

Circulating Baths with PX or DX Temperature Controller

Operator's Manual

Models:	PX/DX07E-25	DX07H175
PX/DX06S150	PX/DX07E-40	DX15H175
PX/DX10S150	PX/DX7LE-25	DX20H175
PX/DX20S150	PX/DX15E-40	DX28H175
PX/DX28S150	PX/DX20E-40	PX07H200
PX/DX07G100	PX/DX28E-40	PX15H200
PX/DX10G100	PX45R-25	PX20H200
PX/DX25G100	PX75R-20	PX28H200
DX17VB6G	PX15ECAL	



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1. Introduction

Thank you for choosing this Circulating Bath with PX Programmable or DX Advanced Controller. 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: These 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.

It will take you very little time to get your new Circulating Bath installed and running. This Operator's Manual is designed to guide you quickly through the process. We recommend that you read it thoroughly before you begin.

1.1 Circulating Bath Models with PX Programmable Temperature Controller

Model Type	Reservoir Capacity	Temperature Range	
		°C	°F
PX07E-25 Refrigerating/Heating	7 liters	-25° to 200°C	-13° to 392°F
PX07E-40 Refrigerating/Heating	7 liters	-40° to 200°C	-40° to 392°F
PX7LE-25 Refrigerating/Heating	7 liters	-25° to 200°C	-13° to 392°F
PX15E-40 Refrigerating/Heating	15 liters	-40° to 200°C	-40° to 392°F
PX20E-40 Refrigerating/Heating	20 liters	-40° to 200°C	-40° to 392°F
PX28E-40 Refrigerating/Heating	28 liters	-40° to 200°C	-40° to 392°F
PX45R-25 Refrigerating/Heating	45 liters	-25° to 135°C ⁽¹⁾	-13° to 275°F ⁽¹⁾
PX75R-20 Refrigerating/Heating	75 liters	-20° to 100°C ⁽¹⁾	-4° to 212°F ⁽¹⁾
PX07H200 Heating Only	7 liters	Ambient +10° to 200°C	Ambient +20° to 392°F
PX15H200 Heating Only	15 liters	Ambient +10° to 200°C	Ambient +20° to 392°F
PX20H200 Heating Only	20 liters	Ambient +10° to 200°C	Ambient +20° to 392°F
PX28H200 Heating Only	28 liters	Ambient +10° to 200°C	Ambient +20° to 392°F
PX06S150 Stainless Steel Open Tank	6 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
PX10S150 Stainless Steel Open Tank	10 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
PX20S150 Stainless Steel Open Tank	20 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
PX28S150 Stainless Steel Open Tank	28 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
PX07G100 Polycarbonate Open Tank	7 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
PX10G100 Polycarbonate Open Tank	10 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
PX25G100 Polycarbonate Open Tank	25 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
PX15ECAL Refrigerating/Heating Calibration Bath	15 liters	-30° to 200°C	-22° to 392°F

1. Maximum operating temperature at which $\pm 0.004^{\circ}\text{C}$ temperature stability can be maintained; PX Controller is capable of higher temperatures.
2. Maximum operating temperature for stainless steel tank. PX Controller is capable of higher temperatures.
3. Maximum operating temperature for polycarbonate tank. PX Controller is capable of higher temperatures.

1.2 Circulating Bath Models with DX Advanced Temperature Controller

Model Type	Reservoir Capacity	Temperature Range	
		°C	°F
DX07E-25 Refrigerating/Heating	7 liters	-25° to 175°C	-13° to 347°F
DX07E-40 Refrigerating/Heating	7 liters	-40° to 175°C	-40° to 347°F
DX7LE-25 Refrigerating/Heating	7 liters	-25° to 175°C	-13° to 347°F
DX15E-40 Refrigerating/Heating	15 liters	-40° to 175°C	-40° to 347°F
DX20E-40 Refrigerating/Heating	20 liters	-40° to 175°C	-40° to 347°F
DX28E-40 Refrigerating/Heating	28 liters	-40° to 175°C	-40° to 347°F
DX07H175 Heating Only	7 liters	Ambient +10° to 175°C	Ambient +20° to 347°F
DX15H175 Heating Only	15 liters	Ambient +10° to 175°C	Ambient +20° to 347°F
DX20H175 Heating Only	20 liters	Ambient +10° to 175°C	Ambient +20° to 347°F
DX28H175 Heating Only	28 liters	Ambient +10° to 175°C	Ambient +20° to 347°F
DX06S150 Stainless Steel Open Tank	6 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
DX10S150 Stainless Steel Open Tank	10 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
DX20S150 Stainless Steel Open Tank	20 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
DX28S150 Stainless Steel Open Tank	28 liters	Ambient +10° to 150°C ⁽²⁾	Ambient +20° to 302°F ⁽²⁾
DX07G100 Polycarbonate Open Tank	7 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
DX10G100 Polycarbonate Open Tank	10 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
DX25G100 Polycarbonate Open Tank	25 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾
DX17VB6G Glass Viscosity Bath	17 liters	Ambient +10° to 100°C ⁽³⁾	Ambient +20 to 212°F ⁽³⁾

1. Maximum operating temperature at which $\pm 0.01^\circ\text{C}$ temperature stability can be maintained; DX Controller is capable of higher temperatures.

2. Maximum operating temperature for stainless steel tank. DX Controller is capable of higher temperatures.

3. Maximum operating temperature for polycarbonate tank and glass viscosity bath. DX Controller is capable of higher temperatures.

1.3 General Safety Information

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

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

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

1.4 Safety information for Models Containing R290 Refrigerant

PX07E-25 DX07E-25

PX07E-40 DX07E-40

PX7LE-25 DX7LE-25

PX15E-40 DX15E-40

PX20E-40 DX20E-40

PX28E-40 DX28E-40

PX15ECAL



- WARNING: Risk of fire or explosion. Flammable refrigerant used.
- Ensure all ventilation openings are not obstructed. Place in a well-ventilated area to prevent accumulation of refrigerant.
- Repair and disposal must be carried out by trained service personnel.
- Do not puncture or damage the refrigeration circuit. No exposed flame during service or repair.
- This unit is intended for use in commercial, industrial, or institutional occupancies as defined in the Safety Standard for Refrigeration Systems, ANSI/ASHRAE 15
- WARNING do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer

1.5 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:

	WARNING: It is the operator's responsibility to read and follow all recommendations provided in this manual. Use of accessories or use of the circulating bath in a manner not recommended in this manual may impair the intended operation and safety protections provided in the unit. Consult manufacturer if there is any doubt regarding intended operation. 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 <i>Technical Information</i> in the rear of this manual for recommended fluids. Use only non-acid bath fluids.
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WARNING:

Circulating Baths equipped with PX Programmable Controllers are suitable for use with Class III flammable fluids per DIN 12876-1. A fire hazard may be present.

Explosive gas mixtures may accumulate if used with insufficient ventilation. Use this Circulating Bath in a well-ventilated area or beneath a suitable fume hood only. Ensure all ventilation openings are not obstructed.

No smoking! No flame! Do not use electrical parts which can produce a spark when operating around the equipment and the application system.

Drain and recover the liquid when the equipment idles, if the bath fluid is used with an open tank and if it is highly volatile at ambient temperature.

WARNING: When using Class III flammable fluids per DIN 12876-1, the user must attach the following warning labels to the front of the unit so that they are well visible:

 Warning Label W09 Colors: Yellow/black		Danger Area. Attention! Observe instructions (operating manual, safety data sheet)
Warning Label W021 Colors: Yellow/black		Flammable fluid
Mandatory Label M018 Colors: Blue/white or Semi S1-0701 Table A1-2 #9 Colors: Blue/white	 	Carefully read the user information prior to beginning operation. Scope: EU Carefully read the user information prior to beginning operation. Scope: NAFTA

	WARNING: Always connect the power cord on this Circulating Bath to a grounded (3-prong) power outlet. Make certain that the outlet is the same voltage and frequency as your unit. Never operate the Circulating Bath with a damaged power cord. Always turn the Circulating Bath OFF and disconnect mains power before performing any maintenance or service.
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	WARNING: Never operate the Circulating Bath 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 type 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. Always drain all fluid from the reservoir before moving or lifting your Circulating Bath. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.
---	--

	WARNING: Always allow the bath fluid to cool to ambient temperature before draining. The reservoir cover, top deck, and/or external pump connections may become hot with continuous use. Exercise caution when touching these parts. Always keep within the 100°C maximum operating temperature limit if using a polycarbonate tank.
---	---

	WARNING: Metal parts of the reservoir and reservoir cover may get extremely cold. Always allow the bath fluid to warm to ambient temperature before accessing these parts.
---	---

	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.
--	--

Safety information for Models Charged with R290 Refrigerant

	• WARNING: Risk of fire or explosion. Flammable Refrigerant Used • Do not damage the refrigeration circuit or increase the risk of a leak
---	---

1.6 Regulatory Compliance & Testing

Intertek (cETLus) (60 Hz units)

UL 61010-1:2012 Ed.3+R:06Jun2023/CSA C22.2#61010-1-12:2012 Ed.3+U1;U2;A1: U3

UL 61010-2-010:2019 Ed. 4 + R:29Sep2023/CSA C22.2#61010-2-010:2019 Ed. 4

UL 61010-2-011:2021 Ed. 2 +R:2Feb2024/CSA C22.2#61010-2- 011:2019 Ed. 2

UL 61010-2-051:2019 Ed. 4 +R:29Sep2023/CSA C22.2#61010-2-051:2019 Ed. 4

Europe (50Hz)/CE

Regulation (EU) 2023/1230 on Machinery

EC Electromagnetic Compatibility Directive 2014/30/EU

RoHS Directive 2011/65/EU, including Directive (EU) 2015/863

EN 61010-1:2010, EN 61010-1:2010/A1:2019/AC:2019-04, EN 61010-1:2010/A1:2019

EN IEC 61010-2-010:2020, EN IEC 61010-2-011:2021, EN IEC 61010-2-011:2021/A11:2021,

EN IEC 61010-2-051:2021, EN IEC 61010-2-051:2021/A11:2021

EN 61326-1:2021, EN IEC 63000:2018

UK: (UKCA) (50 Hz units)

Supply of Machinery (Safety) Regulations 2008

Electromagnetic Compatibility Regulations 2016

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations, 2012

EN 61010-1:2010, EN 61010-1:2010/A1:2019/AC:2019-04, EN 61010-1:2010/A1:2019;

EN IEC 61010-2-010:2020, EN IEC 61010-2-011:2021, EN IEC 61010-2-011:2021/A11:2021

EN IEC 61010-2-051:2021, EN IEC 61010-2-051:2021/A11:2021

EN 61326-1:2021, EN IEC 63000:2018

1.7 Unpacking Your Circulating Bath

Your circulating bath was shipped in packaging specifically designed to exactly fit the unit. Keep – do not discard – all packaging and included materials in the event you need to return the unit for service.



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 Circulating Bath pump.

We recommend that you begin using your Circulating Bath 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 at the back of this manual.



WARNING: Keep unit upright when moving. Be sure to follow your company's procedures and practices regarding the safe lifting and relocation of heavy objects.

Additional Safety information for Refrigerated Circulators Charged with R290 Refrigerant



- **WARNING:** Risk of fire or explosion. Flammable refrigerant used
- Place in a well-ventilated area to prevent accumulation of refrigerant.
- Do not damage the refrigeration circuit.

For refrigerated circulators, the evaporator coil located inside the reservoir tank is part of the refrigerant circuit. Keep all items to be cooled/heated away from the evaporator coil. Do not scratch, puncture or otherwise damage the refrigerant circuit.

1.8 Package Contents

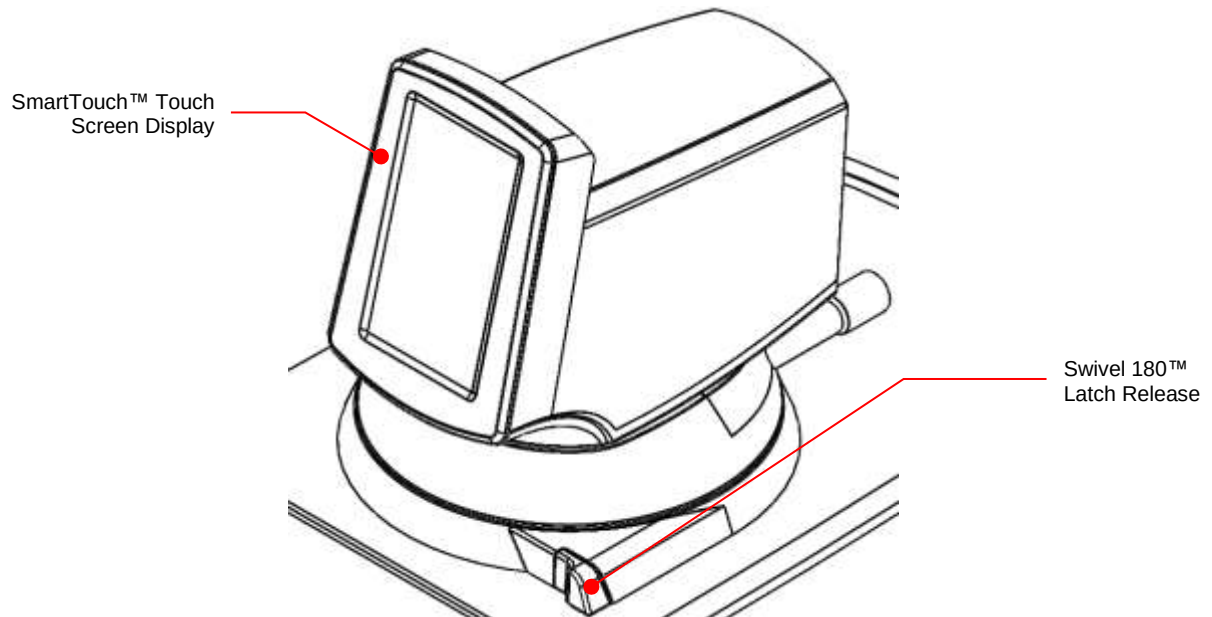
The items included with your Circulating Bath will vary depending on which model you purchased.

	Refrigerating / Heating Bath	Heating Only Bath
Reservoir Cover(s)	•	•
3 ft / 0.91 m IEC-C14 to IEC-C13 Power Cord (250V max)	•	
6 ft / 1.82 m IEC to Mains Power Cord	•	•
Refrigeration Control Cable	•	
Fittings	1/4 in. NPT to 3/16 in. barbed adapter ⁽¹⁾ 1/4 in. NPT to 1/4 in. barbed adapter ⁽¹⁾ 1/4 in. NPT to 3/8 in. barbed adapter ⁽¹⁾ 1/4 in. NPT to M16 threaded adapter ⁽²⁾	
Cooling Coil	N/A	Integral
Bath Lid Sleeves ⁽³⁾	2 x 3 mm, 4 mm, and 6 mm openings	
Certificate of Compliance	•	•
Flash Drive	•	•
Pt100 External Temperature Probe ⁽³⁾	•	•
Quick-Start Guide	•	•
Communication Module	Programmable Model Only	Programmable Model Only

1. 60Hz and 50Hz models
2. 50Hz models only
3. Included only with Calibration Baths (PX15ECAL)

