

Cole-Parmer®



Cole-Parmer RHV-400 Viscosity Bath

USER OPERATION MANUAL



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Introduction

Thank you for choosing the Cole-Parmer® Standard Immersion Circulator. It is intended for the precise temperature control of suitable liquids in a reservoir. Extremely easy to use and maintain, it combines design innovation with highly intuitive operation to deliver convenient and versatile liquid temperature control for a wide range of applications.



WARNING: Circulating Baths are not intended for directly controlling the temperature of foods, pharmaceuticals, medicines, or other objects which may be ingested by or injected in humans or animals. Any such objects must be isolated from contact with the bath fluid and bath surfaces.

Here are some of the features that make the Standard Immersion Circulator so user-friendly:









- Simple, intuitive operation
- Displays actual and set point temperature simultaneously
- Powerful pump, easy flow adjustment
- Attaches securely to both flat and rounded tank walls
- Converts any tank or vessel up to 28 liters into a reliable circulating bath
- Fully enclosed housing prevents direct contact with pump and heater, yet provides quick access for inspection and cleaning
- Suitable for use with Class I non-flammable fluids per DIN 12876-1

It will take you very little time to get your new Standard Immersion Circulator installed and running, This User Guide is designed to guide you quickly through the process. We recommend that you read it thoroughly before you begin.

General Information

General Safety Information






When installed, operated, and maintained according to the directions in this manual and common safety procedures, your Standard Immersion Circulator should provide safe and reliable liquid heating. Please ensure that all individuals involved in the installation, operation, or maintenance of this unit read this manual thoroughly prior to working with the unit.

	This symbol alerts you to a wide range of potential dangers.
	This symbol advises danger from electricity or electric shock.
	This symbol indicates that a hot surface may be present.
	This symbol marks information that is particularly important.
	This symbol indicates alternating current.
	These symbols on the Power Switch / Circuit Breaker indicate that they place the main power supply ON / OFF.
	This symbol on the Power Key indicates that it places the unit in a standby mode. It DOES NOT fully disconnect the unit from the power supply.
	This symbol indicates a protective conductor terminal.

**Read all instructions pertaining to safety, set-up, and operation.
Proper operation is the user's responsibility.**

Safety Recommendations

To prevent injury to personnel and/or damage to property, always follow your workplace's safety procedures when operating this equipment. You should also comply with the following safety recommendations:

	<p>WARNING:</p> <ul style="list-style-type: none">• This Immersion Circulator is suitable only for use with Class I non-flammable fluids (per DIN 12876-1).• Be aware of the chemical hazards that may be associated with the bath fluid used. Observe all safety warnings for the fluids used as well as those contained in the material safety data sheet.• Use only recommended bath fluids; see Technical Information in the rear of this manual for recommendations.• Use only non-acid bath fluids.
	<p>WARNING:</p> <ul style="list-style-type: none">• Always connect the power cord on this Circulator to a grounded (3-prong) power outlet. Make certain that the outlet is the same voltage and frequency as your unit.• Never operate the Circulator with a damaged power cord.• Always turn the Circulator OFF and disconnect mains power before performing any maintenance or service.
	<p>WARNING:</p> <ul style="list-style-type: none">• Never operate the Circulator without bath fluid in the reservoir. Periodically check the reservoir to ensure that the liquid depth is within acceptable levels. Always refill the reservoir using the same bath fluid that is already in the reservoir. Bath oil must not contain any water contaminants and should be preheated to the actual bath temperature before adding as there is an explosion hazard at high temperatures.• Turn electrical power to the unit OFF and remove Immersion Circulator from reservoir before draining. Always drain all fluid from the reservoir before moving or lifting. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.
	<p>WARNING:</p> <ul style="list-style-type: none">• Always allow the bath fluid to cool to ambient temperature before draining.• Always keep within the 85°C maximum operating temperature limit if using a polycarbonate open bath tank.
	<p>WARNING: It is the user's responsibility to properly decontaminate the unit in the event hazardous materials are spilled on exterior or interior surfaces. Consult manufacturer if there is any doubt regarding the compatibility of decontamination or cleaning agents.</p>

Regulatory Compliance and Testing

This equipment is compliant with the European Directive 2002/95/EC and its latest amendments on Restrictions on Hazardous Substances (RoHS) and below the given limits of hazardous substances.

