CHEF Cooling Module

Instruction Manual

Catalog #1703654

#1703655

#1703688

BIO-RAD

Bio-Rad Technical Support Department

The Bio-Rad Technical Support department in the U.S. is open Monday through Friday, 5:00 AM to 5:00 PM, Pacific time.

Phone: 1-800-424-6723, option 2

Email: Support@bio-rad.com (U.S./Canada Only)

For technical assistance outside the U.S. and Canada, contact your local technical support office or click the Contact us link at www.bio-rad.com.

Notice

Revision History

Document	Date	Description of Change
CHEF Cooling Module Instruction Manual (Doc #: INST-222)	April 2021	Added Environment Requirements table

Revision History

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Warranty

Bio-Rad's CHEF Cooling Module is warranted against defects in materials and workmanship for 1 year. If any defects occur in the instrument during this warranty period, Bio-Rad will repair or replace the defective parts free. The following defects are specifically excluded:

1. Defects caused by improper operation.
2. Repair or modification performed by anyone other than a Bio-Rad support specialist or authorized agent.
3. Use of fittings or spare parts supplied by anyone other than a Bio-Rad support specialist or authorized agent.
4. Damage caused by accident or misuse.
5. Corrosion caused by improper buffer or solvent.

The following components are not covered under warranty:

1. Fuses
2. Tubing

For any inquiry or request for repair service, contact Bio-Rad Laboratories, Inc. Inform Bio-Rad of the model and serial number of your instrument.

Note: This Bio-Rad instrument is designed for laboratory use only and is certified to meet IEC/UL/EN-61010 safety standards. Operation of this product is subject to the condition that no harmful radio interference is caused and that any interference must be accepted. Certified products are safe to use when operated in accordance with the instruction manual. This instrument should not be modified or altered in any way. Alteration of this instrument will

- Void the warranty
- Void the IEC/UL/EN-61010 certification, and
- Create a potential safety hazard

Bio-Rad is not responsible for any injury or damage caused by use of this instrument for purposes other than those for which it is intended or by modifications of the instrument not performed by Bio-Rad or an authorized agent.

* EN61010-1 is an internationally accepted electrical safety standard for laboratory instruments.

Section 1

General Information

The CHEF Cooling Module (known in this manual as the Cooling Module) has been specifically designed as a standalone, portable refrigerated apparatus for use with the CHEF-DR II, CHEF-DR III, GenePath, and CHEF-MAPPER pulsed-field instruments. Electrophoresis buffer is circulated from the electrophoresis chamber by the variable speed pump, cooled directly by the liquid refrigerant in a heat exchanger within the Cooling Module, and returned to the electrophoresis chamber. The heat exchanger is electrically isolated from the chassis, compressor, and plumbing to eliminate electrical shock hazard.

The Cooling Module maintains a constant buffer temperature typically within 1°C of the set temperature (after stabilization) in an operating range of 5–25°C for a total buffer capacity of 2.2 liters at a flow rate of 1.0 liter/min. Maximum buffer cooling capacity is 75 watts (255 BTU) of input power at a set temperature of 14°C.

Fig. 1: Cooling Module. A. Main power switch. B. FLOW IN port. C. FLOW OUT port. D. Control panel. E. Electrophoresis chamber internal temperature probe port and fuse (back of unit).

Section 2

Environment Requirements

The Cooling Module has been designed to be safely operated under the environmental conditions listed in the following table.

Table 1. Cooling Module environment requirements

Parameter	Specification
Installation site	Indoor use only
Operating altitude	<2,000 m
Operating temperature	5 to 25°C 59 to 87.8°F
Cooling rate (pre-cool)	0.75°C/min from ambient to 14°C
Cooling capacity (input power)	75 W at 14°C
Relative humidity	20-80% non-condensing
Operating power	90–132 VAC/47–63 Hz/4 amps 198–264 VAC/47–63 Hz/2 amps
MAINS supply voltage fluctuations	±10%
Maximum power usage	<850 watts
Fuses	6.3 amp Slo-Blo (100/120 V) or 3.15 amp Slo-Blo (220/240 V)
Overvoltage category	II
Pollution degree	2

Cooling Module Instrument Specifications

Table 2 lists the specifications for the Cooling Module.

