

# **RTE-101 Bath Circulator**

Thermo NESLAB Manual P/N U00461  
Rev. 11/08/00

## **Installation, Operation and Service Manual**



# RTE-101 Constant Temperature Bath and Circulator

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## Preface

### Compliance

Products tested and found to be in compliance with the requirements defined in the EMC standards defined by 89/336/EEC as well as Low Voltage Directive (LVD) 73/23/EEC can be identified by the CE label on the rear of the unit. The testing has demonstrated compliance with the following directives:

LVD, 73/23/EEC	Complies with UL 3101-1:93
EMC, 89/336/EEC	EN 55011, Class A Verification EN 50082-1:1992 IEC 1000-4-2:1995 IEC 1000-4-3:1994 IEC 1000-4-4:1995

For any additional information refer to the Letter of Compliance that shipped with the unit (Declaration of Conformity).

### Unpacking

Retain all cartons and packing material until the unit is operated and found to be in good condition. If the unit shows external or internal damage, or does not operate properly, contact the transportation company and file a damage claim. Under ICC regulations, this is your responsibility.

### Warranty

Units have a warranty against defective parts and workmanship for one full year from date of shipment. See back page for more details.

### **NES-care Extended Warranty Contract**

- Extend parts and labor coverage for an additional year.
- Worry-free operation.
- Control service costs.
- Eliminate the need to generate repair orders.
- No unexpected repair costs.

Other contract options are available. Please contact Thermo NESLAB for more information.

### After-sale Support

Thermo NESLAB is committed to customer service both during and after the sale. If you have questions concerning the operation of your unit, contact our Sales Department. If your unit fails to operate properly, or if you have questions concerning spare parts, contact our Customer Service Department. Before calling, *please* obtain the following information:

*BOM number* \_\_\_\_\_

*Serial number* \_\_\_\_\_

*Software version* \_\_\_\_\_

The BOM and serial number on a label on the rear of the unit. To display the software version see page 10.

## Section I Safety

### Warnings

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your unit. If you have any questions concerning the operation of your unit or the information in this manual, contact our Sales Department.

**Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.**

**Observe all warning labels.**

**Never remove warning labels.**

**Never operate damaged or leaking equipment.**

**Never operate the unit without bath fluid in the bath.**

**Always turn off the unit and disconnect the line cord from the power source before performing any service or maintenance procedures, or before moving the unit.**

**For 220 - 240 volt units supplied without a line cord, use a harmonized (HAR) grounded 3-conductor cord, type H 0 5 V V - F , with conductors listed below. A suitable cord end is required for connecting to the equipment (see unit socket) and must terminate with an IEC approved plug for proper connection to power supply.**

**Nominal 1.0 mm<sup>2</sup> cross section rated 10 Amps Unit Socket: IEC - 320 C13**

**Always empty the bath before moving the unit.**

**Never operate equipment with damaged line cords.**

**Refer service and repairs to a qualified technician.**

In addition to the warnings listed above, warnings are posted throughout the manual. These warnings are designated by an exclamation mark inside an equilateral triangle with text highlighted in bold print. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, or personal injury, or death.

## Section II General Information

### Description

The RTE Constant Temperature Baths are designed to provide temperature control for applications requiring a fluid work area or pumping to an external system.

The units consist of an air-cooled refrigeration system, heater, circulation pump, stainless steel bath, and a temperature controller.

### Specifications

<b>Temperature Range<sup>1</sup></b>	-12°C to +130°C
<b>Temperature Stability<sup>2</sup></b>	±0.03°C
<b>Cooling Capacity<sup>2</sup></b>	350 watts at 20°C
<b>Pump Capacity<sup>2</sup></b>	11.5 liters per minute @ 0' Head, 14.5' Max (60Hz) 10 liters per minute @ 0' Head, 10.5' Max (50Hz)
<b>Heater<sup>3</sup></b>	800 watts
<b>Bath Work Area<sup>4</sup></b> (L x W x D) <i>Inches</i> <i>Centimeters</i>	5 x 5 x 5 12.7 x 12.7 x 12.7
<b>Bath Volume<sup>5</sup></b> <i>Gallons</i> <i>Liters</i>	1.2 4.5
<b>Unit Dimensions<sup>6</sup></b> (H x W x D) <i>Inches</i> <i>Centimeters</i>	22¾ x 10⅞ x 14½ 57.8 x 25.7 x 36.8

Specifications subject to change.

1. See page 6, Fluid Recommendations.
2. Specifications listed for units operating at +20°C bath temperature, +20°C ambient, using water.
3. 115V units. 220V units have a 1200 watt heater.
4. 115V units. 220V units measure 4 3/4 x 6 x 4 3/4 inches (12.1 x 15.2 x 12.1 centimeters). Work area for both units measured between the reservoir baffle's fill lines.
5. 115V units. 220V units are 1.3 gallons (4.9 liters). Volume for both units measured between the reservoir baffle's fill lines.
6. 115V units. 220V units measure 22 7/8 x 10 3/8 x 15 1/8 inches (58.1 x 26.4 x 38.4 centimeters).