ETL Intertek (60 Hz units)

UL 61010-1 / CSA C22.2 No. 61010-1 — Safety Requirements for Measurement, Control, and Laboratory Use; Part 1: General Requirements

UL 61010A-2-010 / CSA C22.2 No. 61010-2-010:04 — Safety Requirements for Measurement, Control, and Laboratory Use; Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials

UL 61010A-2-051 / CSA C22.2 No. 61010-2-051:04 — Safety Requirements for Measurement, Control, and Laboratory Use; Part 2-051: Particular Requirements for Laboratory Equipment for the Mixing and Stirring

CE (all units)

EC Low Voltage Directive 2006/95/EC

EC Electromagnetic Compatibility Directive 2004/108/EC

IEC 61010-1-2001

IEC 61010-2-2001

IEC 61326:2005 / EN 61326 : 2006

Unpacking Your Immersion Circulator

Your Immersion Circulator is packed in a special carton. You should keep this carton, along with all packing materials, until the unit has been installed and you are certain it is working properly.



CAUTION: Remove any loose packing material that may have fallen into the heater/pump housing during shipping. Before powering up, check that nothing remains around the heater or circulator pump.

We recommend that you begin using your Immersion Circulator immediately to confirm proper operation, since beyond one week you may be eligible for warranty repair only (rather than replacement). You'll find complete warranty information in the back of this manual.

In the unlikely event that the unit was damaged or does not operate properly, immediately contact the transportation company, file a damage claim, and contact the company where your Immersion Circulator was purchased.

Package Contents

The following items are included in the shipping carton:

- Standard Immersion Circulator
- Quick-Start Guide
- Resource Disk with Operator's Manual
- Qualification Test Results

Controls and Components



Front View







Rear View



Main Display

Quick-Start


See Installation and Startup for additional information.

1	Attach Immersion Circulator to reservoir	
2	Fill reservoir with fluid	
3	Connect power cord to electrical outlet	
4	Turn Immersion Circulator "ON"	
5	Enter temperature set point	
6	Set safety thermostat once the unit reaches set point	

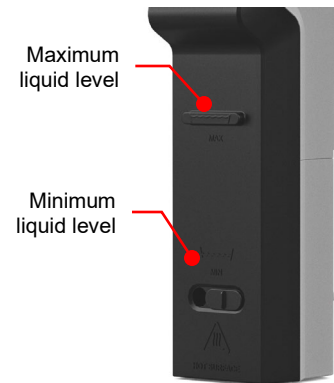
Installation and Startup


Your Standard Immersion Circulator is easily installed. The only tools required are a flat-head screwdriver and a container for adding water or another suitable fluid to the user-supplied reservoir.

1. **Place the flow adjusters in the desired position.** These slide controls allow you to easily adjust the force with which liquid will circulate in the reservoir. You'll achieve maximum circulation by placing both the front and rear flow adjusters in the fully open position.


	WARNING: To avoid the potential for burns, do not change the position of the flow adjusters while your Immersion Circulator is immersed in hot liquid. For safety, turn power to the unit off, remove from reservoir, and allow to cool before making adjustments.
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2. **Attach the Immersion Circulator to the reservoir** (user-supplied). A mounting clamp is provided that mounts securely to both flat and rounded tank walls. Allow a minimum of 1.3 cm / 0.5 inch clearance between the bottom of the Circulator's housing and the bottom of the reservoir.
3. **Add liquid to the reservoir.** The liquid in the reservoir should be maintained somewhere between the "Maximum" and "Minimum" liquid level lines embossed on the heater/pump housing.