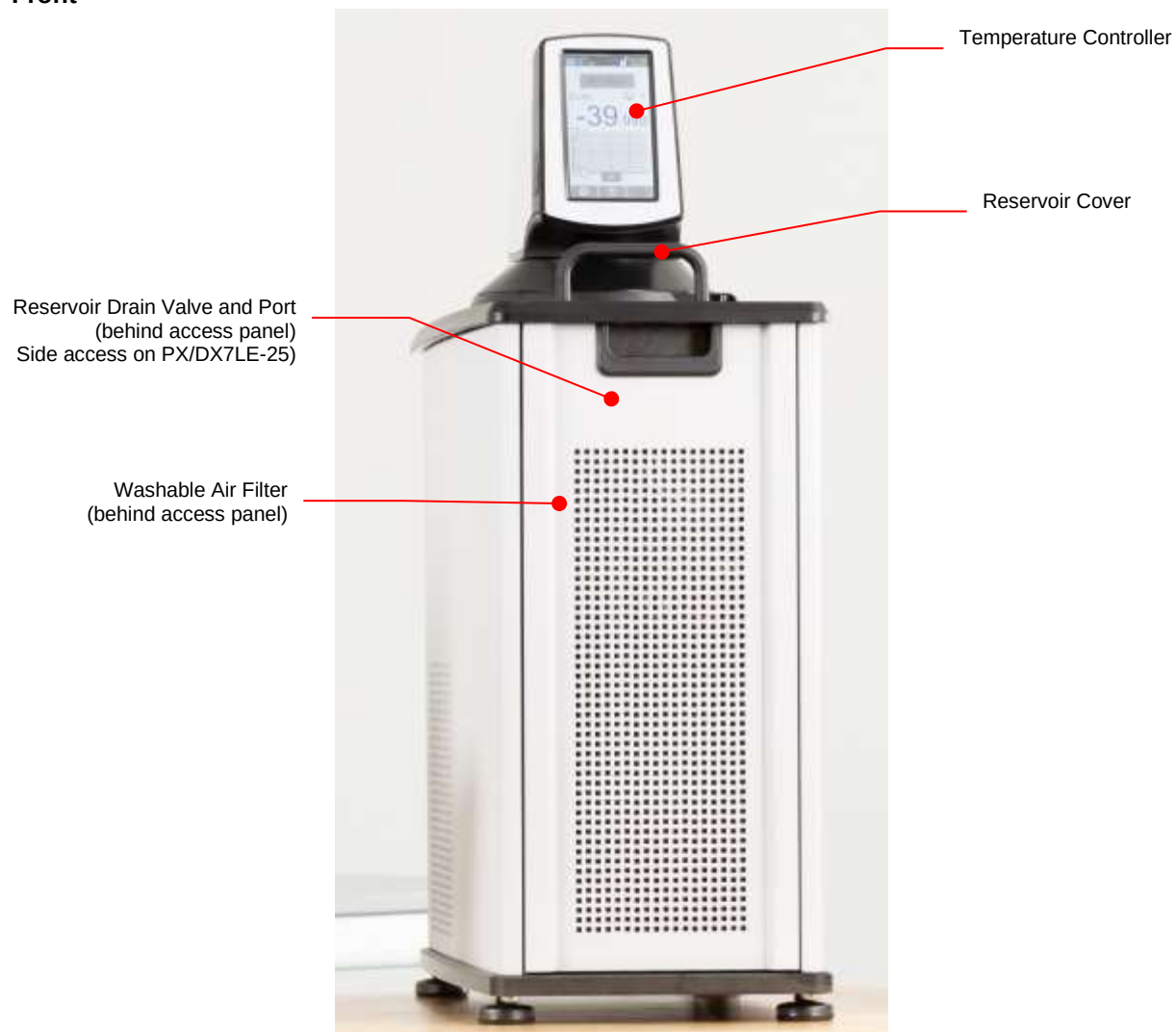
2. Controls & Components

2.1 Temperature Controller



2.2 Refrigerating/Heating Circulating Baths

Front



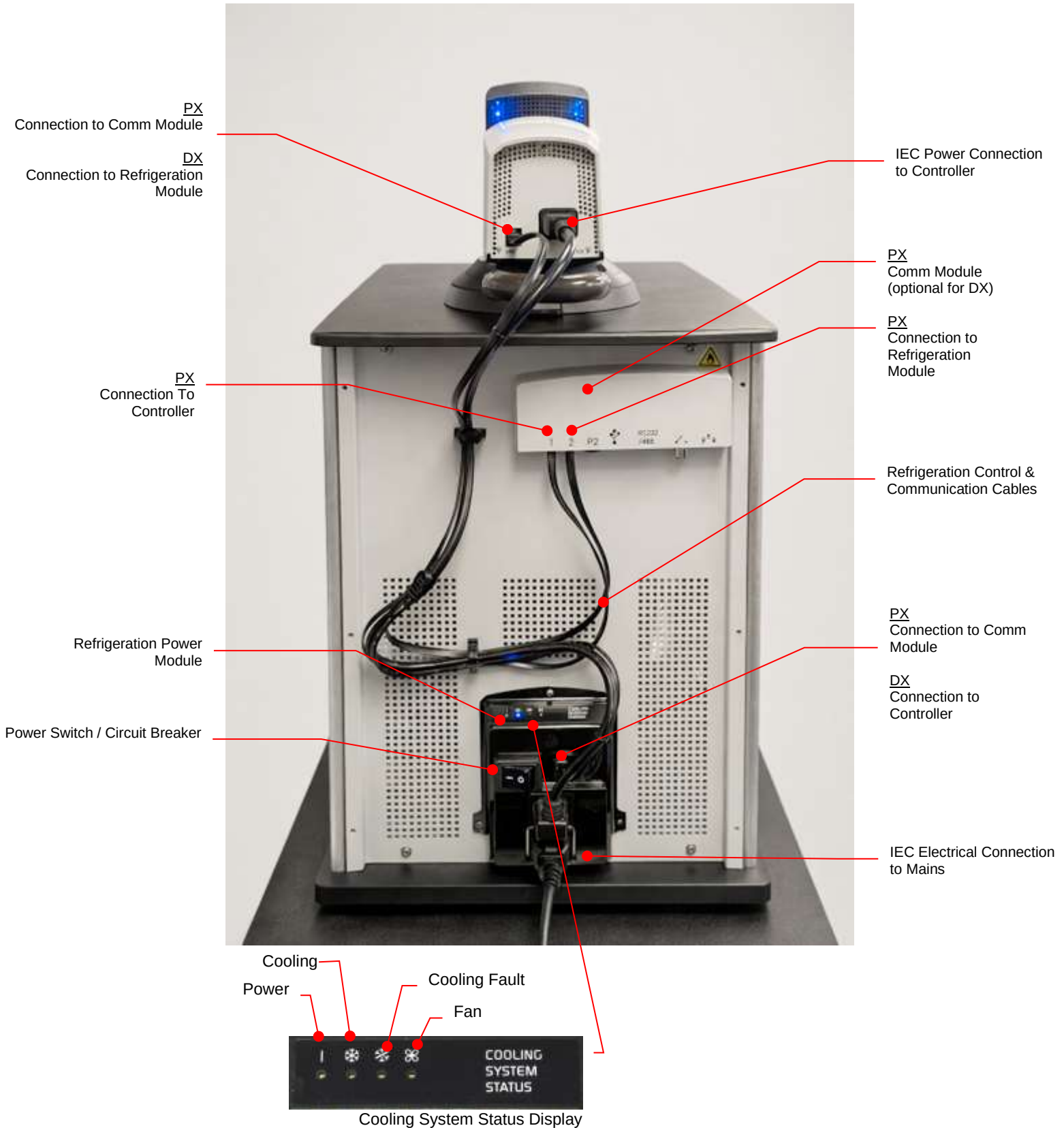
WARNING: To avoid the potential for burns, allow the Circulating Bath to cool completely before cleaning or performing any maintenance.



WARNING:

Metal parts of the reservoir and reservoir cover may get extremely cold. Always allow the bath fluid to warm to ambient temperature before accessing these parts.

Rear



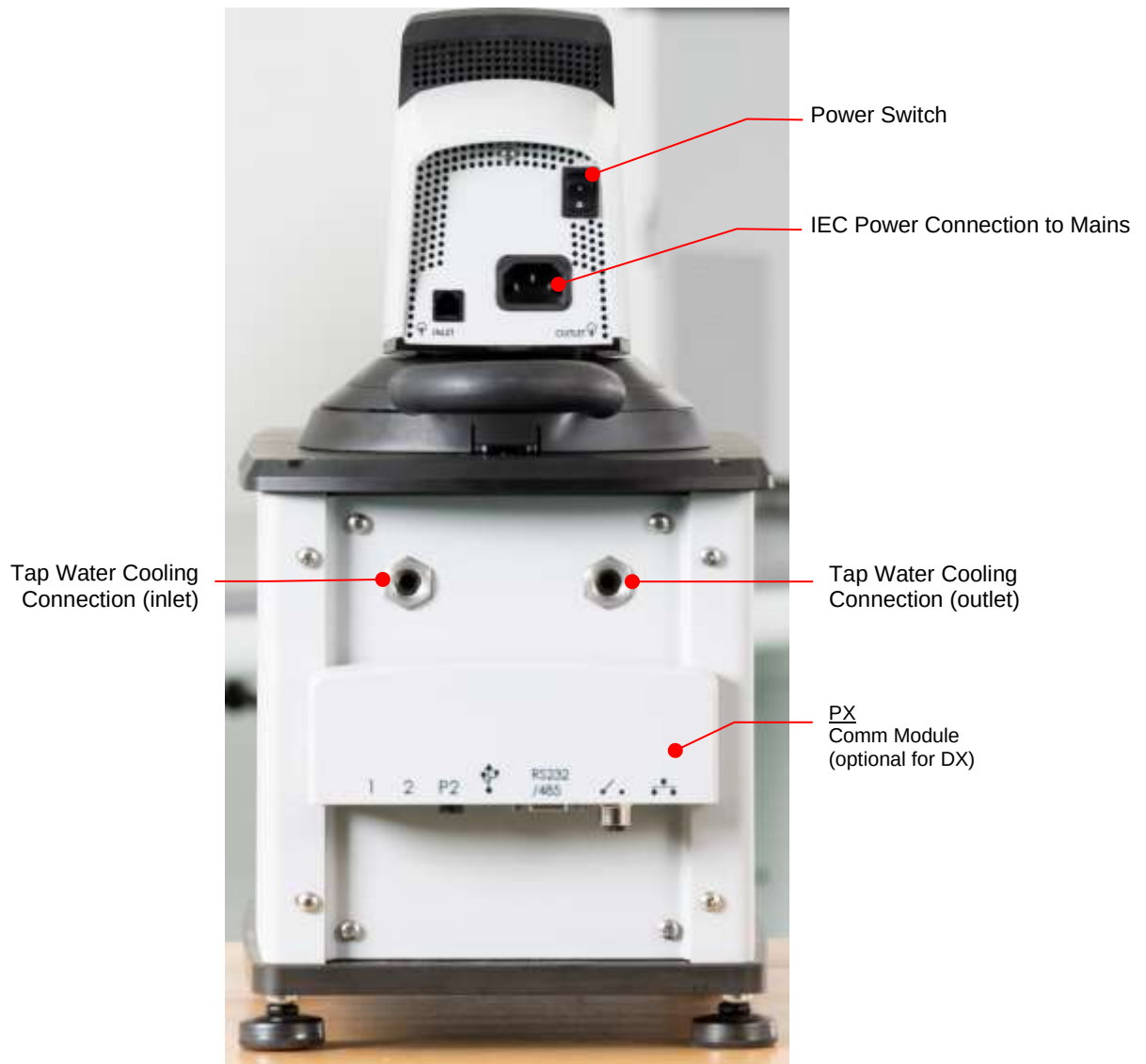
2.3 Heating Only Circulating Baths

Front



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

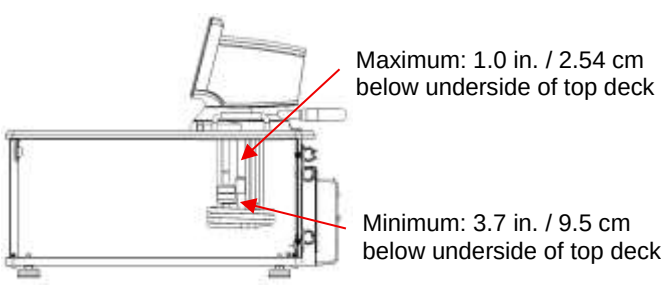
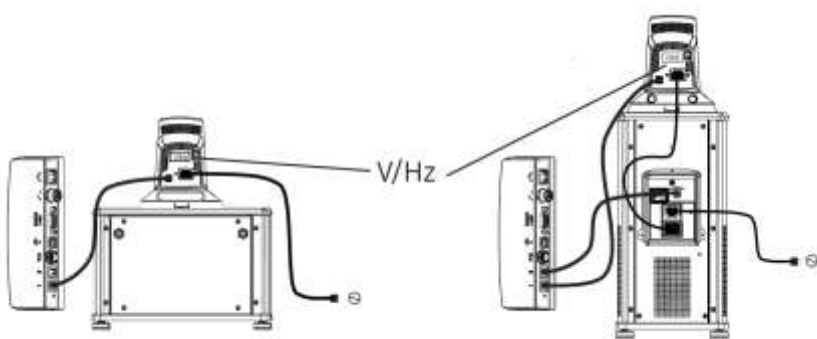
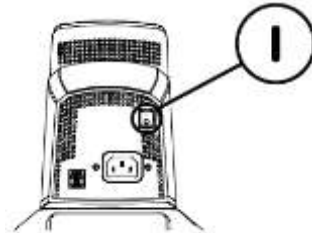
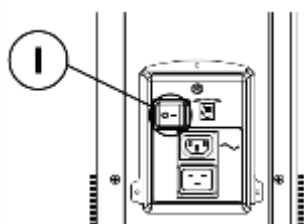
Rear



3. Quick-Start

Unless otherwise specified, quick-start instructions apply to all models.

See *Installation & Startup* for additional information.

1	Fill reservoir with fluid	 Maximum: 1.0 in. / 2.54 cm below underside of top deck Minimum: 3.7 in. / 9.5 cm below underside of top deck
2	Connect all electrical power cords and control cables	 V/Hz
3A	Place Power Switch / Circuit Breaker in ON position	Heating only models 
3B		Refrigerating / Heating models 
4	Turn Controller "ON"	

5	Set Language, Date, and Time	
6	Set Safety Temperature	
7	Set Temperature Set Point	

4. Installation & Startup

Your Circulating Bath with PX Programmable or DX Advanced Controller is designed to be simple to set-up and install. For installation, only a container for adding water or other suitable fluid to the bath reservoir is needed. To adjust the Safety Set Point, a small tool such as a ballpoint pen, small hex wrench, SIM card ejector, or paperclip is needed.

4.1 Environmental & Site Requirements

Locate your Circulating Bath on a level surface free from drafts and direct sunlight. Do not mount it on a surface of flammable material. Do not place it where there are corrosive fumes, excessive moisture, high room temperatures, or in excessively dusty areas.

The power supply plug/coupler serves as the disconnecting device. Locate the Circulating Bath so that the plug/coupler remains accessible.

Refrigerating / Heating Circulating Baths must be 10.2 cm / 4 inches or more away from walls or vertical surfaces so that airflow is not restricted.

Avoid voltage drops by using properly grounded power outlets wired with 14 gauge or larger diameter wire and if possible, be close to the power distribution panel. The use of extension cords is not recommended; this will reduce the potential for problems caused by low line voltage.

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

Voltage fluctuations: +/-10% of nominal voltage

Sound Level: Less than 70 dB(A) A-weighted emission sound pressure level



WARNING: The Circulating Bath is not intended for use in potentially explosive areas. Do not place it where there are corrosive fumes, excessive moisture, high room temperatures, or in excessively dusty areas. Do not mount it on a surface of flammable material.



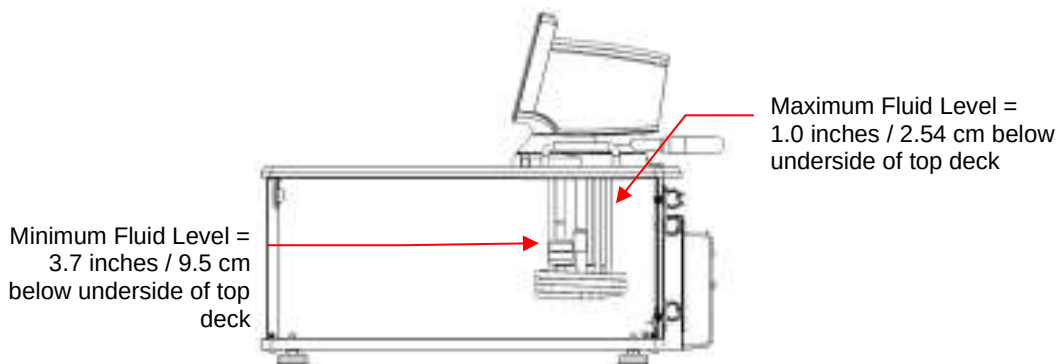
CAUTION: Risk of fire or explosion due to puncture of REFRIGERANT tubing. Follow Handling Instructions carefully. FLAMMABLE REFRIGERANT used.

4.2 Adding Liquid to the Bath Reservoir

	WARNING: When using Class III flammable fluids per DIN 12876-1, the user must attach the following warning labels to the front of the unit so that they are well visible:		
	Warning Label W09 Colors: Yellow/black		Danger Area. Attention! Observe instructions (operating manual, safety data sheet)
	Warning Label W021 Colors: Yellow/black		Flammable fluid.
	Mandatory Label M018 Colors: Blue/white		Carefully read the user information prior to beginning operation. Scope: EU
	or Semi S1-0701 Table A1-2 #9 Colors: Blue/white		Carefully read the user information prior to beginning operation. Scope: NAFTA

	WARNING: Read the safety data sheet for the bath fluid being used carefully before filling the reservoir. WARNING: See <i>Technical Information</i> in the rear of this manual for a list of compatible liquids. 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).
--	---

The liquid in the reservoir should be maintained at a depth between 1.0 inches / 2.54 cm and 3.7 inches / 9.5 cm below the underside of the bath's top deck. Upon startup, it may be necessary to add fluid to the bath to compensate for the fluid required for external circulation. Likewise, be sure to compensate for fluid displacement when placing samples or other materials in the Circulating Bath's reservoir.