## Section III Installation

### Site

The unit should be located on a sturdy table or bench top. Ambient temperatures should be inside the range of +10°C to +35°C.



**Never place the unit in a location where excessive heat, moisture, or corrosive materials are present.**

A minimum clearance of 30 centimeters (12 inches) between the rear of the unit and the nearest wall is required for adequate ventilation through the pump box. This space will also accommodate the pump connections and the tap water cooling coil connections.

Excessively dusty areas should be avoided and a periodic cleaning schedule should be instituted (see Section VI, Cleaning).

### Electrical Requirements



**The unit construction provides extra protection against the risk of electric shock by grounding appropriate metal parts. The extra protection may not function unless the power cord is connected to a properly grounded outlet. It is your responsibility to assure that a proper ground connection is provided.**

Refer to the serial number label on the rear of the unit to identify the specific electrical requirements of your unit.

Ensure the voltage of the power source meets the specified voltage,  $\pm 10\%$ .

The unit is equipped with main circuit protection and thermal protectors for each branch.



**For 220 - 240 volt units supplied without a line cord, use a harmonized (HAR) grounded 3-conductor cord, type H 0 5 V V - F , with conductors listed below. A suitable cord end is required for connecting to the equipment (see unit socket) and must terminate with an IEC approved plug for proper connection to power supply.**

**Nominal 1.0 mm<sup>2</sup> cross section rated 10 Amps Unit Socket: IEC - 320 C13.**

## Plumbing Requirements



**To prevent damage to the plumbing lines, always support the ¾" fittings while installing/removing the pumping caps and lines.**

### Hose Connections

The pump connections are located at the rear of the pump box and are labelled PUMP INLET and PUMP OUTLET. These connections are ¼" MPT fittings. The unit is supplied with hose barbs which accept ⅜" ID tubing.

Flexible tubing, if used, should be of heavy wall or reinforced construction. Make sure all tubing connections are securely clamped. Avoid running tubing near radiators, hot water pipes, etc. If substantial lengths of tubing are necessary, insulation may be required for improved temperature control.

It is important to keep the distance between the unit and your application as short as possible and to use the largest diameter tubing practical. Tubing should be straight and without bends. If diameter reductions are required, they should be made at your application, not at the unit.

### Drain

A drain is located on the rear of the unit. The drain on 60 Hz units has a ¼" MPT fitting. The drain is supplied with a cap plug.

50 Hz units have a knurled valve fitting for a drain. To drain the bath, turn the fitting one turn counterclockwise.

## Fluids



**Never use flammable or corrosive fluids with this unit.**

The selected fluid must have a viscosity of 50 centistokes or less at the lowest operating temperature. Filtered tap water is the recommended fluid for operation from +7°C to +80°C.

Below +7°C, a 50/50 mixture, by volume, of filtered tap water and laboratory grade ethylene glycol is suggested.

Above +80°C, the user is responsible for fluids used.

## Filling Requirements



**If the correct fluid level is not maintained, the heater will be exposed and may become damaged.**

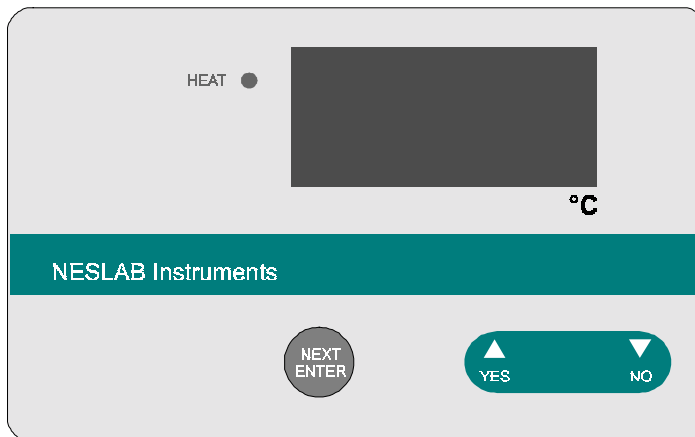
When pumping to an external system, keep extra fluid on hand to maintain the proper level as the circulating lines and external system are filled.



**Never run the unit when the work area is empty. Avoid overfilling. Overfilling the bath may damage the insulation, and affects stability as well as low-end performance.**

## Section IV Temperature Controllers

### Digital Temperature Controller



#### Start Up

Before starting the unit, double check all electrical and plumbing connections and make sure the work area has been properly filled with bath fluid.

To start the unit, place the circuit breaker on the rear of the controller to the I position. The pump will start and the digital display will indicate the temperature of the bath fluid.

Place the Refrigeration Switch to the ON position. The unit will control to the entered setpoint.

**NOTE:** Only 115V units are designed for full range cooling. On 220V units the refrigeration system is designed to operate up to a temperature of +35°C.



