres/min, suitable for a wide range of applications including solvent fumes, asbestos clearance and personal sampling of dusts. Apex pumps are ideally suited to many of the "Total" and

Red LED blocked flow/ fault indicator

Inlet nozzle

On/Off also acts as cancel key

Scroll up through available options, or increase displayed value

Scroll down through available options, or decrease displayed value

Infra red port

Green LED pump running indicator

Covered outlet nozzle

Start/Stop pump, also acts as an Enter key
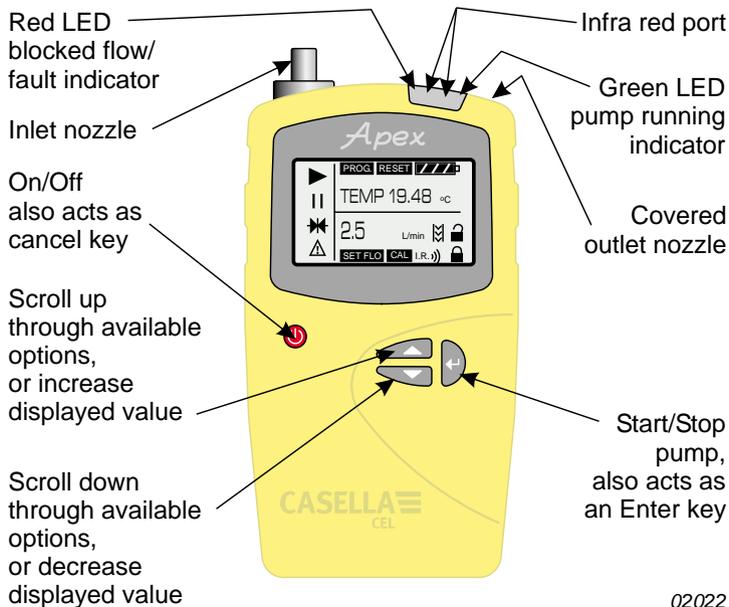
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Figure 2: The Apex personal air sampling pump

and "Respirable" dust sampling techniques detailed in the U.K. Health and Safety Executive's publication MDHS14, and in other reference methods.

The information contained in this handbook relates only to the operation of Casella CEL sampling equipment and is not intended to advise or influence your adopted sampling strategy. For advice on appropriate sampling methods, refer to local legislation and guidelines as dictated by the relevant national and regional health and safety organisations.

The layout of the Apex personal air sampling pump is shown in Figures 1 and 2. The display is shown in Figure 3.

Green LED
Pump running
ndicator

Red LED
Blocked flow/
Error indicator

Inlet nozzle

Outlet nozzle
(for gas bag)

Infra red port

02035
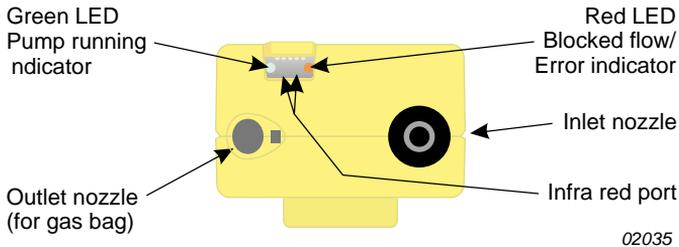
Figure 2: The top panel

1.1 Control Keys

Switches the instrument ON/OFF, also acts as a cancel key.
Hold the key down to switch OFF.

Scrolls up through available options or increases a value.
Has a hold-down to repeat function.

Scrolls down through available options or decreases a value.
Has a hold-down to repeat function.

Accepts a value or option, starts/stops the pump.
Hold the key down to stop the pump.

1.2 Display Symbols

Halt - shows when pump is in Hold Mode , or blinks when halt option available.

Run - shows when pump motor is running.

Flow - indicates real flow monitoring.

plus together - indicate that the pump is paused, but will start again automatically, for example during TWA (time weighted average) or user prepared programs.

Status Icons   Battery Condition

02012

Flow Rate   Varying Messages
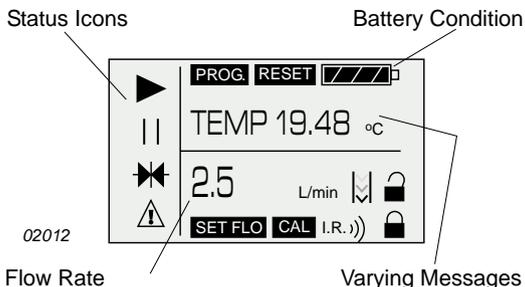
Figure 3: Display layout

⧓ Indicates that all accumulated values displayed can be cleared back to zero (i.e. reset sample volume and run time).
Resetting the store in this way ends the current sample run.

⚠ Warning - indicates flow outside permitted limits or other error conditions.

This warning will be stored with the associated data on Apex Pro versions.

🔋 Battery condition - The symbol empties as the power is drained and blinks when the output approaches the minimum operating voltage.

ºC/ºF Instrument temperature (in user selected units).

🔓 Key pad is partially locked.

🔒 Key pad is fully locked.

1.3 Indicators & Display Messages

Green LED   Flashes when the pump motor is running.

Red LED   Flashes when the pump is unable to maintain the required flow due to a restriction.

PROGEnd   Displayed when the pump has successfully completed a programmed run.

BATTFAIL   Warning when the voltage from battery pack falls below the minimum operating level.

SERV dUE   Warning after 2500 hours of operation that the instrument should be serviced.

BUZZEr   When activated, sounds warnings and indicates key strokes.

2. PREPARATION FOR USE

The following steps are required before the instrument can be operated.

Charge the Battery,
Perform a Calibration,
Connect the Sampling Head.

Manual operation is described in Chapter 4.

2.1 Charging the Battery

Two types of battery pack are available.

Standard 4.8 V, 2.7 Ah nickel-metal hydride (zero cadmium) battery pack that is charged in situ. Depending on loading, a fully charged pack can provide up to 20 hours of continuous operation.

Non-rechargeable pack for emergency use only that takes four standard AA cells. Depending on battery type and flow rate, this can give up to approximately 8 hours of continuous operation.

The battery pack is installed in a compartment located at the bottom rear of the instrument, see Figure 4. A captive screw locks the compartment cover.

Charging is accomplished by inserting the complete Apex unit into a drop-in charger (see Figure 5).

All battery chargers for Apex sampling pumps are intelligent units with safety time-out and standby trickle charge mode to keep the pump ready for use. The use of modern fast charge technology enables a discharged standard battery pack to be fully recharged within 3 hours. Depending on filter type, charging for 1 hour can give a standard battery pack sufficient power for 8 hours operation.

Battery compartment

Buffer pad

Casella CEL
Ni-MH Battery Pack

Sealed battery pack

Hole for captive screw

Connector for battery pack lead

Battery compartment cover

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Figure 4: The battery compartment

A two colour LED on the charger shows the charging state. Red indicates that charging is taking place while green indicates that the full charge is being maintained by a trickle charge. (If neither colour is shown while the pump is in the charger, a fault condition exists.) When placing an Apex unit with discharged battery pack into the charger, check that the red
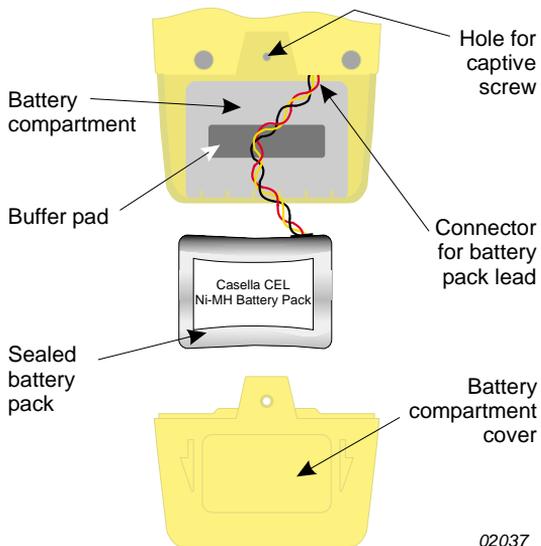
LED is lit. If green is shown, remove the Apex for at least five seconds, then re-insert it. Faster replacement may cause a false status indication.

