QUALITY INSPECTION SUMMARY

We have made every effort to manufacture this instrument to the highest quality standards. All assemblies have been thoroughly tested and inspected at the factory as follows:

Initial Assembly Inspection	_____	☐
Initial QC Inspection/Calibration	_____	☐
24 Hour Burn-In	_____	☐
Final Performance Inspection	_____	☐

Packaging Inspection Initials: _____ Date: _____

Items included with any catalog number may be labeled and packaged separately in shipping carton.

Description	**Quantity**	**Checked**
Cat.# 85-20-0 MRC5000 Refrigeration System Containing: MRC5000 Controller OTS5000 Refrigerated Tray	_____	☐
Cat.# 85-20-0-01 MRC5000 Refrigeration Controller Only	_____	☐
Cat.# 85-20-0-02 MRC5000 Refrigeration Controller Only	_____	☐

EC Declaration of Conformity

We: **FHC Europe (TERMOBIT PROD srl)**

of: **42A Barbu Vacarescu Str, 3rd Fl**
Bucharest 020281 Sector 2
Romania

declare that:

Equipment: **Bath Medium Refrigeration Controller**

Model: **OTS 5000: Catalog No.s 85-20-0 & 86-20-0**

Serial Number: _____

in accordance with the following Directives:

73/23/EEC	Low Voltage Directive *and its amending directives*
89/336/EEC	Electromagnetic Compatibility Directive *and its amending directives*

has been designed and manufactured to the following specifications:

EN61010-2001:	*Safety Requirements for electrical equipment for measurement, control, and laboratory use: Part 1 - General Requirements*
EN50081-1:1992	*Electromagnetic Compatibility – Generic emission standard: Part 1 - Residential, commercial, and light industry*

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

Signed by: Keri S. Seitz Digitally signed by Keri S. Seitz DN: c=US, st=ME, l=Bowdoin, o=FHC, Inc., ou=Admin, cn=Keri S. Seitz, email=kseitz@fh-co.com Date: 2012.10.08 11:19:05 -04'00' Date: _____

Name: Keri Seitz

Position: President, CEO FHC

CE

Done at: *FHC Inc., 1201 Main Street, Bowdoin, ME 04287 USA*

Phone: 1207-666-8190, Fax: 207-666-8292

E-mail: fhcinc@fh-co.com, Website: http://www.fh-co.com

MRC5000 Bath Medium Refrigeration Controller
OTS5000 Refrigerated Tray

85-20-0-01 MRC5000
85-20-0-02 OTS5000 Refrigerated Tray

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Manual A965D: MRC5000
85-20-0

0.1 ***CONDITIONS FOR USE***

Intended Use
The MRC5000 used in conjunction with the OTS5000 Refrigerated Tray (or compatible trays) provides a refrigeration system for maintaining cool bath medium for use in tissue slicing, primarily fresh tissue.

Warnings
The OTS Refrigeration System components should not be disassembled beyond their major assemblies. Any disassembly beyond this may affect function and calibration. If repair is required please contact FHC at (207) 666-8190 for evaluation and to secure a return authorization number (RMA) if necessary.

Storage Precautions
Store at normal room temperatures between -34°C (-29°F) and 57°C (135°F). Do not expose to temperatures below -39°C (-29°F) or greater than 70°C (158°F), or a relative humidity of less than 10% or more than 100%, including condensation, or an atmospheric pressure less than 500hPa or greater than 1060hPa for long-term storage.

Sterilization
None of the OTS Refrigeration System components are designed for sterilization. Any attempt to sterilize them may result in malfunction or component failure.

Handling
While a high degree of durability has been designed into the OTS Refrigeration System components, care should be taken not to drop them. Do not force the couplings of the circulation tubing. Place all cables where they will not be inadvertently pulled or tangled.

1 *OPERATIONAL MANUAL*

1.1 *FEATURES*

- Temperature range of 0°C to 10°C.
- Temperature of medium maintained to .5 degree.
- 3 digit LED display of current bath medium temperature.
- Cooling cold water source attaches to the tray with quick-connect, self-sealing fittings. No tools required.
- Tray is easily removed for cleaning and specimen preparation.
- CLT5000 water tank available soon for closed loop system option.
- MRC5000 Controller compatible with OTS4000 and OTS3000 refrigerated trays.

1.2 *DESCRIPTION*

The MRC5000 Medium Refrigeration Controller and provided OTS5000 Refrigerated Tray add refrigerated medium capabilities to the OTS5000. The controller 3 digit LED displays the current temperature of the bath medium in degrees Celsius (°C). The temperature is maintained within .5°C. User controlled temperature of between 0°C to 10°C is available.

