

5.2.3 PUF Filter Spares

Foam filter - PM _{2.5} (pk of 10)	P118204
Foam filter - PM ₁₀ (pk of 10)	P118206
Foam filter - Respirable (pk of 10)	P118208

**ENVIRONMENTAL
ENCLOSURE
For MICRODUST pro****User Manual**

HB3273-06

COPYRIGHT

The copyright in this document which contains proprietary information is vested in CASELLA CEL Limited. The contents of this document must not be used for purposes other than for which it has been supplied or reproduced or disclosed wholly or in part without the prior written permission of

CASELLA CEL LIMITED

ALTERATION WITOUT NOTICE

The contents of this manual are subject to change without notice.

CASELLA CEL
Regent House
Wolseley Road
Kempston
Bedford
MK42 7JY United Kingdom
Phone: +44 (0)1234 844100
Fax: +44 (0)1234 841490
E-Mail: info@casella.co.uk
Web: www.casella.co.uk

CASELLA CEL INC
Tech Park
17 Old Nashua Road
Box 15
Amherst
NH 03031 U.S.A.
Phone: +1 603 672 0031
Toll Free: +1 800 366 2966
Fax: +1 603 672 8053
E-mail: us-sales@casella-cel.com

TABLE OF CONTENTS

Chapter	Page
WARNINGS	3
BATTERY WARNINGS	3
1. ENVIRONMENTAL ENCLOSURE FOR THE MICRODUST pro	4
1.1 Introduction.	4
1.2 System Overview	5
1.3 Power Supply	7
2. USING THE ENVIRONMENTAL ENCLOSURE	8
2.1 Installation	8
2.2 Battery Charging	9
2.3 PUF Filter Adapter	10
2.3.1 Storage of PUF Filters	10
2.3.2 Inserting / Removing PUF filters	11
2.4 Collection Filter Cassette	11
2.5 Powering Up And Using The System	11
2.5.1 Checking the Instrument's Span	12
2.5.2 Checking Probe Zero	12
2.5.3 Sampling Pump	12
2.6 Starting a Sample Run	13
3. THE VORTEX ASPIRATING PUMP	14
3.1 The Aspirating Pump	14
3.2 Switching the Pump ON and OFF	14
3.3 Resetting the "Elapsed Minutes" Counter.	14
3.4 Adjusting The Flow Rate	14
3.5 Additional Pump Features	15
3.6 Service Interval For Key Components.	16
3.7 Fault Finding	16
4. SERVICE	18
5. TECHNICAL INFORMATION	19
5.1 The Enclosure	19
5.1.1 Specification	19
5.1.2 Ordering Information	19
5.2 VORTEX Pump	19
5.2.1 Specification	19
5.2.2 Additional Features	19
5.2.3 PUF Filter Spares	20

5. TECHNICAL INFORMATION

5.1 Enclosure

5.1.1 Specification

Operating temperature range:	+5 to +40°C in the absence of condensation
Storage temperature range:	-25 to +55°C
Humidity range:	30 to 90% RH provided there is no condensation
Storage humidity range:	0 to 90% RH in the absence of condensation
Size:	410 x 330 x 175 mm
Weight:	7 kg without probe

5.1.2 Ordering Information

Enclosure for U.K.:	176091A
Enclosure for Europe:	176092A
Enclosure for U.S.A.:	176093A
Microdust pro	176000A
Rotameter (optional)	-CM344

5.2 VORTEX Pump

5.2.1 Specification

Flow range	1.5 to 4.5 litres/minute,
Flow control accuracy	±5% for selected flow,
Max. pressure drop	50 cm H ₂ O at 2 litres/minute, 25 cm H ₂ O at 4.0 litres/minute,
Run time	n/a,
Operating temperature	0 to +40°C,
Dimensions	120 x 74 x 50 mm.

5.2.2 Additional Features

- ✘ Six digit elapsed timer in minutes with 1 minute resolution,
- ✘ "Pump Running" indicator,
- ✘ Automatic flow fault indicator and shutdown (due to excessive pressure drop or blockage),
- ✘ Low battery warning indicator and bleeper,
- ✘ Low battery shut down.

4. SERVICE

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 CASELLA CEL's Service Department at our Bedford premises. 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.

Send to: CASELLA CEL LIMITED
(Service Department)
Regent House
Wolseley Road
Kempston
Bedford
MK42 7JY

If purchased outside the United Kingdom, please return to your distributor.