**On 220V units above +35°C, ensure the refrigeration switch is OFF.**

The HEAT LED indicates the controller is adding heat to the reservoir fluid, operating in the heat band. The indicator is on continuously when the controller is operating in the heat band and flashes, with a 50% duty cycle over 2 seconds, when operating in the heat band proportional band.

The digital controller controls temperature using a PID (Proportional-Integral-Derivative) algorithm. It is designed with self-diagnostic features and easy to use operator interface.

#### NEXT ENTER

Use this key to accept and save changes.

#### YES, ▲

This dual purpose key is used to answer Yes to Y/N questions or to increment numerical values upward for setting numeric values.

#### NO, ▼

This dual purpose key is used to answer No to Y/N questions or to decrement numerical values downward for setting numeric values.

When the controller is powered it displays the reservoir fluid temperature. Press the **NEXT ENTER** key to view the setpoint. The display flashes between **SP** and the actual setpoint number. If desired, use the **YES** and **NO** keys to change the setpoint. The display flashes as soon as either key is depressed. Once the desired setpoint is displayed, press the **NEXT ENTER** key.

**NOTE:** The controller will not use the new value until the **NEXT ENTER** key is depressed and the display stops flashing. The controller will not allow you to enter a value above the maximum or below the minimum value, or any illegal value. If you try to enter an illegal value the display will revert to its original value when the last digit was entered.

If the **NEXT ENTER** key is not depressed within one minute, the controller will time out and the new value will not be accepted. The controller will revert to the previous value.

**NOTE:** Error codes are addressed in Section V, Maintenance and Troubleshooting.

## High Temperature Safety

The unit is equipped with an adjustable high temperature safety located on the rear of the control box. The safety prevents the heater from reaching excessively high temperatures that can cause serious damage to the unit. A single temperature sensor, located on the heater coils in the bath, is used as a monitor.

A high temperature fault occurs when the temperature of the sensor exceeds the set temperature limit. In the event of a fault, the **FAULT** lamp will illuminate and the unit will shut down. The cause of the fault must be identified and corrected before the unit can be restarted.

The safety is not preset and must be adjusted during initial installation. The safety can be set for a temperature range of +50°C to +180°C.

To set the safety, locate the adjustment dial and turn it fully clockwise. Turn the **ON/OFF** switch **OFF** then **ON**.

Start the unit. Adjust the temperature setpoint for a few degrees higher than the highest desired operating temperature and allow the bath to stabilize at the temperature setpoint. Turn the dial counterclockwise until you hear a click and the unit shuts down. The **FAULT** lamp on the front of the pump box will light to indicate a fault has occurred.

The safety is now set.

Allow the fluid temperature to cool below the cutout temperature then, without moving the adjustment dial, turn the main circuit protector **OFF** then **ON**.

If a fault ever occurs, once the cause is identified and corrected, turn the main circuit protector **OFF** then **ON** to reset the safety.

## Section V Maintenance & Troubleshooting

### Cleaning

Periodically clean the case and stainless steel bath using a mild soapy solution. **Do not use steel wool; it is too abrasive and will lead to rusting.** Dry the bath using a soft cloth.

For proper operation, the unit needs to pull substantial amounts of air through the condenser. A build up of dust or debris on the fins of the condenser will lead to a loss of cooling capacity. Periodic cleaning of the condenser is necessary.

The frequency of the cleaning depends on the operating environment. After initial installation, we recommend a monthly visual inspection. After several months, the frequency of cleaning will be established.

### Algae

To restrict the growth of algae in the bath, it is recommended that the bath cover be kept in place and that all circulation lines be opaque. This will minimize the entrance of light required for the growth of most common algae.

Thermo NESLAB recommends the use of Chloramine-T, 1 gram per 3.5 liters.