To ensure the maximum life expectancy of rechargeable battery packs, DO NOT allow them to remain in a fully discharged condition for extended periods of time.

Contact tabs for instrument

Charge LED on front face

Power connector

Holes for wall mounting

02039
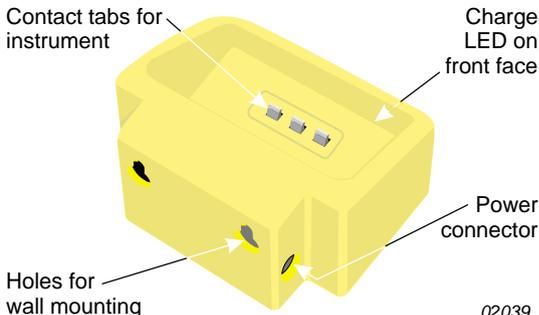
Figure 5: Drop-in charger for Apex units

When changing dry-cells in a non-rechargeable pack, it is recommended not to unplug the connector on the battery pack lead.

2.2   Switching the Instrument On / Off

1.   Press ⏻ until the instrument display is activated to switch the instrument ON.

The display shows all segments, followed by the model name and firmware version number before entering Hold Mode.

On Apex Pro versions only, the day-of-the-week and the time-of-day are also displayed during the start up cycle.

If the display has incorrect contrast, shows messages in an unwanted language or offers unexpected measurement units, make changes as described in Section 2.4.

2.   Press and hold ⏻ to switch OFF.

While the key is pressed, the display shows a count down in seconds, until the instrument switches off and the screen becomes blank.

If ⏻ is released before the countdown has finished, the instrument remains ON.

2.2.1 Hold Mode

When the instrument is ON, but the pump is not running nor a program being executed, it is in Hold Mode, where the display cycles between:

TIME   Accumulated run time since the instrument was last reset.
VOL   Accumulated volume sampled since it was last reset.
TEMP   Current internal air temperature.

2.2.2 Manual Reset (Clear Current Sample)

To clear any accumulated sample duration and volume, the instrument must be in Hold Mode.

1.   Press ⬦ or ⬦ sufficient times to make ⬦ blink on the display.

2.   Press and hold ⬦.

      A **CLR** message and countdown will be displayed.

3.   Hold the key down until the countdown is complete and **CLR** disappears.

      On the standard unit, all accumulated values will be cleared.

      On the Apex Pro, data from any current event is stored and the sample (run) terminated ready for a new run to be started.

2.3 Perform Single Point Calibration (Set Flow)

Attach a sampling head and flow tube or other flow-measuring device to the pump's inlet nozzle to measure the actual flow as shown in Figures 6 - 8.

1.   In Hold Mode, press ⬦ or ⬦ several times until **FLOW SEt** blinks on the display.

2.   Press ⬦ to select it.

3.   Use ⬦ and ⬦ to set the required sampling flow rate.

      As a general rule, the pump should be calibrated to the flow required for the proposed task.

3.   Press ⬦ to accept the setting. The pump will start.

4.   As soon as **CAL SEt** is displayed, use ⬦ and ⬦ to adjust the actual flow measured by the flowmeter to match the set point.
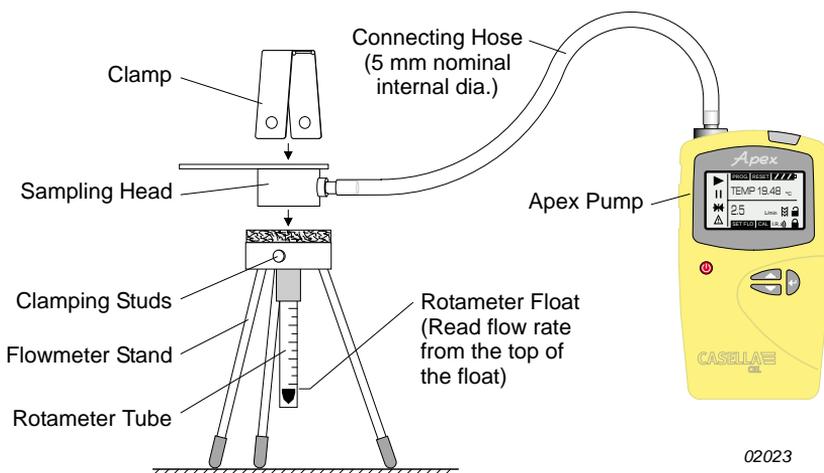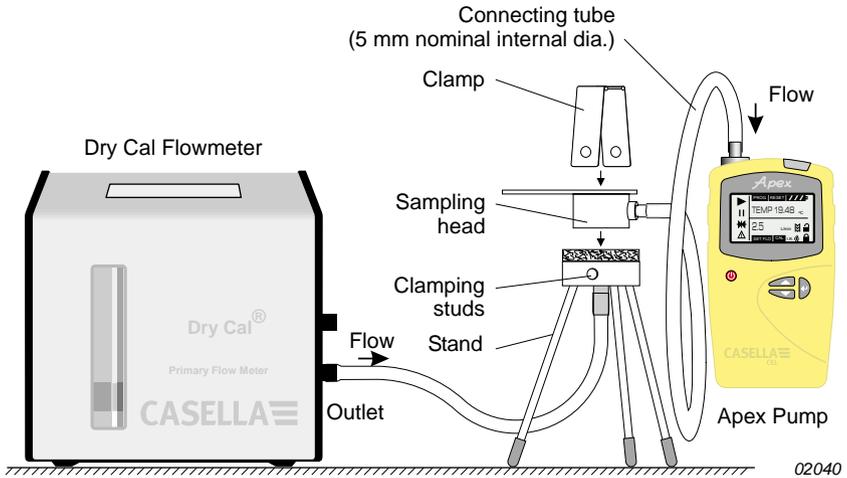

Figure 6: Calibration arrangement with Rotameter

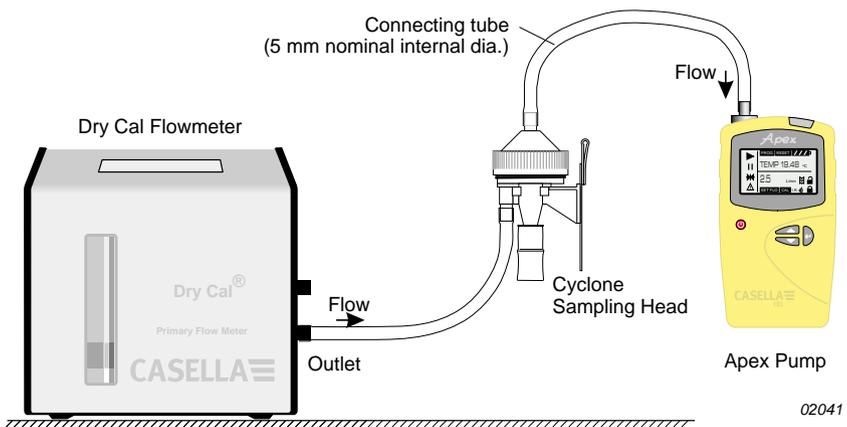*Figure 7: Calibration arrangement with Dry Cal flowmeter*

Figure 8: Calibration arrangement for Cyclone type sampling heads
(a Rotameter may also be used)

5.   When the flow rate is acceptable, press to accept the value.

This calibration point will be saved and used by the pump in all future samples made at this flow.