The OTS Refrigerated Tray is fitted with a Peltier heat exchange unit. A cold water source is circulated through the assembly to transfer heat. The tubing is connected to the tray with quick connect fittings. No tools are necessary for installation. The fittings are self sealing to prevent leaking during installation. The tray fits directly to the mounting platform of the OTS5000.

The CLT5000 Closed Loop Tank will be available for a complete closed-loop refrigeration system.

1.3 *OPERATING ENVIRONMENT*

The MRC5000 is designed to be operated in a typical laboratory environment. The unit should be set up near a water source and in a location to conveniently monitor the temperature reading.

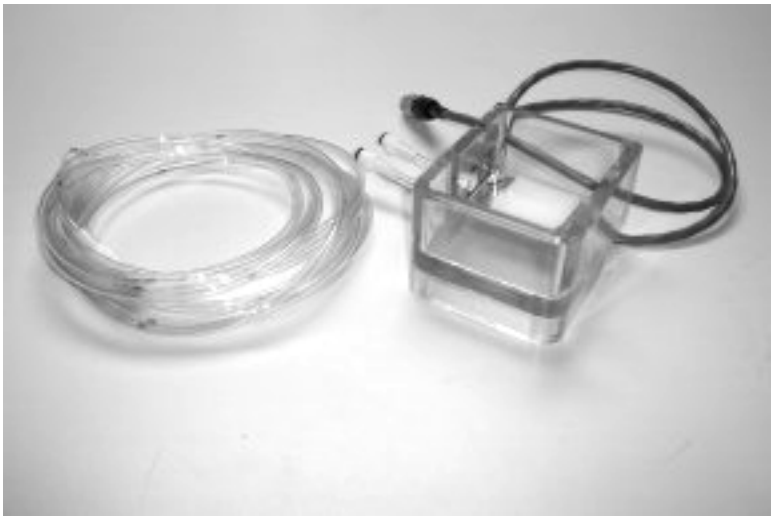
1.4 *INVENTORY*

1.4.1 *ITEMS DESCRIBED IN THIS MANUAL*

The following Items are included under the following catalog numbers:

1 ea. Cat. #85-20-0 MRC5000 Medium Refrigeration Controller

Includes: Controller



1 ea. Cat. #85-20-1 OTS Refrigerated Tray

Includes: Refrigerated Tray

Tubing

1.4.2 *ADDITIONAL ITEMS REQUIRED FOR OPERATION*

The following additional items are ORDERED SEPERATELY:

1 ea. 66-EL-LC-XXX Line Cord (Country specific see sec 2.1.4 of this manual for catalog number)

1.4.3 ***REPLACEMENT ITEMS***

Cat. #85-20-1-01 Replacement Tubing

1.4.4 ***SYSTEM CONFIGURATIONS***

MRC5000 and OTS Refrigerated Tray shown with OTS5000 Tissue Slicer.

1.5 ***CONCEPTS***

1.5.1 ***TERMINOLOGY***

Bath Medium –A solution (generally Potassium Chloride (KCl) for fresh tissue samples) used to aid in maintaining the viability of a sample during slicing.

1.5.2 ***DESIGN DESCRIPTION***

The MRC5000 Medium Refrigeration Controller consists of a temperature control PCB housed in packaging that is consistent with the OTS5000. The 3 digit LED displays the current bath temperature. Temperature is maintained within .5 degree. Temperature control is maintained using a trim pot to set an approximate temperature goal. The heat exchanger assembly will cool the temperature of the bath to the setting on the dial during a period of time, however the goal of the unit is to maintain the temperature of pre-refrigerated solution within a range useful for sample viability. The current temperature of the bath medium is monitored by a thermistor located in the rear of the refrigerated tray. The thermistor connects to a jack in the back of the controller via a 3' cord. The peltier cooling loop is attached to the refrigerated tray by 8' of tubing (1 for in, 1 for out of the tray). The tubing connects to the tray via self-sealing fittings. One of the tubes connects directly to a faucet; the other is placed in a sink for draining. The fittings are interchangeable for input or output.

The refrigerated tray consists of the standard OTS5000 Tray fitted with a peltier heat transfer assembly. The peltier is located in the tray such that any ice buildup does not affect function of the tray platform.

The controller is powered by an internal power supply and (a separately ordered) AC line cord.

1.6 *TECHNICAL SUMMARY*

1.6.1 *SPECIFICATIONS*

MRC5000:

Temperature Control Range: 0-10°C.

Temperature Indication: 3 Digit LED display indicates temperature in .1 degrees Celsius with negative sign indicator.

Power Requirements: 115/230V AC 50-60Hz auto ranging fused at 500mA max current

Dimensions: Control Module: 8.25” X 6.25” X 5.5” (20.9cm X 15.9cm X 13.9cm)

Cooling Tray: 4.25” X 3.5” X 2.625” (10.8cm X 8.9cm X 6.7cm) with 3’ (91.4cm) cable.