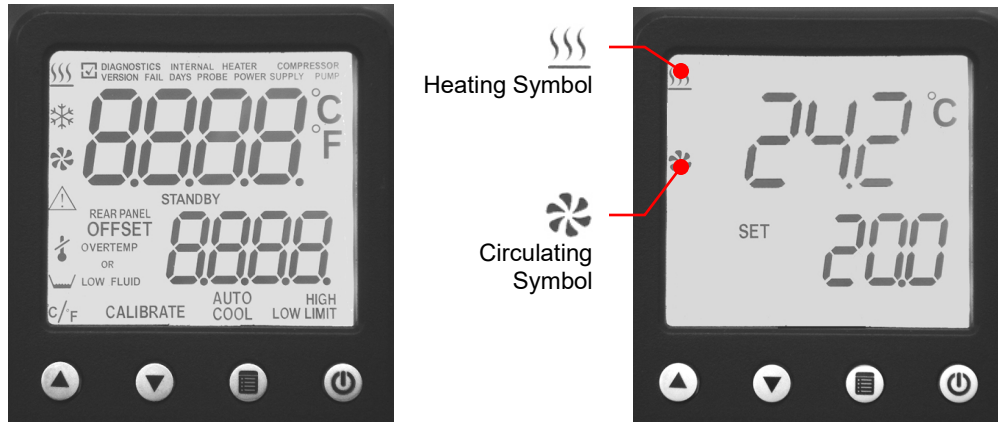
	WARNING: See <i>Technical Information</i> in the rear of this manual for a list of compatible liquids. WARNING: Read the safety data sheet for the bath fluid being used carefully before filling reservoir. WARNING: If the proper fluid level is not maintained, the heater coil may become exposed and possibly damaged (fluid level too low) or the bath may overflow (fluid level too high).
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4. **Plug the power cord into a properly grounded electrical outlet.** The LCD will light and "Standby" will appear on the display.





	WARNING: The correct voltage and frequency for your Immersion Circulator are indicated on the identification label on the back of the unit. The use of an extension cord is not recommended. If one is necessary, it must be properly grounded and capable of handling the total wattage of the unit. The extension cord must not cause more than a 10% drop in voltage to the unit.
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	WARNING: Make certain that the electrical outlet is the same voltage and frequency as your Immersion Circulator.
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5. **Turn power ON.** Press ; all characters and symbols on the LCD will momentarily light. The Immersion Circulator will begin running, actual and set point temperatures will be displayed, and the word “SET” will be continuously lit. The circulating symbol will also be lit and the heating symbol will also be flashing if the actual bath temperature is below the set point temperature.



6. **Set the Safety Set temperature.** This is a “Do Not Exceed” temperature setting for your Circulator and is the temperature at which the heater will be turned OFF in the event that the liquid level in the bath drops too low or the Circulator malfunctions. It is normally set about 5° higher than the desired operating temperature. Setting the Safety Set temperature is a four-step process.


- A. Using a flat blade screwdriver, rotate the Safety Thermostat (located beneath the cover plate on the front of the unit’s housing) clockwise until it stops.
- B. Press the  or  key; “SET” will begin flashing. Continue pressing the  and  keys until the set point temperature is equal to your desired Safety Set temperature. “SET” will stop flashing approximately 10 seconds after the desired temperature has been entered. Allow the Circulator to stabilize at this temperature.



- C. Once the bath temperature has stabilized, slowly rotate the Safety Thermostat counter-clockwise until you hear a soft “click;” the OVERTEMP or LOW FLUID alarm symbol will appear on the display approximately 5-10 seconds later. At this point, the heater will also turn OFF.
- D. Slowly rotate the Safety Thermostat clockwise until the alarm symbol extinguishes. The heater should also turn back ON. You are now ready to start normal operation.







Over-Temperature/Low Liquid Level alarm


	<p>WARNING: The Safety Thermostat is user-adjustable from approximately 40° to 210°C. Do not force the indicator dial beyond the stops at either end of the dial’s range.</p>
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Normal Operation

Keys and Controls

Power		Turns the Immersion Circulator ON.
Menu		Accesses the Temperature Controller's set-up sub-menus. The items in these sub-menus are used to configure the Controller's general operational parameters (temperature unit, upper and lower temperature limits, offset calibration, etc.).
Up Arrow		Used to increase temperature set point and other operational settings/values.
Down Arrow		Used to decrease temperature set point and other operational settings/values.

Turning Your Circulator ON

Press the  key.




All characters/symbols on the LCD will momentarily light. When the Circulator begins running, the actual and set point temperatures will be displayed and the circulating symbol will be lit.









If the actual bath temperature is lower than the set point temperature, the heat symbol will also be lit.


Main Operational Display



Set-Up Sub-Menus

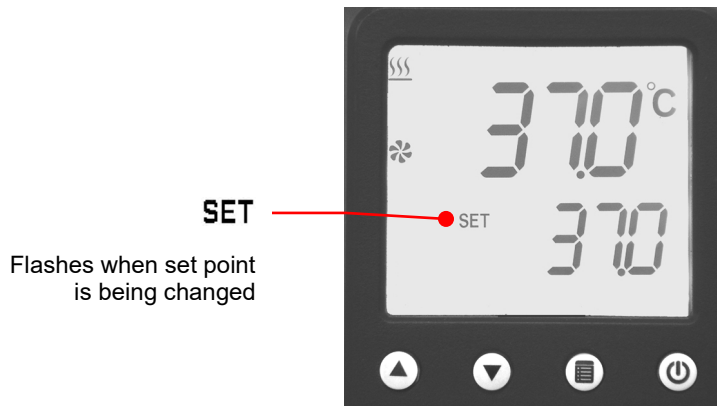
Press the  key to access the Temperature Controller's set-up sub-menus. The  or  keys are used to change the current setting / value in the sub-menu.





