CANTIUM SCIENTIFIC

MicroBio MB1 Bioaerosol Sampler Operating Manual

MicroBio MB1
Bioaerosol Sampler

Operating Manual

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Regulatory Compliance

EC Declaration of Conformity

This is to certify that MicroBio MB1 products manufactured from **April 2014** meet the following European Community Directives:

Electromagnetic Compatibility (EMC) Directive 89/336/EEC repealed by 2004/108/EC to the following standard:

EN 61326-1	Scientific, Test and Measurement Equipment
Referencing:	
EN 55011 / CISPR11	Emissions for Industrial, Scientific and Medical Equipment
EN 61000-4-2	Immunity to Electrostatic Discharge
EN 61000-4-3	Radiated Immunity

Restriction on Hazardous Substances (RoHS) Directive 2002/95/EC

Signed:

S Plumridge CEng MIET MIEEE FRSA
Managing Director
Cantium Scientific Limited

WEEE and Recycling

Applicable to EC States only.

At the end of this product's useful life, please dispose at an appropriate recycling collection point provided in your country, or return it to your local distributor who is obliged to take the product for safe recycling and disposal under the Waste Electrical and Electronic Equipment Directive 2002/96/EC amended by 2003/108/EC.

Outside of the European Community, consult local regulations or your local distributor.

The MicroBio MB1 enclosure and fan housing is manufactured from ABS plastic. The petri dish support plate and fan body are manufactured from glass reinforced nylon. Electronics need to be recycled by approved organisations.

Warranty

The manufacturer warrants this product to be free from defects in materials and workmanship for **24 months** from the date of purchase.

If your product is found to be defective within that period, please contact Cantium Scientific Limited or your local distributor who will arrange for repair of the instrument, or if necessary a replacement.

This warranty does not cover accidental damage, wear and tear, consequential or incidental loss. The warranty excludes rechargeable cells supplied with the sampler.

Damage caused by cleaning materials and methods not recommended by the manufacturer, use beyond the specification, use in wash down areas (unless used in approved protective bags), or modifications without prior permission from the manufacturer will invalidate the warranty.

This warranty does not affect your statutory rights.

MicroBio MB1 Technical Specification

Flow Rate:	100 L.min^{-1} ‡
Sample Volume:	10 to 2,000 litres in varying steps
Sampling Volume Capacity:	~ 60,000 litres before recharge*
d50 Particle size:	1.7 μm (220 x 1mm hole head) 1.35 μm (400 x 0.7mm hole head)
Mean particle velocity:	9.62 ms^{-1} (220 x 1mm hole head) 10.7 ms^{-1} (400 x 0.7mm hole head)
Other Features:	Auto switch off 4-digit 7-seg LED display Sample cancel feature Padded carry bag supplied
Weight (excluding charger and carry bag):	650 g (inc. battery and petri dish)
Dimensions:	196 x 100 x 110 mm (inc. head)
Power:	4 x AA NiMh Cells 6V at 250mA (maximum)
Noise Level:	< 75dB @ 1m
Environmental Operating Range:	-10 to 50°C up to 90% RH‡
Sampling Plate:	55mm/65mm contact plate or 90mm petri dish
Sampling Head:	316 grade stainless steel 220 x 1mm holes **or** Anodised aluminium 400 x 0.7mm holes

* Based upon random samples until low battery warning given. These tests were undertaken on units fitted with new and fully charged Ansmann Max-e 2500 mA.Hr NiMh cells. Actual battery life may vary due to volume taken per sample, interval between samples, age of cells, and other environmental effects, such as humidity and temperature.

‡ Calibrated at 1013mbar 20ºC. Environmental conditions will affect air pressure thus mass/volumetric flow rates.

Introduction

The MicroBio MB1 is part of the MicroBio range of bioaerosol samplers and is one of the most economical hand-held samplers in the world for monitoring airborne micro-organisms or bioaerosols.

The MicroBio range meets the standard required for a reference sampler, as fully validated by the UK Department of Trade and Industry Validation of Analytical Methods (VAM) programme.

The sampler collects airborne micro-organisms by drawing a stream of air at a constant flow rate through a series of small holes in a metal head. Particles suspended in the air stream impinge onto the surface of a sterile culture medium in a contact plate or petri dish.