If no control key is pressed within 30 seconds, the pump will revert to Hold Mode automatically.

6.   If it is decided not to save this calibration, press and hold for a moment to abort and return to Hold Mode.

The combination of automatic flow control and intelligent internal calibration procedures can substantially reduce the number of calibration points required.

When a more comprehensive calibration is required, the basic calibration can be fine-tuned during normal operation by making further single-point flow calibrations at specific flows as described above.

For information about recalibrating the whole range of an Apex or Apex Pro unit, refer to Chapter 5.

2.4   Configuration Mode

This allows basic settings such as display language and measurement units to be changed, gives access to Calibration and Duration modes, plus the additional modes available to an Apex Pro. When the current configuration settings are acceptable, proceed directly to Chapter 3.

Configuration Mode can be activated only while switching the instrument on.

1.   Press to switch the instrument ON.

2.   Immediately hold both and down.

The following series of configuration options is displayed. The settings that are adjustable will blink.

LANG	Sets the display language from:
ENG	English,
FRA	French,
DEU	German,
ITA	Italian,
ESP	Spanish,
DAN	Danish.
TEMP	Sets the temperature display units as Centigrade or Fahrenheit.
VOL	Sets the volume display mode to Auto or m^3
	Auto displays volumes below 1000 litres in litres and above this as m^3.
	m^3 always displays volumes in m^3.
BUZZEr	Sets an audible alarm to:
OFF	No alarm,
Err	Any error sounds the alarm,

	On	Any error or key press sounds the alarm.
PROG Mode		Gain access to program features, including programmable run times on the standard unit and all programmable features on the Apex Pro.
	ON	Makes any advanced program features available,
	OFF	Hides any advanced program features.
LIFE		Read-only message that shows the total run time for the pump. It can be be used to determine maintenance schedules.
LCD		Sets the LCD contrast.

LCD   Use ⬆ to increase the value (make darker) and ⬇ to decrease (make lighter).

CAL SET   Activates Calibration Mode, which allows the entire calibration for the pump to be reset based on two point calibrations.
The instrument will have been accurately calibrated at the factory prior to delivery. Therefore it is recommended that this operation be performed only as part of a routine service or when specific fine tuning is required to ensure that any selected flow rate will be as close to the true flow as possible.
NO   Do not recalibrate the pump.
YES   Recalibrate the pump.
For information about recalibrating the whole range of an Apex or Apex Pro unit, refer to Chapter 5.

3. Use ⬆ or ⬇ to make a change, then press ↵ to accept it and move to the next option.

3.   MANUAL OPERATION

3.1   Run Mode

1.   To start sampling and enter Run Mode, press ⏎ while in Hold Mode.

   In Run Mode the display will cycle between, current duration of the sample, volume sampled, and internal air temperature.

2.   To stop sampling while in Run Mode, press and hold ⏎ until the ❚❚ symbol stops blinking and ▶ disappears.

   The instrument will display and save the accumulated duration and sample values until manually reset.

   Clearing values by a manual reset to close the run sample upon completion of an event ensures that all downloaded data will be conveniently arranged to correspond with the sample result.

3.2   Flow Restriction

If the input flow becomes restricted, both ⚠ and the Red LED will flash to indicate a problem and if enabled, the buzzer will sound. When the problem lasts for eight or more seconds, the pump motor will switch itself OFF. After one minute, the pump will switch ON again in an attempt to determine whether the problem has gone. When the problem remains for a further eight seconds, the pump will switch OFF and remain off with the instrument still ON and ⚠ displayed.

   If the output flow is restricted, both ⚠ and the Red LED will flash to indicate a problem and if enabled, the buzzer will sound. When the problem lasts for three or more seconds, the pump motor will switch itself OFF and remain OFF with the instrument still ON and ⚠ displayed.

   Normal operation cannot be resumed until the flow restriction has been removed. When the restriction is removed, the pump may start again automatically; if it does not, switch the Apex unit OFF then ON again.

3.3   Bag Mode

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

1.   Use a suitable length of 5 mm (nominal internal diameter) tubing to connect the gas bag to the pump outlet shown in Figure 2.

2.   In Hold Mode, press ▲ or ▼ several times until **FLOW SEt** blinks on the display.

3.   Press ⏎ to select it.

4.   Use ▼ to set the flow to less than 0.8 litres/min.

   The pump enters Bag Mode.

5.   Press ⏎ to start the pump.

The display will show **BAG** and a percentage flow, with no volume or time information.

6.   Once the pump has started, ⬆ and ⬇ may be used to change the flow rate to a different percentage.

When the back-pressure from the bag indicates that it is full, a **FULL** message will be displayed and the pump stops automatically.

3.4   Use With Low Flow Adaptor

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

1.   Connect the inlet of an Apex unit to a flowmeter such as the Dry Cal and calibrate the flow rate to 1.5 litres/min.

2.   Stop the pump and disconnect the flowmeter.

3.   Starting from the Apex inlet, connect the following: constant pressure regulator, low flow adaptor, sorbent tube holder and a low flow flowmeter such as the Dry Flow or Dry Cal shown in Figure 9.
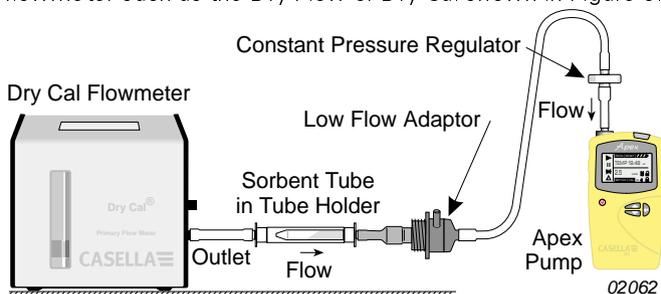
Figure 9: Arrangement using low flow adaptor

4.   Break both ends off a sorbent tube and put it in the holder with the arrow pointing towards the pump.

5.   Start the Apex pump and adjust the flow to the required rate using the screw on the side of the low flow adaptor.

6.   Perform the measurements using a fresh sorbent tube.

3.5   Fixed Duration Sampling (DUR)

This mode is available on both Apex and Apex Pro models to allow the pump to sample for a fixed period, then switch off automatically when the period has elapsed. This feature is useful where a stated flow rate must be sampled for a long period. The duration of the run can be set from the instrument keypad. On Apex Pro, the duration can also be set via Pump Manager software.

1.   Switch Program Mode ON and accept it as described in Section 2.4.

The instrument reverts to Hold Mode.

2.   Press ⬈ or ⬊ several times until **DUR** blinks on the display.

3.   Press ⏎ to select it.

The programmed duration blinks to indicate it can be changed by ⬈ and ⬊.

Run durations between 3 minute and 1 hour can be set in 1-minute steps and durations between 1 and 25 hours in 10-minute steps.

4.   Make changes to the duration as necessary.

5.   Press ⏎ to accept the duration and start sampling.

In addition to the ▶ symbol, the display shows **PROG.** to indicate that a program is active.

While the program is running, the display cycles through current run time, volume sampled, air temperature, and programmed duration.

Once completed, the pump will switch OFF and the display show ‖ and a **PROGEnd** message.

6.   Press any key to return the pump to Hold Mode.

3.6   Locking the Keypad

The keypad may be partially or fully locked to prevent unauthorised tampering with the instrument settings. The keypad can also be locked in the Program Modes.