Sub-Menu	Selection / Range	To Change Current Value
Temperature unit	°C or °F	Press  for °C Press  for °F
Offset Calibration	-3.0°C to +3.0°C	Press  or 
Low Limit	-55° to +10°C / -65° to +50°F	Press  or 
High Limit	+40° to +155°C / +100 to +305°F	Press  or 


To accept a value in a sub-menu, press  or allow the display to 'time out' (approximately 10 seconds).

Adjusting the Temperature Set Point

This is the temperature at which the fluid in your circulating bath will be maintained. It may be set to one-tenth of a degree over a range of -50° to +135°C / -60° to +275°F. The factory default is 20°C / 68°F.

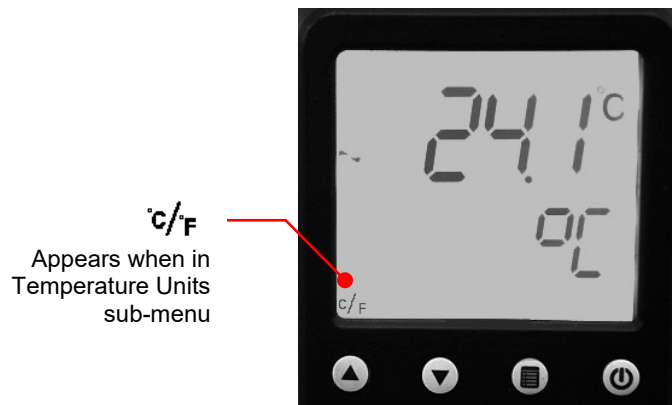



To Change: Press the  or  key. The word "SET" will begin flashing. Continue holding or repeatedly press  or  until the desired set point temperature is displayed.

To Accept: Press  or allow the LCD to return to the main operational display (approximately 10 seconds).


Selecting the Temperature Unit

The temperature units sub-menu ($^{\circ}\text{C}$ / $^{\circ}\text{F}$) allows you to select the temperature unit in which the actual bath temperature and set point temperature are displayed. The factory default is $^{\circ}\text{C}$.



To Access: Press the  key until the $^{\circ}\text{C}/^{\circ}\text{F}$ appears on the display.

To Change: Press  to select $^{\circ}\text{C}$; press  to select $^{\circ}\text{F}$.




To Accept: Press  or allow the LCD to return to the main operational display (approximately 10 seconds).


Setting the Offset Calibration

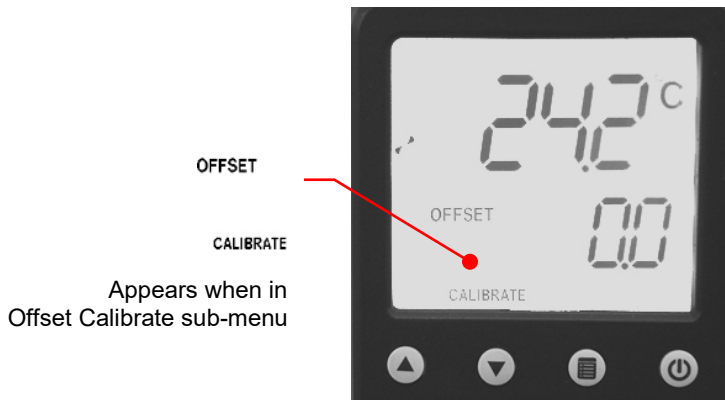
This sub-menu allows you to match the Circulator's temperature display to an external reference thermometer. A value from -3.0° to +3.0°C may be entered; the factory default is 0.0°C.




IMPORTANT: To prevent the Offset Calibration value from being changed unintentionally, the following power down/power up sequence is required to enable the Offset Calibration function.