	WARNING: Always drain all fluid from the reservoir before moving or lifting your Circulating Bath. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.
---	--

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

	WARNING: Metal parts of the reservoir and reservoir cover may get extremely cold. Always allow the bath fluid to warm to ambient temperature before accessing these parts.
---	---

4.3 Pump Inlet and Outlet Connections

	WARNING: When connecting tubing to an external application, it is the user's responsibility to make sure that the tubing and fittings connected to the Circulating Bath are suitable for the fluid being used and the temperature range of operation. CAUTION: The Circulating Bath's bypass tubing is secured to the fluid inlet and outlet connections by high temperature nylon hose clamps, which can be removed by carefully cutting them with diagonal cutters. CAUTION: Secure the tubing to the inlet and outlet fittings using hose clamps with a minimum ID of 7/8 inch (22 mm). Do not operate the unit without hose clamps.
---	---

	WARNING: If the Circulating Bath will not be used for external circulation, the inlet and outlet ports should remain connected using the Silicone bypass tubing provided with the unit.
---	---

The pump inlet and outlet ports are female ¼ inch NPT connections that permit use of barbed tubing adapters or hard plumbing fittings. Use appropriate ID tubing and hold it in place with a hose clamp.

If the pump inlet and outlet are not used for external circulation, the Bypass Tubing provided with the unit should be left in place to optimize fluid mixing within the reservoir.

The nylon barbed tubing adapter fittings supplied with the unit are intended for applications from -40° to 93°C. For applications above 93°C, brass, stainless steel, or Teflon® fittings are recommended. ¼ inch NPT to M16 stainless steel male adapter fittings are provided with all 50Hz models.

	NOTE: The use of quick-connect fittings is not recommended as they typically restrict flow rate.
---	--

4.4 External Closed Loop Circulation

Connect the pump inlet and outlet to the external apparatus. To maintain adequate flow, avoid restrictions in the tubing. When connecting the Circulating Bath to more than two closed loops, the use of a manifold made of "Y" adapters to divide the fluid into multiple banks is recommended. After setting up multiple closed loops, check for adequate flow at the return manifold of each loop and check that the bath fluid is at an adequate level. A booster pump may be added to closed loops without damaging the Circulating Bath's pump.

The temperature control stability of a closed loop system is better at the external apparatus than in the Circulating Bath reservoir (provided the control point of the apparatus represents a constant load and is well insulated). For example, if you circulate fluid through a viscometer at 50°C, the temperature variation observed in the Circulating Bath reservoir may be ±0.1°C while the temperature variation in the viscometer may be only ±0.05°C.

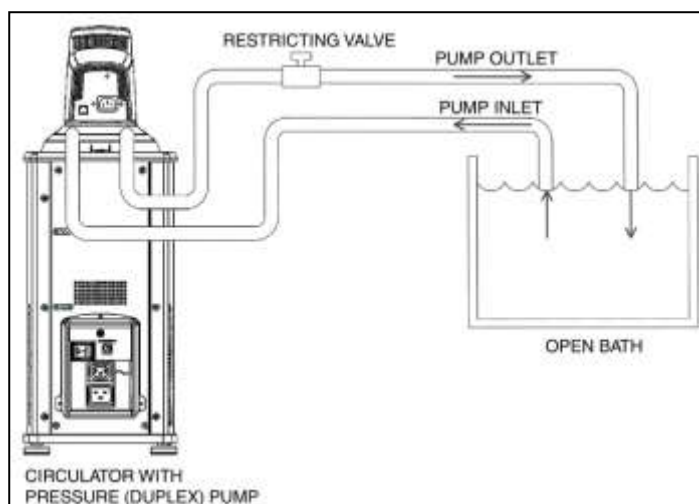
Although temperature stability is generally better at the external apparatus control point, depending on the length of tubing used and the efficiency of the insulation, the actual temperature reading at the external apparatus may be slightly different than the temperature reading at the Circulating Bath reservoir.

4.5 External Open Loop Circulation

The duplex (pressure/suction) pump permits circulation to and from an external open bath. To prevent siphoning when the Circulating Bath is turned off, position both baths so that the two fluid levels are at the same elevation.

Connect the pump inlet and outlet to the external bath using tubing of the same diameter and length. The same size fittings should also be used on both the inlet (suction) and outlet (pressure). This helps ensure a balanced flow. A restricting valve or pinch clip should be installed in the pressure (outlet) tubing and adjusted to match the return suction (inlet) flow rate. Cut the external end of the suction tube into a “V” shape so that the tube will not seal itself against the wall of the external tank. Both the pressure and suction tubing should be securely fastened to the external tank to prevent movement during use.

When using flexible tubing, the suction tubing must have a wall thickness that will not collapse under vacuum, particularly when going around bends.



4.6 Circulating Bath Height Regulation

Position the ends of the pressure and suction tubes at the desired maximum fluid level in the external bath and fill the bath to that level. Fill the Circulating Bath to a height one inch (25mm) below the top of the reservoir. Start the pump and adjust the restricting valve/pinch clip on the outlet tubing until the liquid height in both baths remains constant. Add fluid to the baths as needed to compensate for the fluid in the inlet and outlet lines.

4.7 Electrical Connection - Refrigerating / Heating Circulating Baths



WARNING: The Circulating Bath's power cord must be connected to a properly grounded electrical receptacle. Make certain that this electrical outlet is the same voltage and frequency as your Circulating Bath. The correct voltage and frequency for your Circulating Bath are indicated on the identification label on the back of the Controller.



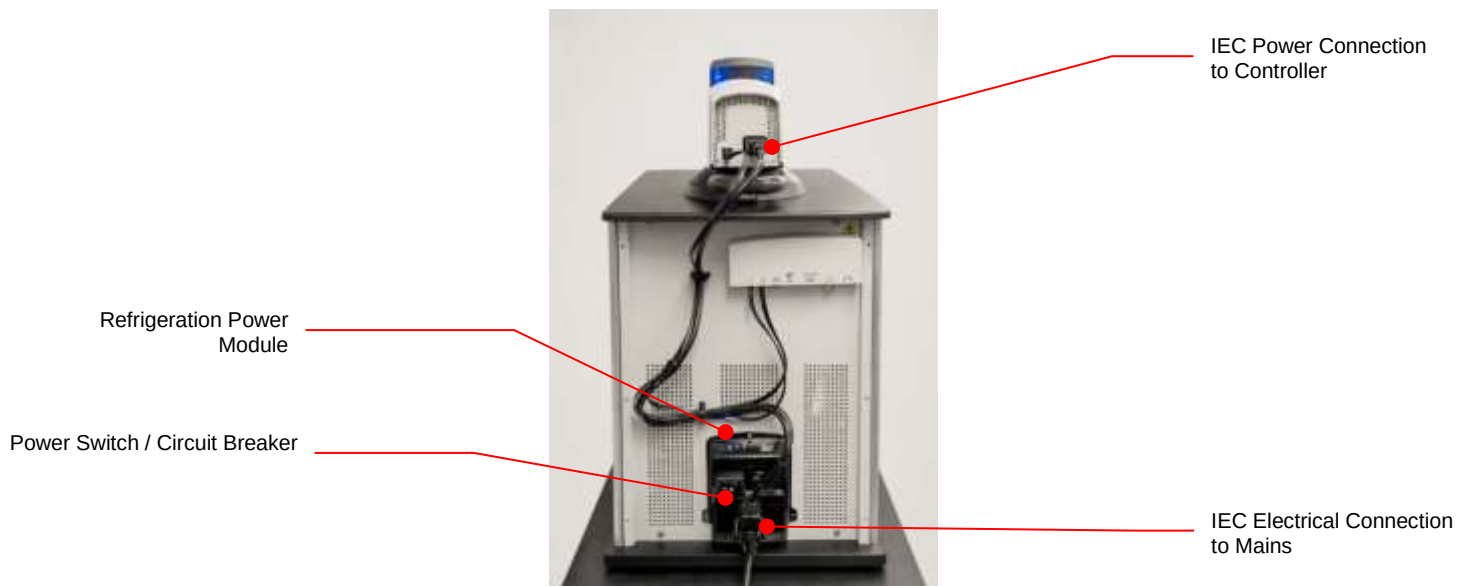
CAUTION: The use of an extension cord is not recommended. If one is necessary, it must be properly grounded and capable of handling the total wattage of the unit. The extension cord must not cause more than a 10% drop in voltage to the unit.

Attach the 3-ft / 0.91 m power cord to the IEC electrical connectors on the Temperature Controller (male) and the Refrigeration Power Module (female). The IEC electrical connector on the refrigeration power module is only intended to be connected to the temperature controller.



Connect to IEC connector on power module only.

Attach the 6-ft / 1.8 m power cord to the IEC electrical connection on the Refrigeration Power Module and then plug the male connector into the Mains electrical outlet.



4.8 Electrical Connection - Heat Only Circulating Baths and Open Bath Systems



WARNING: The Circulating Bath's power cord must be connected to a properly grounded electrical receptacle. Make certain that this electrical outlet is the same voltage and frequency as your Circulating Bath. The correct voltage and frequency for your Circulating Bath are indicated on the identification label on the back of the Controller.



CAUTION: 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.

Attach the 6-ft / 1.8 m power cord to the IEC electrical connection on the Temperature Controller and then plug the male connector into the Mains electrical outlet.

Place the Power Switch on the Temperature Controller in the ON position. The display screen will light and "Standby" will appear on the display. The PolyScience logo and the Power Key will also light.

Serial Tag: Voltage
and Frequency info



Power Switch /
Circuit Breaker
(located on Refrigeration
Power Module on
Refrigerating/Heating
Circulators)

IEC Electrical
Power Inlet

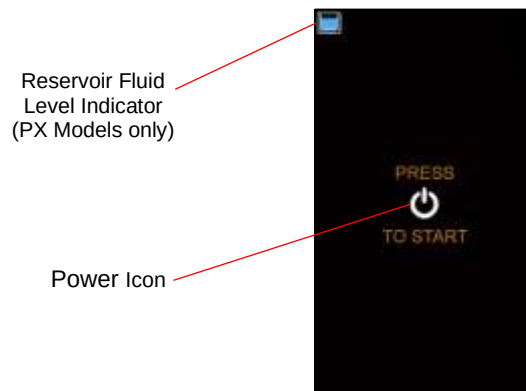
5. Controller Setup & Operation

Safety information for Models Charged with R290 Refrigerant

	• WARNING: Risk of fire or explosion. Flammable Refrigerant Used • Do not damage the refrigeration circuit or increase the risk of a leak
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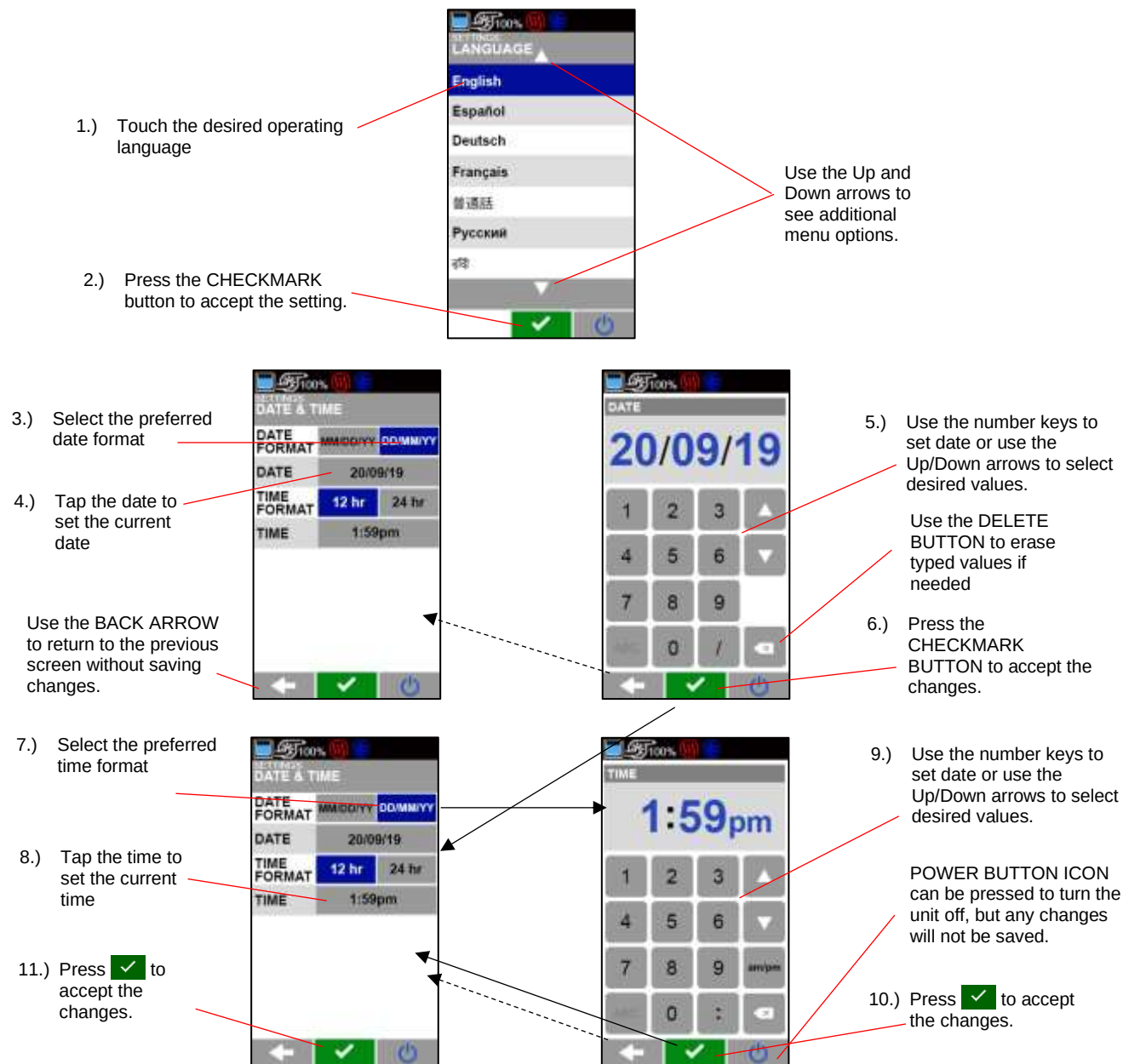
5.1 Standby Mode

With the Circuit Breaker/Power Switch in the ON position, the unit will default to a low-power Standby mode. While in Standby, power to the Heater, Compressor and Pump will remain off. The reservoir bath level indicator is displayed in the upper left corner (PX Models only) while in Standby Mode. Pressing  will turn the unit on. Pressing  while the unit is running will return the Circulating Bath back to Stand By mode.



5.2 Initial Power-On Sequence

Place the Circuit Breaker on the rear of the unit to the ON position. The unit will display STANDBY. Press  on the Touchscreen Display to turn the unit on. After a brief initialization period, the unit will power on. The unit will begin an initial setup sequence:



1.) Touch the desired operating language

2.) Press the CHECKMARK button to accept the setting.

3.) Select the preferred date format

4.) Tap the date to set the current date

5.) Use the number keys to set date or use the Up/Down arrows to select desired values.

6.) Press the CHECKMARK BUTTON to accept the changes.

7.) Select the preferred time format

8.) Tap the time to set the current time

9.) Use the number keys to set date or use the Up/Down arrows to select desired values.

10.) Press  to accept the changes.

11.) Press  to accept the changes.

Use the Up and Down arrows to see additional menu options.

Use the BACK ARROW to return to the previous screen without saving changes.

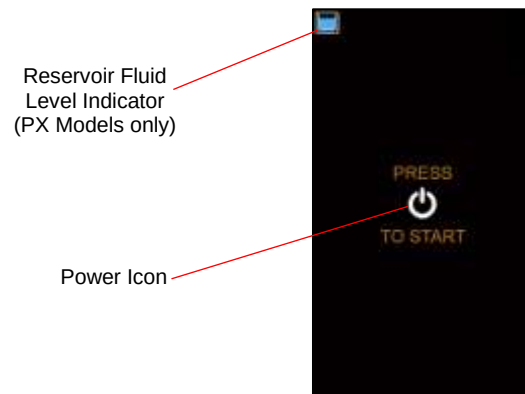
Use the DELETE BUTTON to erase typed values if needed

POWER BUTTON ICON can be pressed to turn the unit off, but any changes will not be saved.

The Home screen will be displayed, and the unit will begin operating with factory default values. The initial setup sequence is only run when the unit is turned on for the first time or after resetting the unit to factory defaults.