### Error Codes

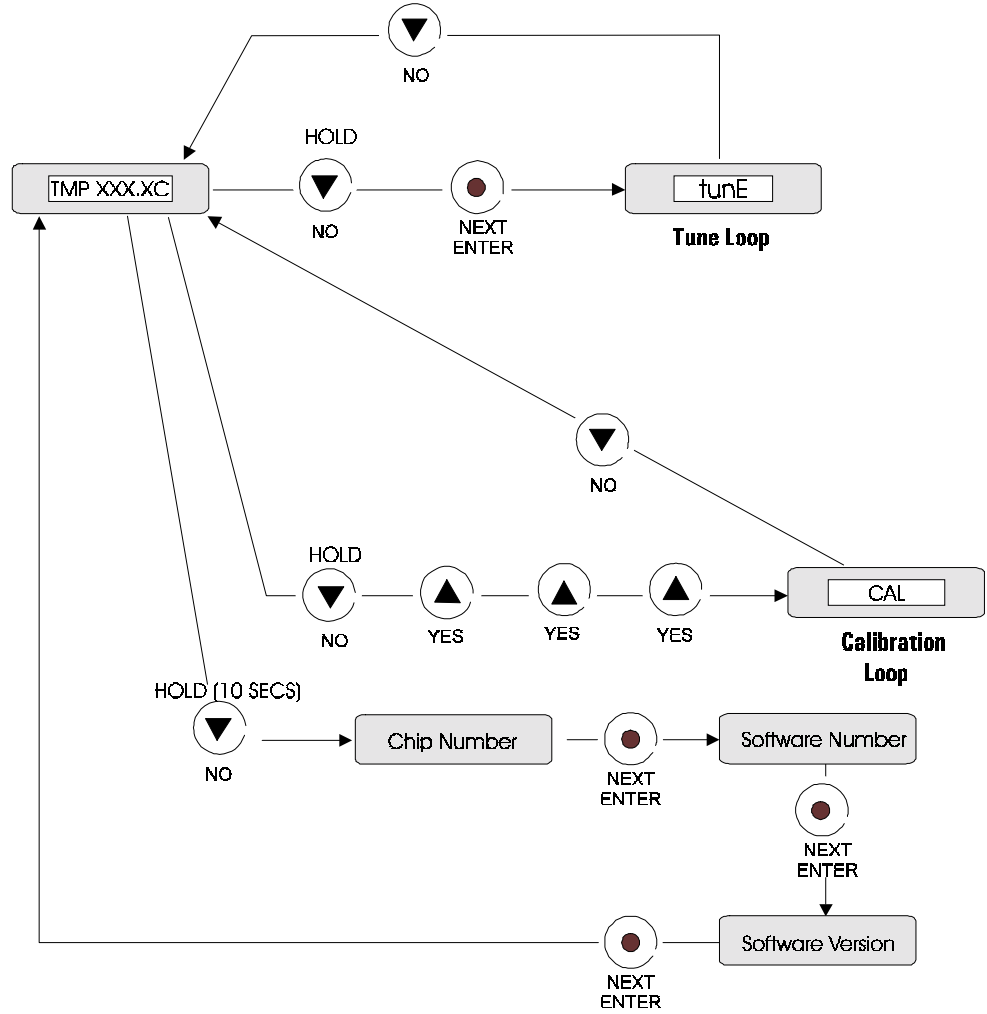
The controller also has the capability to display error codes. The codes are:

<b>Display</b>	<b>Indication</b>
Er 16	Bad calibration data, see Controller Displays
Er 25	Shorted RTD1
Er 26	Open RTD1
Er 19	Hit High temperature limit exceeded, see Controller Displays
Er 21	Lot Low temperature limit exceeded, see Controller Displays

The unit will continue to run with any of the above codes. If any other code appears contact Thermo NESLAB customer service, see Preface.

## Controller Displays

An alphanumeric display presents numeric readings of various operating conditions within the bath. Display function is selected by pressing the appropriate keys shown below and the next two pages.