1. Turn Mains power OFF by disconnecting the electrical cord from the outlet.
2. Turn Mains power ON while pressing and holding the  key.
3. When STANDBY appears on the display, release the  key and press . You can now proceed as outlined below.

The Offset Calibration function will remain enabled until the electrical power is turned OFF by pressing the  key.



To Access: Press the  key until OFFSET CALIBRATE appears on the display.

To Change: Press  or .

To Accept: Press  or allow the LCD to return to the main operational display (approximately 10 seconds).

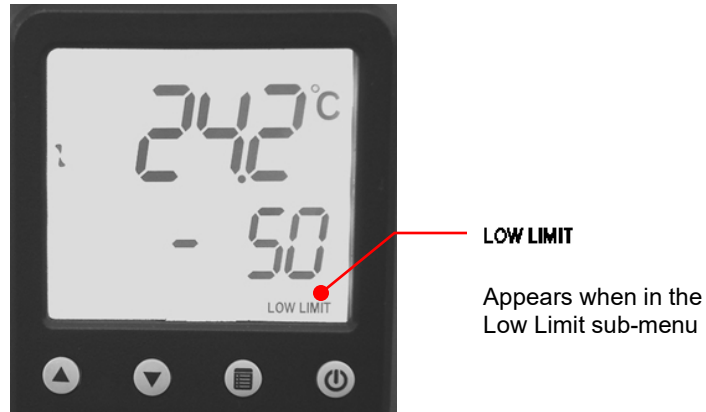



CAUTION: The Offset Calibration value is always shown in degrees C, even if degrees F is selected as the temperature unit in which the control and actual bath temperatures are displayed. Your Immersion Circulator will automatically convert the °C offset calibration value to the correct °F display offset value.

Setting the Low Limit Temperature


This sub-menu allows you to limit how low the temperature set point may be set. It also serves as a low limit safety, alerting you if bath temperature falls below the low limit temperature setting. The Low Limit value may be set from -55° to +10°C / -65° to +50°F; the factory default is -50°C / -60°F.

To avoid an unwanted alarms or shutdown during regular operation, the Low Limit value should be set at least 5° lower than the selected control temperature.



To Access: This Press the  key until LOW LIMIT appears on the display.

To Change: Press  or .


To Accept: Press  or allow the LCD to return to the main operational display (approximately 10 seconds).

Setting the High Limit Temperature


This sub-menu allows you to limit how high the temperature set point may be set. It also serves as a high limit safety, alerting you if bath temperature rises above the high limit temperature setting. The High Limit value may be set from +40° to +155°C / +100° to +305°F; the factory default is +150°C / +300°F.

To avoid an unwanted shutdown during regular operation, the High Limit value should be set at least 5° higher than the selected control temperature.






To Access: Press the  key until HIGH LIMIT appears on the display.

To Change: Press  or .

To Accept: Press  or allow the LCD to return to the main operational display (approximately 10 seconds).

Resetting the Factory Default Values

You can return your Circulator to all factory-set default as follows:

1. Press the  key to turn the Circulator OFF.
2. Unplug the power cord from the electrical outlet.
3. Plug the power cord back into the electrical outlet while pressing either the  or  button.


The factory default values are:

Operational Parameter	Factory Default Value
Temperature Scale	°C
Temperature Set Point	20°C / 68°F
Calibration Offset	0.0°C
Low Limit	-50°C / -60°F
High Limit	+150°C / +300°F

Loss of Power Restart



WARNING: The unit will start automatically after a disruption in electrical power.




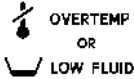
In the event that electrical power is lost while your Circulator is in use, it will begin operating automatically once power is restored. FAIL POWER will appear on the display to alert you that there was a power disruption. To clear the message, turn the Circulator OFF and then back ON again using the  key.