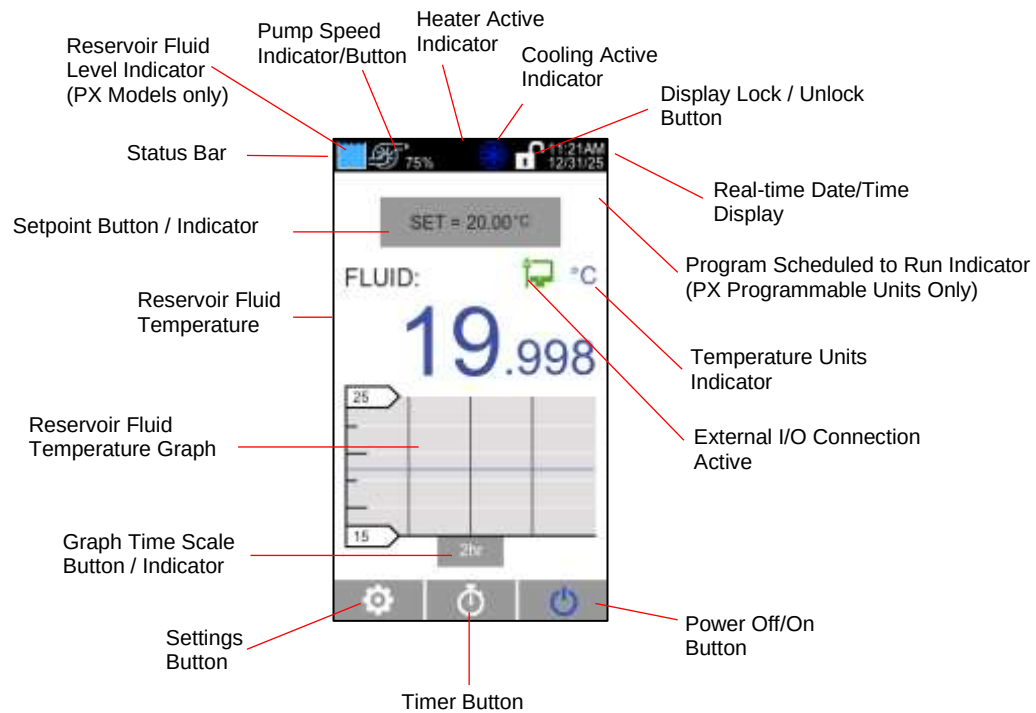
5.4 Turning the Circulating Bath On

1. Place the Circuit Breaker on the rear of the unit in the ON position.
2. Pressing  will turn the unit on.

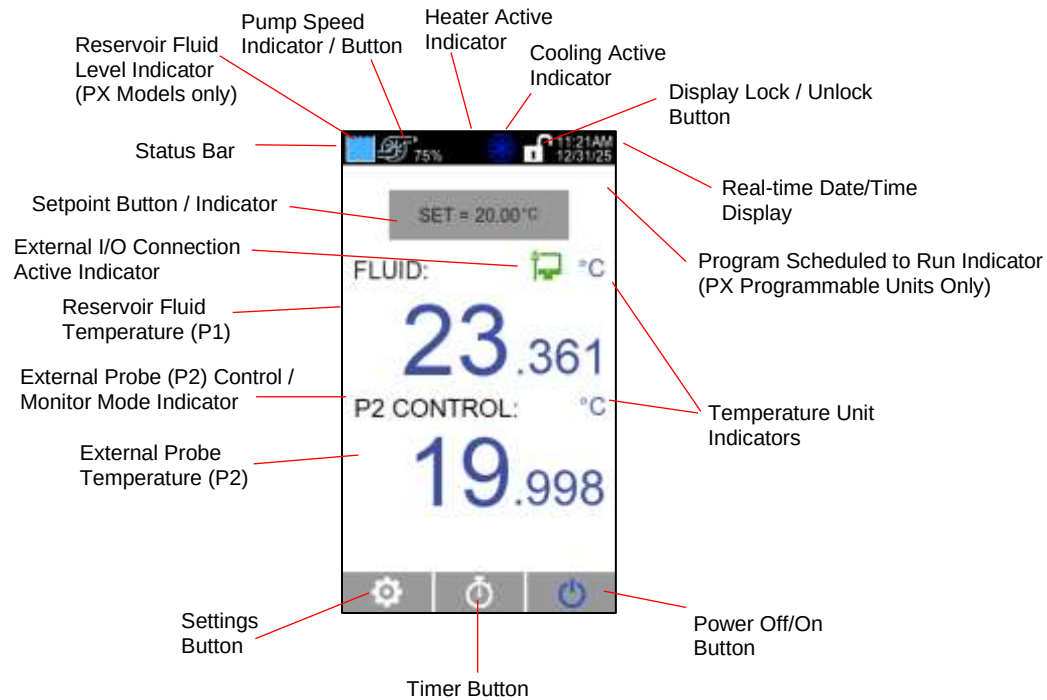


3. The display will show the Home Screen and the Circulating Bath will begin to operate using the most recently set values.

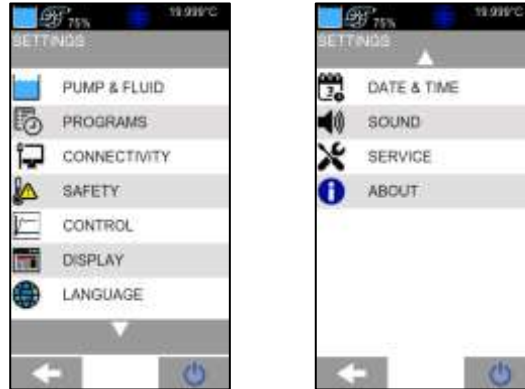
5.5 Home Screen Overview - No External Probe (P2) Installed



5.6 Home Screen Overview - With External Probe (P2) Installed



5.7 Settings Menu – Navigation Overview



5.8 Numeric Keypad – Navigation Overview



5.9 Text Keypad – Navigation Overview



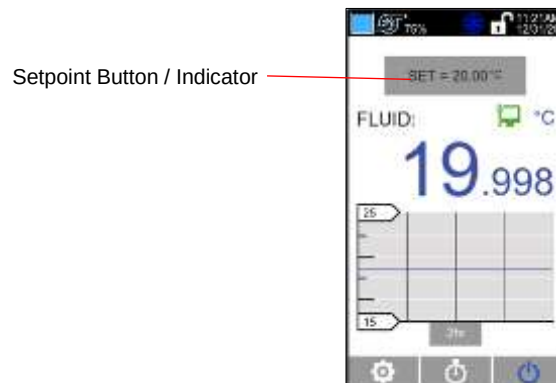
5.10 Setting Fluid Temperature Set Point

This is the temperature at which the fluid in your Circulating Bath will be maintained, and it can be set in increments as small as 0.01° over a range of -50.00 to +200.00°C/-60.00 to +390°F. The factory default setpoint is +20.0°C/+68.0°F.



NOTE: Although temperature can be displayed with three decimal point resolution, set point temperatures may only be set to two decimal points.

- 1.) The current set temperature is displayed on the Setpoint Button / Indicator. Press the Setpoint Button/Indicator to access the Setpoint keypad.



- 2.) Use the Numeric Keypad to enter the desired temperature.
The Up/Down arrows can also be used to scroll to the desired temperature value.
 - a. Use the +/- Button to specify a negative value, if desired.
 - b. The Delete Button can be used to delete values.

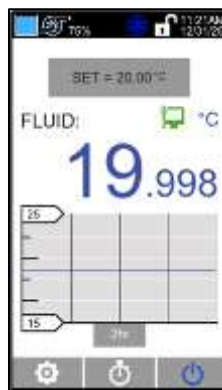
3.) Press the Checkmark Button to confirm the changes.

a. The Back Arrow can be used to exit this screen without saving changes.



5.11 Timer

1.) To set the countdown timer, press the  at the bottom of the Home screen. Enter the desired duration in hours and minutes (hh:mm).



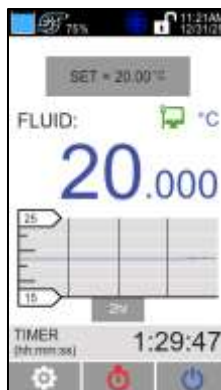
2.) Press the  button to start the timer or press  to cancel and return to the home screen.



- 3.) The time left (hours, minutes, seconds) on the timer will appear at the bottom of the screen. When the timer finishes, the time will turn red and begin counting up, indicating how much time has elapsed since the timer ended.



- 4.) To pause or end the timer, press the  icon.



- a. To pause the timer, press the  icon. To resume, press the  icon.



- b. To end the timer, press  button. You will be asked to confirm stopping the timer. Press  to confirm and end the timer or press  to cancel and allow the timer to resume.

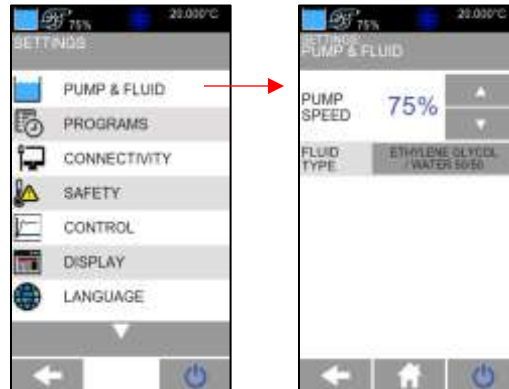


5.12 Settings Menu Overview

Main Menu	Sub Menu Items	Description
Pump & Fluid	Pump Speed	Set the pump speed from 5 to 100%
	Fluid Type	Select or edit Fluids to be used in the Circulating Bath
Programs	<i>List of programs</i>	Create, Edit, Delete, Schedule and Start Time/Temperature Profiles
Connectivity	Data log to USB Drive	Enable or disable output of time/temperature data to a USB flash drive
	USB to PC Mode	Select Serial Port Emulation or USBTMC mode for USB to PC communication
	RS-232 BPS	Select the bits per second data rate for RS-232 communications
	Ethernet	View and edit network settings: DHCP On/Off, IP Address, Subnet, & Mac address. Enable/Disable access to the circulating bath by web browser
	RS-485	Set the RS-485 Address
	Command Set	Select the Command Set for data communication. Allows for compatibility with your current equipment.
Safety	Auto Restart (PX models only)	Select whether the unit returns to the last running state or enters standby mode when power is restored after a power failure.
	Low Alarm	Set the low-end bath fluid temperature at which the unit will provide an audible and visual alarm.
	Low Limit	Set the lowest temperature that the bath setpoint can be set to.
	High Alarm	Set the high-end bath fluid temperature at which the unit will provide an audible and visual alarm.
	High Limit	Set the highest temperature that the bath setpoint can be set to.
	Safety Setpoint	Set the high-end temperature at which the secondary Over-Temperature Protection safety system will turn the unit off.
	Safety Probe	This read-only temperature value displays the temperature read by the Over-Temperature Safety System probe.
Control	Display Filter	Set the averaging time for displaying temperature information. Higher settings reduce temperature fluctuations, while lower settings provide data closer to real-time temperature readings
	Control Probe	If an external temperature probe (P2) is installed, choose which probe (P1 for the internal fluid reservoir or P2 for the external probe) should control the temperature.
	Auto Refrigeration	Refrigerated/Heating units only. Set the bath fluid temperature at which the cooling system will become active.
	Max P2-P1 Differential	If an external temperature probe (P2) is installed, set the maximum allowable difference between the temperature read by the internal reservoir fluid temperature probe (P1) and the external fluid temperature probe (P2). This setting prevents uncontrolled heating or cooling should the external temperature probe become disconnected or fail.
	PID	Enables the user to adjust the pre-configured factory PID (Proportional/Integral/Derivative) values. This feature is intended for experienced users with a comprehensive understanding of PID control and should be used with caution.

Main Menu	Sub Menu Items	Description
Display	Time & Date	Choose whether to display the time and date in the status bar.
	Graph	Choose whether to display the internal reservoir Time/ Fluid Temperature graph. Not available if P2 is installed.
	° Units	Set the temperature units to use (°C or °F)
	° Resolution	Set the displayed temperature resolution.
	Brightness	Set the screen brightness.
Language	<i>List of languages</i>	Select the operating language
Date & Time	Date Format	Select the date format to be used (Day/Month/Year or Month/Day/Year)
	Date	Set the current date
	Time Format	Select the time format to be used (AM/PM or 24 hour)
	Time	Set the current time
Sound	Button Sound	Choose whether a sound is played when an on-screen button is pressed
	Button Tone	Select the sound played when an on-screen button is pressed Click or Beep)
	Alarm Volume	Select low or high volume for audible alarms
	Alarm Tone	Select the alarm sound to be used for audible alarms (Siren or Beep)
Service	Air Filter Service Reminder	Set the Air Filter Service Reminder interval, view days since last service and reset the reminder.
	Fluid Service Reminder	Set the bath Fluid Service Reminder interval, view days since last service and reset the reminder.
	Calibration	Perform multi-point calibration of the internal (P1) and external (P2) (if installed) fluid temperature probe(s)
	Self-Diagnostics	Run a self-diagnostic test to compare the circulating bath's current performance with its performance at the time of manufacture.
	View Last Diagnostic	View the results of the last Self-Diagnostic test
	Factory Defaults	Reset the unit to the original factory default settings
About	Total Operation Time	Displays the total operating time of the unit since it was first powered on outside of the factory.
	Display Firmware Version	Displays the current Display firmware version
	Motor Control Firmware Version	Displays the current Motor Control firmware version
	Refrigeration Firmware Version	Displays the current Refrigeration Control firmware version
	Product Identifier	Displays unit reference identifier
	<i>Factory Access</i>	Only used by the factory or authorized service personnel.

5.13 Pump & Fluid



5.13.1 Setting Pump Speed

Set pump speed using the UP and DOWN arrows between 5 and 100% of maximum speed. In certain configurations, high pump speeds may result in excessive turbulence in the reservoir, which can cause false low liquid level alarms. In the event of false low liquid level alarms, reduce the pump speed as needed for continuous operation.

For operation at extreme low temperatures, elevated pump speeds may reduce the cooling capacity needed to achieve extreme low temperatures. Reduce pump speed as needed to achieve extreme low temperatures.



5.13.2 Fluid Type

5.13.2a Select Fluid, for Controller Optimization

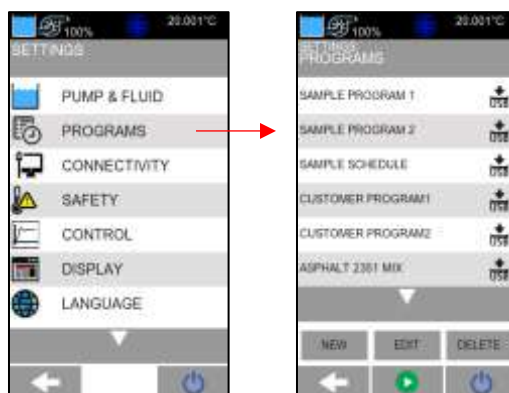
This setting optimizes the control PID parameters for a specific fluid type.



5.13.2b Add, Edit or Delete a Fluid



5.14 Programs (PX Models Only)



IMPORTANT: The first step of a program establishes the bath temperature that must be achieved before the Program will begin to run. If the actual bath temperature is above or below the first step, cooling (if the Circulating Bath is refrigerated) or heating will be applied to bring the bath to the Step Start temperature. Once that temperature has been achieved, the program will begin running.

5.14.1 Running an Existing Program



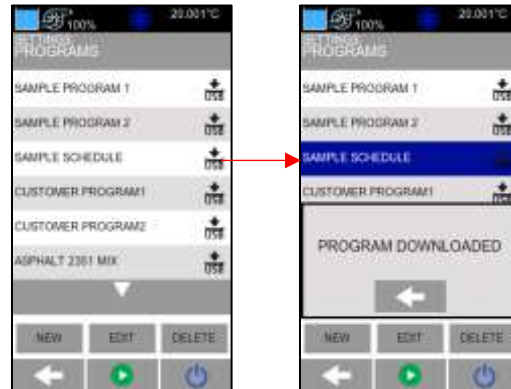
5.14.2 Pause/Resume a Program



5.14.3 Stop a Program Manually



5.14.4 Export a Program to a USB Flash Drive



5.14.5 Create a New Program or Edit an Existing Program

1. To create a new program, tap the NEW button.
To edit an existing program, tap the program to change then press the EDIT button.



2. **Program Name** - Click the EDIT button. Use the keypad to enter the desired program name and click  to accept the change.



3. **Priority** - Programs can be run with either Time or Temperature as the priority.
 - Select Temperature if reaching exact temperatures is critical in each step.
 - Select Time if completing the program within the specified time is essential.

- If the time to reach the set temperature is beyond the capability of the Circulating Bath to achieve, this setting will determine if the unit waits longer than specified for the set temperature to be achieved (TIME priority) or if it moves on to the next step once the time has elapsed (TEMPERATURE priority).



4. **Repeat-** The number of times the program will repeat when finished is shown. Press the EDIT button and use the numeric keypad to specify or change the number of times the program will repeat automatically. Press  to accept the entered value.



Note: A running program can be stopped manually at any time from the home screen.

5. **Steps** – The number of steps in an existing program is displayed next to the EDIT button. Press EDIT to add, delete or change the program steps.