Table 2. Cooling Module instrument specifications

Parameter	Specification
Chassis	Aluminum
Dimensions	■ L: 42 cm; 17 in ■ W: 23 cm; 9 in ■ H: 24 cm; 9.5 in
Weight	14 kg; 30 lb
Compressor	1/12 HP
Refrigerant	CFC 12
Heat exchanger	Stainless steel

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Section 3

Safety Information

The Cooling Module is operated in conjunction with an electrophoresis apparatus connected to a high voltage power supply. Although those components of the Cooling Module which are in contact with the electrically charged buffer are electrically isolated, certain precautions should be taken to eliminate electric shock hazard.

1. The power supply should be off when connecting or disconnecting tubing.
2. The tubing must be firmly seated against the rubber grommets on the “FLOW IN” and “FLOW OUT” ports to prevent accidental contact with the metal tubing of the heat exchanger.
3. The safety interlock of the electrophoresis chamber lid should never be bypassed to permit operation of the instrument without the lid.

Definition of Symbols

Caution, risk of electric shock

Caution (refer to accompanying documents)

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Section 4

Maintenance

When the Cooling Module will not be used for an extended time, rinse the heat exchanger thoroughly with distilled water to remove all traces of electrophoresis buffer. Drain the residual water from the heat exchanger, and dry it with laboratory air.

Section 5

General Instructions

Installation

The Cooling Module is supplied with 2 two-foot lengths of 1/4" tubing, two 1/4" tubing clamps, and two 3/8" to 1/4" reducers.

To prepare the Cooling Module for installation

1. Attach one of the two-foot lengths of 1/4" flexible tubing to the “FLOW IN” port (Figure 1B) and attach the other length to the “FLOW OUT” port (Figure 1C) of the Cooling Module.

   Be sure that the tubing is firmly seated against the rubber grommet to prevent accidental contact with the metal heat exchanger, and avoid putting undue stress on the ports. If the tubing ever needs to be removed, slit the tubing with a sharp knife or razor blade, rather than pulling it off.

2. Secure one 1/4" clamp onto the end of each length of tubing attached to the Cooling Module. The clamp must be secure to prevent air leakage into the buffer circulation system.

3. Insert one 3/8" to 1/4" reducer into the other end of the “FLOW IN” tubing.

To add the Cooling Module to the CHEF buffer circulation system

1. Attach the buffer inflow tube (3/8" tube from the left front connector of the electrophoresis chamber) to the reducer on the end of the tubing attached to the “FLOW IN” port.

   The maximum total recommended length of tubing from the chamber connector to the “FLOW IN” port is 4 feet.

2. Attach the length of tubing from the “FLOW OUT” port of the Cooling Module to the inflow port of the recirculating pump.

3. The maximum total recommended length of tubing from the outflow port of the recirculating pump to the electrophoresis chamber is 4 feet. Cooling capacity and efficiency will increase if shorter overall lengths of tubing are used.

This configuration is recommended (as compared to having the buffer flow through the pump first into the Cooling Module) for the following reason:

Residual buffer (from a previous run) can freeze in the heat exchanger of the Cooling Module if it is turned on, but the recirculating pump is not. This frozen buffer will block the flow of buffer from the pump to the Cooling Module, and may cause the tubing between the pump and Cooling Module to come loose or burst. This could result in leakage of gel buffer from the system. In the recommended configuration, no buffer will be drawn into the pump if a blockage occurs.