WARNINGS !

The Microdust pro and associated Environmental Enclosure is non-intrinsically safe and must not be used within a hazardous area.

BATTERY WARNINGS !

DO NOT ENABLE the charger circuit in the Microdust pro while non-rechargeable batteries are installed in the instrument.

DO NOT leave the main power switch ON when the system is out of use. The Enclosure's 12 volt lead acid battery will discharge into the Microdust pro battery causing DAMAGE.

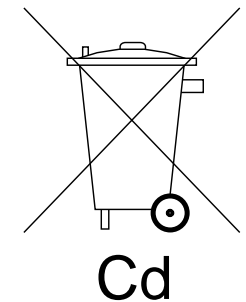
DO NOT use any other charger than the one supplied by CASELLA CEL. The charger is designed for indoor operation only.

DO NOT allow the batteries to remain discharged. Permanent damage may be done to both instrument and batteries if they are left discharged. Re-charge as soon as possible after use.

DO NOT connect the Environmental Enclosure power supply / battery charger directly to any Microdust Instrument. Damage to the instrument will occur.

DISPOSAL OF BATTERIES: Batteries and battery packs must never be disposed of by placing in a fire or incinerator, nor must they be punctured, crushed or otherwise mutilated or opened up in any way.

NiCd batteries contain CADMIUM and must be disposed of in a safe manner; in some countries this may involve specialist licensed waste disposal companies.



1. ENVIRONMENTAL ENCLOSURE FOR THE MICRODUST pro

1.1 Introduction.

With the increased awareness of environmental pollution from fine particulate and the introduction of the Air Quality legislation throughout the world, the demand for portable real-time monitors of PM₁₀ and PM_{2.5} has increased. The need for real-time particulate information is also a requirement in general industry, when looking at Total Suspended Particulate (TSP), and at inhalable and respirable dust levels as a health issue.

CASELLA CEL have introduced the Environmental Enclosure for exactly this application. This accessory provides a simple solution to fixed site monitoring with the Microdust pro and can be used for internal or ambient applications.

When monitoring ambient conditions, this system should not be used under conditions of high humidity, condensation, rain or fog - the APM is recommended for use under such conditions.

The IP65 case is designed to accommodate a standard Microdust pro as well as a sampling pump system to maintain a precise inlet flow rate. The pump also provides purge air to the measuring optics, which is an important feature to maintain long term reliability.

The Environmental Enclosure has been designed as an accessory for existing Microdust pro users as well as for potential customers looking for a complete system. The complete system would require the purchase of the Environmental Enclosure kit PLUS the following additional items:

- Microdust pro,
- PUF – Polyurethane Foam Filters,
- Suitable Flow Meter Kit and Sampling Filters.

The key component to this accessory is the sampling inlet which utilises PUF size-selective filter techniques. Size-selective filters were originally developed for operation in the Conical Inhalable Sampler (CIS) as detailed within the



Figure 1:
The Microdust pro

SYMPTOM	POSSIBLE CAUSE	SERVICE HINT
Pump runs but NO AIR drawn	Diaphragm RUBBER SPLIT.	REPLACE.
	Pulsation damper MEMBRANE SPLIT.	RENEW pulsation damper.
	TUBE between pulsation damper and valve chest SPLIT or DISCONNECTED.	REPLACE.
Pump runs but CANNOT ACHIEVE DESIRED FLOW RATE	LEAK on pump assembly.	LOCATE & correct.
	DIRT under valves or valve DAMAGE.	CLEAN / REPLACE.
	Inlet FILTER CLOGGED.	REMOVE & CLEAN.
	Flow POTENTIOMETER inoperative.	REPLACE circuit board.
Flow RATE NOT MAINTAINED through full working shift	INCOMPLETE CHARGE.	RE-CHARGE.
	Battery BELOW CAPACITY.	FULLY CHARGE & check voltage. It should be at least 12.0 V.
		If below, CHECK OUTPUT from charger.
	If output is correct, REPLACE BATTERY.	
High current consumption due to MECHANICAL DEFECT in pump.	LOCATE & CORRECT.	
Filter DISC CLOGGED.	REPLACE.	

3.6 Service Interval for Key Components

The equipment is designed and engineered for long and dependable service but as a precision instrument it should be given the best of care. The typical service intervals for key sampler components are as follows.