1.   Press ⏻ three times within 2 seconds to activate Partial Lock Mode.

The 🔓 symbol is displayed, the counters and flow rate cannot be changed, so the only keypad options available are:

Start/stop sampling,
Switch the pump OFF,

Unlock Partial Lock (Press ⏻ three times within 2 seconds),
Select full lock.

2.   While the pump is running (sampling), press ⏻ three times again within 2 seconds to activate Full Lock Mode.

The 🔒 symbol is displayed, the pump cannot be switched OFF and the only available keypad option is to release Full Lock.

3.   Press ⏻ three times within 2 seconds while in Full Lock Mode to fully release the control keys.

(Similarly, while the pump is not running (sampling) in Partial Lock Mode, press ⏻ three times within 2 seconds to fully release the control keys.)

4. ADDITIONAL SAMPLING MODES AVAILABLE ONLY TO THE APEX PRO

These modes are available when Program Mode on an Apex Pro has been enabled from within Configuration Mode as described in Section 2.4.

4.1 TWA Sampling Mode

Time weighted average (TWA) mode allows the pump to sample for a fixed percentage of a specified run time. The instrument calculates the required ON/OFF cycle automatically to spread the total sample time evenly over the entire run time as shown in Figure 10.

This feature is useful when the requirement is to sample a stated volume of air over the course of a long period.

For example, when 10 litres must be sampled over an 8-hour work shift, the pump flow can be set to run at a flow rate of:

$$\frac{10}{8 \times 60} = 0.021 \text{ litres / min} = 21 \text{ millilitres / min}$$

For the whole shift, which is a very low flow.

Alternatively, the TWA mode can be used to run the pump for short periods at a higher rate, for example 1 l/min, with the pump actually running for only:

$$\frac{10}{1} = 10 \text{ minutes} \quad \text{during 8 hour shift}$$

Using TWA mode, the sampling (**RUN**) time should be set to 8 hours and the pump-on exposure (**EXP**) time to 10 minutes, as follows.

1. Enter Configuration Mode, select Program Mode / ON and accept it as described in Section 2.4.

   The instrument reverts to Hold Mode.

2. Press ⬆ or ⬇ several times until **TWA** blinks on the display.
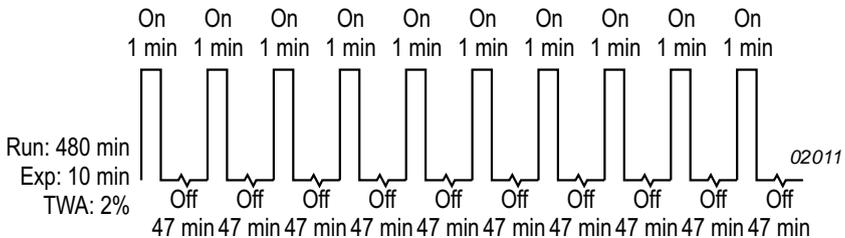
3. Press ⏎ to select it.

Figure 10: TWA ON / OFF cycle for the example

RUN is displayed and the run time blinks to indicate that it can be changed.

4. Use or to select a run time.

Sampling (**RUN**) durations between 3 minute and 1 hour can be set in 1-minute steps and durations between 1 and 25 hours in 10-minute steps.

5. Press to accept the selected run time.

EXP is displayed, and the exposure time blinks to show it can be changed.

6. Use or to select an exposure time.

The available range is from 2 minutes to "1 minute less than the run time", in 1-minute steps.

7. Press to accept an exposure time and start sampling.

In addition to the usual ▶ and ‖ symbols, the display shows **PROG.** to indicate that a program is active.

The pump ON-times are fixed at 1 minute, and the instrument calculates the necessary OFF-times to spread these 1 minute intervals evenly throughout the run time.

While the program is running, the display cycles through current accumulated run time, volume sampled, air temperature and calculated TWA (as a percentage of run time).

During OFF-times (pump not running) the ▶ and ‖ symbols are displayed to show the instrument is paused.

Once the run is completed, the pump will switch OFF and the display show the ‖ symbol and a **PROGEnd** message.

8. Press any key to return to Hold Mode.

The whole duration is stored as a single "sample" (run) with each ON / OFF sequence of the pump included as a discrete "event".

4.2   User Program Modes

This allows complex sampling schedules (created using the Pump Manager PC software and downloaded via the infrared transducer) to be run by the pump. Two user programs can be stored: **Pr1** and **Pr2**.

This mode is ideal for taking samples where an operator spends time working in different parts of the site and a separate exposure at each location must be determined. For example, an operator may spend 4 hours working in a quarry, take 1 hour for lunch, work 3 hours near a crusher and a final 1 hour in a workshop. The work schedule can be set as a user program, with samples taken and stored for the separate periods.

1. Enter Configuration Mode, select Program Mode / ON and accept it as described in Section 2.4.

    The instrument reverts to Hold Mode.

2. Press ⬆ or ⬇ several times until the required program, **Pr1** or **Pr2** blinks on the display.

3. Press ⮐ to select the program.

4. If required press ⬆ and ⬇ to view the various steps in the program.

5. Press ⮐ again to accept the program and start it running.

    In addition to the usual ▶ and ❙❙ symbols the display shows **PROG.** to indicate that a program is active.

    During OFF-times (when the motor is not running) ▶ and ❙❙ are displayed to show the unit is paused.

    Once the run is completed, the display will show the ❙❙ symbol and a **PROGEnd** message.

6. Press any key to return the pump to Hold Mode.

7. When it is required to terminate the program early, press and hold ⮐ to show the **STOP** option, then keep the key pressed until the pump reverts to Hold Mode.

    The whole duration is stored as a single "sample" (run) with each ON / OFF sequence of the pump included as a discrete "event".

5. CALIBRATION MODE

This mode is intended primarily for factory use during manufacture and servicing. This is a two point calibration which ensures that any selected flow rate will be as close as possible to the true value.

It is suggested that this procedure might be employed by the user ONLY when it is suspected that the primary calibration has been disturbed. Therefore only a brief description of the procedure will be given.

Caution !

Use this procedure with caution, it changes the basic calibration for the ENTIRE flow range of the pump.

Attach a sampling head and flowmeter to the pump's inlet nozzle to measure the actual flow as shown in Figures 6 - 8 in Section 2.3.

1. Enter **CAL SET** from Configuration Mode.

    A display message asks for the lower calibration point to be set.

2. Use ⬛ and ⬛ to set the flow required at the calibration point.

    The instrument will restrict the actual range in which the lower calibration can be set.

3. Press ⬛ to accept the setting. The pump will start.

4. Use ⬛ and ⬛ to adjust the actual flow measured by the flowmeter to match the set point.

5. Press ⬛ to accept the lower setting. The pump will stop.

    A display message asks for the upper calibration point to be set.

6. Use ⬛ and ⬛ to set the flow required at the calibration point.

    The instrument will restrict the actual range in which the upper calibration can be set.

7. Press ⬛ to accept the setting. The pump will start.

8. Use ⬛ and ⬛ to adjust the actual flow measured by the flowmeter to match the set point.

9. Press ⬛ to accept the upper setting.

The instrument uses these points to recalibrate the entire flow range. This calibration can then be fine-tuned during normal use by making single point flow calibrations at specific flows as in Set Flow.

6. PUMP MANAGER SOFTWARE

6.1 Pump Manager Introduction

Casella CEL Pump Manager application software is designed to be used with the Casella Apex Pro range of personal air sampling pumps and offers a convenient way to store, manage and present sample data.

This software allows the Duration, TWA and User Program Modes of Apex Pro pumps to be programmed. In addition, it saves sample results together with extra information related to the sample, and prints comprehensive reports.

Communication between the PC and pump is via an infrared transducer. Once the infrared transducer has been connected to a PC's serial (RS232) port there will be no need to connect (and disconnect) cables between instrument and PC to facilitate communication. This eliminates wear and tear on any connectors and cables. All infrared communication is fully error checked to prevent data corruption.