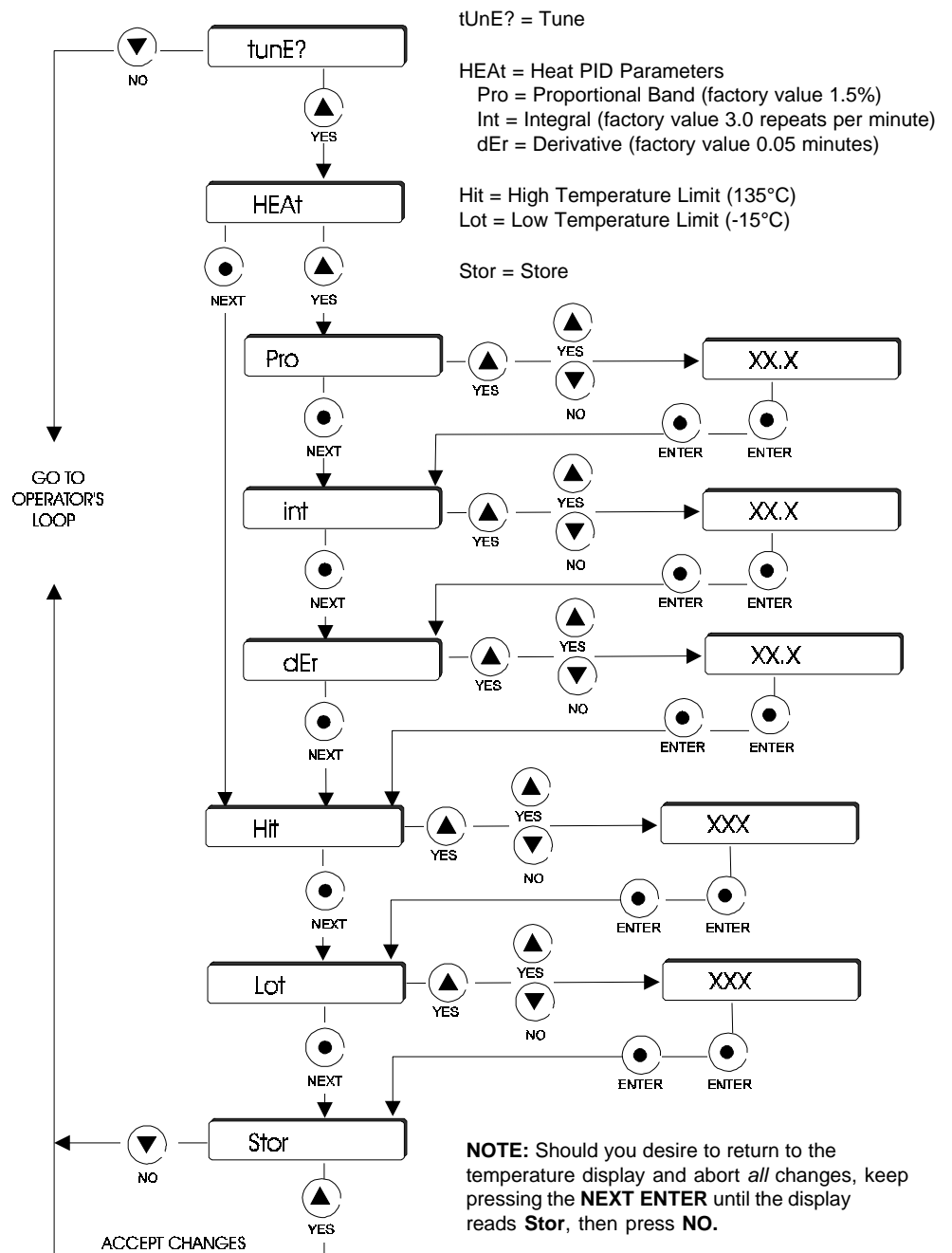
## Tune Loop

This loop is used to adjust the controller's PID parameters and set the high/low temperature limits.

Enter the loop from the reservoir temperature display by pressing and holding the NO key, then press the NEXT ENTER key. Use the YES/NO keys to adjust the values. Press the NEXT ENTER key twice to accept the new value.

While in the loop, if any key is not pressed during a one minute time span, the controller will automatically return to the reservoir temperature display.

**NOTE:** If the unit exceeds either temperature limit, the appropriate error message will flash, see page 9. The unit will not shut down (unless the temperature exceeds the high temperature cutout setting, see page 8).



### Calibration Loop

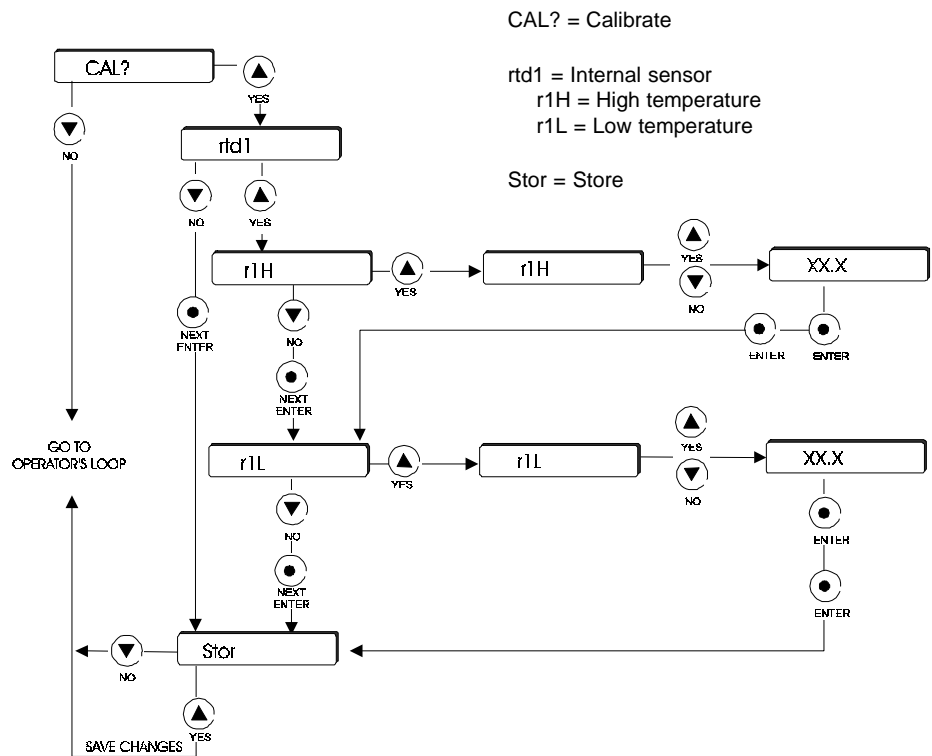
This loop is used to calibrate the controller's internal temperature sensor.

To calibrate the sensor install a calibrated reference thermometer in the bath. Adjust the setpoint to an appropriate high-end temperature.

Once the bath reaches the setpoint and stabilizes, go to the Calibration Loop by pressing and holding the NO key while pressing the YES key three times. Enter the actual reference thermometer reading at the r1H prompt. Store the change.

