

# Cole-Parmer®

FSB-200 Series  
Fluidized Sandbath

Instruction Manual  
7002755-CPB Version 23.1

**Cole-Parmer®**  
essentials



## IMPORTANT SUPPLEMENTARY SAFETY INFORMATION

### Introduction

Cole-Parmer fluidized baths are safe and effective equipment when installed and operated correctly in accordance with the user manual. However, if used incorrectly they can pose a safety risk. Antylia Scientific have designed all models of fluidized baths to protect operators from hazards but users should pay attention to the following points.

### Caution

1. Please read the user manual before installation and use.
2. Cole-Parmer fluidized baths can heat up to 600°C, 700°C or even 1100°C. High temperatures are dangerous and can cause serious burns to operators and ignite combustible material.
3. Use care and wear protective gloves to protect hands and protective glasses to protect eyes.
4. Do not put hot objects on or near combustible objects.
5. Do not operate the unit close to inflammable liquids or gases.
6. Do not place any liquid directly in the unit.
7. Always ensure a suitable, adequate ventilation system is used when equipment is in use.
8. Always install fireproof metal ducting with sufficient airflow.

### Maintenance

1. When performing maintenance always disconnect from power supply and cool below 50°C.
2. Antylia Scientific recommend regular cleaning of fluidized baths. Externally, wipe with a damp soapy cloth. No abrasive cleaners. Care should be taken to prevent any water entering the unit.
3. Regular internal and external inspection of extraction ducting is recommend to detect any damage and ensure the internals are clean. Any build-up of particles or debris discovered in the extraction ducting requires the ducting to be cleaned or replaced.
4. In fluidized baths used for polymer burn-off, please regularly inspect fluidising medium, remove any foreign debris and replace with clean fluidising medium as required.
5. Never top-up a hot fluidized bath with cold fluidising medium. Always cool below 50°C first.

### Please note

1. Please ensure an adequate risk assessment is performed before use of a fluidized bath.
2. Please ensure the appropriate temperature is used for the application, always stay safely below the combustion temperature of any material or sample in a fluidized bath.
3. Fluidising airflow must be switched on before heating a fluidized bath, and left operational until the baths cools to below 50°C unless performing dead-bed calibration function.
4. Do not overfill fluidising media. The fill-level is 6 inches (15cm) below top surface when cold.
5. In fluidized baths used for polymer burn-off, always remove excess polymer from sample.
6. In applications where materials being treated produce acidic vapours during thermal decomposition, it is recommended a fume scrubber is utilised to ensure fume emission from the plant conforms to local regulations.
7. If you have any questions please contact [cptechsupport@coleparmer.com](mailto:cptechsupport@coleparmer.com).

## FSB-200-D OPERATOR'S MANUAL

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## SAFETY AND INSTALLATION

Please read all the information in this booklet before using the unit.

### WARNING

HIGH TEMPERATURES ARE DANGEROUS: they can cause serious burns to operators and ignite combustible material.

Antylia Scientific have taken great care in the design of these units to protect operators from hazards, but users should pay attention to the following points:

- USE CARE AND WEAR PROTECTIVE GLOVES TO PROTECT HANDS.
- DO NOT put hot objects on or near combustible objects.
- DO NOT operate the unit close to inflammable liquids or gases.
- DO NOT place any liquid directly in your unit.
- At all times USE COMMON SENSE.

### OPERATOR SAFETY

All users of Cole-Parmer equipment must have available the relevant literature needed to ensure their safety. It is important that only suitably trained personnel operate this equipment, in accordance with the instructions contained in this manual and with general safety standards and procedures. If the equipment is used in a manner not specified by Antylia Scientific the protection provided by the equipment to the Operator may be impaired.

If a safety problem should be encountered, switch off at the mains socket and remove the plug from the supply.