The software must be installed (Section 6.2) and infra-red communication established (Section 6.3) before data can be downloaded from an Apex Pump to a PC.

Pump Manager can be left running in the background on the Windows system as an icon. When a pump comes within range of the infrared computer link, the application will wake up and download data from the pump and store it in a database. It is possible to configure Pump Manager to start up in background scanning mode when Windows starts, thus minimising the amount of user intervention required.

All data is stored in a database and identified according to the Apex pump from which it was downloaded, and optionally by details of the person who used the pump. This helps to maintain traceability of data. All data is automatically stored when it is changed, so if you have a system failure (e.g. power failure) you should not lose any data.

6.2 Software Installation / Un-installation on Windows™ 95, 98, ME, NT 4, XP & 2000

System Requirements

IBM™ compatible PC with Pentium II or better processor,
At least 8 MB of free RAM space,
Microsoft Windows 98/ME/2000/XP and NT 4/95 with IE4 or later,
Hard drive with at least 5 MB of free space,
$3^1/_2$" high density (1.4 MB) floppy disk drive for program installation,
Super VGA colour monitor (1024 x 768 16 M colours recommended),
Mouse or other Windows compatible pointing device,
Printer - optional.

Pump Manager is supplied on two $3^1/_2$" floppy disks. Before installation, it is recommended that a back-up copy be made of the program disks. Keep the originals in a safe place and use the copies to install the software. It is also

advisable to ensure that no other applications are running while installation takes place.

The Setup program for Pump Manager will install files in the specified program directory and the Windows\System directory. It will also add an icon to the desktop and a new folder and item to your Programs menu, either of which can be used to start Pump Manager.

If installing on Windows 95, first run the program TapiUpdate.exe placed in the installation folder. This updates the version of TAPI on the PC to the version required by Pump Manager. When installing on Windows 98, Windows NT or later systems, this update is not required and SHOULD NOT be performed.

To install:

1.   Start Windows.

2.   Insert Pump Manager Disk 1 into the floppy disk drive.

3.   Click the **Start** button on the task bar, then click the **Run...** option.

4.   Type **a:\setup**, where "a" identifies the floppy disk drive, then press **Enter**.

5.   Wait for the Casella welcome screen to be displayed, then follow the on-screen instructions.

Once installation is complete, you will find the Pump Manager icon

 on your Windows desktop.

To un-install:

1.   Click the **Start** button on the task bar.

2.   Select the **Settings...** option and click on the **Control Panel** option.

3.   Double click on **Add/Remove Programs** icon.

4.   In the list of installed software, select **Pump Manager** and click the **Add/Remove** button.

5.   Follow the on-screen instructions.

6.3   Establishing Infrared (IR) Communication

When used with Windows 2000, the IR transducer supplied by Casella CEL is plugged into one of the PC COM ports, where it acts as a plug and play unit. For other versions of Windows, please follow the installation instructions supplied with the transducer.

Once installed, Windows will assume the IR transducer is a Windows managed device and take over complete control of it, preventing control by Pump Manager. To avoid this conflict, Windows control must be disabled in the PC as follows.

1. Click the **Start** button at bottom left of the PC display.

2.   Select the **Control Panel** option from the **Settings** menu.

A **Control Panel** window is displayed.

3.   Select the **Wireless Link** option and display the **Wireless Link** dialog.

4.   Select the **Hardware** tab.

The **Devices** field should include:
"ACTiSYS IR-220L Serial Infrared Device".

5.   If the **Device Status** is shown as "This device is working properly", it is being controlled by Windows and must be disabled. Click the **Properties** key.

6.   Open the **Device Usage** menu.

7.   Select **Do not use this device (Disable)** and click **OK**.

The Device Status should now be shown as "This Device is Disabled" so that it can be controlled by Pump Manager software.

Now configure the IR link in Pump Manager as follows.

1.   Start Pump Manager by double clicking on its desktop icon, by entering its name in the **RUN** menu obtained via the **Start** button **Run** option, or using **Start - Programs...** option.

The top level window shown in Figure 11 will be displayed.

As the cursor is moved to each button, the relevant function will be displayed on the message line at the bottom left of the display.
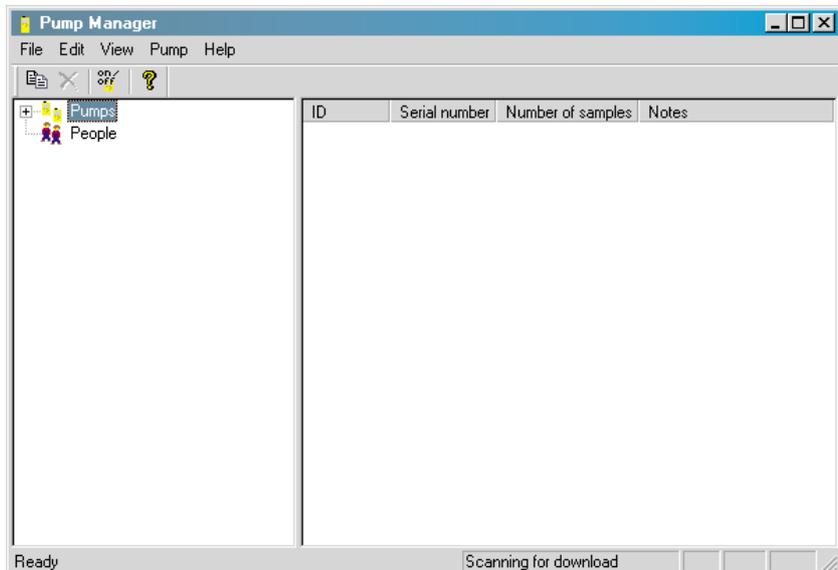

Figure 11: The top level window

2. Click the **Pump** button and select the **Communications...** option.

    A **Communication Port** dialog is displayed.

4. Specify the port used by the IR link, then click **OK** to confirm the choice.

    An active IR link icon ![icon] should be shown in the System Tray to the right of the Status Bar at the bottom of the PC display. This indicates that the device is waiting to communicate with an Apex Pump.

    Best communication with the pump is achieved when the IR link is positioned in line with the IR interface window of the pump, with the two devices no more than 60 cm (2 ft) apart.

    The fold out sheet at the back of this book shows a diagram of the main menus and options available from Pump Manager software. A Help menu offers on-line help via Contents, Index and Find options.

6.4 Configuring the Software and Adding a Pump

Select a communication port then add pump and person identities to the software as follows.

1. Select the **Pump** menu and see the following options.

Communications	Specifies the communication port to be used by the IR Transducer.
Program	Allows the TWA and the two user defined programs available to the Apex Pro to be edited and sent to the pump as described in Section 6.5.

2. Select the **Communications** option, then choose the port to be used from the **Communications Port** dialog, normally COM1 or COM2.

3. Select the **File** menu and see the following options.

New	This option allows pump and person details to be added to the Directory field in the top level window.
Print Setup	Standard dialog.
Minimise to System Tray	Use this option to remove the Pump Manager button from the Status Bar, but leave the IR link icon in the System Tray (bottom right of the display) to show that the software is active in background.
Run on Startup	Enable (√) this option to start Pump Manager automatically whenever Windows is started.

Exit   Standard dialog.

All data will be identified by the serial number of the pump from which it was downloaded. The serial number is set at the factory and cannot be edited by the software. However, further information can be added via a **New Pump** dialog, and via the similar **Pump Properties** dialog obtained by right clicking on the pump name.

Downloaded results can also be identified by user (person), with details added via a **New Person** dialog.