FAIL POWER

Indicates electrical power was disrupted during operation

Alarm Messages

Alarm Symbol	Description	Corrective Action
FAIL POWER	Informational Message: Indicates that electrical power was lost during operation.	Using the  key, turn the Circulator OFF and then back ON. This will clear the message.
LOW LIMIT (flashing)	Warning: The temperature set point is below the Low Limit temperature value.	Decrease the Low Limit temperature value or increase the temperature set point.
HIGH LIMIT (flashing)	Warning: The temperature set point is above the High Limit temperature value.	Increase the High Limit temperature value or decrease the set point temperature.
 LOW LIMIT	Alarm: The bath temperature has fallen below the Low Limit temperature value. Power to the pump and heater will remain OFF until the problem is corrected.	Allow bath to warm or add heat load. Decrease the Low Limit temperature value.
 HIGH LIMIT	Alarm: The bath temperature has risen above the High Limit temperature value. Power to the heater and pump will remain OFF until the problem is corrected.	Allow bath to cool or increase High Limit temperature value. Replace fluid.
 OVERTEMP OR LOW FLUID	Fault: The liquid in the bath has dropped too low or the temperature of the bath fluid has exceeded the Safety Set temperature. Power to the heater will remain OFF until the problem is corrected.	Fluid level in reservoir has fallen below minimum level; add fluid as required. Fluid temperature is higher than Safety Set temperature; increase Safety Set temperature setting. Controller failure; consult factory.
INTERNAL FAIL PROBE	Fault: The Circulator's temperature sensor has failed.	Consult factory.
HEATER FAIL	Fault: The Circulator's heater has failed.	Consult factory.

Routine Maintenance and Troubleshooting



WARNING: Always turn your Circulator OFF and disconnect it from the electrical power outlet before performing any maintenance or service.



WARNING: To avoid the potential for burns, allow the Immersion Circulator to cool completely before cleaning or performing any maintenance.



WARNING: Turn electrical power to the unit OFF and remove Immersion Circulator from reservoir before draining. Always drain all fluid from the reservoir before moving or lifting. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.



CAUTION: Always clean and dry your Standard Immersion Circulator thoroughly before storing.

Maintaining Clear Bath Water

Optimum temperature and moisture conditions for algae growth existing when using water as a bath fluid. To prevent algae contamination and minimize the frequency of draining the reservoir, an algaecide should be used.




WARNING: Do not use chlorine bleach.

Cleaning Your Immersion Circulator



WARNING: It is the user's responsibility to properly decontaminate the unit in the event hazardous materials are spilled on exterior or interior surfaces. Consult the manufacturer if there is any doubt regarding the compatibility of decontamination or cleaning agents.

Temperature Controller

Turn the Temperature Controller OFF by pressing  and unplug power cord from the electrical outlet.

Remove Temperature Controller from bath reservoir and, keeping it upright, wipe the housing with a clean cloth dampened with a mild detergent and water or mild all-purpose cleaner.



CAUTION: Do not spray cleaning liquids directly onto the Temperature Controller or allow them to enter the Controller's vents. Do not use abrasives as these could scratch the housing or the digital display.




CAUTION: Never immerse the Circulator's controls or display in water or other liquids or place under running water. Do not clean the unit in a glassware washer.

Bath Reservoir and Wetted Components

A concentrated bath cleaner is available to remove mineral deposits from the Temperature Controller's wetted parts. The cleaner should be added to the bath reservoir at the prescribed dosage and circulated at 60°C / 140°F until the scale is removed.

Pump Impeller

In the unlikely event that debris becomes lodged in the pump impeller, a soft brush can be used to remove any lodged particles. If necessary, soak in a solution of distilled water and bath cleaner to soften before brushing.

	CAUTION: Do not use hard utensils or abrasive pads to remove trapped debris.
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Checking the Over-Temperature Safety System

Your Circulator incorporates over-temperature protection according to IEC 61010. For optimum safety, this system should be checked for proper operation at least every six months. This check must be performed with the unit running.

1. Enter a temperature set point of approximately 50°C and then allow the bath to stabilize at that temperature. The amount of time this will take will depend on the size of the bath and the difference between the initial bath temperature and the Safety Set temperature.
2. Once the bath temperature has stabilized, slowly rotate the Safety Thermostat counter-clockwise until you hear a soft “click;” the OVERTEMP or LOW FLUID alarm symbol will appear on the display approximately 5-10 seconds later. At this point, the heater will also turn OFF.
3. Slowly rotate the Safety Thermostat clockwise until the alarm symbol extinguishes (you may also hear a soft “click”). The heater should turn back ON.
4. Reset the Safety Set temperature to the desired temperature value (see *Installation and Startup*).