- a. To create a new step, press NEW.
To edit an existing step, press EDIT.

To remove a step, select the step to be removed and press DELETE.
The Step Number (#) is automatically generated/adjusted as the next number in the existing sequence.

#	FROM (°C)	TO (°C)	DURATION (hr:min)
1	20.00	-20.00	01:00
2	-20.00	-20.00	01:00
3	-20.00	32.00	01:00
4	32.00	32.00	01:00
5	32.00	48.00	01:00

- b. Press the START °(C/F) button to specify the step Start temperature. Use the numeric keypad to enter the desired step starting temperature. Use the +/- button to specify a negative value, if desired. Press to accept the changes.



- c. Press the END °(C/F) button to specify the step End temperature. Use the numeric keypad to enter the desired step ending temperature. Use the +/- button to specify a negative value, if desired. Press to accept the changes.



- d. Press the DURATION button and use the numeric keypad to specify the step duration time in hours and minutes. Press to accept the changes.



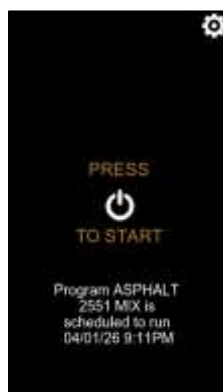
The graph at the bottom of the screen shows a summary of the program up to the current step.

NOTE: If the time to reach the specified temperature is beyond the capability of the circulating bath to achieve, the TIME/TEMPERATURE priority feature (see step 3 above) will determine if the Circulating Bath will wait longer than the specified time to allow the temperature to be reached (TIME priority) or if it will move on to the next step once the specified time has elapsed regardless of fluid temperature (TEMPERATURE priority).

6. **Schedule** – By default, a program will need to be run manually by selecting it and hitting run in the main Program menu screen. If desired, a Time and Date can be set for the program to begin running and specify if the unit should continue running when the program ends or enter standby mode upon program completion.

	CAUTION: This equipment can be scheduled to run unattended. Ensure the following: - Conduct regular checks or use remote monitoring. - Verify all shutoff and emergency systems are functional. - Ensure operators are properly trained. - Confirm the area is free of hazards and has adequate ventilation. - Perform routine maintenance. Ensure fluid levels are adequate, and all hoses are tight and free from leaks. - Ensure a stable power supply.
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In order for a scheduled program to run, the rear circuit breaker must be in the ON position. It is recommended that the unit be placed in Standby mode before a scheduled program is to be run.



If the unit is already operating, a warning screen will be displayed once, five minutes before the program is scheduled to run.



7. Canceling/Clearing a Program Schedule

- a. To cancel a program schedule, select the related program and press the EDIT button.



- b. Press the button on the SCHEDULE line.



- c. Press the clear schedule button if a schedule has been set. The unit will confirm that you want to delete the schedule. Press  to confirm or  to cancel.



5.14.6 Deleting a Program

To remove an existing program, select the program to be removed and click the DELETE button. The unit will ask you to confirm your choice. Press  to confirm deleting the program or press  to cancel.



5.15 Connectivity



NOTE: Except for datalogging to a USB drive, the functionality described in this section requires the installation of the optional Temperature Controller Communications Module. If the module is not connected, your menu screen will show fewer options than illustrated above.

5.15.1 Datalogging to a USB Flash Drive

The USB A port on the rear of the Temperature Controller can be used for data logging to a USB flash drive; Data is output to a .CSV file that can be read and edited by spreadsheet programs such as Microsoft Excel® or Google Sheets®. To allow data logging, insert a flash drive into the USB A port on the side of the controller and press the ON button. Press the OFF button to disable data logging through the USB port.

Data is output to the flash drive in a .CSV file that can be read in spreadsheet programs such as Microsoft Excel® or Google Sheets® The data is output in the following format:

MIN.SEC	[V]	UNIT	SET	P1	P2
4	[v0013]	C	10	15.19	14.89
4	[v0013]	C	10	15.18	14.88
4.22	[v0013]	C	10	15.03	14.71
4.23	[v0013]	C	10	15.02	14.7
4.24	[v0013]	C	10	15	14.69
4.25	[v0013]	C	10	15	14.69
4.26	[v0013]	C	10	14.99	14.68
4.27	[v0013]	C	10	14.98	14.67

MIN.SEC = Minutes and seconds.

V = Firmware version.

UNIT = Selected temperature unit.

SET = Temperature set point

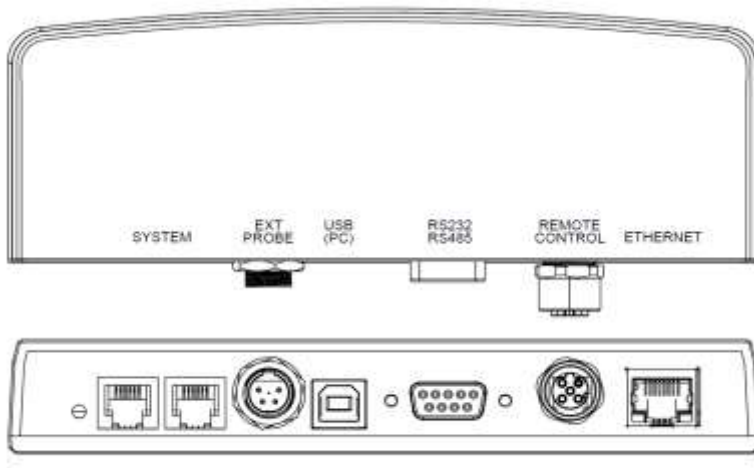
P1 = Fluid temperature as measured by the Internal probe

P2 = Fluid temperature as measured by the External probe (if connected)



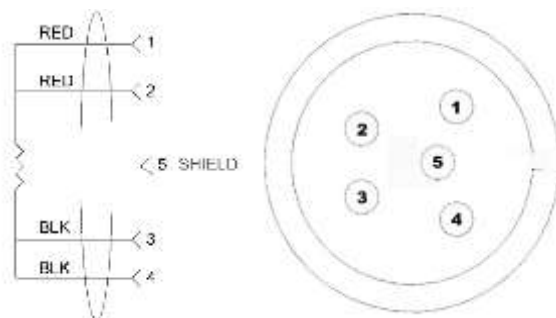
NOTE: The time stamp on the first line of data represents the time when data began being logged. The time stamp will indicate 0.01 if data logging was enabled after a flash drive or computer was connected to the USB port. It will show a later time if data logging was enabled before the storage device was connected. In the example shown above, the flash drive was connected to the USB port 4 minutes after data logging was enabled.

5.15.2 Temperature Controller Communications Module (optional for DX)



The I/O Communication Module can be purchased and added to your DX Digital Circulating Bath to provide several connection and communication options, allowing for remote control, monitoring and data logging. It is included standard with PX Programmable models.

5.15.2.a Pin Diagram — External (P2) Temperature Probe Connection



RTD SENSOR: 4 WIRE CIRCUIT, 100 OHMS @ 0 DEGREES C,
MAXIMUM OPERATING TEMPERATURE @ 200° C, CLASS A 0.003850 OHMS/DEGREES C.

5.15.2.b Remote ON / OFF and Status

Contact Closure — To use a contact closure to turn the Circulating Bath ON and OFF, connect pin 4 to 5. The Circulating Bath will be ON when the switch is closed and OFF when the switch is open. These pins present an open circuit voltage of +12Vdc.

VDC Signal — To use a VDC signal to turn the Circulating Bath ON and OFF, connect to pins 1 (Positive) and 5 (Ground). The Circulating Bath will be ON when a +9 to +24 VDC signal is applied; it will be OFF when the signal is removed.

Status — The normally open contacts of a changeover relay are available between pins 2 and 3. This circuit is closed when the unit is ON and running normally, and will open when the unit is OFF, in Standby, or has a Fault. Maximum 30 Vdc/25 Vac, 1A.

5.15.3 USB to PC Mode



NOTE: The functionality described here requires the installation of the optional Temperature Controller Communications Module.

The USB B port on the Temperature Controller Communications Module can be connected to a PC for remote control, monitoring and data logging.

SERIAL EMULATION mode allows the Circulating Bath to be detected by a connected PC as a standard COM port device, providing access to data logging, remote monitoring/control and communication with PC-based applications. When in serial port emulation mode, the Temperature Controller uses the following additional serial communications settings:

- Data bits — 8
- Parity — None
- Stop bits — 1
- Flow control — None

BPS (Baud rate) of the emulated serial port can be configured in the Windows Device Manager and must match the rate set in the software being used to communicate with the Circulating Bath. Additional configuration assistance may be required from your organization's IT staff to configure the serial port as needed.

5.15.4 RS-232 BPS



NOTE: The functionality described here requires the installation of the optional Temperature Controller Communications Module.

The active selected Bits Per Second (BPS) value for the RS-232 port is shown on the button. Press the button to cycle through available options. 57600 or higher is recommended for best performance.

The Temperature Controller uses the following additional serial communications settings:

- Data bits — 8
- Parity — None
- Stop bits — 1
- Flow control — None

5.15.4 Ethernet



NOTE: The functionality described here requires the installation of the optional Temperature Controller Communications Module.

The Circulating Bath can be connected directly to a PC or to a network using the Ethernet port on the Temperature Controller Communications Module. Direct connection to a Wi-Fi router or gateway will also allow wireless connection to your established network. Additional configuration assistance may be required from your organization's IT staff to allow access to your network.

The current IP address of the unit (if already connected) is shown on the button. Press the button to change the settings of the Ethernet connection.



5.15.4a DHCP

Use this function to turn DHCP (Dynamic Host Configuration Protocol) should be on or off. This setting is determined by your network configuration. When DHCP is off, a static IP address will need to be assigned to the Circulating Bath. Additional configuration assistance may be required from your organization's IT staff to properly configure this setting.

5.15.4b IP Address

The currently assigned IP is displayed on the button. If DHCP is off, you can press the button to set the static IP address for your circulating bath. Additional configuration assistance may be required from your organization's IT staff to properly configure this setting.



5.15.4c Subnet

The currently assigned subnet mask is displayed on the button. If DHCP is off, you can press the button to set the static IP address for your circulating bath. Additional configuration assistance may be required from your organization's IT staff to properly configure this setting.



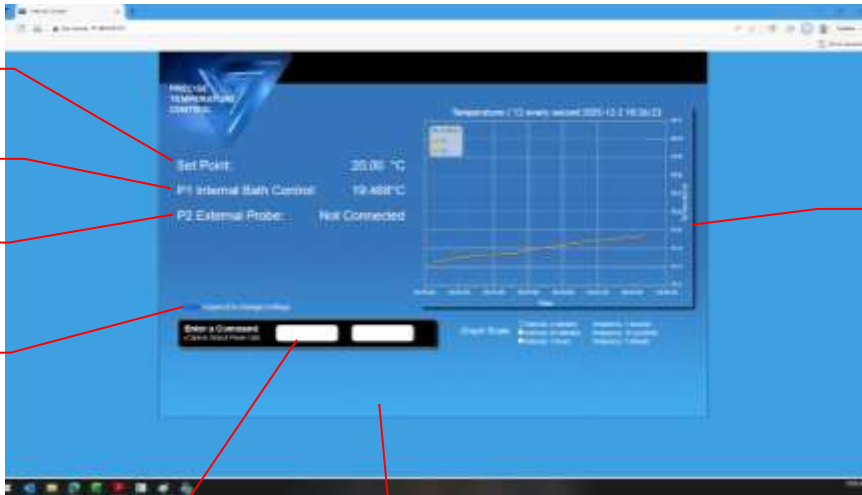
5.15.4d IP Web Browser Control

You can access the Circulating Bath via a web browser if it is connected to a network. This function allows you to monitor temperatures and change settings using the Command Set. You will need to know the unit's IP address to connect to it (See section 5.14.4b).



Sending commands to the unit will require entering the password you set in the web browser. You can set the password by tapping the Password button on this screen. The password can be changed at anytime by entering a new password on this screen.

To view Circulating Bath status using a browser, enter its IP address in the browser address bar. A screen will appear with the following information and interactive fields:



Set point temperature

P1 internal temperature reading

P2 external temperature reading

Login with password to control the Circulating Bath

Serial command entry
Double-click to access command list

Setting / value field
Read commands: shows current setting or value
Set commands: enter desired setting or value

Temperature trend graph

5.15.4e MAC Address

This read-only field displays the Circulating Bath's MAC (Media Access Control) address. This is a unique value assigned by the manufacturer that allows it to be identified on a network.

5.15.5 RS-485



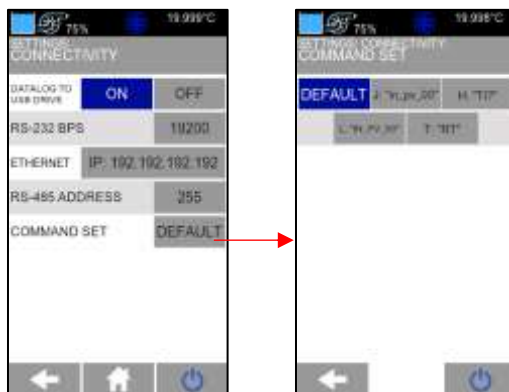
NOTE: The functionality described here requires the installation of the optional Temperature Controller Communications Module.



Press the ENTER ADDRESS button to set the address for RS485 communications. The Circulating Bath supports cable lengths up to 1000 ft / 304.8 m.

5.15.6 Command Set

This function lets you change the Communications Command Set for the Circulating Bath, if you wish to emulate communications protocols of other common circulating baths. The command set is identified by the command used to set the setpoint temperature. If changed from the default, the set setpoint temperature command for the selected command set will appear on the button.



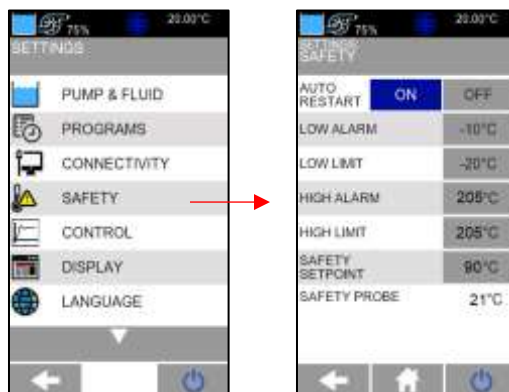
USB Serial Port Emulation and RS232 commands must be entered using the command only; RS485 commands must be entered using @ and the RS485 address (E.g., @001) followed by the actual command. All commands must be entered in the exact format shown. Do not send a [LF] (line feed) after the [CR] (carriage return). Be sure to follow character case exactly.

A response followed by an exclamation point (!) indicates that a command was executed correctly. A question mark (?) indicates that the Controller could not execute the command (either because it was in an improper format or the values were outside the allowable range). A response must be received from the Controller before another command can be sent. All responses are terminated with a single [CR].

5.15.6a Default Communications Command Set

Command	Format	Values	Return Message
Set Command Echo	SEi[CR]	Echo: i = 1 No Echo: i = 0	![CR]
Set Set Point	SSiii.ii[CR]	i = any integer from 0-9	![CR]
Set On Off	SOi[CR]	On: i = 1 Off: i = 0	![CR]
Set High Alarm	SHiii[CR]	i = any integer from 0-9	![CR]
Set Low Alarm	SLiii[CR]	i = any integer from 0-9	![CR]
Set Pump Speed	SMi[CR]	i = any integer from 5-100 in increments of 5	![CR]
Set Restart Power Status	SWi[CR]	Restart: i = 1 Standby: i = 0	![CR]
Set Internal / External Control	SJi[CR]	External: i = 1 Internal: i = 0	![CR]
Read Set Point Temperature	RS[CR]		iii.ii[CR]
Read Temperature Unit	RU[CR]		C[CR] or F[CR]
Read Internal Temperature	RT[CR]		iii.ii[CR]
Read External Temperature	RR[CR]		iii.ii[CR]
Read Operating Status	RO[CR]	Running: i = 1 Standby: i = 0	i[CR]
Read High Alarm Setting	RH[CR]		iii[CR]
Read Low Alarm Setting	RL[CR]		iii[CR]
Read Pump Speed	RM[CR]	Low: i = 1 High: i = 2	i[CR]
Read Alarm Status	RF[CR]	No Faults: i = 0 Fault: i = 1	i[CR]
Read the Auto-Cool Set Point	RA[CR]		ii[CR]
Read Number of Program Running	RV[CR]		ii[CR]
Read Number of Steps in Program Running	Rs[CR]		ii[CR]
Read Number of Loops in Program Running	RK[CR]		ii[CR]
Read Current Program Step	RC[CR]		ii[CR]
Read Program Status	RG[CR]	Running: i = 1 Stopped: i = 0 Paused: i = 2	i[CR]
Read Current Program Loop	RI[CR]		ii[CR]
Read Elapsed Time from Program Start	RE[CR]	Format: h:mm:ss	ii[CR]
Read the Firmware Version	RB[CR]		i-ii-iii[CR]

5.16 Safety



5.16.1 Auto Restart

DX models

DX models do not have auto restart feature. If electrical power is lost while your DX Circulator is in use, the DX Circulating Bath will begin operating automatically when power is restored. An alarm will sound, and the display will indicate the time, date and duration of the lost power condition.