4.   On the **File** menu, select **New** followed by **Pump** to add a new pump, (or right click on the name of an existing pump) to display its details.

(A New Pump dialog is displayed automatically whenever the software detects an unknown pump within range of the IR Transducer.)

The **New Pump** dialog has the following options.

Delete   Standard dialog.
Properties   Offers the following options.
                                ID   Alphanumeric characters can
                                            be entered to identify a
                                            specific sampling pump.
                                Serial Number (set by the factory)
                                            Seven numeric characters
                                Notes/Service History
                                            Allows separate notes to be
                                            included about the pump and
                                            its service history.

5.   Add a pump ID, Notes and Service History (such as date of last service, or date of next service) as required.

6.   When data is also to be identified by user, select **New** followed by **Person** to add a new person, (or right click on the name of an existing person) to display their details on the **New Person** dialog.
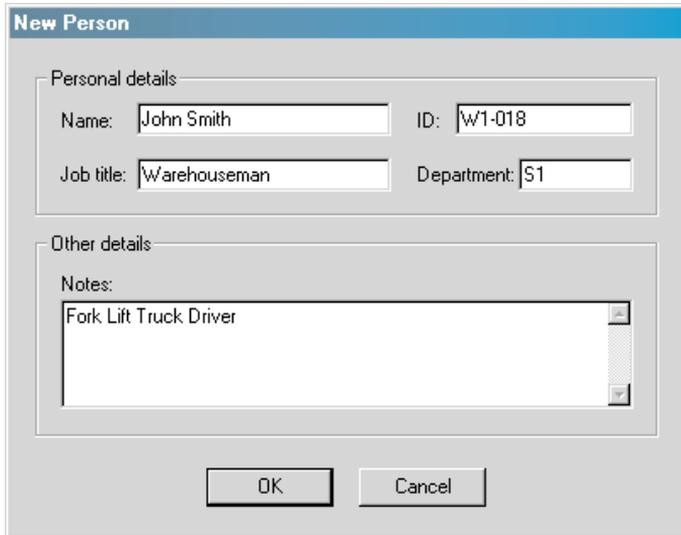
Delete   Standard dialog.
Properties   Offers the following options.
                Name   Alphanumeric characters of the person's name can be entered.
                ID   Alphanumeric characters to identify the person can be entered.
                Job Title Additional information.
                Department
                        Additional information.
                Notes   Allows separate notes to be included about the person.

7.   Add a person's Name, ID (for example a payroll number), Job Title, Department and Notes as required.

8.   Select the View menu and see the following options.

Toolbar   Standard dialog.
Status Bar   Standard dialog.
Units   Offers options to:
                                Display temperature in ^{o}C or ^{o}F,
                                Display volume in ml, Ltrs or m^3.

9.   Choose temperature and volume units to suit the task.

6.5 Downloading Data

Data is downloaded from pump to PC automatically, with a minimum of user intervention. When Pump Manager is running (showing the active IR link icon), it transmits a request every second via the transducer, asking for data from any Apex Pro within range.

If no pump containing data is within range, there will be no response, and the software continues transmitting the request and listening for a reply. However, when a pump containing data is within range, it will be detected and the download process started automatically.

A **Data Download** status dialog will be displayed which identifies the pump and displays progress messages for the download operation. Once all data has been downloaded, the software clears the data from the pump memory.

When both Apex Standard and Pro models are actively running a program, they must be kept away from the IR Transducer. This prevents the Transducer from trying to empty the pump of any saved data and interrupting the current data sample.

If a pump is detected that has not been configured by the software, i.e. is not included in the Pump Manager Directory field, a "New Pump"

message will be displayed and the new pump added automatically to the application. The operator should add the remaining pump properties as soon as possible. (An Apex Standard model will be shown as a pump with no data.)

If **People** have been defined, the option will be offered to select the person who has been using the pump, or to select **No pump user**.

The downloaded data is stored in the application database where it is identified by pump, and when defined, also by person. The display is updated to include the new data in a "sample" (run) folder that shows each time the pump was switched ON and OFF as a separate "event".

6.6 Inspecting Data, Adding Supplementary Information and Printing a Report

Stored data can be inspected, supplementary information added and a report displayed and printed. All reports can be exported to other software for further processing.

1.   Display data by highlighting the name of the relevant pump or person in the Directory.
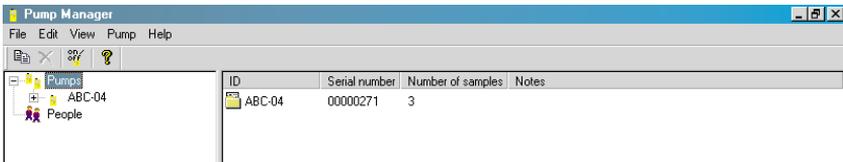
A directory containing all samples from the selected pump or person will be shown in the Data area of the top level window. Headings identify the pump and show the number of samples included.

2.   Click on the pump or person name to show the samples in the Directory.
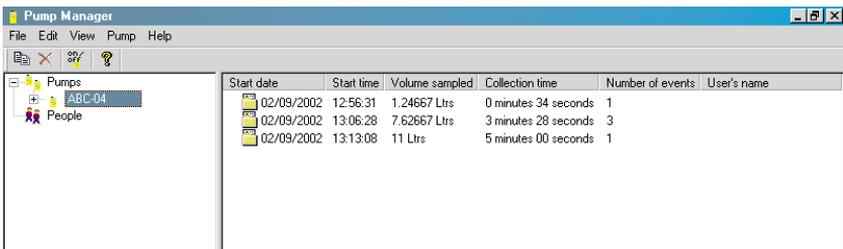
3.   Highlight the required sample folder.
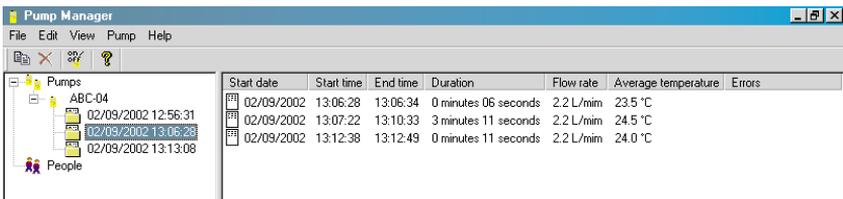
Each event contained in the sample is shown in the Data area, with headings that give a summary of information from the event.

4.   To inspect further data from any event, double click on the sample.
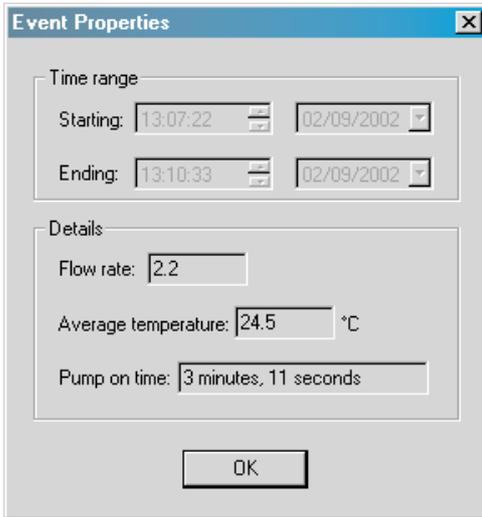
An Event Properties dialog is displayed that contains additional information.

5.   To inspect further data from any sample, or to add supplementary information, highlight the sample folder then right click.