Valves	Part No 101189A	1500 hours,
Pump diaphragm	Part No 102164B	1500 hours,
Damper assembly	Part No B8351/7	1500 hours,
Eccentric 2.85 stroke	Part No 158008A	1500 hours,
Bearing	Part No BRE42	1500 hours,
Motor	Part No 104056B	3000 hours.

For rapid first line maintenance of the samplers, it is recommended that the following stock of modular sub-assemblies also be purchased.

Diaphragm pump Part No 151312A.

3.7 Fault Finding

SYMPTOM	POSSIBLE CAUSE	SERVICE HINT
PUMP does not run, (green LED not lit).	BATTERY fully discharged.	RECHARGE.
	FLOW adjustment set too low.	Turn FLOW CONTROL up.
	WIRING LOOM disconnected at some point.	LOCATE & re-solder.
	Fault on JOINT.	REPLACE circuit board.
PUMP does not run, (green LED is lit).	Eccentric BEARING SEIZURE.	REPLACE bearing.
	Motor SHAFT SEIZURE.	REPLACE motor.
	Broken WIRE.	REPAIR connection.
Motor runs but PUMP IN-OPERATIVE	GRUB SCREW securing eccentric to motor shaft LOOSE.	RE-TIGHTEN.

Health and Safety Executive publication MDHS 14/3. The foam filter specifications and dimensions determine the desired aerosol size selection characteristics and eliminate particle sizes greater than PM₁₀, PM_{2.5} or Respirable (4 µm) as appropriate. The larger particles become trapped and collect within the foam matrix, whilst all particles below these “cut-off points” pass through the PUF filters and enter the measurement chamber, where the real time mass concentration is established.

After passing through the Microdust pro, particulate matter is deposited on a 37 mm filter which may be used for gravimetric or chemical analysis.

Remember however, although the Environmental Enclosure has been designed to monitor particulate fraction concentrations in a variety of environments, it does have some operating limitations. The instrument is not designed to operate continuously out of doors for long periods of time (in the order of days or weeks).

Due to the light scattering principle used within the instrument, any moisture which individual particles attract at periods of high humidity or temperatures approaching “dewpoint” will be “seen” by the instrument as larger particles. This biases results towards greater concentrations. Also, during these periods, any air being drawn through the instrument which is high in humidity may condense on the optics and distort the light beam, producing spurious results.

With this limitation in mind, it is recommended that the Microdust pro not be used to monitor continuously for days at a time. Any application requiring this type of monitoring regimen, will need a particulate monitor with internal heater, to drive off any water vapour within the incoming air stream, thus eliminating erroneous readings.

The Casella Ambient Particulate Monitor (APM950) is considered the best tool for this job and can run continuously and unattended for months at a time. Please contact CASELLA CEL or your distributor for more information.

1.2 System Overview

The internal configuration of the Environmental Enclosure is shown in Figure 2. The system incorporates a sampling pump to draw the sample air through the inlet pipe at a user selected flow rate. PUF filters are designed to operate at a flow rate of 3.5 litres/minute. The inlet head is designed to prevent the ingress of insects and other large foreign objects. A dust cap is provided to seal the inlet port on the case lid whenever the inlet tube is removed for transit purposes.

Size selection of the sample stream is performed by passing the sample through a PUF foam filter appropriate to the chosen sampling strategy,