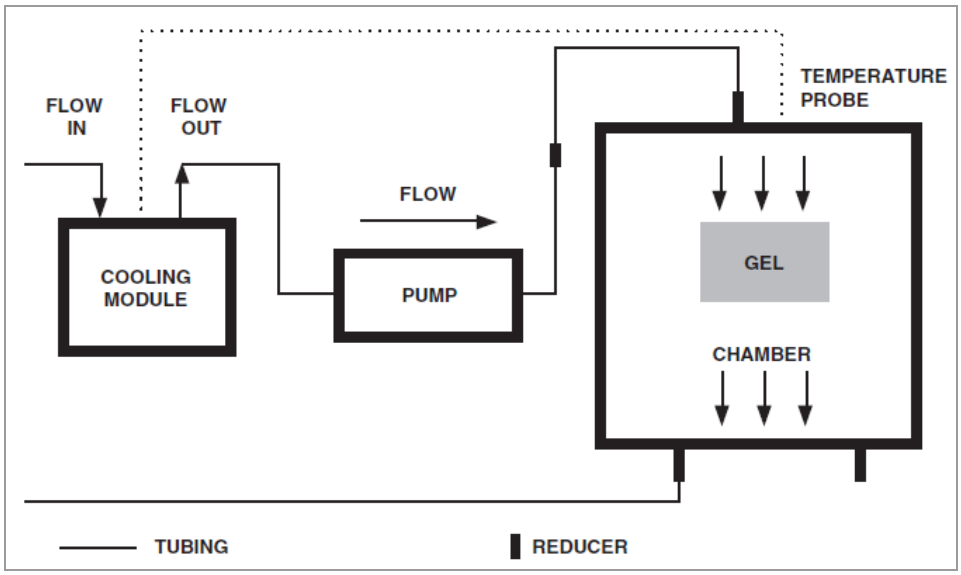

Fig. 2: Schematic diagram of Cooling Module installation in CHEF-DR II, CHEF-DR III, GenePath or CHEF-MAPPER system.

Electrophoresis Chamber Internal Temperature Probe

The internal temperature probe monitors buffer temperature in the electrophoresis chamber. If the electrophoresis cell's internal temperature probe is connected to the Cooling Module, buffer temperature will be automatically monitored at the cell's internal probe. There is a 9-pin connector on the back of the Cooling Module for the cell's internal temperature probe. Buffer temperature is also automatically monitored at the "FLOW OUT" port (Fig. 1 on page 8) of the Cooling Module by its own internal temperature sensor.

Operation

After the Cooling Module has been connected, the following steps should be followed for optimal operation.

To operate the Cooling Module

1. Switch on the recirculating pump, and adjust flow rate to 1.0 liter/min (setting of 70–80).
2. Switch on the Cooling Module (main power switch is on the front panel of the unit). The temperature display will read "14.0" after ten beeps, indicating that the unit is on (Fig. 3 on page 15), and the red light above the "SET TEMP" button will illuminate (Figure 3B).
3. Enter the desired run temperature (14°C is recommended) by pressing the "LOWER" or "RAISE" button (Figure 3F) until the desired number is reached.
4. After 100 sec have elapsed, the compressor will engage (if the set temperature is below ambient temperature), and the red light above "COOLING" will illuminate (Figure 3D). This 100 sec delay allows pressure equalization in the system to avoid mechanical damage.
5. Press the "ACTUAL TEMP" button (the red light above the button will illuminate; Figure 3C) to read the current temperature monitored at the internal temperature probe (located in the "FLOW OUT" port), or at the Cell's internal temperature probe (if connected).
6. After the Cooling Module has cooled the buffer to the desired set temperature, the "COOLING" light will occasionally go on and off accompanied by a click. This is an indication of the refrigerant bypass valve cycling on and off to maintain average buffer temperature within 1°C of set temperature. Greater temperature fluctuations may occur with longer tubing length, low buffer flow rates, and/or high amounts of input power and high ambient temperatures. However, the built-in adaptive algorithm will compensate for these conditions so that the average temperature is typically within 1°C.

Note: Please allow sufficient room for ventilation at both the front and rear of the unit. The cooling fan is located in the rear.