In the event of a stalled pump or similar mechanical interruption, the DX Circulating Bath will begin operating automatically once the interruption is removed.

PX models

Auto Restart determines how the PX unit will begin operating after a disruption to electrical power or for a stalled pump or similar mechanical interruption. When ON is selected, the Circulating Bath will begin operating automatically when power is restored. When OFF is selected, the PX Circulating Bath will power up in Standby mode. An alarm will sound, and the display will indicate the time, date and duration of the lost power condition.

Default mode for PX models is with Auto Restart OFF.

5.16.2 Low Alarm

This sub-menu allows you to set the maximum allowable temperature range for the unit. If the fluid temperature goes outside of this range, the system will shut down. The low alarm can be set between -72°C to +20°C/-97.6° to +68°F maximum. The factory default is -35°C/-30°F.

5.16.3 Low Limit

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 the bath temperature falls below the low limit temperature setting. The low limit value may be set from -72° to +20°C /-97.6° to +68°F. The factory default is -35°C/-30°F.

5.16.4 High Alarm

This sub-menu allows you to set the maximum allowable temperature range for the unit. If the fluid temperature goes outside of this range, the system will shut down. The high alarm can be set between 25°C to +202°C/77° to +396°F maximum. The factory default is +140°C/+285°F.

5.16.5 High Limit

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 the bath temperature rises above the high limit temperature setting. The high limit value may be set from 25°C to +202°C/77° to +396°F maximum. The factory default is +140°C/+285°F.

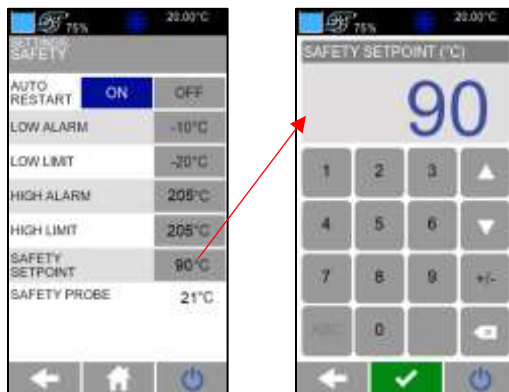
5.16.6 Safety Setpoint



NOTE: The Safety Set Temperature is displayed and set in whichever temperature unit is currently selected. The default is °C.

This is a “Do Not Exceed” temperature setting for your Circulating Bath and is the temperature at which the heater will be turned OFF should the liquid level in the bath drop too low or the heater malfunctions. It is normally set 10° higher than the desired operating temperature. Refer to the fluid tables in Section 11.2 for recommended settings based on fluid used. The maximum it can be set to is 210°C (410°F).

- 1.) The current Safety Setpoint is displayed on the button. Press the Safety Setpoint button to change the Safety Setpoint. Enter the desired Safety Setpoint and press  button to confirm the change.



- 2.) A 30 second countdown timer will be displayed and begin counting down. During this time the recessed Safety Setpoint Acknowledge Button located on the side of the display must be depressed using a small tool such as a ballpoint pen, small hex wrench, SIM card ejector, or paperclip is needed.



Safety Setpoint
Acknowledge Button

- 3.) If the timer expires before the button is pressed, you will be given the option to start the countdown again or cancel the change.



5.16.7 Safety Probe

This read-only value shows the current temperature as read by the safety temperature probe.

5.17 Control



5.17.1 Display Filter

The current set value is displayed on the button. This setting determines the averaging time used when displaying temperature information. Higher settings will generally result in less visual fluctuation, while lower settings will more accurately reflect real-time temperature probe data. This setting only effects the displayed temperature and does not affect the performance of the Circulating Bath. Press the button to cycle through available options. The default value is 4 seconds.

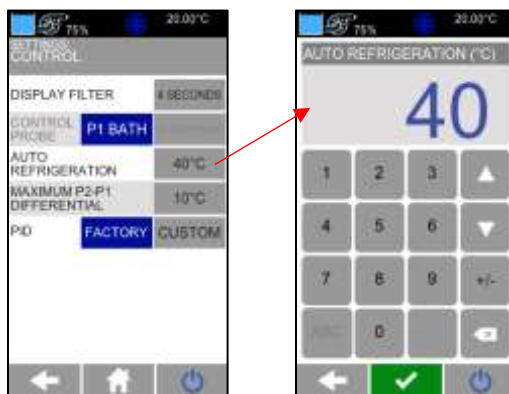
5.17.2 Control Probe



NOTE: An external temperature probe (P2) can only be selected when a remote temperature probe is connected to the Temperature Controller using the optional Temperature Controller Communications Module.

Set whether temperature control will be based on the fluid temperature within the Circulating Bath reservoir or the fluid temperature at an external device. Touch the P1 Bath button to select internal control; touch the P2 External button to select external control.

5.17.3 Auto Refrigeration



This control setting functions only on refrigerated Circulating Baths. The setting determines the bath temperature at which refrigeration will be activated. This permits more precise control when operating at high temperatures as well as more rapid cool downs. For most applications, a set point that is 15°C above room temperature is recommended. The auto refrigeration control range is from +2°C to 152°C.

Cool Command® Refrigeration — -40°C 7 liter Refrigerating/Heating Circulating Baths and 15 liter and larger Refrigerating/Heating Circulating Baths feature the Cool Command® modulating refrigeration control system. Cool Command allows the refrigeration system to turn on at a fluid temperature up to 152°C when the temperature set point is changed to or below the Auto-Refrigeration set point (152°C maximum). As a result, bath fluid cools more quickly.

Conventional Refrigeration — -25°C 7 liter Refrigerating/Heating Circulating Baths use a conventional refrigeration system. The refrigeration system will turn on when the bath fluid temperature and set point are below the Auto-Refrigeration set point (70°C maximum).

5.17.4 Maximum P2-P1 Differential



NOTE: An external temperature probe (P2) can only be selected when a remote temperature probe is connected to the Temperature Controller using the optional Temperature Controller Communications Module.

This setting is for use when external temperature control (P2) is being used. It establishes the maximum allowable differential between the external and internal measured temperatures and is intended to prevent uncontrolled heating or cooling should the external temperature probe be dislodged or fail.

5.17.5 PID



CAUTION: Temperature Controller's factory PID settings have been adjusted to achieve optimum temperature control. User-set PID values should only be used by individuals with thorough knowledge and understanding of Proportional/Integral/Derivative control.

This selects whether Factory or User-set PID settings are used for temperature control. To manually adjust PID values, press the CUSTOM button. Current values are displayed on the P, I, and D buttons. Press the corresponding button to modify the desired value.



To return the PID settings to factory defaults, press the FACTORY button.

5.18 Display

This menu allows you to turn OFF and ON the displayed Time and Date, turn the home screen graph OFF and ON, change the units of operation between Centigrade and Fahrenheit, adjust the display temperature resolution, and adjust the screen brightness.



5.19 Language

This menu allows the displayed language to be changed.



5.20 Date & Time

The current Date and Time can be adjusted in this menu, as well as changing the time format between 12 and 24 hour.



5.21 Sound

Warning and Fault alarm sounds can be turned OFF and ON using this menu.



5.22 Service



5.22.1 Air Filter Service Reminder

This menu, if applicable, is to be used as a reminder to clean the air filter. Press the RESET button to reset the timer. Pressing on the time remaining allows the frequency to be adjusted.



5.22.2 Fluid Service Reminder

This menu is to be used as a reminder to replace the fluid. Press the RESET button to reset the timer. Pressing on the time remaining allows the frequency to be adjusted.



5.22.3 Calibration



CAUTION: The maximum calibration offset for any given temperature point is $\pm 2.0^{\circ}\text{C}$. Calibrations are always performed in degrees C. Make sure your calibrated reference thermometer is placed in the location intended to be calibrated.

Press START to begin the calibration process.



Select which probe is going to be calibrated, then press NEW POINT.



Press the SET = button to set the desired temperature for calibration. Allow the bath to fully stabilize at the target temperature and then enter temperature from the reference thermometer.



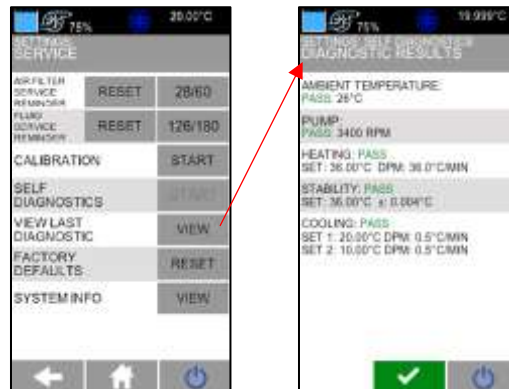
Continue to Add, Edit, or Delete calibration points as required.

5.22.4 Self Diagnostics

This allows the unit to run through a specific sequence of temperatures and compare the performance against data from when the unit was first built. To perform this test the unit should be disconnected from any external equipment, the reservoir should be emptied, and the fluid should be replaced with distilled water.

5.22.5 View Last Diagnostic

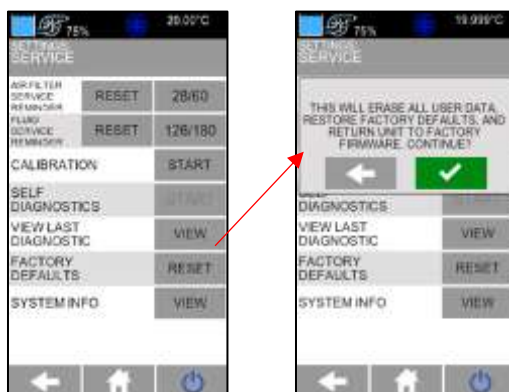
This will allow viewing of the results from the previous self diagnostic test.



5.22.6 Factory Defaults

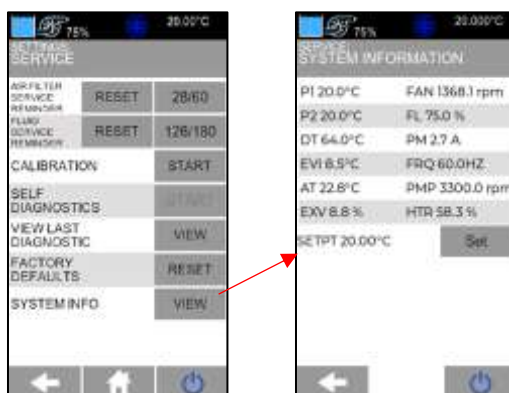


CAUTION: All time/temperature programs, calibrations, and other user-set values are erased when Factory default values are restored. Be sure to save any programs you wish to keep to a flash drive and record any settings that you have changed.



5.22.7 System Info

This screen shows useful details about the current operating point of the system. NOTE: All parameters are not applicable for all models.



6. Changing Your Circulating Bath's Viewing Angle

Your Circulating Bath is equipped with Swivel 180™, an innovative feature which permits viewing of the temperature display from anywhere over a 180° arc.



NOTE: There are positive stops at 45° intervals; however, the viewing angle may be set anywhere within a 180° arc.

To change the viewing angle, slide the release latch to the right and rotate the Temperature Controller to the desired angle. The latch release will automatically return to the locked position at every 45° positive stop.



Swivel 180™ Latch Release

7. Tap Water Cooling

Tap water cooling allows for more rapid bath cool down from high temperatures and/or more precise operation at temperatures near ambient.

Heat only Circulating Baths feature an integrated cooling coil as standard equipment. The tap water connections are made on the rear of the unit. Two 0.25 inch / 64 mm female NPT fittings are provided for these connections.

If applicable, the Responsible Body shall ensure that means are provided to prevent back-siphonage to potable water systems. The back-siphonage means used shall meet all required local and national regulations.

Glass Viscosity Baths feature a cooling coil with two 0.375 inch / 9.5 mm OD straight barb fittings at which the fluid inlet and outlet connections can be made. Either connection may serve as the fluid inlet or outlet. Be sure to secure the tubing with the appropriate size hose clamps.

An optional cooling coil is available for use on stainless steel and polycarbonate Open Bath systems. This cooling coil has two 0.375 inch / 9.5 mm OD straight barb fittings at which the fluid inlet and outlet connections can be made. Either connection may serve as the fluid inlet or outlet. Be sure to secure the tubing with the appropriate size hose clamps.



WARNING: The fluid outlet must be connected and flow to a suitable drain or vessel located at a level below that of the inlet.

8. Reservoir Cover Storage

Refrigerating/Heating and Heat Only Circulating Baths feature the LidDock® system to eliminate mess when adding fluid or samples to the reservoir. Specially positioned notches in the inner lip of the top deck allow you to stand the reservoir cover up upright over the bath opening, allowing condensate to flow back into the bath.



NOTE: 75 liter Refrigerating/Heating Baths and Calibration Baths are not equipped with LidDock®.

9. Routine Maintenance & Troubleshooting



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



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



WARNING: Always drain all fluid from the reservoir before moving or lifting your Circulating Bath. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.

Additional Safety information for Models Charged with R290 Refrigerant



- **WARNING:** Risk of fire or explosion. Flammable refrigerant used.
- Ensure all ventilation openings are not obstructed. Place in a well ventilated area to prevent accumulation of refrigerant.
- Repair and disposal must be carried out by trained service personnel.
- Do not puncture or damage the refrigeration circuit. No naked flame during service or repair.
- This unit is intended for use in commercial, industrial, or institutional occupancies as defined in the Safety Standard for Refrigeration Systems, ANSI/ASHRAE 15

9.1 Maintaining Clear Bath Water

Optimum temperature and moisture conditions for algae growth exist when using water as a bath fluid. To prevent algae contamination and minimize the frequency of draining the reservoir, a clarifier such as Polyclean Bath Clarifier (004-300040) should be used.



WARNING: Do not use chlorine bleach.

9.2 Draining the Bath Reservoir (Units with Drains)



WARNING: Always drain all fluid from the reservoir before moving or lifting your Circulating Bath. Be sure to follow your organization's procedures and practices regarding the safe lifting and relocation of heavy objects.



WARNING: Bath fluids should be stored and disposed of according to applicable laws and regulations.

Refrigerated / Heating and Heat only Circulating Baths are equipped with a drain valve and port located either beneath the front access panel or on the righthand side of the unit.

To drain fluid from the bath, attach a short length of suitable 0.45 inch / 11.5 mm ID tubing to the drain port and secure it using a hose clamp with a minimum ID of 0.7 inch / 18 mm. Open the drain valve using a flat blade screwdriver. When closing the valve, do not overtighten.



WARNING: Be sure to close the drain valve before refilling the bath reservoir. Do not over tighten.



9.3 Checking the Over-Temperature / Low Liquid Level Safety Systems

9.3.1 Checking the Over-Temperature System

The Circulating Bath comes with built-in over-temperature protection. It is recommended to check these systems at least every six months. These checks should be done while the unit is running.:

1. Press the Settings button to access the Main menu.
2. Touch the Safety button to access the Safety sub-menu.
3. Set the over-temperature to 10 degrees lower than the operating setpoint. The unit should shut down.
4. Return the Safety set temperature to the desired over-temperature value.

9.3.2 Checking the Low-Liquid System (PX models only)

1. Set the temperature set point to ambient and allow the Circulator to stabilize at that temperature.
2. Increase the temperature set point to about 5°C above ambient and slowly drain the fluid from the bath.
3. Continue draining fluid until the unit shuts down. The fluid level at this point should be approximately 7.6 cm/3.0 inch below the underside of the Circulator's top deck.
4. Replace the bath fluid and return to normal operation.

9.4 Cleaning the Circulating Bath



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.

9.4.1 Cleaning the Temperature Controller and External Surfaces

Turn the Temperature Controller OFF by placing the rear On/off Switch/Circuit Breaker in the OFF position. Unplug the power cord from the electrical outlet.

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.

9.4.2 Cleaning the Bath Reservoir



CAUTION: Before using any cleaning product on your equipment, review the ingredients against the fluid selection guidelines in the operator's manual.

To avoid scratching the reservoir, do not use abrasive cleaners or scrubbing sponges/pads or steel wool.

Fill the Circulating Bath Reservoir with clean water mixed with a few drops of a mild detergent. Run the Circulating Bath running 60-70°C to clean the walls of the tank and other wetted parts. Once clean, turn the unit off and allow to cool. Drain and refill the circulating bath with clean water and repeat until all cleaning solution is rinsed out..

