
User Guide

LS-Series Compact Chiller



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Introduction

The LS-Series Compact Chiller provides cooling power for demanding applications and serves as an economical alternative to tap water cooling systems. It features a microprocessor-based controller, digital temperature display (°C or °F), and simple operation and maintenance.

To optimize cooling efficiency and performance, this sophisticated Chiller also features a modulated refrigeration system. As a result, temperature stability is greatly enhanced and compressor life extended.

The Chiller is equipped with either a magnetic drive centrifugal pump or a turbine pump. Wetted parts within the recirculation system are brass, copper, stainless steel, EPDM rubber, Alcryn, nylon, PVC, and polyethylene.

General Information

General Safety Information

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



This symbol alerts you to wide range of potential dangers.



This symbol advises you of danger from electricity or electric shock.



This symbol marks information that is particularly important.



This symbol indicates alternating current.



These symbols on the Power Switch / Circuit Breaker indicate that they place the main power supply ON / OFF.



This symbol on the Power Switch indicates that it places the unit in a standby mode. It DOES NOT fully disconnect the unit from the power supply.



This symbol indicates a protective conductor terminal.

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

Safety Recommendations

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



- Always connect the power cord on this unit to a grounded (3-prong) power outlet. Make certain that the outlet is the same voltage and frequency as your unit.
- Never operate the unit with a damaged power cord.
- Always turn the unit OFF and disconnect Mains power before performing any maintenance or service.

Unpacking Your Chiller

Your Chiller is shipped in a special carton. Retain the carton and all packing materials until the unit is completely assembled and working properly. Set up and run the unit immediately to confirm proper operation. Beyond one week, your unit may be warranty repaired, but not replaced. If the unit is damaged or does not operate properly, contact the transportation company, file a damage claim and contact the company where your unit was purchased immediately.



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

Regulatory and Compliance Testing

Canada USA (60Hz units)

CAN/CSA C22.2 No. 61010-1-12 — Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part I: General Requirements.

CAN/CSA C22.2 No. 61010-2-010-04 (R2014) – Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials.

UL Std No. 61010-1 (2012) — Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part I: General Requirements.

UL Std No. 61010-2-010 (2015) – Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 2: Particular Requirements for Laboratory Equipment for the Heating of Materials.

CE (50Hz units)

Machinery Directive 2006/42/EC

EC Electromagnetic Compatibility Directive 2014/30/EU

IEC 61010-1 / EN 61010-1:2010

IEC 61010-2-010 / EN 61010-2-010:2014

IEC 61326:2012 / EN 61326:2013

RoHS Directive 2011/65/EU

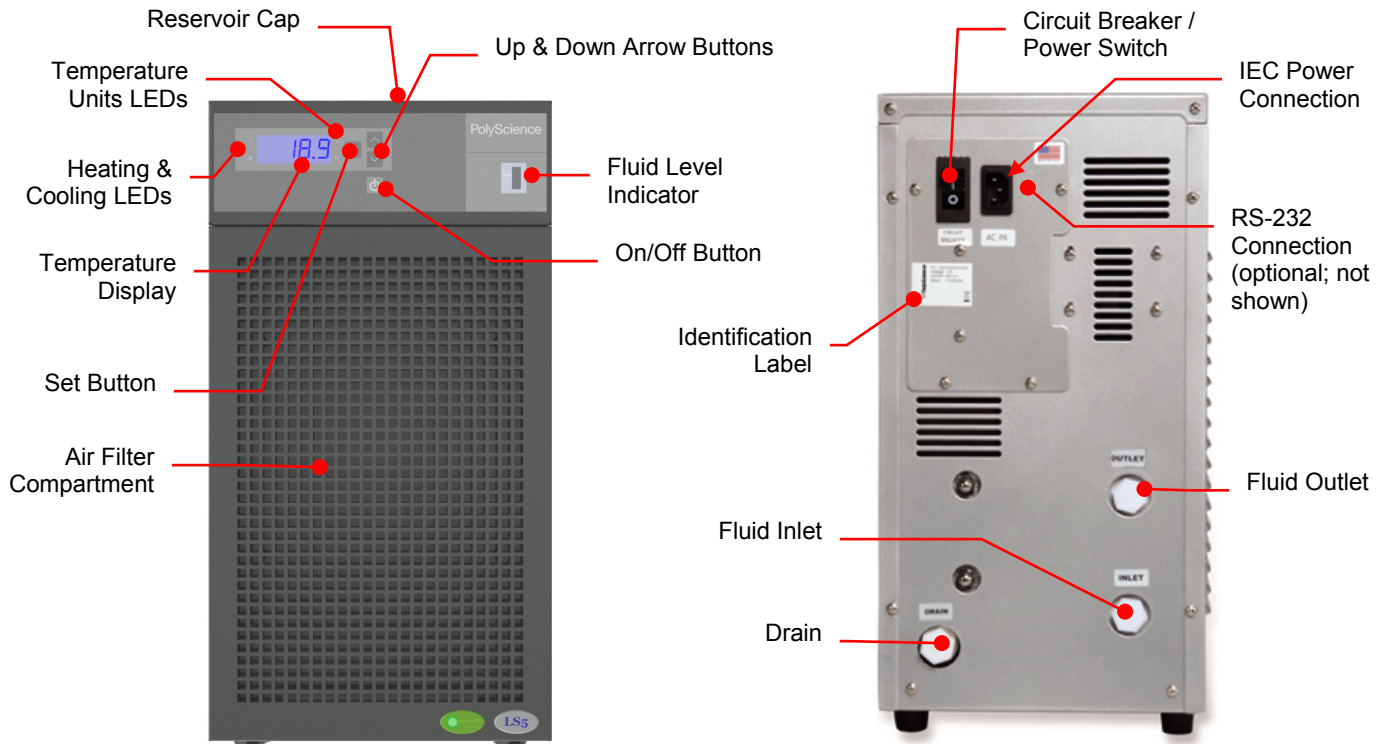
Highly Accelerated Life Test (HALT) and Vibration Tests per ASTM D4169-8 (All units)