After exposure to a set volume of air, the contact plate or petri dish is removed and incubated. The number of colonies which develop are counted, enabling a calculation to be made to determine the concentration of micro-organisms in the air (CFU / m^3 - colony forming units per cubic metre).

Installing Battery

The battery is held in a compartment at the back of the MicroBio MB1. The unit is supplied with 4 x AA NiMH rechargeable cells. The cells must be removed for re-charging.

To open the battery compartment press firmly on the “OPEN” marking on the battery compartment lid near the serial number label and then slide downwards.

The orientation of the cells is indicated within the battery compartment.

Carefully replace the lid with an upwards sliding motion ensuring the “OPEN” label on the lid is towards the serial number label.

NOTE:

Please read the instructions supplied with the charger before charging the NiMh cells. To avoid corrosion, we recommend cells are removed from the unit if it is to be left unused for extended periods and always fully charge before use.

Sampling

The selection of the sample volume is important for reliable sampling. If the contact plate or petri dish is overloaded with colonies it is difficult to make an accurate count. With experience, the user will anticipate the probable bioaerosol concentration in an area, but it may be necessary to make a preliminary survey at a number of sampling volumes to identify the optimum setting. Each sample should be repeated several times and a statistical mean value and confidence value determined.

Selection of Media

The agar media used in the contact plate or petri dish should be chosen to suit the micro-organisms being monitored. For a wide range of micro-organisms, consider using tryptone soy agar (TSA), casein soy peptone agar (CPSA) or nutrient agar (NA). There are other selective agars for more specific micro-organisms. For fungi (yeasts and moulds), consider using malt extract agar (MEA) or rose bengal agar (RBA). **Appendix C** details various culture media types.

IQ / OQ / PQ

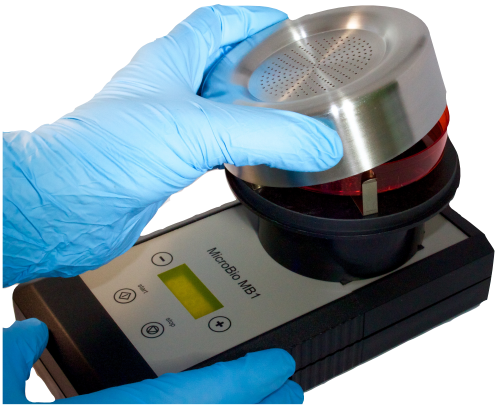
Documentation templates are available from Cantium Scientific Limited or your local distributor to support in-house Installation, Operational and Performance Qualification.

Download templates from: **https://www.cantiumscientific.com/support/information/**

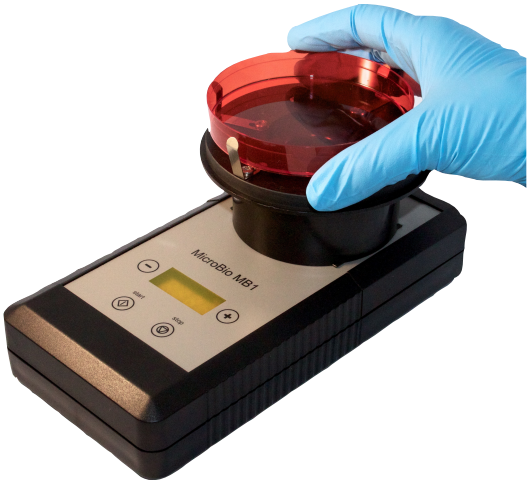
Customised templates area available upon request.

Inserting a Contact Plate or Petri Dish

Carefully remove the sampling head cover from the MicroBio MB1, unless it is being carried separately in a sterile container. Only hold the edge of the head. **Do not touch the perforated or inside surfaces.**



With the sampling head removed, insert a petri dish / contact plate inside the springs, so that its base sits firmly on the three support posts, then re-fit the sampling head.



The standard MicroBio MB1 can use 220 or 400 hole sampling heads. The 220 hole sampling head can be used with both 55mm / 65mm contact plates or 90mm petri dishes, but only the centre 55mm of the petri dish will collect samples. Using the 400 x 0.7mm hole sampling head will give nearly full coverage of a 90mm petri dish, improving reliability of counts.