### SYMBOLS DEFINED



WARNING



FIRE HAZARD



HOT  
SURFACE



RISK OF  
ELECTRIC  
SHOCK



HEAVY OBJECT  
2 PERSON LIFT  
REQUIRED

## INSTALLATION

1. All Cole-Parmer units are supplied with a power cable. This may be integral or plug-in.
2. Before connecting the mains supply, check the voltage against the rating plate. The rating plate is on the rear of the unit. Connect the mains cable to a suitable plug according to the table below.

**Note that the unit must be earthed to ensure proper electrical safety.**

<i>Connections</i>	<i>220/240V</i>	<i>110/120V</i>
Live	Brown	Black
Neutra	Blue	White
I Earth	Green/yellow	Green

The fused plug supplied with the mains lead (for use in the UK) is fitted with the following value fuse to protect the cable: 13 AMP.

3. Place the unit on a suitable bench or flat workspace, or in a fume cupboard if required, ensuring that the air inlet vents on the underside are free from obstruction.
4. The unit must be installed with an appropriately rated switch and/or circuit breaker included in the installation.
5. The switch or circuit breaker should also be clearly marked as the disconnecting device for the unit.
6. The supply wiring should be of a specification suitable for the ratings indicated on the rating plate. In addition it should comply with local, national and international standards where applicable.

## INSTALLATION CONDITIONS

This equipment is designed to operate safely under the following conditions:

- For indoor use only
- Use in a well ventilated are
- Ambient temperature range 5°C to 35°C (41°F to 95°F)
- Altitude to 2000m (6500ft)
- Relative humidity not exceeding 75% decreasing to 30% and free from condensation
- Mains supply fluctuations not exceeding 10% of nominal
- Overvoltage category II IEC60364-4-443
- Pollution degree 2 IEC664

## AFTER USE

When you have finished heating samples, remember that parts of the unit – the tubes, blocks and associated accessories – may be very hot. Take the precautions listed earlier.

## GUARANTEE

The unit is guaranteed against any defect in material or workmanship for the period specified on the enclosed guarantee card. This period is from the date of purchase, and within this period all defective parts will be replaced free of charge provided that the defect is not the result of misuse, accident or negligence. Servicing under this guarantee should be obtained from the supplier.

Notwithstanding the description and specification(s) of the units contained in the Operator's Manual, Antylia Scientific hereby reserves the right to make such changes as it sees fit to the units or to any component of the units.

This Manual has been prepared solely for the convenience of Antylia Scientific customers and nothing in this Instruction Book shall be taken as a warranty, condition or representation concerning the description, merchantability, fitness for purpose or otherwise of the units or components.

## **OPERATOR MAINTENANCE**

NOTE: THAT THIS EQUIPMENT SHOULD ONLY BE DISMANTLED BY PROPERLY TRAINED PERSONNEL. REMOVING THE SIDE, FRONT OR REAR PANELS EXPOSES POTENTIALLY LETHAL MAINS VOLTAGES. THERE ARE NO OPERATOR MAINTAINABLE PARTS WITHIN THE EQUIPMENT.

In the unlikely event that you experience any problems with your unit which cannot easily be remedied, you should contact your supplier and return the unit if necessary. Please include any details of the fault observed and remember to return the unit in its original packing. Antylia Scientific accept no responsibility for damage to units which are not properly packed for shipping: if in doubt, contact your supplier. See the Decontamination Certificate supplied with your unit.

### **1. Cleaning**

Before cleaning your unit ALWAYS disconnect it from the power supply and allow it to cool below 50°C.

Your unit can be cleaned by wiping with a damp soapy cloth. Care should be exercised to prevent water from running inside the unit. Do not use abrasive cleaners.

### **2. Fuses**

Your unit is protected by one or two fuses. These should only be changed by suitably qualified personnel. If the fuses blow persistently, a serious fault is indicated and you may need to return the unit to your supplier for repair.

## **WARNING**

Poor fluidisation causes hot spots, heater failure, and damage to other parts. Follow instruction book carefully. For correct fluidisation, pay attention to;

### **INSTALLATION**

Ensure bath is level and air supply is adequate.