Weight: 4.66lbs (2.12kg)

1.6.2 *CONTROLS/CONNECTORS*

Display – MRC5000 Front Panel:

Temperature: Three digit LED display (including – sign) of current bath temperature in degrees Celsius (°C)

Controls - MRC5000 Front Panel:

Temperature Control: Graduated dial used to set target temperature. Number corresponds to degree Celsius

Connections – MRC5000 Back Panel:

Power Input: 85-265VAC, 50-60 Hz, 500mA max universal power input

Tray Input: 4 pin female socket for connecting tray cable.

Connections – OTS Refrigerated Tray:

Flow Connectors: Male Quick Connect couplings for attaching tubing to water source and drain (reversible)

Tray Cable: 4 Pin male connector for connecting to controller

1.6.3 ***COMPATIBILITIES***

MRC5000 is compatible with the OTS4000 and OTS3000 refrigerated trays.

1.7 ***ILLUSTRATIVE PROCEDURE***

Note: It is recommended that the bath medium solution be refrigerated previous to, and between, uses in order to reduce the “cooling down” time.

1. Ensure that the water tubing is installed correctly.
2. Circulate cold water from the tap at a rate of 250/300mL/min. The exact flow rate is not critical as long as it exceeds 250 mL/min (no air bubbles visible in the line).
3. Ensure that no air pockets are trapped in the cooling unit and that water is flowing from the outlet tube.
4. Connect the output cable from the tray to the jack on the back panel of the MRC5000.
5. Fill the tray to within 5-6mm of the top with chilled bath medium.
6. With water circulating through heat exchanger from the tap, turn on the MRC5000 via the back panel switch.
7. Set the temp control to a goal temperature (commonly 3). This is the temperature that the bath will cool to over a period of time from the initial temperature. In most cases, it is not necessary to wait until the bath has reached the target temperature before performing the slice procedure.

2 *REFERENCE MANUAL*

2.1 *REFERENCE INFORMATION*

2.1.1 *PACKAGING*

The MRC5000 is enclosed in a two-piece (bottom and back, top) ABS UL94V0 plastic enclosure. The overall dimensions are 27cm x 40cm x 21.5cm (10.5" x 16" x 7.5"). The top portion is connected to the interior chassis on the top of the unit, the back panel, and the bottom portion of the case through the base plate.

2.1.2 *MOUNTING*

The MRC5000 is designed as a stand-alone unit. It is not designed to be rack mounted.

2.1.3 *INSPECTION*

FHC Modules are factory checked and calibrated but should be carefully inspected upon receipt, before using, or activating power. If any exterior damage to the shipping carton is noted, the instrument(s) should be inspected for obvious physical damage. The contents of each package should be physically checked against the inventory list (sec. 1.3) to determine shortages or errors in inventory.

2.1.4 *POWER CONNECTIONS*

The OTS5000 is powered through an internal 15V power supply. (input:85-265VAC, 50-60Hz, 500mA max) An international pattern Line Cord (not shown) is ordered separately, and is specified by country per the catalog number. (See table below for catalog numbers.) The power entry uses double pole switching and fusing. (2 ea. 5X20, 500mA slo-blo fuses) Contact Technical Services at (207) 666-8190 for assistance.

66-EL-LC-AUS	Australia
66-EL-LC CH	China
66-EL-LC -DAN	Denmark
66-EL-LC -EURO	Europe
66-EL-LC -ISR	Israel
66-EL-LC -ITA	Italy
66-EL-LC -JA	Japan
66-EL-LC -SAF	South Africa
66-EL-LC -SWI	Switzerland
66-EL-LC -UK	United Kingdom
66-EL-LC -USA	North America

To replace fuses:

1. Remove line cord if applicable
2. Remove fuse drawer located between the line cord entry and power switch by squeezing the tabs on each end of the drawer, and pulling out.
3. Replace fuses with the correct value (2 ea. 1, amp slo-blo)
4. Insert drawer back into slot until tabs “click”.

2.1.5 ***WARRANTY***

All FHC products are unconditionally guaranteed against defects in workmanship for one year from date of shipment as long as they have been exposed to normal and proper use. Although the one-year warranty may have expired, please contact our Service Department before attempting any repairs or alterations. Many of these repairs will still be performed at the factory at no charge to the customer.

2.1.6 ***POLICIES***

1.TECHNICAL SUPPORT: It is our policy to provide our customers with the most comprehensive technical support in the industry. If any questions arise or problems occur, we encourage you to call or write and we promise to promptly and comprehensively respond to your requirements.