6.   Use the **Properties** option.
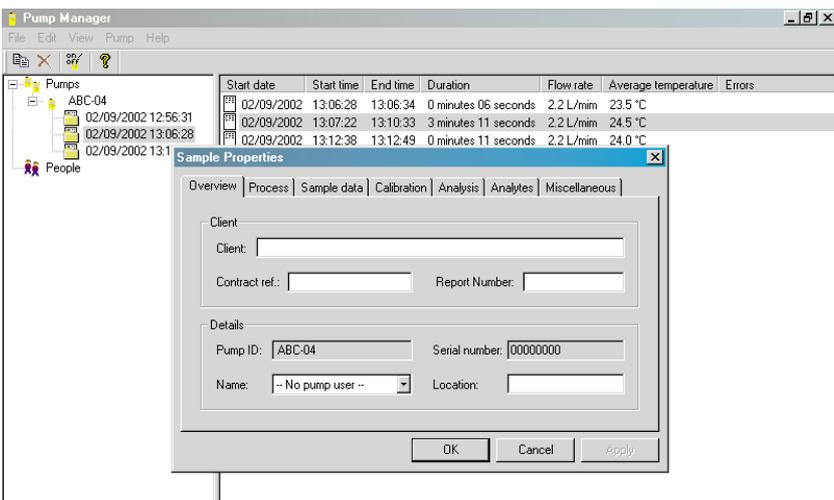
A multi-page Sample Properties dialog is displayed, which allows the user to inspect the data and add additional information to the sample folder. There are seven pages, where the pages contain additional information as follows.

Overview Page adds identifying information to the sample folder.

Client	A name can be added,
Contract ref.	A reference can be added,
Report Number	A number can be added,
Pump ID	Data from the pump,
Name	A person name can be selected,
Serial Number	Data from the pump,
Location	A location can be added.

Process Page adds details of the process and substances involved to the sample folder.

Process notes	Field for adding detailed information about the process,
Substances	Field for adding detailed information about the substances involved.

Sample data Page contains data downloaded from the pump.

Starting time	Downloaded data,
Starting date	Downloaded data,
Ending time	Downloaded data,
Ending date	Downloaded data,
Sample period	Downloaded data,
Set flow rate	Downloaded data,
Average temp.	Downloaded data,
Sample volume	Downloaded data.

Calibration Page allows calibration information to be added and applied to the data.

Use calibration data	Tick to use the displayed information,
Calibrator S/N	Allows a serial number to be added,
Initial flow	Field for a flow rate to be entered,
Final flow	Field for a flow rate to be entered,
Sample period	Field for a measurement period to be entered.

Analysis Page adds analysis information to the sample folder.

Sample number	A sample identity can be added,
Sample data	Sample analysis information can be added.

Analytes Page adds details of up to 9 analytes to the sample folder.

Analyte1 Etc.	Analyte identities can be added,
Exposure time	Allows an exposure time to be added.

Miscellaneous Page adds further information to the sample folder.

Notes	General notes can be added,
Sampled by	The user / report author can be identified,

Date	The date of the sample or of the report can be entered,
Audited by	The data / report checker can be identified,
Date	The date of checking can be entered.

7. Enter information into these dialogs as relevant to the particular sample folder or report.

8. When all required additional information has been added to the sample folder, highlight the sample folder, then right click.

6. Use the **Report** option. A dialog is displayed with four options.

Company Logo	Allows a bitmap image file to be selected to be printed in the top right corner of reports.
Print	Prints a report based on data downloaded from the pump that includes information entered via the Sample Properties dialog. The layout of a Pump manager report is shown in Figure 12.
Print Preview	Displays a preview of the printed report.
Copy	Copies the report to the PC clipboard, so it can be pasted into a word processor and customised. The pasted report has minimal formatting and may require minor layout work such as font sizes and tab setting.

6.7   Creating and Loading Pump Programs

All operations to create and load pump programs for the Apex Pro are controlled via the **Pump Programs** dialog.
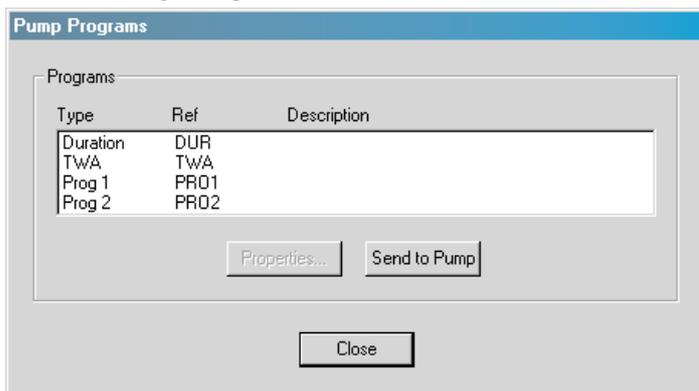
The following different types of programs are available.

Duration	(DUR) the pump samples for a fixed period and switches off automatically when finished,

Pump Manager
Sampling Report

CASELLA≡
CEL

Client: **Contractor Ref:**
Name: **Report No:**
Location:

Process Notes:

Substances:

Pump Data:-
Pump: **I.D.:**
Run Data:-
Start: **End:**   **Period:**
Set flow rate: **Ave. temperature**   **Sampled volume**

Volume sampled: **Sample number:**

Sample data:-   **Sample data:-**

Notes:-

Sampled by: **Audited by:**

Date: **Date:**

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Figure 12: The report page layout from Pump Manager

TWA		(Time weighted average) the pump samples for a fixed percentage of the run, calculating the required ON/OFF cycle automatically,
Prog 1 / 2		(Pr1 / Pr2) samples to complex schedules created in Pump Manager.

The properties for all four programs can be edited then sent to the pump at the same time as follows.

1.   Select the **Pump** menu.

2.   Select the **Program** option.

     The **Pump Programs** dialog will be displayed showing program types: Duration, TWA, Prog 1 and Prog 2, plus the following option.

     Send to Pump   This sends the complete package of four programs to the pump.

3.   Select a pump program to edit.

     This enables the **Properties** button.

4.   Click the **Properties** button.

     As shown on the fold out sheet at the back of this book, each program has its own individual **Properties** dialog for information specific to the program.

5.   To set **Duration**, go to step 6,
     For **TWA**, go to step 8,
     For **Prog 1** and **Prog 2**, go to step 10.

6.   Display the **Duration Properties** dialog which has the following options.

     Description   Requires alphanumeric characters to identify the program.

     Duration   Specifies a run time that can be set in 1 minute steps up to 1 hour, and 10 minute steps from 1 hour to 24 hours and 50 minutes.

7   Enter a **Description** to identify the program and a **Duration** (total sample = run time), then click **OK** to confirm the selection and go to step 16.

8.   Display the **TWA Properties** dialog (next page) which has the following options.

     Description   Requires alphanumeric characters to identify the program.

     Duration   Specifies a run time that can be set in 1 minute steps up to 1 hour, and 10 minute steps from 1 hour to 24 hours and 50 minutes.

On Time   Specifies a pump ON time that can be set
                                 in 1 minute steps up to 1 hour, and
                                 10 minute steps from 1 hour to 24 hours
                                 and 50 minutes.

9.   Enter a **Description** to identify the program, a **Duration** (total
         sampling = run time), the **On Time** for the pump, then click OK to
         confirm the selection and go to step 16.

10.   Display the **Prog 1 Properties** or **Prog 2 Properties** (Pr1 or Pr2)
         dialog which has the following options.

         Description   Requires alphanumeric characters to
                                      identify the program.
         Display name   Four characters as a display name.
         Times   9 sets of times to define start and stop
                                      days and times for the run.
                                      A day of the week can be specified,
                                      where "All days" allows the instrument
                                      to be used on any day.
                                      Start and end times can be specified in
                                      1 minute steps up to 24 hours and 59
                                      minutes.

11.   Enter a **Description** to identify the program and a four character
         Display Name that will appear on the pump display.