### **OPERATION**

Adjust air valve for even fluidisation.

Do not insert objects larger than recommended.

Ensure objects do not lie in contact with container wall or porous plate.

### **MAINTENANCE**

Regularly inspect and maintain air filter to eliminate oil vapour in air supply.

### **ALUMINA**

Should the fluidized bath be stirred for a long period of time under damp or humid conditions, moisture may be absorbed by the alumina which is hygroscopic. To avoid violent fluidisation which occurs when damp alumina is heated above 100°C, operate the bath for a period of approximately 8 hours at 90°C prior to operation at elevated temperatures.

NEVER ADD COLD OR DAMP ALUMINA TO A HOT BATH AS THIS WILL ALSO CAUSE VIOLENT FLUIDISATION WHICH CAN BE DANGEROUS. Allow the bath to cool then add the fresh alumina. If this fresh alumina is a large portion of the charge then dry the whole charge as above.

### **FUME EXTRACTION**

When used for processing items which may emit toxic or inflammable fumes, it is essential that an adequate fume extraction system be installed. The extraction system must be correctly sized to ensure that any toxic fumes are removed from the working environment.

To eliminate the risk of spontaneous ignition, the concentration of inflammable fumes above the bath and within the exhaust duct work must be kept below the lower explosive limit.

## GENERAL DESCRIPTION

The FSB-200-D bath inner is a cylindrical stainless steel vessel of welded construction and inside diameter 230 mm (9"). This vessel is suspended in, but thermally insulated from, an outer mild steel cylindrical container. The porous plate is made of either sintered or woven mesh stainless steel and is mounted across the vessel between compression flanges. Bath insulation is provided by fibreglass but some circulation of air is provided to prevent the outer container from getting too hot.

Each of these fluidized baths have 1kW Inconel sheathed electric heating elements mounted just above the porous plate. The FSB-200-D has four heaters. The air control valve is mounted at the right hand side of the bath. A pneumatically operated safety switch is fitted which switches off the heating current in the event of failure of the air supply.

Temperature control is achieved by a manually operated energy regulator. This may be by-passed by setting it to maximum and fitting an externally connected controller, the Cole-Parmer FSB-200-TC-L. On the FSB-200-D switches are fitted for the selection of either 1kW or 2kW or 3kW heat input but only the initial 1kW is controlled by the energy regulator. A switch is fitted for the selection of the fourth boost heater, this heater is not controlled by the energy regulator.

Each heater has its own neon light indicator to show when it is working.

The air supply must be from a filtered and regulated air line or alternatively a Techne air pump, F119D for 240V or F119P for 120V, may be used. The air pump includes a safety valve and special filters and is driven by 1/4 HP electric motor.



## OPERATOR SAFETY

It is important that only suitably instructed personnel operate this equipment. It must also be used in accordance with the instructions contained in this manual and with proper safety standards and procedures.

It is imperative that all personnel who may come into contact with our equipment have available such of our literature as they require to ensure their safety.

### Principles of operation

Small solid particles can be readily 'fluidized' by means of a suitable gas (air) stream. Clean dry air at a constant pressure of about  $21\text{ kN/m}^2$  ( $3\text{ lb/in}^2$ ) from a pump, or from an air line, is supplied via a control valve to a chamber beneath the diffuser (porous plate). This diffuser ensures a uniform flow of air across the full section of the container and acts also as a support plate for the sand.

As the control valve is slowly opened the solid sand bed remains undisturbed and the air finds its way between the particles; under such conditions the pressure drop is proportional to the rate of flow of air. As the valve is opened further the air drag on the particles will cause them to separate and the whole mass of the bed can be seen to have expanded. The bed now behaves as a fluid and is said to be 'fluidized'. Further opening of the valve is not accompanied by an increase in pressure drop, which remains constant at a value corresponding to the head of the column of particles, but the bed becomes more turbulent and will have the appearance of boiling liquid. The heat transfer and most uniform temperatures are obtained when the bath is in this 'boiling' state.