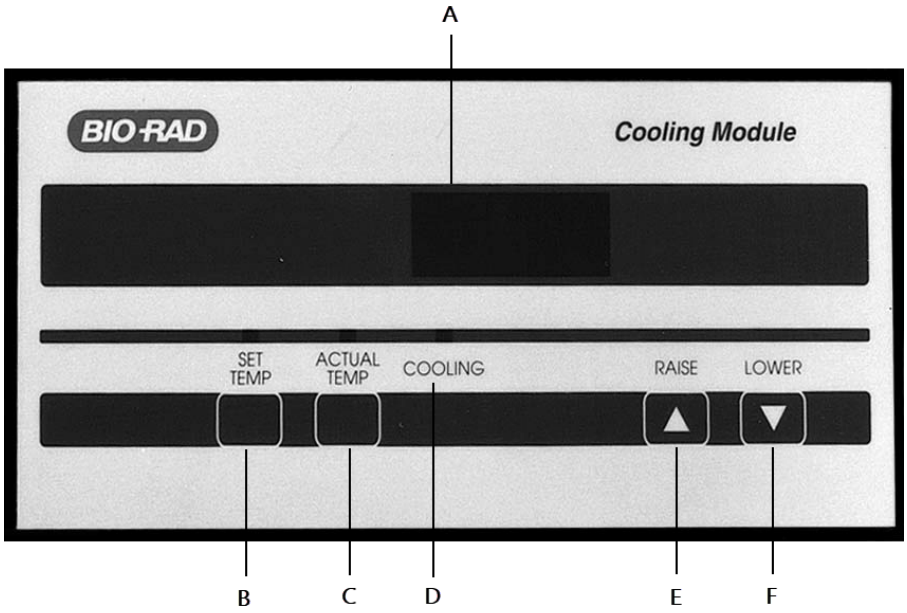

Fig. 3: Control panel of Cooling Module. A. Digital display (3 numerical places plus decimal point). B. Temperature set button and indicator light C. Actual temperature button and indicator light. D. Compressor running light. E. Raise button. F. Lower button.

Bio-Rad recommends that the buffer in the system be pre-cooled to the desired run temperature. The Cooling Module can quickly pre-cool the system, at an approximate rate of 0.75°C/min in the absence of input power to the recommended operating temperature of 14°C (to pre-cool from ambient temperature to 14°C only takes 10–15 min), and is designed to maintain set temperature during the run. If the buffer is not pre-cooled, the presence of input power (from the electrophoresis power supply) will greatly increase the time required to bring the system to the set temperature.

Note: The 0.75°C/min pre-cooling rate decreases for set temperatures lower than 14°C.

Section 6

Troubleshooting Guide

Problem	Solution
No power	■ Check fuse in main power switch on back panel of unit (see Section 7 on page 17) ■ Fuse in main power switch OK; contact Bio-Rad Technical Support
Power on, compressor not running	■ Reset timer ■ Temperature set too high; lower setting ■ Still in 100 sec delay period
No or low buffer flow	■ Check tubing for kinks ■ Pump flow rate too low ■ Frozen buffer in head exchanger; turn pump on; raise set temperature above ambient until buffer flow resumes, then lower set temperature to desired setting
Insufficient cooling	■ Pre-cool buffer to set temperature prior to beginning gel run ■ Buffer concentration too high ■ Buffer flow rate too high ■ Electrophoresis or buffer flow conditions outside design range limits
Unusual noise or vibration	■ Frozen buffer in head exchanger in variable speed pump, see above ■ Air leak from loose tubing connection
Small pool of liquid under Cooling Module	■ Frost may form on heat exchanger under certain operating conditions resulting in small amounts of water following Cooling Module shutdown

Section 7

Main Switch Fuse Check

To check the main fuses

1. Turn the unit around so that the back of the unit is facing forward, and locate the black plastic assembly containing the power cord receptacle on the lower left corner.
2. Turn the unit off and remove the main power cord from the receptacle (grasp the female plug, not the cord, and pull gently).
3. Insert a small-bladed flat screwdriver into the narrow slot at the top and twist firmly. This slot can be seen from above when looking down at the main power cord receptacle. The front cover will open revealing two light gray fuse holders.
4. Using the screwdriver, gently pull the fuse holders forward (out). Remove the fuse from the holder and examine. If the fuse is obviously burned, replace it with a 6.3 Amp, 250 V Slo-Blo fuse (100/120 V) or 3.15 Amp, 250 V Slo-Blo fuse (220/240 V). Otherwise, check the fuse with a volt-ohmmeter.
5. Place the fuse holders back into the slots such that the arrows on the fuse holders points in the same direction as the two arrows on the inside of the front cover. Press the fuse holders firmly into place, then close the front cover by pressing firmly at the top corners.
6. Replace the power cord. The unit is now ready for operation. If the unit still does not turn on, or the fuse burns again, please contact Bio-Rad Technical Support.

Bio-Rad
Laboratories, Inc.

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Website *bio-rad.com* ***USA*** *1 800 424 6723* ***Australia*** *61 2 9914 2800* ***Austria*** *00 800 00 24 67 23* ***Belgium*** *00 800 00 24 67 23*
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