Switching On and Off

To switch the unit on press any of the four buttons for at least half a second. If a button is held for too long (greater than 2 seconds), the unit switches off. This protects the sampler from being inadvertently switched on. The MicroBio MB1 will display the last volume setting used. The unit will switch off automatically if not used or after sampling has completed.

When the battery needs re-charging the display will show four dots below the volume setting. If the battery level is too low, the MicroBio MB1 will not allow samples to be taken.

Setting Sample Volume

Use the ⊕ or ⊖ buttons to select the volume of air to be sampled.

Volumes can be set as follows:

- 10 to 200 litres in 20 litre steps
- 200 to 500 litres in 50 litre steps
- 500 to 1000 litres in 100 litre steps
- 1000 to 2000 litres in 250 litre steps

Starting / Stopping Samples

Press the **start** button to start the sample process. When running the display will countdown showing how many litres remain to be sampled. The MicroBio MB1 will stop sampling when the required volume of air has been sampled.

Press and hold the **stop** button at any time to stop sampling.

Temperature and Humidity

It is useful to take a note of these values at the time of each sample. Temperature and humidity are important factors in the likely concentration and viability of airborne micro-organisms. For example, some bacteria survival rates are 35 to 65 times higher at 80%RH compared to 40%RH.

Determining Results

Once the sample has been taken, the contact plate or petri dish should be removed and sealed with its protective lid. A note should be made on the lid regarding time, location and volume sampled.

The plate should then be incubated for a period of time and temperature dependant on the requirements of the media.

Once incubated, the colony growths are then counted, either manually or using an automatic colony counter. Due to the statistical nature of the sampling method and the chance more than one colony impinged at one point on the dish, a count correction needs to be performed.

The tables in **Appendix A** and **Appendix B** gives the corresponding corrected value for the 220 hole and 400 hole sampling heads respectively.

Alternatively, the following equation can be used to determine a corrected count.

$$n_c = n_f \left(\frac{1.075}{1.052 - \frac{n_f}{n_h}} \right)^{0.483}$$

Where n_h is the number of holes on the sampling head, n_f is the number of counted colonies and n_c is the corrected count.

If the counted colonies, (n_f) exceeds the number of sampling head holes (n_h), then the equation will fail and the results cannot be trusted. If this is the case, then the sample dish can be considered as overloaded with micro-organisms and the user should consider lower sampling volumes.

The colony concentration is the corrected count per volume of air sampled. The results are normally expressed in colony forming units per cubic metre.

To convert the corrected count to CFU/m^3 use the equation:

$$CFU/m^3 = 1000.\frac{n_c}{V_s}$$

Where n_c is the corrected number of colonies counted and V_s is the sampled volume in litres.

Spreadsheets to automate the correction process and to collate and present results are available for free download from:

https://www.cantiumscientific.com/support/information

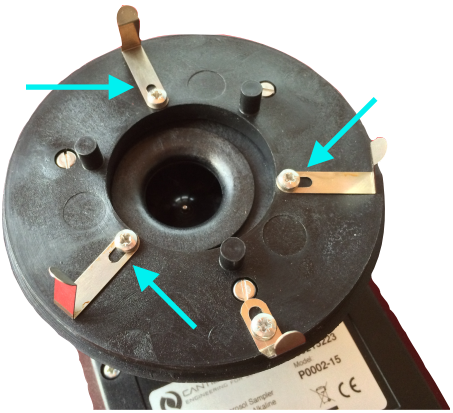
Alternatively, use our on-line tool to determine corrected counts and CFU by visiting:

https://www.cantiumscientific.com/membership/count-correction

Change Plate / Dish Type

The MicroBio MB1 can accommodate both 55mm / 65mm contact plates or 90mm petri dishes. The MicroBio MB1 is factory fitted with the petri dish springs, but these can be removed and replaced with the supplied contact plate springs (Cantium Scientific Limited part number P0001M007).

The springs for both types have slots to allow a degree of adjustment to suit dish / plate manufacturer variations.