2.TRADE-UP POLICY: It is our policy to offer customers trade-up ability as new and/or expanded capabilities for their instruments are announced. In many cases, full credit will be given. In general, we will allow 100% credit for two years and depreciate 20% per year thereafter. Please contact our Marketing Department for information relating to your particular situation.

2.1.7 ***SERVICE***

Should service be required, please contact our Service Department for a return authorization number and instructions (207-666-8190). Please have the model and serial number on hand (Both are located on the back panel). Carefully pack the instrument before returning.

Please include a note indicating:

1. The model number and purchase date of the instrument
2. The person to contact if questions arise
3. The "symptoms" indicating that repair is necessary
4. A note stating that the unit is free from any biological contaminates

If the instrument is not covered by the warranty, a quotation will be forwarded to the sender detailing the repairs necessary and charges, before repair is begun.

2.2 ***INSTALLATION***

1. Set the unit on a solid level surface.
2. Install the line cord into the receptacle on the back of the unit.
3. Ensure power switch on the back panel is in the "Off" position. (Indicated by the O side of the rocker switch pressed in.)
4. Plug the line cord into a into a properly grounded wall receptacle.
5. Install the tray onto the slicer per instructions in the slicer manual.
6. Attach the open end of one of the tubes to a water source (faucet) and the fitting end to one of the fittings on the tray. The fittings should “snap”.
7. Attach the other tube to the other tray fitting and place the open end in a drain.
8. Connect the output cable from the tray to the jack on the back panel of the MRC5000.

2.3 ***OPERATIONAL INFORMATION***

Note: It is recommended that the bath medium solution be refrigerated previous to, and between, uses in order to reduce the "cooling down" time.

1. Ensure the unit is installed correctly per section 2.2 of this manual.
2. Circulate cold water from the tap at a rate of 250/300mL/min. The exact flow rate is not critical as long as it exceeds 250 mL/min (no air bubbles visible in the line).
3. Ensure that no air pockets are trapped in the cooling unit and that water is flowing from the outlet tube.
4. Fill the tray to within 5-6mm of the top with chilled bath medium.
5. With water circulating through heat exchanger from the tap, turn on the MRC5000 via the back panel switch.
6. Set the temp control to a goal temperature (commonly 3). This is the temperature that the bath will cool to over a period of time from the initial temperature. It is not necessary to wait until the bath has reached the target temperature on the display before performing the slice procedure. The previously chilled bath medium temperature will be maintained.

2.4 ***SCHEDULED MAINTENANCE***

Calibration Procedure

Equipment required: Decade resistance box
Digital voltmeter
Oscilloscope

A. Digital display calibration (refer to 1057B1.01). Trim pots are located on the front panel digital display board.
    1. Connect the decade resistance box (R) across pins 3 and 4 of the module SENSOR/ELEMENT connector on back panel. Set R to 19,050Ω. Adjust T2 for a voltage of 3.2 volts at Test Point 2. Adjust T1 for a voltage of 3.5 volts at Test Point 1.

    2. Set R to 9,050Ω. Adjust T1 for a digital display reading of 12.0 degrees.
    3. Set R to 19,050Ω. Adjust T2 for a digital display reading of –3.0 degrees.
    4. Steps 2 and 3 interact and should be repeated until both specified display readings are obtained.
B. Temperature controller calibration (refer to 1148B1.01). Trim pots T1 and T2 are located on the main circuit board.
    1. Adjust T1 for 2.7 volts at Test Point 3 and T2 for 3.2 volts at Test Point 4.
    2. Two trim pots must be adjusted so that the front panel TEMPERATURE control knob corresponds to the temperature at which the Peltier cooling device switches ON and OFF. Connect the oscilloscope to Test Point 5. The voltage at this point will either be "low" (about zero volts) or "high" (about 12-15 volts, indicating that the Peltier cooler is being turned on). In steps 3 and 4 below the trim pots will be adjusted so that this voltage at Test Point 5 is just at the transition point between the high and low states.
    3. Adjust R for a digital display reading of 0 (R approximately 16.3KΩ). Set the TEMPERATURE control knob to 0. Adjust T2 so that Test Point 5 just switches "high" (if Test Point 5 is already high then adjust so that it's just on the switching point).
    4. Adjust R for a display reading of 10 (R approximately 9.95KΩ). Set the TEMPERATURE control knob to 10. Adjust T1 so that Test Point 5 just switches "low" (if already low then adjust so that it's just at the switching point).

5. Steps 3 and 4 interact and will have to be repeated to obtain the results described. When properly calibrated the voltage at test Point 5 should be “high” if the TEMPERATURE control setting (0-10) is lower than the temperature indicated on the digital display.

Temperature VS Thermistor Resistance Table

Degrees Celsius	-5	-3	0	12	25
R(Ω)	21.17K	19.06K	16.33K	9.05K	5K