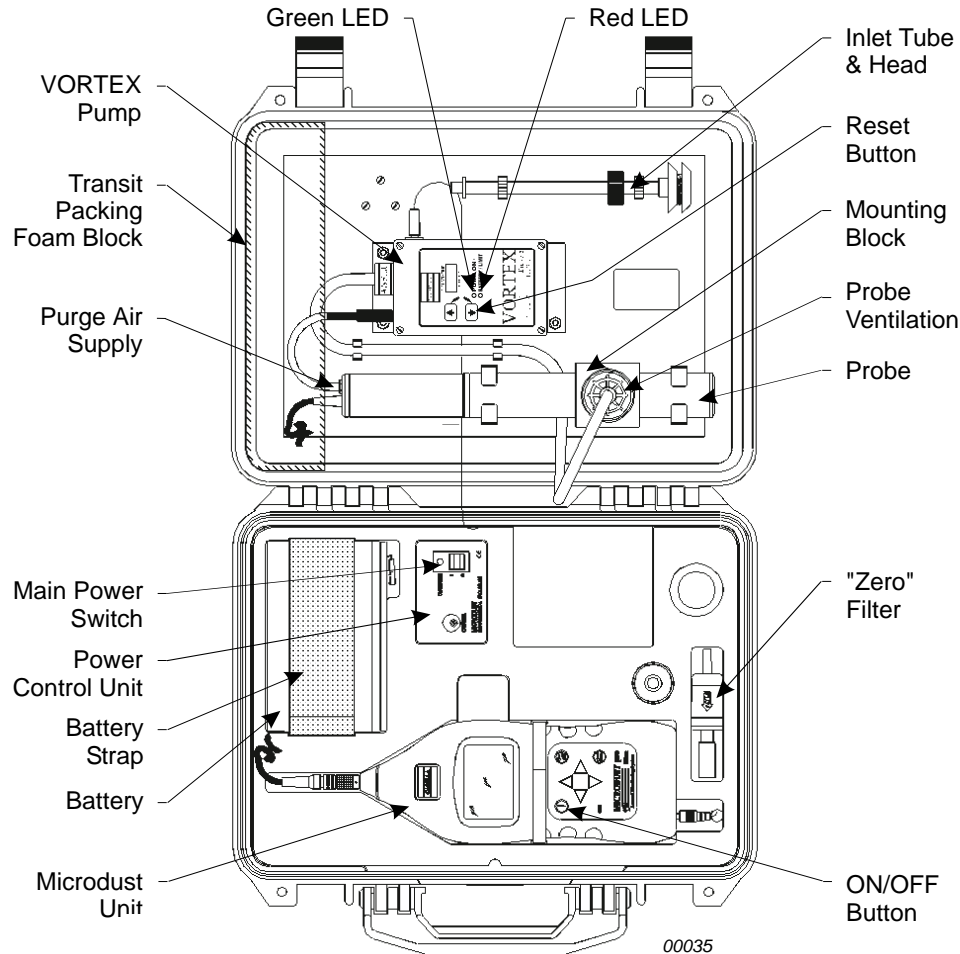


Figure 2: Components and controls for the Environmental Enclosure

(PM₁₀, PM_{2.5} or Respirable). PUF filter adaptors are described in Section 2.3 and shown in Figures 5 and 6. The PUF filter is fitted in the inlet side of the probe mounting block and may be accessed by carefully pulling the probe and block assembly squarely away from the case lid. **DO NOT twist or lever the probe away.**

The probe should unclip from the spring clips. A nozzle on the mounting block is a push fit into the inlet fitting on the case lid. A "purge" outlet on the pump delivers clean air to the surface of sensitive optical components within the measuring probe. A protective shield of clean air around the optical components prevents possible contamination and ensures reliable, long term

4. Check the flow if required, using a Casella -CM344 Rotameter, to be ordered separately.

This is able to calibrate flowrates over the range from 0.5 to 5.0 litres/minute.

PUF filters are designed to operate at a flow rate of 3.5 litres/minute.

Note: If the external power is removed from the pump, the flow setting will be lost.

3.5 Additional Pump Features

Pump ON indicator A green LED indicates that the pump is switched ON and is running.

Battery Limit and Shut Down Indicator

If the pump is unable to maintain the selected flow rate due to excessive pressure drop or an inlet blockage, the red "Battery/Limit" LED will begin to flash and the warning tone will beep rapidly. After 10 seconds the pump will automatically shutdown.

The red "Battery/Limit" LED and a continuous warning tone indicate that a flow fault has occurred.

To reset the flow fault alarm, switch the pump off by pressing both keys simultaneously.

Low battery warning A slowly flashing red "Battery/Limit" LED and warning tone are used to indicate that the battery is in a discharged condition.

This occurs for battery terminal voltages of approximately 4.7 volts or less and signifies that the battery should be re-charged.

Battery low switch off The pump will automatically switch off when the battery voltage falls below approximately 4.4 volts.

This prevents a deep battery discharge cycle and potential cell damage.

3. THE VORTEX ASPIRATING PUMP

3.1 The Aspirating Pump

The Environmental Enclosure uses a modified version of the VORTEX "Timer 2" personal sampler. This compact and reliable sampling pump is designed to provide a flow rate capability of up to 4.0 litres/minute whilst using a 37 mm GFA filter head (at up to 25 cm H₂O pressure drop). Automatic flow control circuitry is used to maintain a stable sample flow rate over varying pressure drop conditions.


The pump is powered directly from the 12 volt lead acid system battery.