To change the spring type remove the three screws and springs, as highlighted by the arrows opposite, then refit using the same screws and the contact plate springs. Care must be taken not to over-tighten or cross-thread any of the screws.

Replacement screws are available from Cantium Scientific Limited, part number P0001SCR003, or contact your local distributor.

Cleaning

The sampling head should be sterilised preferably by autoclave, but in the field disinfect with suitable sterilising wipes, such as IPA wipes or Tuffie 5 wipes (VernaCare part number 901SW225TY). Wipes may also be used for general cleaning of the sampler body. In areas of low bioaerosol levels, observe a disinfection regime between each sample. Always sample from areas of lower contamination towards those of higher contamination. Wash exposed skin and clothing before sampling and avoid drinking, eating and smoking in the test area. All equipment should be handled aseptically.

The MicroBio MB1 is suitable for use with Hydrogen Peroxide Vapour (H_2O_2 vapour) bio-decontamination. As the MicroBio MB1 has a fan within the sampling head, it is recommended for optimum decontamination the MicroBio MB1 is set to sample at maximum volume, allowing H_2O_2 vapour to be drawn through the head, fan and exhaust.

Tests have been carried out by Bioquell (UK) Ltd on a range of sensitive electronic equipment to determine effects of such processes. The conditions of these tests were:

Gas Concentration	1000 ppm
Conditioning time	20 minutes
Gassing time	30 minutes
Aeration time	150 minutes

Vapour sterilisation above the test conditions levels and times will invalidate the warranty.

Throughout the tests, Bioquell demonstrated that bio-decontamination with H_2O_2 vapour does not appear to be detrimental in any way, affect operational aspects or aesthetics of sensitive electronic equipment. For further information on Bioquell H_2O_2 vapour material compatibility, please refer to Bioquell document BDS-3-MATCOMP-V3.2 (www.bioquell.com).

Validation

Some industries require sampling equipment to be validated before being used. For the MicroBio MB1 this can be achieved using the MicroBio Validation Kit, part number P0059 available from Cantium Scientific Limited or your local distributor.

Calibration

It is recommended the MicroBio MB1 is regularly calibrated in accordance with specific industry best practice. Typically, this will be on the anniversary of the instrument entering service.

The only calibration adjustment on the instrument is the flow rate, by default set to a volumetric flow rate of 100 litres per minute. Calibration is normally performed at an air pressure of 1013 mbar at 20ºC. The normalised conditions the unit is calibrated at are printed on the calibration label on the rear end of the MicroBio MB1 and on the calibration certificate.

Troubleshooting

The MicroBio MB1 will give many years of trouble-free service with minimal routine maintenance. However, below are some common questions and answers relating to the use of the MicroBio MB1 Bioaerosol Sampler.

Q. The unit will not switch on.

A. Check the batteries are inserted correctly and fully charged. If this does not resolve the situation, please contact technical support.

Q. The sampler cuts out and switches off during sampling.

A. This is due to exhausted or low quality batteries. Replace batteries or recharge. Low quality cells may present a high terminal voltage, but as soon as a load is applied, this will drop drastically under load below a point where the sampler will not function properly.

Q. The sampling head fits loosely.

A. There is a retaining spring inside the sampling head area that keeps the head tight. This may, with time and use, have moved. Loosen the screw, slide the spring to the edge of the sampling head plate and re-tighten. Try this until a secure fit is obtained.

Q. The contact plate or petri dish fits loosely.

A. With time the springs that hold them in place may have loosened. Undo the screws, move the springs and re-tighten until a secure hold of the plate / dish is obtained. There is variation in the outside diameter of plates from one manufacturer to another. The MicroBio MB1 holding springs can be adjusted to accommodate this variation.