Troubleshooting Chart

Problem	Possible Causes	Corrective Action
Unit does not run (Digital Display is blank)	No power to unit	Check that the electrical cord is secure and connected to an operating electrical outlet.
Unit does not run (STANDBY appears on Digital Display)	Unit in Standby mode	Press Power Key on front panel.
No fluid circulation	Insufficient fluid in reservoir Pump impeller jammed	Add fluid to reservoir. Inspect pump and remove debris as required.
Insufficient circulation	Fluid viscosity too high Low line voltage	Replace with lower viscosity bath fluid. Check and correct as required.
Unit does not heat	Insufficient fluid in reservoir Temperature set point too low Safety Set Temperature too low	Add fluid to reservoir. Increase temperature set point. Increase Safety Set temperature.
Insufficient heating	Insufficient circulation Low line voltage Ambient temperature too cool Excessive heat loss	See Insufficient circulation, above. Check and correct as required. Increase ambient temperature or relocate unit. Check for vapor/heat loss from internal reservoir.
Temperature unstable	Insufficient circulation Debris or mineral build-up on pump, heater, or temperature sensor.	Check pump flow and operation. Clean as required.

Technical Information

Performance Specifications

Operating Temperature Range:	Ambient +10° to 135°C Ambient +20° to 275°F
Temperature Stability:	±0.07°C / ±0.13°F
Heater Wattage:	1100 watts
Electrical Requirements:	120V, 60Hz, 10 amps or 240V, 50Hz, 6 amps
Environmental Conditions	Indoor use only
	Maximum Altitude: 2000 meter
	Operating Ambient: 5° to 35°C (41° to 95°F)
	Relative Humidity: 80%, non-condensing
	Installation Category: II
	Pollution Degree: 2
	Ingress Protection: IP 31
	Climate Class: SN
	Software Class: B
	Output Waveform: Sinusoidal


Specifications subject to change without notice.


Attainable Temperatures:

Your Standard Immersion Circulator can be used with reservoirs of various capacities and shapes as well as different fluids. These variables may adversely affect temperature accuracy and stability. For example, a reservoir with a large surface area loses heat more quickly, which may prevent the Circulator from attaining the desired temperature.

Reservoir Fluids

Depending on your needs, a variety of fluids can be used with your Immersion Circulator. No matter what bath fluid is selected, it must be chemically compatible with the reservoir and the materials in your Immersion Circulator. It must also be suitable for the desired temperature range.

	WARNING: Do not use a flammable liquid as a bath fluid as a fire hazard may result.
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	WARNING: Always use fluids that satisfy safety, health, and equipment compatibility requirements.
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For optimum temperature stability, the fluid's viscosity should be 50 centistokes (cSt) or less at its lowest operating temperature. This permits good fluid circulation and minimizes heating from the pump.

For temperatures from 10°C to 90°C, distilled water is recommended. For temperatures below 10°C, a mixture of laboratory grade ethylene glycol and water should be used. Do not use deionized water.

The following chart is intended to serve as a guide in selecting a bath fluid for your application. For optimum temperature stability and low vaporization, be sure to stay within the fluid's normal temperature range.

You are responsible for proper selection and use of the fluids. Avoid extreme range operation.

Fluid Description	Viscosity (cSt) @ 25°C	Specific Heat			Normal Temperature Range	Extreme Temperature Range
		@ Fluid Temperature	BTU/lb°F	KJ/Kg°C		
distilled water	1	50°C	1.00	4.18	10° to 90°C	2° to 100°C
Ethylene glycol (50/50 mix with distilled H ₂ O)	20	-20°C	0.78	3.26	-25° to 100°C	-30° to 115°C
Ethylene glycol (30/70 mix with distilled H ₂ O)	12	0°C	0.89	3.72	0° to 95°C	-15° to 107°C
Propylene glycol (50/50 mix with distilled H ₂ O)	20	-10°C	0.83	3.47	-20° to 100°C	-30° to 115°C
Propylene glycol (30/70 mix with distilled H ₂ O)	12	5°C	0.92	3.85	5° to 90°C	-10° to 107°C

	<p>WARNING: DO NOT USE THE FOLLOWING LIQUIDS:</p> <ul style="list-style-type: none"> • Automotive antifreeze with additives** • Hard tap water** • Deionized water with a specific resistance > 1 meg ohm • Any flammable fluids • Concentrations of acids or bases • Solutions with halides: chlorides, fluorides, bromides, iodides or sulfur • Bleach (Sodium Hypochlorite) • Solutions with chromates or chromium salts • Glycerine • Syltherm fluids <p>** At temperatures above 40°C, additives or mineral deposits can adhere to the heater. If deposits are allowed to build up, the heater may overheat and fail. Higher temperatures and higher concentrations of additives will hasten deposit build up.</p>
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Application Notes

At a fluid's low temperature extreme:

- The presence of ice or slush adversely affects temperature stability.
- A viscosity above 10 centistokes adversely affects temperature uniformity.
- A high fluid viscosity and high pump speed adds heat to the fluid being pumped.