3.2 Switching the Pump ON and OFF

To switch the pump on, press both keys on the VORTEX at the same time, the buzzer will bleep twice and the green LED will be illuminated indicating "PUMP ON".


To switch the pump off, press both keys simultaneously until the pump shuts down; all indicator lights should now be extinguished.



3.3 Resetting the "Elapsed Minutes" Counter

To return the count to zero, press and hold  for 3 seconds. This can be carried out while the pump is on or off.

3.4 Adjusting The Flow Rate

The pump is factory set to a flow rate of 3.5 litres/minute. Measurement of the sample flow should be performed by connecting a suitable rotameter to the inlet tube.

1. To adjust the flow rate, press and hold  until the green LED begins to flash.
2. Release the key.

The green LED will continue to flash for five seconds.
3. During this time you may press  to increase the flow or  to reduce the flow.

The flow rate will change slowly at first then more quickly the longer the key is held down.

operation. The pump incorporates a 0.9 µm filter and adjustable bleed valve. The valve is factory set to provide approximately 0.5 litres/minute of purge air when the main sample flow rate is 3.5 litres/minute.

1.3 Power Supply

A sealed, rechargeable 12 volt, lead acid gel battery is used to power the Environmental Enclosure and provides typically in excess of 24 hours sampling. The pump is powered directly from this battery.

Whilst the Microdust *pro* contains its own batteries, a small power supply control unit is used to provide additional power from the main 12 volt battery and extends the instrument's normal run time.

Observe the Battery Warnings on page 3.

Three versions of the enclosure are available; select the correct one for the local mains supply.

176091A
176092A
176093A

Enclosure for U.K. mains supply,
Enclosure for European mains supply,
Enclosure for U.S.A. mains supply.

2. USING THE ENVIRONMENTAL ENCLOSURE

2.1 Installation

A dense foam block is used to prevent the battery from moving during transit. Remove this transit packing block before using the Environmental Enclosure and keep it for use the next time the Enclosure must be transported.

Note also that the Microdust *pro* unit is a very close fit in the foam cutout intended for it. Install the unit in the enclosure as follows

1. Hold the unit over the cutout at an angle of approximately 45° as shown in Figure 3.
2. Ease the probe clip into the slot provided for it as shown.
3. Lower the unit into the cutout, ensuring that the edge of the clip is below the surface of the foam and pushed firmly against the back of the slot.
4. Connect the power supply cable to the charging socket of the Microdust *pro* as shown in Figure 4.
5. When removing the Microdust *pro* unit, disconnect the power supply from the charging socket, then place a finger in the slot indicated in Figure 4 to gently lever the unit from the foam.

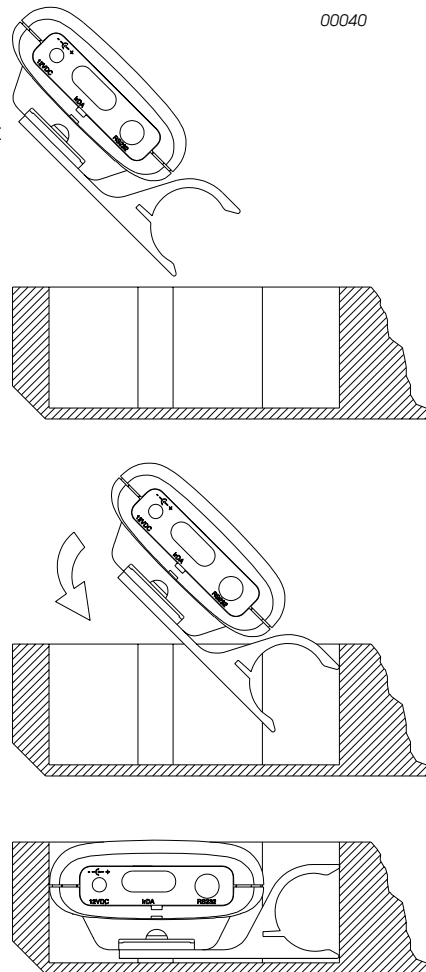


Figure 3: Installing the instrument

The following additional steps must be performed before the Environmental Enclosure can be used under operating conditions.

1. Re-set the timer display on the pump by holding down the "RESET" button on the VORTEX until the display re-sets to 0.
2. Start the pump by pressing both buttons on the VORTEX simultaneously until the green LED comes on.
3. Start the Microdust logger according to the Microdust *pro* User Manual.