12.   Select one of the program **Times** and use the **Edit** button.

13   Specify **Start** and **End** dates and times on the **Program Times**
         dialog.

14.   **Enable** the selected **Time** (√) so it will be used by the program.
         (See opposite.)

15.   Select and enable further start and end times, then click **OK** to
         confirm the selection.

16.   To send the complete package of four programs to the Apex Pro, place the unit in range of the infrared transducer, and click the **Send to Pump** button.

Please note: It is not possible to send an individual program to the pump.

The four current programs will be transferred to the pump, while a **Pump Programming Status** dialog gives progress information.

The PC takes this opportunity to synchronise the clock in the Apex unit to the same time and date as the PC.

17.   Once the program has been sent to the Apex unit, the unit can be removed from the transceiver.

6.8   Error Messages

The following error messages may be displayed by Pump Manager.

"ERROR: Unable to get status record from the pump."

"ERROR: Unable to download record %i."

"ERROR: Pump changed during download."

"ERROR: Unable to verify the pump's serial number."

"ERROR: Unable to clear the pump's memory."

"ERROR: No pump found to program."

"ERROR: Cannot set pump's time."

"ERROR: Cannot set pump's date."

"ERROR: Could not send program to the pump."

"ERROR: Could not get the pump's serial number."

"ERROR: The pump has changed during programming."

"ERROR: Could not find a pump."

"ERROR: Could not open communications."

"Invalid serial number"

"Pump shut down but restarted following a temporary inlet blockage."

"Pump terminated the event due to a fatal inlet blockage or flow control problem."

"Pump event terminated due to a discharged battery condition."

7.   TECHNICAL INFORMATION
7.1   Pump Model Specification

Flow range	0.8 to 5 litres/min 5 to 750 millilitres/min with low flow adaptor
Flow control accuracy	<±5% for selected flow, ±3% for calibrated point,
Flow performance (Flow, max vacuum pressure)	1.0 litres/min @ 80 cm H_2O 2.0 litres/min @ 80 cm H_2O 3.5 litres/min @ 32 cm H_2O 4.0 litres/min @ 18 cm H_2O 5.0 litres/min open flow
Battery voltage and capacity	4.8 V NIMH / 2.7 Ah
Inlet pulsation ratio	< 10% using Dewell Higgins Cyclone @ 2 litres/min approx. 7.5 cm H_2O. Satisfies EN1232 , NIOSH 0600
Displayed values	Real flow rate, volume sampled, elapsed sample time, temperature, operating mode, program details
Pump MTBF	Typically >2500 hrs
Operating temperature	5°C to 45°C
Storage temperature	-10° to $+ 50^{o}$C
Charging technique	Drop-in Intelligent fast charger. dT/dt fast-charge termination with safety time out. Standby trickle charge mode keeps pump ready for use.
Typical charge time	3 hours for full charge
External PSU (for drop-in charger)	Output 12 VDC, 0.8 A, Universal input voltage
Memory protection time with main battery pack removed (Apex Pro model)	Approximately 20 minutes
Communications	Infrared transducer (via RS232-infrared computer link)
Recorded values	Start & stop times, flow rate, average sample temperature, volume sampled and errors.
Dimensions	Approximately 136 x 78 x 46 mm
Weight (including battery)	Approximately 460 g

7.2   Pump Performance

	Typical filter pressure load in cm H_2O, Typical battery life in hours				
Filter Type	1.0 litres/min	2.0 litres/min	2.2 litres/min	3.5 litres/min	4.0 litres/min
25 mm GFA	5 cm, 34 hrs	9 cm, 22 hrs	9.5 cm, 20 hrs	16 cm,12 hrs	18 cm, Marginal
25 mm 0.8 μm	18 cm, 21 hrs	31cm, 14 hrs	34 cm, 13 hrs	56 cm, NA	64 cm, NA
25 mm 1.2 μm	11 cm, 27 hrs	21cm, 16 hrs	23 cm, 15 hrs	37 cm, N/A	42 cm, NA
37 mm GFA	3 cm, 40 hrs	5 cm, 25 hrs	6 cm, 23 hrs	9 cm, 14 hrs	11 cm, 12 hrs
37 mm 0.8 μm	7 cm, 33 hrs	13 cm, 20 hrs	14 cm, 18 hrs	23 cm, 11 hrs	26.5 cm, NA

Note: NA represents a flow rate and pressure loading combination beyond the pump capability.

7.3   CE Compliance

The APEX and APEX Pro Personal Air Sampling Pumps comply with the EMC Directive 89/336/EEC of the European Union. They have been tested according to the standard delivery schedule and comply with the following standards.

EN 50081-1 : 1992, EN 50081-2 : 1993:

Generic emission standards for residential, commercial, light industry and industrial environments.

EN 50082-1 : 1992, EN 50082-2 : 1995:

Generic immunity standards (for both RF fields and electrostatic discharge) for residential, commercial, light industry and industrial environments.

EN 61000-4-2 : 1995, IEC 61000-4-2 : 1995:

Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test.

8.   SERVICING

Casella CEL's in house service department offers a comprehensive range of repair and calibration services, designed to effect 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 manufacturers equipment.

For further information please contact our service department at our Bedford headquarters. We will be happy to provide quotations for individual repairs or provide annual maintenance under contract.

We recommend factory service by technicians trained and equipped to repair your instrumentation. Should you wish factory repair assistance, send your equipment in a package equivalent to the original packaging. Insure to full value and ship pre-paid. Include a letter giving full details with your packing list and send to the Casella CEL Service Department at Bedford.

For service outside the United Kingdom, please return to our appointed distributor.

8.1   Maintenance

Your Apex Personal Air Sampling Pump is designed to provide long and reliable service. Routine maintenance is minimal.

¤ Make sure the battery pack never stays in a discharged condition.

¤ Keep the instrument body clean and free from dirt.

¤ DO NOT operate without a filter connected to the inlet. Ingested dirt and dust particles may cause internal damage, malfunction or erratic flow.

¤ DO NOT unplug the connector lead when changing cells in the emergency dry cell battery pack.

8.2   Fault Finding

The following table outlines some possible fault conditions.

Symptom	Fault	Suggested Remedy
Failure to switch ON	Battery not charged. Does the red charger LED come on ?	Check that the battery is plugged in - internally Clean the battery connectors on the Apex unit, Clean the battery connectors on the charger, Push the Apex unit firmly into the charger. Charger fault - return for repair, Keypad fault - return for repair.
	Software locked up ?	Disconnect the battery for a few seconds, then reconnect. If this fails - return for repair

Symptom	Fault	Suggested Remedy
Pump runs fast	Control error	Damaged flow pressure sensor - return for repair, Water ingress - clean or return for repair, Tubes to sensor squashed or damaged - return for repair, Electrical fault - return for repair, Calibration error - perform fundamental calibration in Config Mode.
Poor control response, Non-repeatable flow settings	Leakage	Contamination or damage to valves - return for repair Check all connections, If internal leakage is suspected - return for repair.

8.3 Ordering Information

182000B   Apex Personal Air Sampling Pump.

182063B   Apex Pro Programmable Personal Air Sampling Pump.

182091A   Pump Manager Software.

CMC39   Infrared Communication Transducer (uses existing Windows software).

182073B   Spare Rechargeable Battery.

182094A   Dry-Cell Battery Pack.

P104104   Standard Starter Kit, includes standard carry case with foam and accessories box, 0.3 to 3 l/min flowmeter, flowmeter stand, IOM head and casette (1 off), plastic cyclone and casette (pack of 5), tweezers.
                  Please order the sampling pump and charger separately.

P104103   Upgraded Kit, as above but with metal carry case.

Casella Instrumentation and Software is designed, manufactured and serviced by:
Casella CEL.