9.4.3 Cleaning the 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 mild detergent to soften before brushing.

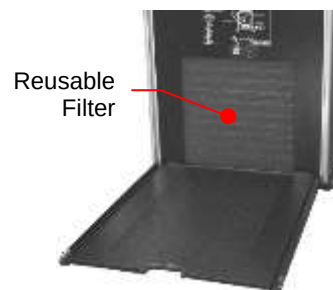


CAUTION: Do not use hard utensils or abrasive pads to remove trapped debris.

9.4.4 Cleaning the Condenser, Air Vents, and Reusable Filter (if equipped)

To keep the refrigeration system functioning at optimal capacity, the condenser, removable air filter and all air vents (front, side, back) should be kept free of dust and dirt. Be sure to check them on a regular basis and clean them as required.

The reusable filter is easily accessed from the front of the unit by removing the access panel. Use a mild detergent and water solution to wash off any accumulated dust and dirt. Rinse and dry thoroughly before reinstalling.

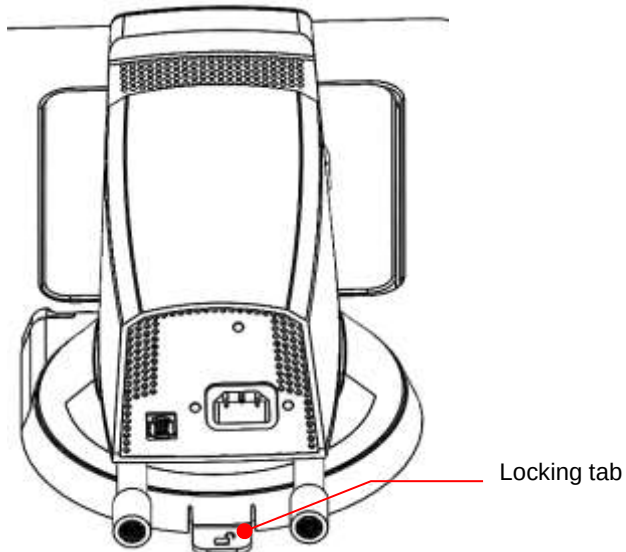


9.5 Temperature Controller Removal and Re-Installation

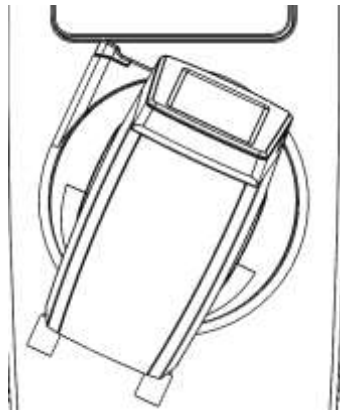
9.5.1 Temperature Controller Removal

The Temperature Controller on your Circulating Bath is designed to be easily removed from the top deck without the use of special tools. It is removed as follows:

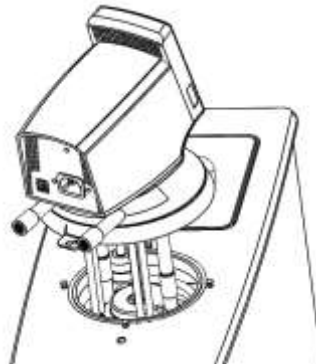
1. Place the tip of a small flat blade screwdriver under the retaining ring locking tab and pry up gently.



2. Rotate the Temperature Controller clockwise until it stops (about 0.75 inch / 1.9 cm).



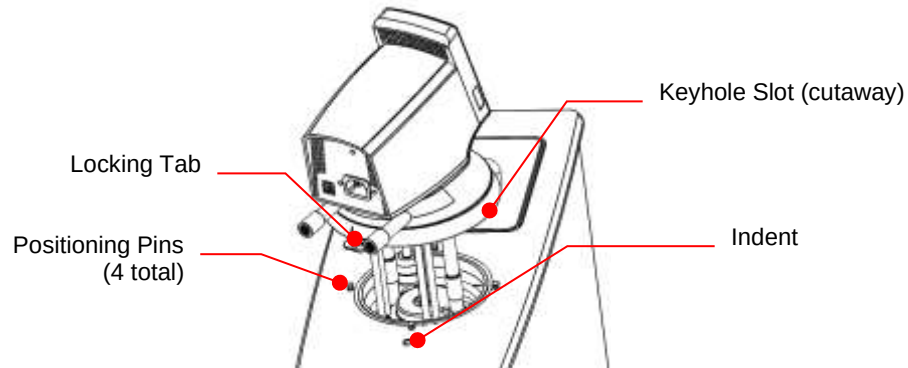
3. Lift the Controller straight up and out of the opening of the Circulating Bath's top deck.



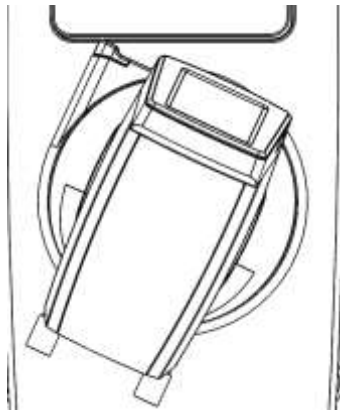
9.5.2 Temperature Controller Re-Installation

The top deck of your Circulating Bath incorporates four pins to facilitate positioning of the Temperature Controller when it is being reinstalled. These pins correspond to keyhole slots on the interior of the Circulating Bath's retaining ring.

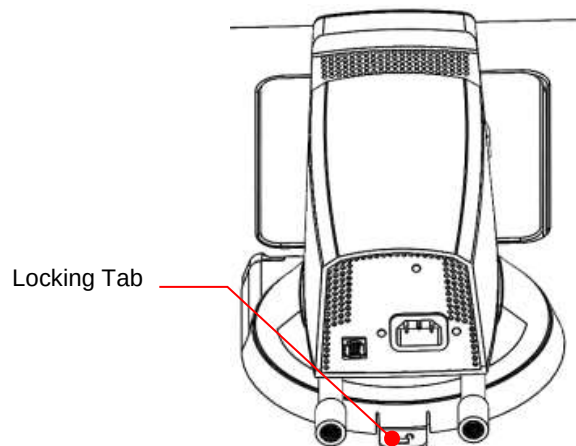
1. With the retaining ring locking tab oriented above one of the indents on the top deck, slowly lower the Temperature Controller into the top deck opening until it is resting on top of the positioning pins.



2. Gently rotate the Temperature Controller until it drops down on the positioning pins.



3. Rotate the Temperature Controller counterclockwise until the Locking Tab engages the indent on the top deck.



9.6 Updating Firmware



CAUTION: The current version of firmware as well as all time/temperature programs, calibrations, and other user-set values are erased when new Firmware is installed. Be sure to record any and record settings that you have changed.

1. Turn the rear switch OFF.
2. Download the latest firmware from <https://www.polyscience.com/support/software-downloads> and save it to the root of a FAT32 formatted USB flash drive. Do not place the file in a subfolder or the Circulator Controller will not be able to locate it.
3. Please ensure this is the only file on the flash drive.
4. Insert the flash drive into the USB port of the Circulator to be updated.
5. Turn the rear switch on.
6. The unit will now cycle through a few screens as it checks the flash drive for a valid version of firmware, erases the current version of firmware from the unit, and then programs the unit with the firmware from the flash drive. Once completed, the Circulator will enter Standby.
7. Remove the flash drive.
8. The process is complete, the Circulator can be returned to normal operation.

9.7 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 External tubing diameter too small Low line voltage	Replace with lower viscosity bath fluid. Replace with larger diameter tubing. 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 heat loss from external tanks and hoses; 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.
Unit does not cool	Dust build up on air filter or condenser Blocked air ventilation screens Temperature set point is too high Excessive heat load Ambient air temperature too high (>35°C / 95°F) Low or high line voltage	Clean air filter and/or condenser as required. Remove blockages as required. Decrease temperature set point. Check that heat load does not exceed capacity of bath; correct as required. Decrease ambient air temperature. Check and correct as required.

Problem	Possible Causes	Corrective Action
Insufficient cooling	Dust buildup on air filter or condenser Blocked air ventilation screens Temperature set point is too high Excessive heat load Ambient air temperature too high (>35°C / 95°F) Low or high line voltage Communication cable between controller head and refrigeration power module disconnected	Clean air filter and/or condenser as required. Remove blockages as required. Decrease temperature set point. Check that heat load does not exceed capacity of bath; correct as required. Decrease ambient air temperature. Check and correct as required. Check cable and connections, reinstall or replace cable if needed.
Unable to achieve low end extreme temperatures	Pump speed too high Incorrect bath fluid Insufficient insulation on external fluid lines Ambient air temperature too high (>35°C / 95°F) Low or high line voltage Dust buildup on air filter or condenser Blocked air ventilation screens Excessive heat load	Reduce pump speed. Check that the fluid being circulated is capable of reaching the required temperature. Check external fluid lines for proper insulation. Decrease ambient air temperature as required. Check and correct as required. Clean air filter or condenser as required. Remove blockages as required. Check that heat load does not exceed capacity of bath; correct as required.

9.8 Service & Technical Support

If you have followed the troubleshooting steps outlined previously and your Circulating Bath 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

10. Warning and Fault Messages

10.1 Warnings

Warnings alert you to conditions such as the disconnection of the external temperature sensor or that the desired set point is above or below the user-set limits. The warning message appears briefly on the status bar when the condition is detected. It also appears when power is turned Off and then back On.

Warning Message	Cause	Corrective Action
SET TEMPERATURE IS ABOVE THE HIGH LIMIT	Desired set point temperature is above High Limit setting	Lower set point temperature or increase High Limit setting
SET TEMPERATURE IS BELOW THE LOW LIMIT	Desired set point temperature is below Low Limit setting	Raise set point temperature or decrease Low Limit setting
PROBE 2 DISCONNECTED	External temperature probe disconnected	Reconnect external temperature probe or select internal (P1) control
SET TEMPERATURE IS ABOVE THE SAFETY SETPOINT	Desired set point temperature is above the safety set temperature	Lower set point or increase safety set temperature
FLUID SERVICE REQUIRED	Bath fluid replacement maintenance reminder	Replace bath fluid and reset service reminder
SET TEMPERATURE IS ABOVE THE HIGH ALARM	Desired set point temperature is above High Alarm setting	Allow bath fluid to cool or increase High Alarm setting
SET TEMPERATURE IS BELOW THE LOW ALARM	Desired set point temperature is below Low Alarm setting	Allow bath fluid to warm or decrease Low Alarm setting
POWER LOSS BETWEEN "Time Stamp1" AND "Time Stamp2". "Fluid Temperature" AT RESTART.	Mains power was interrupted while the unit was running.	Check electrical supply
LOW LIQUID LEVEL	Fluid in the reservoir is low (Programmable models only)	Check fluid level and add as needed
THE PROGRAM "Program Name" IS SCHEDULED TO RUN IN 5 MINUTES.	Unit is on and a program will begin running within 5 minutes (Programmable models only)	Allow the program to run Cancel the program
AIR FILTER SERVICE REQUIRED	Air filter cleaning maintenance reminder (Refrigerated models only)	Clean air filter and reset service reminder
REFRIGERATION CONTROL MODULE DISCONNECTED.RECONNECT REFRIGERATION CONTROL CABLE	Refrigeration control module is not detected (Refrigerated models only)	Check interconnecting cables

10.2 Faults

Faults alert you to conditions which may compromise safety or component failures which affect performance. When a fault condition is detected, power to the heater, condenser, and pump are disconnected and a fault message appears continuously on the display. The fault message includes the type of fault, cause, and corrective action.

Fault Message	Cause	Corrective Action
PROBE 2 DISCONNECTED Note: This fault will only appear if External (P2) Control is active.	The external temperature probe may have failed.	Check that the external temperature probe is plugged in correctly. Inspect probe for damage such as frayed or exposed wires. If problem persists, please contact your supplier.
BATH TEMPERATURE IS ABOVE THE HIGH ALARM CHECK SET TEMPERATURE AND ALARM SETPOINT	The fluid temperature exceeds the High Alarm setting. Fluid is too warm.	Decrease fluid temperature or increase High Alarm setting. If problem persists, please contact your supplier.
OVER TEMPERATURE SAFETY SYSTEM ACTIVATED ADD FLUID TO THE BATH	The fluid temperature exceeds the Safety Set.	Check fluid level. Check fluid temperature and set point. Ensure that Safety Set is higher than the fluid set point. If problem persists, please contact your supplier.
INTERNAL FAILURE CONTACT SUPPLIER FOR ASSISTANCE	An internal electronics failure may have occurred.	Restart the machine. If problem persists, please contact your supplier.
PROBE FAILURE CONTACT SUPPLIER FOR ASSISTANCE	The internal temperature probe may have failed.	If problem persists, please contact your supplier.
BATH TEMPERATURE IS BELOW THE LOW ALARM CHECK SET TEMPERATURE AND ALARM SETPOINT	The fluid temperature is lower than the Low Alarm. Fluid is too cold.	Increase temperature set point or decrease Low Alarm setting. . If problem persists, please contact your supplier.
LOW LIQUID DETECTED ADD FLUID TO THE BATH	The float switch has activated due to insufficient fluid. Excessive turbulence in the bath has caused the level switch to activate	Check the fluid level in the bath, and add more fluid, if required. Reduce pump speed until Circulating Bath controller is able to operate continuously; this problem may occur more frequently on smaller reservoirs.
SAFETY PROBE FAILURE CONTACT SUPPLIER FOR ASSISTANCE	The safety temperature probe may have failed.	If problem persists, please contact your supplier.
PUMP MOTOR LOCKED CHECK FOR BLOCKED IMPELLER OR EXTREMELY HIGH FLUID VISCOSITY	The fluid is too viscous. Something may be impeding the pump impeller(s).	Try increasing the pump speed. Check and/or clean the pump impeller(s) and volute(s). If problem persists, please contact your supplier.

11. Technical Information

11.1 Performance Specifications - Models with PX Programmable Temperature Controller

Operating Temperature Range:	Model dependent; see table below	
Temperature Stability:	±0.004°C (±0.01°F)	
Pump Type:	Variable speed pressure/suction	
	<u>60Hz models</u>	<u>50Hz models</u>
Maximum Pressure:	6 psi (0.41 bar)	6 psi (0.41 bar)
Maximum Pressure Flow Rate:	6.9 gpm (26 lpm)	6.9 gpm (26 lpm)
Maximum Suction Flow Rate:	5.3 gpm (20 lpm)	5.3 gpm (20 lpm)
Heater Wattage:	1200 Watts	2200 Watts
Refrigerant	R290 (propane); Models PX07E-25, PX07E-40, PX7LE-25, PX15E-40, PX20E-40, PX28E-40, PX15ECAL	
Refrigerant	R513A; Models PX45R-25, PX75R-20	

Model Type	Reservoir Capacity	Temperature Range	Electrical Requirements	
			60Hz	50Hz
PX07E-25 Refrigerating/Heating	7 liters	-25° to 200°C -13° to 392°F	120V, 60Hz, 12A	240V, 50Hz, 12A
PX07E-40 Refrigerating/Heating	7 liters	-40° to 200°C -40° to 392°F	120V, 60Hz, 12A	240V, 50Hz, 12A
PX7LE-25 Refrigerating/Heating	7 liters	-25° to 200°C -13° to 392°F	120V, 60Hz, 12A	240V, 50Hz, 12A
PX15E-40 Refrigerating/Heating	15 liters	-40° to 200°C -40° to 392°F	120V, 60Hz, 13A	240V, 50Hz, 13A
PX20E-40 Refrigerating/Heating	20 liters	-40° to 200°C -40° to 392°F	120V, 60Hz, 13A	240V, 50Hz, 13A
PX28E-40 Refrigerating/Heating	28 liters	-40° to 200°C -40° to 392°F	120V, 60Hz, 13A	240V, 50Hz, 13A
PX45R-25 Refrigerating/Heating	45 liters	-25° to 135°C ⁽¹⁾ -13° to 275°F ⁽¹⁾	208-240V, 50/60Hz, 13A	208-240V, 50/60Hz, 13A
PX75R-20 Refrigerating/Heating	75 liters	-20° to 100°C ⁽¹⁾ -4° to 212°F ⁽¹⁾	208-240V, 50/60Hz, 13A	208-240V, 50/60Hz, 13A
PX07H200 Heating Only	7 liters	Ambient +10° to 200°C Ambient +20° to 392°F	120V, 60Hz, 11A	240V, 50Hz, 11A
PX15H200 Heating Only	15 liters	Ambient +10° to 200°C Ambient +20° to 392°F	120V, 60Hz, 11A	240V, 50Hz, 11A
PX20H200 Heating Only	20 liters	Ambient +10° to 200°C Ambient +20° to 392°F	120V, 60Hz, 11A	240V, 50Hz, 11A
PX28H200 Heating Only	28 liters	Ambient +10° to 200°C Ambient +20° to 392°F	120V, 60Hz, 11A	240V, 50Hz, 11A
PX06S150 Stainless Steel Open Tank	6 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX10S150 Stainless Steel Open Tank	10 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX20S150 Stainless Steel Open Tank	20 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX28S150 Stainless Steel Open Tank	28 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A

PX07G100 Polycarbonate Open Tank	7 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX10G100 Polycarbonate Open Tank	10 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX25G100 Polycarbonate Open Tank	25 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
PX15ECAL Refrigerating/Heating Calibration Bath	15 liters	-30° to 200°C -22° to 392°F	120V, 60Hz, 13A	240V, 50Hz, 13A

1. Maximum operating temperature at which $\pm 0.004^{\circ}\text{C}$ temperature stability can be maintained; PX Controller is capable of higher temperatures.
2. Maximum operating temperature for stainless steel tank. PX Controller is capable of higher temperatures.
3. Maximum operating temperature for polycarbonate tank. PX Controller is capable of higher temperatures.