2.6 Starting a Sample Run

1. Remove the protective dust cap and fit the sample inlet tube/head to the case.
2. Switch the Power Control unit on.
3. Switch the Microdust *pro* and VORTEX pump on.
4. Confirm the Microdust zero calibration setting using the in-line filter.
5. Insert the PUF filter foam(s) and sample filter (as required).
6. Check the inlet flow rate.
7. Start the Microdust logger according to the MICRODUST *pro* User Manual.
8. Zero the pump counter if required.
9. Leave to sample for the required run time.

All optical measurement systems are sensitive to the presence of moisture droplets both in the air and bonded to particulate matter. To prevent possible measurement errors, the system should not be used in conditions of high humidity, rainfall or condensation.

The main ON/OFF switch and Red indicator are located on the control unit adjacent to the charger socket. When this switch is set ON, the Microdust pro will be powered from the 12 volt lead acid battery, extending the run time beyond the normal 20 hours (with alkaline batteries).

When the system is not being used, set this switch OFF to prevent the 12 volt lead acid battery discharging into the Microdust battery.

Switch the Microdust pro ON.

2.5.1 Checking the Instrument's Span

The span of the Microdust pro should be checked in accordance with the relevant User Manual; refer to Chapter 2.

The span can also be checked by inserting the calibration filter and checking the reading. If required, adjust the span control according to the User Manual.

2.5.2 Checking Probe Zero

An inline filter is provided to simplify the task of zeroing the dust monitor.

1. Remove the inlet head and fit the filter to the end of the inlet tube.
2. Start the pump by pressing both buttons on the VORTEX simultaneously.
3. Allow the purge air to blow any residual dust from the probe.
4. When a steady zero is achieved, set the zero calibration point of the Microdust pro.
5. Stop the pump by pressing both buttons on the VORTEX until the pump stops.
6. Remove the inlet filter and replace the inlet head.

2.5.3 Sampling Pump

Check the performance of the sampling pump and adjust the flow rate as described in Chapter 3.

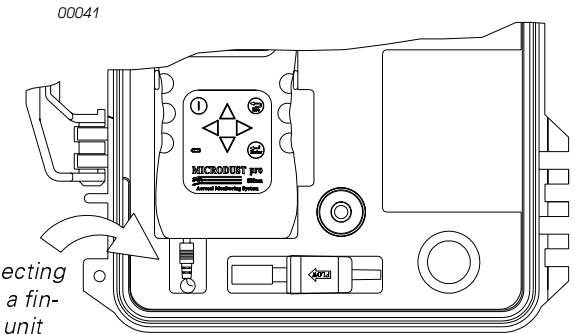


Figure 4: After disconnecting the power lead, insert a finger here to ease the unit from the cutout

2.2 Battery Charging

Warning !

DO NOT connect the Environmental Enclosure charger directly to any Microdust Instrument. DAMAGE to the instrument will occur.

DO NOT enable the Microdust pro internal charging circuit unless re-chargable batteries have been installed.

DO NOT leave the main power switch ON when the system is out of use. The Enclosure's 12 volt lead acid battery will discharge into the Microdust pro battery causing DAMAGE.

Observe the other Battery Warnings on page 3.

It is safe to leave the charger (supplied by CASELLA CEL) connected and switched on until the unit is required for use. The charger is suitable for indoor use only.

The Environmental Enclosure is powered by a 12 volt lead acid gel battery which may be re-charged via the socket located on the power control unit within the enclosure. The charger is a "split rate" type that will "fast charge" the battery to full capacity and then switch to "trickle charge". Plug the lead from the charger into the socket on the power control unit and connect the charger to the mains electricity supply.

The light on the charger will show "Red" to indicate that the battery is charging, "Yellow" to indicate the battery has reached 80% of capacity, and "Green" to indicate that the battery is fully charged and ready for use. Once the battery has reached 80% capacity there is sufficient charge for **at least 24 hours continuous use**. When the charger is connected, the 12 volt lead acid battery and the nickel cadmium battery in the Microdust will both be charged at the same time.

2.3 PUF Filter Adapter

For size-selective monitoring applications, it is necessary to load the appropriate foam filter(s) into the inlet adapter. If TSP (Total Suspended Particulate) monitoring is required, then no foams should be fitted within the inlet assembly.