### Characteristic of a fluidised bath

A bath of fluidized solid particles behaves as a bath filled with an insulating non-volatile liquid and it shares with liquid baths the desirable characteristics of accessibility, uniformity of temperature and good heat transference. It is not, however, possible to obtain such a close temperature control as in a true liquid as the effective specific heat of a fluidized solid is much less than that of a liquid. On the other hand this small thermal capacity gives a rapid heat up from room temperature.

A typical heat transfer figure is  $600\text{ W/m}^2/\text{°C}$ . Mr H. Sutcliffe\* has pointed out the advantages of a fluidized bath for testing electrical components. The only electrical leakage that takes place is by physical transfer of charged particles so that the leakage currents are very small, being of the order of 10-9 amperes for a potential difference of 200 volts between electrodes 10 mm square at a spacing of 5 mm.

A fluidized bath is, of course, much cleaner than an oil bath and objects do not have to be cleansed on removal from the bath. A light dusting of the object with a brush is enough to return particles to the bath. It is necessary to clamp vessels as the fluidized bath produces appreciable buoyancy.

\* *Electronic Engineering, February 1961. pp. 94-95.*

### Cleaning your unit

Before cleaning your unit ALWAYS disconnect from the power supply and allow to cool below  $50\text{°C}$ . The outside of your fluidized bath can be cleaned by wiping with a damp soapy cloth. Care should be exercised to prevent water from running inside the unit. Do not use abrasive cleaners.

Before using any cleaning or decontamination method, except those recommended here, the customer should check with Antylia Scientific that the proposed method will not damage the fluidized bath.

## TECHNICAL SPECIFICATION

### FSB-200-D

Temperature Range	Minimum	50°C
	Maximum	600°C
Short Term Stability	at 50°C	±1°C
	at 600°C	±3°C
Heater power		4 x 1 KW
	Note: at 230V this is 17 amp	
Heat up time 20°C to 600°C		1 h 45 min
Cool down time to 200°C		5 h 30min
Electrical supply		240 V 50/60 Hz
Air supply	Pressure	21 kN/m <sup>2</sup> (3 psi)
	Max Flow	57 l/min
Overall Dimensions excluding tap	Diameter	385 mm
	Height	695 mm
Internal Dimensions	Diameter	228 mm
	Usable Depth	350 mm
Weight	Net	49 kg
Alundum		32 kg
Fuses	Contact your local sales specialist or email <a href="mailto:cspares@antylia.com">cspares@antylia.com</a> for full details	

## INSTALLATION

Before connecting the mains supply check the voltage with that marked on the rating plate.

Connect the mains cable to a suitable supply as follows:

<i>CONNECTIONS</i>	<i>220/240V</i>	<i>110/120V</i>
Live	Brown	Black
Neutra	Blue	White
I Earth	Green/yellow	Green

The FSB-200-D will use 17 amps and needs its own separate supply capable of taking this current.

Ensure that the air control valve is closed, then connect the air inlet to the correct supply. 21 kN/m<sup>2</sup> (3 l/in<sup>2</sup>) and up to 57 l/min (2 ft<sup>3</sup>/min) is required. It is most important that clean, dry air is used. For permanent set-ups the use of standard hose clips is recommended at the connections.

NOTE: If the pump unit supplied by Antylia Scientific is used, no adjustments are necessary and the unit can be connected directly to the bath.

Set both the energy regulator and heater control switches to the OFF position before connecting to the correct electrical supply.

IF THIS PRODUCT IS USED FOR PROCESSING ITEMS WHICH MAY EMIT TOXIC FUMES, IT IS ESSENTIAL THAT AN ADEQUATE FUME EXTRACTION SYSTEM BE INSTALLED.

### **ALUNDUM**

Should the fluidized bath be stored for long periods of time under damp or humid conditions, moisture may be absorbed by the alundum which is hygroscopic. To avoid violent fluidisation which occurs when damp alundum is heated above 100°C, operate the bath for a period of approximately 8 hours at 90°C prior to operation at elevated temperatures.