Return to the reservoir temperature display. Adjust the setpoint to an appropriate low-end temperature. Once the bath reaches the setpoint and stabilizes, return to the Calibration Loop and enter the reference thermometer reading at the r1L prompt. Store the change.

**Do not pick points that are outside the safe operating limits of the fluid in your application. For example with a water bath, 90°C and 5°C would be typical calibration points.**



## Checklist

### Unit will not start

Make sure the voltage of the power source meets the specified voltage,  $\pm 10\%$ . Refer to the serial number label on the rear of the unit to identify the specific electrical requirements of your unit.

Check the high temp safety. If the FAULT light is on, ensure the fluid level in the bath is between baffle marks and the high temp setting is greater than the bath temperature. Turn the main circuit protector OFF then ON. Attempt to restart.

### No external circulation

Check for obstructions, kinks, or leaks in the circulation tubing.

Circulation will cease when the pump head pressure has been exceeded.

Check the high temp safety. If the FAULT light is on, ensure the fluid level in the bath is between baffle marks and the high temp setting is greater than the bath temperature. Turn the ON/OFF switch OFF then ON. Attempt to restart.

### Loss of Cooling Capacity

Be sure the refrigeration switch is on and the green refrigeration indicator is illuminated.

Be sure the cooling capacity of the unit has not been exceeded if circulating to an external system.

When the unit is shut off, wait approximately five minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.

Proper ventilation is required for heat removal. Make sure ventilation through the unit is not impeded and free of dust and debris.

Ice build up on the cooling coil can act as insulation and lower the cooling capacity. Raise the temperature of the bath to deice the cooling coil and increase the concentration of non-freezing fluid.

## Service Assistance

If, after following these troubleshooting steps, your unit fails to operate properly, contact our Service Department for assistance. Our Service Department can also provide you with list of spare parts for your unit (see Preface, After-sale Support). Before calling, *please* obtain the following information:

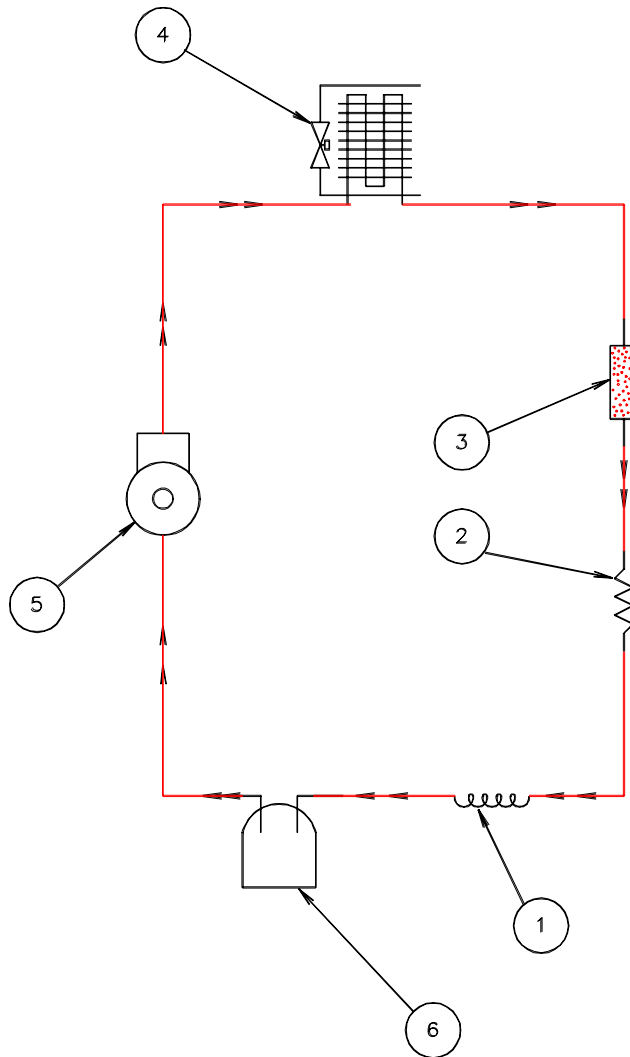
*BOM number*

*Serial Number*

*Voltage of power source*

# Section VI Diagrams

## Flow Diagram



6	1	ACCUMULATOR		
5	1	COMPRESSOR		
4	1	CONDENSER		
3	1	DRYER		
2	1	CAPILLARY TUBE		.036 DIA. x 5 FT.
1	1	TANK COIL		

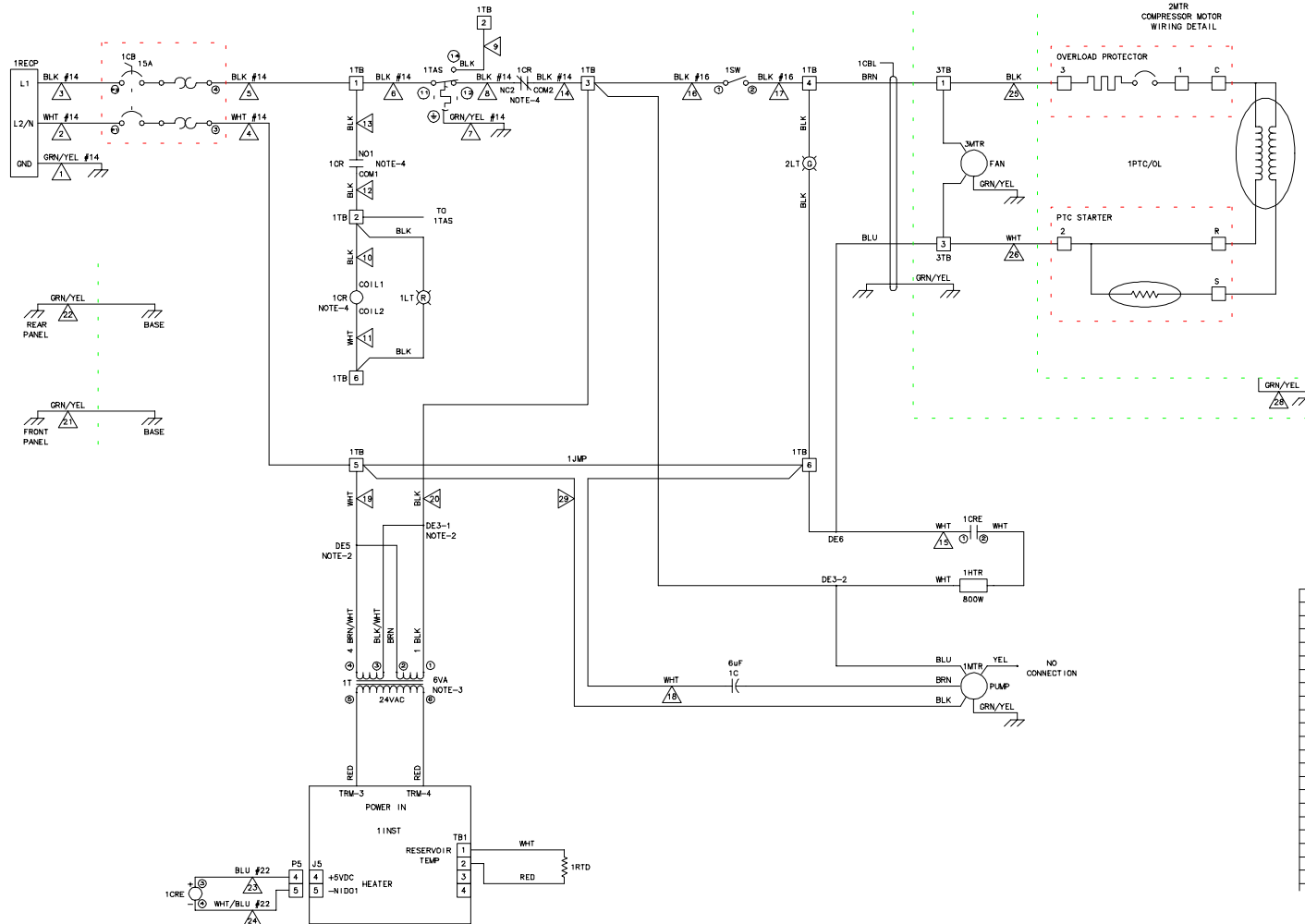
JOLIN 8-4-94  
 McDONOUGH 8-9-94  
 SPENCER 8-10-94

AS LISTED

REFRIGERATION  
 FLOW DIAGRAM  
 RTE-101

A F00428 A  
 NTS 1 OF 1

# Wiring Diagram 60Hz Units



A7C	A	ADDED: 1PTC/OL AND P3 TO P/L; PANEL GND5; 12-24-98	BAJ	JCH	REP
C7, 7	B	VARIOUS WIRE COLORS/GAUGES, CHANGED; VARIOUS WIRE COLORS, DELETED; VARIOUS DEAD END CONNECTORS.			
B5	B	ADDED: WIRE KIT NOS #1-22, #25, ECD 13032	1-20-99	BAJ	KL3 REP
A7	D	ADDED: WIRE KIT NOS #23 & #24, CHANGED: PS WAS P/N 010069, ECD 13374	4-9-99	BAJ	JCH REP
B5	D	CHANGED: WIRE KIT #23	6-4-99	BAJ	CLG CAD
D5	D	CHANGED: 1TB P/N WAS 029591; 1JMP WAS 2JMP; 1SW WAS 2JMP; 1MTR BLK WIRE WAS TO 1TB-8 (PREVIOUSLY 1TB-6); VARIOUS TERMINAL BLOCK NUMBERS, DELETED; 1TB-8 AND 1JMP FROM 1TB-6 (PREVIOUSLY 1TB-8); ECD 13843	9-9-99	BAJ	CLG CAD
B5	E	CHANGED: 1CBL BLU WIRE WAS TO 1TB-1; 1MTR BLU WIRE WAS TO 1TB-3; 1C WHT WIRE WAS TO A DEADEND CONNECTOR; 1TB-5 WAS 1TB-1; 1TB-2 WAS 1TB-1; 1TB P/N WAS 029330; ECD 13873	9-9-99	BAJ	CLG CAD
B5	F	CHANGED: 1JMP WAS 1CJMP IN P/L; 1C WHT WIRE WAS TO 1TB-1; 1JMP WAS 2JMP; DELETED: 1JMP ON 1TB-3, ECD 14527	3-3-00	BAJ	