Technical Support

The first point of call for technical support should be your local distributor. Otherwise, please contact Cantium Scientific Limited via our web form:

https://www.cantiumscientific.com/contact/

Appendix A - 220 Hole Count Correction Table

Count	Corrected	Count	Corrected	Count	Corrected	Count	Corrected
1	1	41	46	81	101	121	175
2	2	42	47	82	102	122	177
3	3	43	48	83	104	123	179
4	4	44	49	84	106	124	182
5	5	45	50	85	107	125	184
6	6	46	52	86	109	126	186
7	7	47	53	87	110	127	188
8	8	48	54	88	112	128	191
9	9	49	56	89	114	129	193
10	10	50	57	90	115	130	196
11	11	51	58	91	117	131	198
12	12	52	59	92	119	132	201
13	13	53	61	93	120	133	203
14	14	54	62	94	122	134	206
15	15	55	63	95	124	135	208
16	16	56	65	96	126	136	211
17	18	57	66	97	127	137	213
18	19	58	67	98	129	138	216
19	20	59	69	99	131	139	219
20	21	60	70	100	133	140	222
21	22	61	71	101	135	141	224
22	23	62	73	102	136	142	227
23	24	63	74	103	138	143	230
24	26	64	76	104	140	144	233
25	27	65	77	105	142	145	236
26	28	66	78	106	144	146	239
27	29	67	80	107	146	147	242
28	30	68	81	108	148	148	245
29	31	69	83	109	150	149	248
30	32	70	84	110	152	150	251
31	34	71	86	111	154	151	254
32	35	72	87	112	156	152	257
33	36	73	89	113	158	153	261
34	37	74	90	114	160	154	264
35	38	75	92	115	162	155	267
36	39	76	93	116	164	156	271
37	41	77	95	117	166	157	274
38	42	78	96	118	168	158	278
39	43	79	98	119	170	159	282
40	44	80	99	120	173	160	285

Appendix B - 400 Hole Count Correction Table

Count	Corrected	Count	Corrected	Count	Corrected	Count	Corrected
1	1	41	44	81	91	121	144
2	2	42	45	82	92	122	145
3	3	43	46	83	93	123	147
4	4	44	47	84	95	124	148
5	5	45	48	85	96	125	150
6	6	46	49	86	97	126	151
7	7	47	50	87	98	127	153
8	8	48	51	88	100	128	154
9	9	49	53	89	101	129	156
10	10	50	54	90	102	130	157
11	11	51	55	91	103	131	159
12	12	52	56	92	105	132	160
13	13	53	57	93	106	133	161
14	14	54	58	94	107	134	163
15	15	55	59	95	109	135	164
16	16	56	61	96	110	136	166
17	18	57	62	97	111	137	167
18	19	58	63	98	113	138	169
19	20	59	64	99	114	139	170
20	21	60	65	100	115	140	172
21	22	61	66	101	117	141	174
22	23	62	68	102	118	142	175
23	24	63	69	103	119	143	177
24	25	64	70	104	121	144	178
25	26	65	71	105	122	145	180
26	27	66	72	106	123	146	181
27	28	67	74	107	125	147	183
28	29	68	75	108	126	148	184
29	30	69	76	109	127	149	186
30	31	70	77	110	129	150	188
31	33	71	78	111	130	151	189
32	34	72	80	112	131	152	191
33	35	73	81	113	133	153	192
34	36	74	82	114	134	154	194
35	37	75	83	115	136	155	196
36	38	76	85	116	137	156	197
37	39	77	86	117	138	157	199
38	40	78	87	118	140	158	200
39	41	79	88	119	141	159	202
40	42	80	90	120	143	160	204

Appendix C - Culture Media Types

Micro-organism	Agar Culture Medium	Incubation Temperature
Bacteria:		
Human Flora	Blood Agar	35 - 37°C
Possible Pathogens	Heart Infusion Agar Soya bean-casein digest agar (SCDA)	35 - 37°C
Environmental saprophytic	SCDA or R2A	25 - 30°C
Thermophylic	EMB or Endo Agar	35 - 37°C
Fungi:		
Environmental saprophytes	Malt Extract Agar(MEA)	Room Temp
	Sabouraud Dextrose	Room Temp
	Rose Bengal Agar (RBA) (with streptomycin), Inhibitory Mould Agar	20 - 25°C
Xerophylic	Malt Extract Agar with added NaCl, sucrose or dichloran- glycerol	20 - 25°C

Appendix D - Replacement Parts

HEAD RETAINING SPRING (PART NO. P0001M009)

Replacement sampling head retaining spring. Sold individually

Head Retaining Spring

CONTACT PLATE HOLDING SPRINGS (PART NO. P0001M007)

Replacement springs used to hold 55 mm contact plates. 3 per pack.