11.2 General Performance Specifications – Models with DX Digital Temperature Controller

Operating Temperature Range:	Model dependent; see table below	
Temperature Stability:	$\pm 0.01^{\circ}\text{C}$ ($\pm 0.02^{\circ}\text{F}$)	
Pump Type:	Variable speed pressure-only	
	<u>60Hz models</u>	<u>50Hz models</u>
Maximum Pressure:	4.5 psi (0.31 bar)	4.5 psi (0.31 bar)
Maximum Pressure Flow Rate:	5.8 gpm (22 lpm)	5.8 gpm (22 lpm)
Heater Wattage:	1100 Watts	2200 Watts
Refrigerant	R290 (propane); Models DX07E-25, DX07E-40, DX7LE-25, DX15E-40, DX20E-40, DX28E-40	

Model Type	Reservoir Capacity	Temperature Range	Electrical Requirements	
			60Hz	50Hz
DX07E-25 Refrigerating/Heating	7 liters	-25° to 175°C -13° to 347°F	120V, 60Hz, 12A	240V, 50Hz, 12A
DX07E-40 Refrigerating/Heating	7 liters	-40° to 175°C -40° to 347°F	120V, 60Hz, 12A	240V, 50Hz, 12A
DX7LE-25 Refrigerating/Heating	7 liters	-25° to 175°C -13° to 347°F	120V, 60Hz, 12A	240V, 50Hz, 12A
DX15E-40 Refrigerating/Heating	15 liters	-40° to 175°C -40° to 347°F	120V, 60Hz, 13A	240V, 50Hz, 13A
DX20E-40 Refrigerating/Heating	20 liters	-40° to 175°C -40° to 347°F	120V, 60Hz, 13A	240V, 50Hz, 13A
DX28E-40 Refrigerating/Heating	28 liters	-40° to 175°C -40° to 347°F	120V, 60Hz, 13A	240V, 50Hz, 13A
DX07H175 Heating Only	7 liters	Ambient +10° to 175°C Ambient +20° to 347°F	120V, 60Hz, 11A	208-240V, 50/60Hz, 13A
DX15H175 Heating Only	15 liters	Ambient +10° to 175°C Ambient +20° to 347°F	120V, 60Hz, 11A	240V, 50Hz, 11A
DX20H175 Heating Only	20 liters	Ambient +10° to 175°C Ambient +20° to 347°F	120V, 60Hz, 11A	240V, 50Hz, 11A
DX28H175 Heating Only	28 liters	Ambient +10° to 175°C Ambient +20° to 347°F	120V, 60Hz, 11A	240V, 50Hz, 11A
DX06S150 Stainless Steel Open Tank	6 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX10S150 Stainless Steel Open Tank	10 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A

DX20S150 Stainless Steel Open Tank	20 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX28S150 Stainless Steel Open Tank	28 liters	Ambient +10° to 150°C ⁽²⁾ Ambient +20° to 302°F ⁽²⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX07G100 Polycarbonate Open Tank	7 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX10G100 Polycarbonate Open Tank	10 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX25G100 Polycarbonate Open Tank	25 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A
DX17VB6G Glass Viscosity	17 liters	Ambient +10° to 100°C ⁽³⁾ Ambient +20 to 212°F ⁽³⁾	120V, 60Hz, 11A	240V, 50Hz, 11A

1. Maximum operating temperature at which $\pm 0.01^{\circ}\text{C}$ temperature stability can be maintained; DX Controller is capable of higher temperatures.
2. Maximum operating temperature for stainless steel tank. DX Controller is capable of higher temperatures.
3. Maximum operating temperature for polycarbonate tank. DX Controller is capable of higher temperatures.

Specifications subject to change without notice.

11.3 Reservoir Fluids

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

	WARNING: Always use fluids that satisfy safety, health, and equipment compatibility requirements. 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. 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. Use only non-acid bath fluids.
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	WARNING: When using Class III flammable fluids per DIN 12876-1 Circulating Baths equipped with PX Programmable Controllers are suitable for use with Class III flammable fluids per DIN 12876-1. A fire hazard may be present. Explosive gas mixtures may accumulate if used with insufficient ventilation. Use this Circulating Bath in a well-ventilated area or beneath a suitable fume hood only. Ensure all ventilation openings are not obstructed. No smoking! No flame! Do not use electrical parts which can produce a spark when operating around the equipment and the application system. Drain and recover the liquid when the equipment idles, if the bath fluid is used with an open tank and if it is highly volatile at ambient temperature. WARNING: When using Class III flammable fluids per DIN 12876-1, the user must attach the following warning labels to the front of the unit so that they are well visible:		
	Warning Label W09 Colors: Yellow/black		Danger Area. Attention! Observe instructions (operating manual, safety data sheet)
	Warning Label W021 Colors: Yellow/black		Flammable fluid
	Mandatory Label M018 Colors: Blue/white Or Semi S1-0701 Table A1-2 #9 Colors: Blue/white	 	Carefully read the user information prior to beginning operation. Scope: EU Carefully read the user information prior to beginning operation. Scope: NAFTA

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For optimum temperature stability, the fluid's viscosity should be 50 centistokes 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 charts are intended to serve as guides 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. The operator is responsible for proper selection and use of the fluids. Avoid extreme range operation.

Fluid Description	Viscosity (cSt) @ 25°C	Specific Heat			Normal Temperature Range	Recommended Safety Set Temperature*
		@ Fluid Temperature	BTU/lb°F	KJ/Kg°C		
distilled water	1	50°C	1.00	4.18	10° to 90°C	100°C
polycool EG -25 (50/50 mix with distilled H ₂ O)	20	-20°C	0.78	3.26	-25° to 100°C	110°C
polycool EG -25 (30/70 mix with distilled H ₂ O)	12	0°C	0.89	3.72	0° to 95°C	105°C
polycool PG -20 (50/50 mix with distilled H ₂ O)	20	-10°C	0.83	3.47	-20° to 100°C	110°C
polycool PG -20 (30/70 mix with distilled H ₂ O)	12	5°C	0.92	3.85	5° to 90°C	100°C
polycool MIX -25 (50/50 mix with distilled H ₂ O)	20	-20°C	0.78	3.26	-25° to 100°C	110°C
polycool HC -50	3	-30°C	0.62	2.59	-50° to 100°C	110°C

Flammable Liquid options

Fluid Description	Viscosity (cSt) @ 25°C	Specific Heat			Normal Temperature Range	Safety Set maximum
		@ Fluid Temperature	BTU/lb°F	KJ/Kg°C		
polytherm S150	50	100°C	0.41	1.71	50° to 150°C	210°C*
polytherm S200	125	150°C	0.40	1.67	100° to 200°C	210°C*
polytherm S250	500	200°C	0.39	1.63	150° to 250°C	210°C*
polytherm PAG140 ¹	42 (at 40°C)	200°C	0.51	2.14	-40° to 200°C	210°C*
Duratherm S	36 (at 40°C)	200°C	0.48	2.02	-51° to 200°C	210°C*

¹For use with PX models only



*The recommended safety setpoint setting is 10° above the normal temperature setting. The maximum safety setpoint setting is 210°C.



WARNING: DO NOT USE THE FOLLOWING LIQUIDS

- Automotive antifreeze with additives**
- Hard tap water**
- Deionized water with a specific resistance > 1 meg ohm
- 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

** 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.

11.4 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.

11.5 Tubing and Fitting Temperature Ranges

Material	Temperature Range
Silicone tubing	-50° to 198°C
Buna N tubing	-40° to 120°C
Viton® tubing	-32° to 200°C
Braided Teflon® lined tubing	-50° to 225°C
Stainless steel fittings	-45° to 225°C
Nylon fittings	-40° to 90°C
Brass fittings	-40° to 200°C

11.6 Fluid Compatibility

	Silicone Tubing	Buna N Tubing	Viton Tubing	Braided Teflon Tubing	Stainless Steel Fittings	Nylon Fittings	Brass Fittings
polycool EG -25	A	A	A	A	B	A	B
polycool PG -20	A	A	A	A	B		B
polycool HC -50		B	B	A	B	B	B
polytherm S150		B	B	A	B		B
polytherm S200		B	B	A	B		B
polytherm S250		B	B	A	B		B
polytherm PAG140	B	B		A	A	A	B
polycool MIX -25	A	A	A	A	B	A	B

A = Excellent B = Good

12. Replacement Parts & Accessories

Additional Safety information for Models using R290 Refrigerant

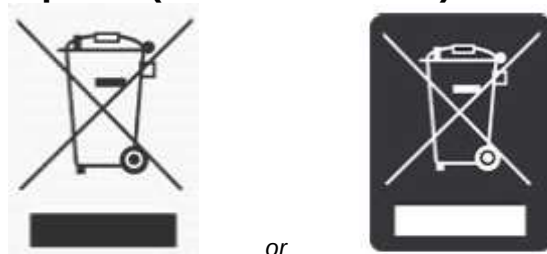
	• WARNING: Risk of fire or explosion. Depending on the model, a flammable refrigerant may have been used. • To reduce risk of possible ignition due to incorrect or improper service, servicing repair and disposal must be carried out ONLY by service personnel trained in the use of flammable refrigerants. • Component parts shall be replaced with like components only.
Description	Part Number
IEC to IEC Power Cord (Refrigerating/Heating Circulating Baths)	225-661
IEC to Mains Power Cord, U.S. plug type, 120V, 60Hz (7 to 28 liter Refrigerating/Heating Circulating Baths)	225-473
IEC to Mains Power Cord, U.S. plug type, 230V, 60Hz (45 liter and 75 liter Refrigerating/Heating Circulating Baths)	225-230
IEC to Mains Power Cord, European plug type, 240V, 50Hz (Refrigerating/Heating Circulating Baths)	225-346
IEC to Mains Power Cord, U.S. plug type, 120V, 60Hz (Heating Circulating Baths)	225-227
IEC to Mains Power Cord, European plug type, 240V, 50Hz (Heating Circulating Baths)	225-228
Refrigeration Control Cable (Refrigerating/Heating Circulating Baths)	225-651
Reservoir Cover for 7L Refrigerating/Heating and Heat only Circulating Baths	510-726
Reservoir Cover for 15L Refrigerating/Heating and Heat only Circulating Baths	510-727
Reservoir Cover for 20L Refrigerating/Heating and Heat only Circulating Baths	510-728
Reservoir Cover for 28L Refrigerating/Heating and Heat only Circulating Baths	510-729
Reservoir Cover for 45L Refrigerating/Heating and Heat only Circulating Bath	510-730
Reservoir Cover (small) for 75L Refrigerating/Heating Circulating Bath	510-730
Reservoir Cover (large) for 75L Refrigerating/Heating Circulating Bath	510-731
Reservoir Cover for 15L Calibration Baths	510-732
Bypass Tubing Kit, Silicone	510-713
Bypass Tubing Kit, Buna N	510-711
Bypass Tubing Kit, Viton®	510-495
Teflon-lined Tubing, stainless steel overbraid	060310
RS232 Cable, 9.8-ft (3 m)	225-173
USB A to USB B Cable, 6-ft (1.8 m)	225-669
Ethernet cable, 7-ft (2.1 m)	225-670
Flash Drive, 1 GB	250-096
Pt100 External Temperature Probe, 2-ft (0.6 m)	525-876
Pt100 External Temperature Probe, 10-ft (2 m)	525-870
Pt100 External Temperature Probe, 25-ft (8 m)	525-871
Pt100 External Temperature Probe, 50-ft (15 m)	525-872
USB A to USB B Cable, 9-ft (3 m)	225-669
Fitting, 1/4" male NPT to 1/8" (3 mm) hose barb, brass (set of 2)	060305-2

Fitting, ¼" male NPT to 3/16" (5 mm) hose barb, stainless steel (1 each)	776-204
Fitting, ¼" male NPT to 3/16" (5 mm) hose barb, nylon (1 each)	300-049
Fitting, ¼" male NPT to 3/16" (5 mm) hose barb, brass (1 each)	776-193
Fitting, ¼" male NPT to ¼" (6 mm) hose barb, nylon (1 each)	300-048
Fitting, ¼" male NPT to ¼" (6 mm) hose barb, brass (1 each)	776-194
Fitting, ¼" male NPT to ¼" (6 mm) hose barb, stainless steel (1 each)	776-203
Fitting, ¼" male NPT to 5/16" (8 mm) hose barb, brass (set of 2)	060305
Fitting, ¼" male NPT to 3/8" (9.5 mm) hose barb, stainless steel (1 each)	776-202
Fitting, ¼" male NPT to 3/8" (9.5 mm) hose barb, nylon (1 each)	300-047
Fitting, ¼" male NPT to 3/8" (9.5 mm) hose barb, brass (1 each)	776-195
Fitting, ¼" male NPT to M16 x 1, stainless steel (1 each)	775-290
Fitting, M16 x 1 female to 8 mm (1/4") hose barb, brass (1 each)	776-191
Fitting, M16 x 1 female to 12 mm (7/16") hose barb, brass (1 each)	776-192
Fitting, ½" male NPT x ½" (13 mm) hose barb, nylon (for integrated cooling coil)	300-096
Flow Adapter, 2 ports with shutoffs. ¼" male NPT x two ¼" (6 mm) hose barbs, brass	510-666
Reusable Air Filter for PX7LE-25 and DX7LE-25 Refrigerating/Heating Circulating Bath	305-057
Reusable Air Filter for PX07E-25 and DX07E-25 Refrigerating/Heating Circulating Bath, PX15ECAL Calibration Bath	305-054
Reusable Air Filter for PX15E-40, DX15E-40, PX20E-40, DX20E-40, PX28E-40 and DX28E-40 Refrigerating/Heating Circulating Baths	305-055
Reusable Air Filter for PX45R-25, PX75R-20 and Refrigerating/Heating Circulating Baths	305-056
O-Ring, Drain Valve (for Refrigerating/Heating and Heat only Circulating Baths)	400-843
Display Module Assembly	510-528
Circuit Breaker / Power Switch	215-330
Leveling Glide; Refrigerating/Heating and Heat only Circulating Baths	400-814
Sleeve kit for calibration bath lid: 2 mm inserts x (2), 4.0 mm insert x (1)	510-748
Sleeve kit for calibration bath lid: 3 mm inserts x (2), 4.0 mm insert x (1)	510-745
Sleeve kit for calibration bath lid: 4 mm inserts x (2), 4.0 mm insert x (1)	510-746
Sleeve kit for calibration bath lid: 5 mm inserts x (2), 4.0 mm insert x (1)	510-749
Sleeve kit for calibration bath lid: 6 mm inserts x (2), 4.0 mm insert x (1)	510-747
Sleeve kit for calibration bath lid: 8 mm inserts x (2), 4.0 mm insert x (1)	510-750
Solid plug for calibration bath lid, Viton®	300-831

13. Recommended Circulating Bath Fluids

Circulating Bath Fluid	Quantity	Part Number
polyclean Clarifier	8 oz / 236 ml	004-300040
polyclean Clarifier	Twelve 8 oz / 236 ml bottles	004-300041
polycool EG -25 (ethylene glycol)	1 gal / 3.8 liter	060340
polycool PG -20 (propylene glycol)	1 gal / 3.8 liter	060320
polycool HC -50 (water-based heat transfer fluid)	1 gal / 3.8 liter	060330
polytherm S150 (silicone oil)	1 gal / 3.8 liter	060326
polytherm S200 (silicone oil)	1 gal / 3.8 liter	060327
polytherm S250 (silicone oil)	1 gal / 3.8 liter	060328
polytherm PAG140 (polyalkylene glycol)	1 gal / 3.8 liter	060350
polycool MIX -25 (50/50 blend polycool EG -25 / H ₂ O plus polyclean clarifier)	Five 0.5 gal / 2.27 liter	004-300060

14. 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.

14.1 Disposal Safety information for Refrigerated Models with R290 Refrigerant

	- CAUTION: Risk of fire or explosion. Flammable Refrigerant Used. Dispose of properly in accordance with Federal or Local Regulations. - Disposal must be carried out ONLY by service personnel trained in the disposal of flammable refrigerants.
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15. 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 insure 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 PolyScience, 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 POLYSCIENCE 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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