The type of foam filter loaded into the adapter determines the size of particulate matter being monitored by the Microdust pro and collected on the filter. Although the PUF foam inserts have been designed as size-selective filters to capture particles larger than a specified mean aerodynamic size, it is also possible to weigh the PUF inserts before and after measurement to establish both the total suspended particulate (TSP) value and the desired size fraction.

2.3.1 Storage of PUF Filters

The PUF filters should be kept in a clean and preferably air-conditioned environment.

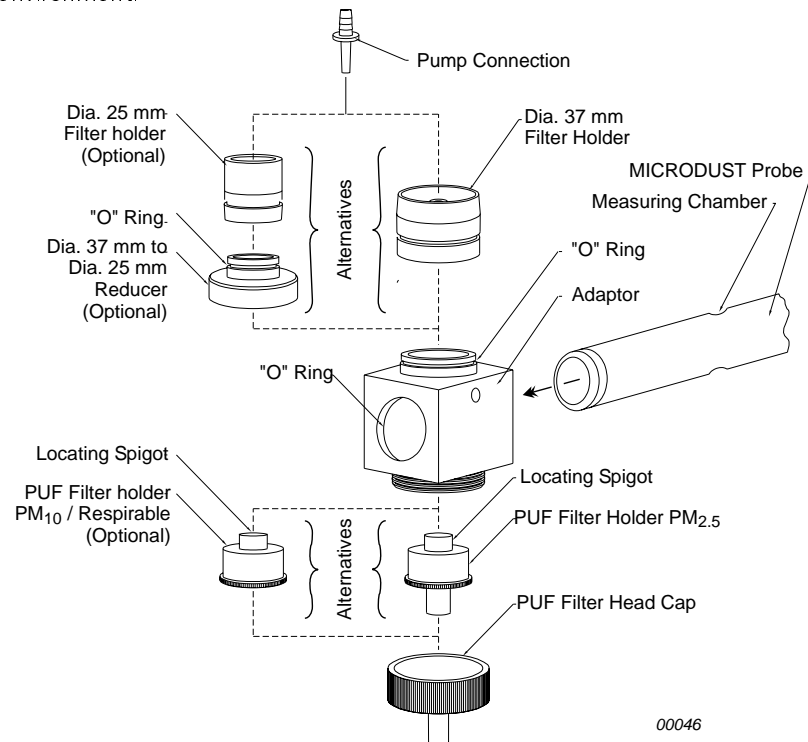


Figure 5: PUF filter installation

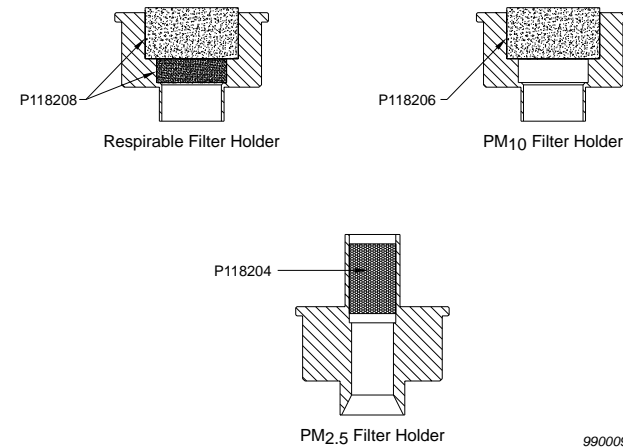


Figure 6: Filter Housings

2.3.2 Inserting / Removing PUF Filters

The PUF filters should be carefully inserted or removed from their respective cassettes using clean tweezers and plastic gloves. Avoid subjecting the filters to physical damage, creasing or folding.

Filters should be loaded into the relevant housing as shown in Figure 6.

The probe should be inserted into the Adaptor Block and correctly aligned so that the locating spigot on the PUF Filter Holder locks it into the Probe Measuring Chamber. When locked correctly into position, the complete assembly is prevented from rotating or moving laterally on the probe.

2.4 Collection Filter Cassette

A Filter Cassette is provided to accommodate a 37 mm filter, (25 mm is available on request). The desired filter type (typically of the GFA type) should be conditioned and pre-weighed (if required) before being loaded into the cassette. Always handle filters with care to prevent contamination or physical damage. Never operate the system without an inlet filter being fitted – the filter protects the pump from any ingress of dirt.

2.5 Powering Up And Using The System

Caution !

The Environmental Enclosure is completely airtight when closed. It is necessary to unscrew and remove the pressure relief valve located under the carrying handle before use.