Contact Plate Springs

PETRI DISH RETAINING SPRINGS (PART NO. P0001M008)

Replacement springs used to hold 90 mm Petri dish plates. 3 per pack.

MicroBio Petri Dish Springs

SPRING RETAINING SCREWS (PART NO. P0001SCR003)

Replacement stainless steel M3 x 6 screws used to fasten the dish, plate and head retaining springs. Sold in a pack of 10.

MicroBio Head Screws

Appendix E - Bioaerosols

What is a bioaerosol?

Bioaerosols are airborne particles, solid or liquid. They can be large molecules or volatile compounds. They contain living organisms. They will vary in size from a fraction of a micron to around 100 microns. As with inert “dust” particles, all bioaerosols are governed by the laws of gravity and will be affected by air movements being transported by turbulence and diffusion.

Air will often contain micro-organisms such as viruses, bacteria, and fungi. None of these actually live in the air, the atmosphere tends to kill off most of them. However, they are frequently transported attached to other particles, such as skin flakes, soil, dust, or dried residues from water droplets. Aggregation of cells into clumps can enhance the survival whilst airborne.

Bacterial cells when they become airborne normally rapidly die, within a few seconds, due to evaporation of water associated with the particle. Thus with higher humidity, higher bioaerosol levels can prevail. Airborne fungal cells (yeasts, moulds, spores) can remain viable for much longer periods, even at low relative humidity and high or low temperature extremes. These can pose health risks for humans and animals.

Sources of Bioaerosols

Outdoor areas: Wind action on soil, agitation of open water and raindrop impaction are major sources of bioaerosols. Farming of land, wastewater and sewage treatment are also significant outdoor sources. Other farming activities, cattle, swine animal houses will generate bioaerosols. Food processing plants, particularly of dairy products can generate higher levels of bioaerosols. With today’s emphasis on renewables, power station biomass storage and industrial scale composting facilities are sources of bioaerosols.

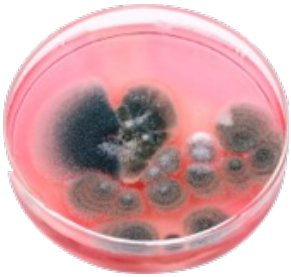
Indoor areas: Many indoor areas are associated with bioaerosol problems. In all food processing plants, hygiene requires that levels of airborne micro-organisms are kept as low as possible. Hospitals and healthcare facilities are not only sources of a variety of organisms, but require that patients are not exposed to any of them. The presence of undesirable bioaerosols is often associated with sick building syndrome, being one of a number of factors which contribute to building related illness.

Monitoring of Bioaerosols

Although the use of simple settle plates can be used for collection of bacteria and fungal spores, it can never give a quantitative determination. This passive technique will also fail to enumerate very small particles such as bacteria, which will remain suspended.

The simplest quantitative method of monitoring is to use impact samplers such as the MicroBio MB1 or MB2 units. These are single stage sieve impactors, which collect bacteria and fungal spores from air flowing at 100 litres per minute through a series of air inlets, onto an agar filled 55 mm contact plate or 90 mm Petri dish, up to a volume of 2,000 litres.

The agar media used should be chosen to suit the organisms which are being monitored. For a wide range of bacteria use tryptic soy agar (TSA), casein soy peptone agar (CPSA) and nutrient agar (NA). There are other selective agars for more specific micro-organisms. For fungi (yeasts and moulds) use is made of malt extract agar (MEA) or rose bengal agar (RBA). After sampling with the MicroBio samplers, the agar plates are incubated for specified times and temperatures (typically 1 to 2 days at 25 to 37 deg C) and the colonies which develop are counted.



A correction is applied to the count to allow for the possibility that two organisms going through one sampling hole will result in only one colony growth being observed (positive hole correction). This is determined from tables or using the MicroBio PC Reporter software supplied with all MicroBio samplers. From the corrected count and the sampling volume used, the number of colony forming units per cubic metre (CFU/m3) can be determined.

NOTES:

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