NEVER ADD COLD OR DAMP ALUNDUM TO A HOT BATH AS THIS WILL ALSO CAUSE VIOLENT FLUIDISATION WHICH CAN BE DANGEROUS. Allow the bath to cool then add the fresh alundum. If this fresh alundum is a large proportion of the charge then dry the whole charge as above.

## OPERATION

1. Fill the FSB-200-D to within 76 mm (3") from the top with the alundum. Make sure it is dry.
2. Slowly open the air control valve until the bed gives the appearance of continuous boiling. The bath is now ready for use and temperature setting.
3. If a rapid heat-up of the bath is required, set the heater switches to 'high' (FSB-200-D, 4kW, and set the energy regulator knob to a high value (say 8 or 9 on the scale), then as the desired temperature is approached the knob should be slowly turned anti-clockwise to a lower reading until control about the desired mean temperature is achieved. At this stage it may be necessary to switch out some of the heaters.  
NOTE: The energy regulator has an arbitrary scale which is not a temperature scale. At a setting of 10 the heater will be continuously on. A little practice will soon enable rapid temperature selection. A Cole-Parmer FSB-200-TC-L temperature controller may be connected externally into the circuit provided the energy regulator remains set at 10.
4. With increase in temperature, or when objects are placed into or taken from the bath, adjustment of the air control valve may be necessary, but the bed must be kept vigorously boiling.
5. AS THIS UNIT DOES NOT CONVEY THE EFFECTS SUCH AS VAPOUR OR SMELL NORMALLY ASSOCIATED WITH HIGH TEMPERATURE BATHS, WE ADVISE THAT ONLY TRAINED OPERATORS BE ALLOWED TO USE IT.

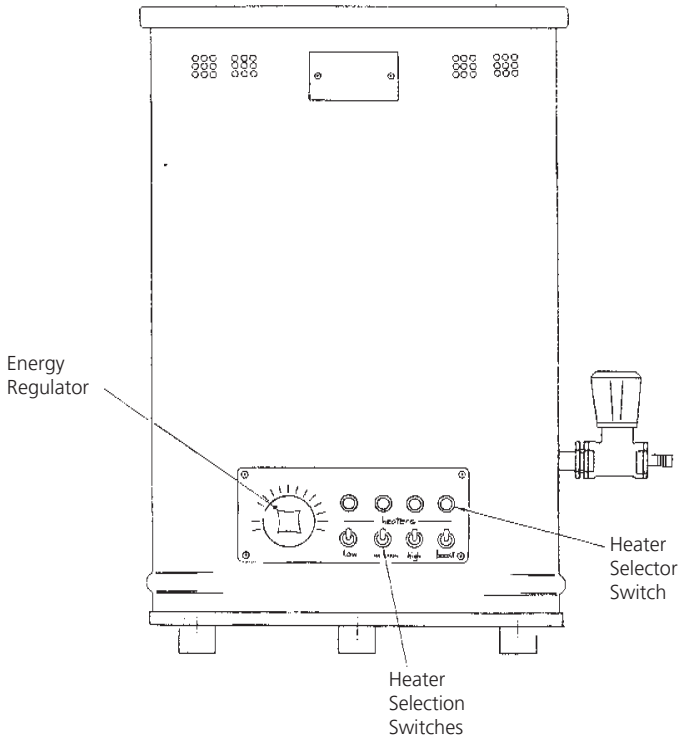
6. For the FSB-200-D the following table indicates the heat input required to maintain a range of temperatures, with the energy regulator control:

Bath Temperature	Heater Switches	Energy Reg Setting
200°C (392°F)	LOW	7 to 8
300°C (572°F)	LOW	9 to 10
400°C (752°F)	MEDIUM	2 to 3
500°C (932°F)	MEDIUM	8 to 9
600°C (1112°F)	HIGH	4 to 5

The fourth heater is only used as a 'boost' heater.