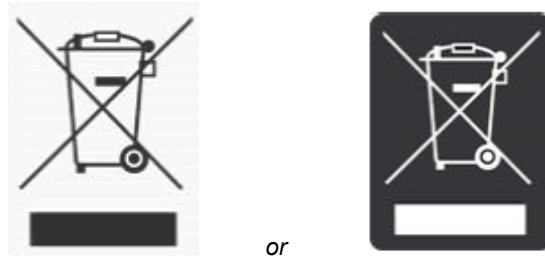
At a fluid's temperature above ambient without refrigeration:

- If your set point temperature is less than 15°C above the ambient temperature, the viscosity of the fluid should be 10 centistokes or less to minimize friction heating of the fluid.
- Heat loss should be encouraged by uncovering the fluid and lowering the pump speed.

At fluid's high temperature extreme:

- Heat loss from vapor adversely affects temperature stability.
- To prevent the accumulation of vapors inside the room, the reservoir may need to be placed in a fume hood.
- Use a cover and/or floating hollow balls to help prevent heat and vapor loss.
- Replenish fluid lost from vapor frequently.

Equipment Disposal (WEEE Directive)



This equipment is marked with the crossed out wheeled bin symbol to indicate it is covered by the Waste Electrical and Electronic Equipment (WEEE) Directive and is not to be disposed of as unsorted municipal waste. **Any products marked with this symbol must be collected separately, according to the regulatory guidelines in your area.**

It is your responsibility to correctly dispose of this equipment at lifecycle-end by handing it over to an authorized facility for separate collection and recycling. It is also your responsibility to decontaminate the equipment in case of biological, chemical and/or radiological contamination, so as to protect the persons involved in the disposal and recycling of the equipment from health hazards. By doing so, you will help to conserve natural and environmental resources and you will ensure that your equipment is recycled in a manner that protects human health.

Requirements for waste collection, reuse, recycling, and recovery programs vary by regulatory authority at your location. Contact your local responsible body (e.g., your laboratory manager) or authorized representative for information regarding applicable disposal regulations.

Service and Technical Support

If you have followed the troubleshooting steps outlined previously and your Circulator still fails to operate properly, contact the supplier from whom the unit was purchased. Have the following information available for the customer service person:

- Model, Serial Number, and Voltage (from back panel label)
- Date of purchase and purchase order number
- Supplier's order number or invoice number
- A summary of the problem

Warranty

The manufacturer agrees to correct for the original user of the product, either by repair (using new or refurbished parts), or at the manufacturer's election, by replacement (with a new or refurbished product), any defects in material or workmanship which develop during the warranty period. The standard warranty is twenty-four (24) months after delivery of the product. In the event of replacement, the replacement unit will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer. For purposes of this limited warranty, "refurbished" means a product or part that has been returned to its original specifications. In the event of a defect, these are your exclusive remedies.

If the product should require service, contact the manufacturer's/supplier's office for instructions. When return of the product is necessary, a return authorization number is assigned and the product should be shipped, transportation charges pre-paid, in either its original packaging or packaging affording an equal degree of protection to the indicated service center. To ensure prompt handling, the return authorization number must be placed on the outside of the package. A detailed explanation of the defect should be enclosed with the item.

The warranty shall not apply if the defect or malfunction was caused by accident, neglect, unreasonable use, improper service, acts of God, modification by any party other than Cole-Parmer, or other causes not arising out of defects in material or workmanship.

EXCLUSION OF IMPLIED WARRANTIES. THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THOSE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WHICH EXTEND BEYOND THE DESCRIPTION AND PERIOD AS STATED IN THE OPERATOR'S MANUAL INCLUDED WITH EACH PRODUCT.

LIMITATION ON DAMAGES. THE MANUFACTURER'S SOLE OBLIGATION UNDER THE WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT OF A DEFECTIVE PRODUCT AND THE MANUFACTURER SHALL NOT, IN ANY EVENT, BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND RESULTING FROM USE OR POSSESSION OF THIS PRODUCT.

Some states do not allow: (A) limitations on how long an implied warranty lasts; or (B) the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may have other rights that vary from state to state.

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