- NOTES:
1. ALL WIRES ARE #18 AWG UNLESS OTHERWISE SPECIFIED.
  2. APPROPRIATE DEAD END CONNECTORS WHERE REQUIRED.
  3. COMPONENT 11 (025987) THERMAL FUSE, 1 TIME LINE 1, 3, 133°C

4.

CONTACT TYPE	MANUFACTURERS	
	MAGNECRAFT	MIDTEX
COM 1	PIN 7	PIN 5
NO 1	1	1
NO 1	4	3
COM 2	9	6
NC 2	3	2
NO 2	6	4
COIL 1, 2	A, B	A, B

5. DIAGRAM PARTS LIST USED AS REFERENCE ONLY.

PS	CONNECTOR, PLUG	010634	8P
3TB	TERMINAL BLOCK	001582	REFRIGERATION ASSEMBLY
1TB	TERMINAL BLOCK	029630	
1TAS	TEMPERATURE ACTUATED SWITCH	025913	HIGH TEMPERATURE
1T	TRANSFORMER	025987	
1SW	SWITCH, POWER MAIN	001638	
1RTD	RESISTIVE TEMPERATURE DEVICE	005720	
1PTC/OL	COMPRESSOR PTC/OL	007541	
1RECP	RECEPTACLE	001392	
3MTR	MOTOR, FAN	007401	
2MTR	MOTOR, COMPRESSOR	007268	
1MTR	MOTOR, PUMP	001859	EXTERNAL ROTOR
2LT	LIGHT, REFRIGERATION ON	025677	GREEN
1LT	LIGHT, FAULT HEATER	005922	RED
1JMP	JUMPER, TERMINAL BLOCK	024952	
1INST	INSTRUMENT	025413	
1HTR	HEATER	005048	800W, 115V
1CRE	CONTROL RELAY ELECTRONIC	010423	
1CR	CONTROL RELAY, FAULT	006082	
1CBL	CABLE, 16/3	001387	
1CB	CIRCUIT BREAKER	000342	15A
1C	CAPACITOR	005774	6uF

JOL IN 9-15-98  
 PRATT 10-15-98  
 PRATT 10-15-98

RTE-101  
 D2  
 115V, 60HZ

AS LISTED  
 D  
 6.3722 F

6.3486, 6.3696  
 1 OF 1



## WARRANTY

Thermo NESLAB Instruments, Inc. warrants for 12 months from date of shipment any Thermo NESLAB unit according to the following terms.

Any part of the unit manufactured or supplied by Thermo NESLAB and found in the reasonable judgment of Thermo NESLAB to be defective in material or workmanship will be repaired at an authorized Thermo NESLAB Repair Depot without charge for parts or labor. The unit, including any defective part must be returned to an authorized Thermo NESLAB Repair Depot within the warranty period. The expense of returning the unit to the authorized Thermo NESLAB Repair Depot for warranty service will be paid for by the buyer. Thermo NESLAB's responsibility in respect to warranty claims is limited to performing the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or rescission of the contract of sales of any unit. With respect to units that qualify for field service repairs, Thermo NESLAB's responsibility is limited to the component parts necessary for the repair and the labor that is required on site to perform the repair. Any travel labor or mileage charges are the financial responsibility of the buyer.

The buyer shall be responsible for any evaluation or warranty service call (including labor charges) if no defects are found with the Thermo NESLAB product.

This warranty does not cover any unit that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the operating or maintenance instructions specified in Thermo NESLAB's Instruction and Operation Manual. This warranty does not cover any unit that has been altered or modified so as to change its intended use.

In addition, this warranty does not extend to repairs made by the use of parts, accessories, or fluids which are either incompatible with the unit or adversely affect its operation, performance, or durability.

Thermo NESLAB reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Thermo NESLAB'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND Thermo NESLAB DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION.

Thermo NESLAB ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to units sold in the United States. Any units sold elsewhere are warranted by the affiliated marketing company of Thermo NESLAB Instruments, Inc. This warranty and all matters arising pursuant to it shall be governed by the law of the State of New Hampshire, United States. All legal actions brought in relation hereto shall be filed in the appropriate state or federal courts in New Hampshire, unless waived by Thermo NESLAB.