THE FOURTH HEATER IS NOT CONTROLLED BY THE ENERGY REGULATOR AND SHOULD BE SWITCHED OFF WHEN CONTROLLING TEMPERATURES REACHED.

Maximum temperature for this bath: 600°C (1112°F).



## MAINTENANCE

This unit is designed for continuous operation and requires very little routine maintenance.

1. The bath level should be maintained regularly and periodically the bath should be emptied and the alundum screened (or replaced).  
Should the fluidised bath be stored for long periods of time under damp or humid conditions, moisture may be absorbed by the alundum which is hygroscopic. To avoid violent fluidisation which occurs when damp alundum is heated above 100°C, operate the bath for a period of approximately 8 hours at 90°C prior to operation at elevated temperatures.  
**NEVER ADD COLD OR DAMP ALUNDUM TO A HOT BATH AS THIS WILL ALSO CAUSE VIOLENT FLUIDISATION WHICH CAN BE DANGEROUS.** Allow the bath to cool then add the fresh alundum. If this fresh alundum is a large proportion of the charge then dry the whole charge as above.
2. Always ensure that clean, dry air is used and that the correct electrical supply is properly connected.
3. Periodically check the following components for damage or malfunctioning:
  - a) Porous Plate. Check for cracks, or leakage of air through the rubber seal around the periphery
  - b) Heaters. Check for bad 'scaling' or signs of local deterioration.
  - c) Energy Regulator. When switched on the contacts can be heard to 'click' on and off periodically except when set at 10 position.
  - d) Safety Switch. When the sand bed is solid, the heater circuit should be automatically broken. With the bed just 'fluidised' the heater circuit should be completed. (Both tests should be made with the energy regulator set at 10).

## FAULT FINDING

The following guide has been prepared to help you get your fluidized bath back into service as soon as possible, should a fault develop. If in doubt, please return the unit to the manufacturers for servicing. Please refer to the next section for dismantling procedure.

<b>Fault</b>	<b>Action required</b>
<b>1 Sand Bed will not fluidise</b>	
a Air lines blocked	Check all air lines and connections for leaks or restrictions.
b Incorrect air supply	Check air supply for correct pressure 21 kN/m <sup>2</sup> (3 lb/in <sup>2</sup> ) and adequate flow (up to 57 l/min) (2ft <sup>3</sup> /min).
c Filters blocked or leaking	Check all filters for leaks or restrictions.
d Control valves not working correctly	Check functioning of all regulators or control valves in the air line.
e Bed material damp	If the bed material has become damp due to spillage of liquid, etc., then empty the bath immediately. Blow air through the porous plate to remove all moisture and dry the bath material by other means before replacing it in the bath.  DO NOT ATTEMPT TO DRY OUT REALLY DAMP MATERIAL IN THE BATH ITSELF.
<b>2 Bed 'boiling' erratically in one spot</b>	
a Porous plate cracked	Check porous plate or its seal for cracks or leaks. Replace porous plate if damaged.
<b>3 Bath not heating</b>	
a Incorrect electrical supply	Check supply (220/250 volts, 50/60Hz or 110/125 volts, 50/60Hz) and all external connections.
b Energy regulator not	Connect an ammeter (range up to 15 amps functioning a.c.) into the mains lead:- adjust the heater switch to the LOW position. Fluidise the bed and by switching the energy regulator to a reading of 5, observe that current flow alternates from 0 to approx. 4.3 amps. If no current flows at all then check items c to f and then if necessary replace the regulator.

c Fail safe switch not functioning

Connect an ammeter (range up to 15 amps a.c.) into the mains lead:-

Adjust the heater switch to the LOW position and set the energy regulator at 10. Fluidise the bed (continuous boiling action) and observe that the ammeter registers approx. 4.3 amps. Position the heater switches on the FSB-200-D to the MEDIUM position and observe that a current of approx. 13 amps flows. On the FSB-200-D a similar check should be made for the fail safe switch on the boost heater. If this current is not registered then check all other items; if necessary replace the fail safe switch.

d Internal electrical wiring damaged

With the electrical supply disconnected:- remove the baseplate of the unit and carefully check all internal wiring. Insulation meter or resistance meter would be useful for third check. A practical wiring layout is shown in the diagram. Connect an ammeter (range up to 15 a.c.) into the mains lead:-

e Heater switch not functioning  
or heaters burnt out

Adjust the heater switches to the LOW position and set the energy regulator at 10. Fluidise the bed and if both switch and heater function correctly a current of approx. 4.3 amps will flow. The top neon should also light. With the heaters switched to MEDIUM on the FSB-200-D, a current of 8.7 amps should flow. FSB-200-D: Switch set to HIGH 13 amps should flow. Replace either heater or switch as necessary.

f Failure of pneumatic safety switch  
(situated within outer case)

Check connecting pipe from the control valve through to the switch. Disconnect the rubber tube at a convenient point and check operation of the switch by blowing into the tube, a definite click should be heard from the switch.

#### 4 Bath overheating

a Energy regulator damaged b

Repeat checks as in 3 b above.

Heater switch damaged

Repeat checks as in 3 e above.

**Alternatively, all checks in sections 3 and 4 can be carried out with the power disconnected and by using an appropriate resistance or insulation meter.**



## ACCESSORIES AND SPARE PARTS

### **Optional Accessories**

Please visit [www.coleparmer.com](http://www.coleparmer.com) for a full list of available accessories.

### **Spare Parts**

Please contact your local sales specialist or email [cpspares@antylia.com](mailto:cpspares@antylia.com) to enquire about available spares

**NOTES**



This product meets the applicable CE Directives and UKCA Legislation for radio frequency interference and may be expected not to interfere with, or be affected by, other equipment with similar qualifications. We cannot be sure that other equipment used in its vicinity will meet these standards and so we cannot guarantee

that interference will not occur in practise. Where there is a possibility that injury, damage or loss might occur if equipment malfunctions due to radio frequency interference, or for general advise before use, contact the manufacturer.

Declaration of Conformity is available to view online at [www.coleparmer.com](http://www.coleparmer.com)

**EU Representative address**

Antylia Scientific GmbH  
Futtererstraße 16  
97877 Wertheim  
Deutschland  
Tel: +49 9377 9203-0  
Email: [sales@coleparmer.de](mailto:sales@coleparmer.de)

**UK Representative address**

Antylia Scientific  
9 Orion Court  
Ambuscade Road  
Colmworth Business Park  
St. Neots  
PE19 8YX  
United Kingdom  
Tel: +44 (0) 1480 277339  
Email: [enquiries@antylia.com](mailto:enquiries@antylia.com)

# Ordering Information

Order No.	Series	Model	Legacy SKU
01189-50	FBS-200	FSB-200-D	F946D

## Warranty Registration



### UK

T: +44 (0) 1480 272279  
E: uk.sales@antylia.com  
W: coleparmer.co.uk

### India

T: +91 22 61394444  
E: info@antylia.com  
W: coleparmer.in

### Germany

T: +49 (0) 9377 92030  
E: de.sales@antylia.com  
W: coleparmer.de

### China

T: +1 847 549 7600  
E: sales@antylia.com  
W: coleparmer.com

### France

T: +33 (0) 1486 37800  
E: fr.sales@antylia.com  
W: coleparmer.fr

### USA

T: +1 847 549 7600  
E: sales@antylia.com  
W: coleparmer.com

### Italy

T: +39 (0) 284349215  
E: it.sales@antylia.com  
W: coleparmer.it

### Canada

T: +514 355 6100  
E: info.antylia.ca  
W: coleparmer.it

### Other

T: +1 847 549 7600

**Cole-Parmer®**  
essentials

Antylia Scientific Ltd  
Beacon Road,  
Stone,  
Staffordshire,  
ST15 0SA  
United Kingdom