Contents

The following items have been included with your Chiller:

- Operator's Manual
- IEC Power Cord
- Two sets of Inlet/Outlet Adapters: 1/2 inch NPT to 1/2 inch hose barb;
 1/2 inch NPT to 3/8 inch hose barb

Controls and Components



 **NOTE:** When controlling at the set point temperature, it is not uncommon for both the heating and cooling LEDs to be lit simultaneously.

Installation and Startup



WARNING: Be sure all power is off before proceeding.

Site Requirements

Ambient Temperature and Relative Humidity

The Chiller is designed for indoor installation in ambient temperatures between 5° and 35°C (41° and 95°F); relative humidity should not exceed 80% (non-condensing).

Location

The Chiller should be installed on a strong, level surface. It should be located as close to possible to the process requiring cooling. It should not be installed closer than 1.4 meters (4 feet) to a heat-generating source, such as heating pipes, boilers, etc. If possible, the Chiller should be located near a suitable drain to prevent flooding in the event of leaks. Do not place it where corrosive fumes, excessive moisture, excessive dust, or high room temperatures are present.



NOTE: The Chiller may be located at a level below that of the equipment being cooled. As long as the process remains closed, overflow will not occur when adding cooling fluid to the Chiller reservoir.

Clearance

Adequate clearance should be allowed on the front, sides, top, and rear of the Chiller for access to connections and components. The front and side vents of the Chiller must be a minimum of 21 cm (8 inches) away from walls or vertical surfaces so air flow is not restricted.

Electrical Power

An IEC power cord is provided with the Chiller. It should be attached to the receptacle on the rear of the enclosure. Make sure that the power outlet used for the Chiller is properly grounded and matches the voltage and frequency indicated on the identification label on the back of the Chiller.

To help prevent voltage drops, position the Chiller as close as possible to the power distribution panel. Avoid voltage drops by using a properly grounded power outlet wired with 14 gauge or larger diameter wire.

The use of an extension cord is not recommended. However, 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 Chiller.



WARNING: DO NOT plug the Chiller into the electrical outlet until the unit is ready for Startup.

Optional RS232 Serial Output

This option allows you to remotely control the Chiller and/or output temperature readings to an external recorder or other auxiliary device. The maximum communications distance for Chillers equipped with the RS232 option is 15 meters (50 feet). A 9-pin D-connector is provided on the rear of the instrument enclosure for this connection. See the *Technical Information* section (page 18) for the RS232 serial communication protocol.

Plumbing

Process Piping

The Chiller has two internally threaded (0.5 inch ID NPT) fittings on the rear of the instrument housing for the process fluid connections. Two sets of 90° barbed hose adapters (0.5 inch and 5/8 inch) are supplied with the unit for connecting these fittings to the process piping.

To maintain a safe workplace and avoid leaks, special care should be taken when choosing hoses and connectors for the Chiller. It is the user's responsibility to ensure that the tubing and fittings connected to the Chiller are compatible with the fluid, temperature, and pressure being used.

- Pressure Ratings — Hoses should be able to withstand the largest pressure that they will encounter.
- Flexible Tubing — Avoid tubing that will expand and take up fluid volume when operating at the desired pressure.
- Hose Diameter — Process piping/hosing with a diameter smaller than 0.5 inch ID can be used if desired. However, keep in mind that using smaller diameter hosing increases pressure and reduces flow in the circulating system and may result in a flow alarm. The minimum recommended tubing size is 3/8 inch ID.
- Couplings and Clamps — The use of screw-tightened hose clamps is necessary on all joints to insure good, tight connections. Quick connectors are not recommended as they have the potential for restricting flow rate.

Fluid Filter

If particulate matter may be present in the fluid, the installation of a 50 micron filter on the chiller inlet is recommended.

50 micron fluid filter: Part number 510-519

Reservoir Drain

A 0.5 inch NPT connection is provided for the reservoir's gravity drain. It should be piped to a drain or receptacle positioned below the bottom of the drain. If a receptacle is used, be sure it is of sufficient volume to hold all the water in the reservoir, process, and process lines.

Closed System or Cooling Coil Setup

Connect the Chiller's inlet and outlet to the external apparatus with hoses or pipes. The direction of the flow through the system can be controlled by the way the connections are made. Fluid is drawn into the Chiller through the "Inlet" connection; fluid is pumped out of the Chiller through the "Outlet" connection.



NOTE: If the Chiller is connected to an external apparatus with a built-in shutoff, an external bypass loop assembly may be needed. This bypass assembly continues flow circulation to and from the pump even though the main flow to the external apparatus has been blocked.

External bypass loop assembly: Part number 510-147

Startup

Process Coolant

Suitable Fluids



WARNING: Only use fluids that will satisfy safety, health, and equipment compatibility requirements. Caustic, corrosive, or flammable fluids must never be used.

The Chiller is designed to accommodate a variety of coolant fluids (water, glycol mixtures, etc). For most applications above 20°C (68°F), distilled water is satisfactory. For operation at or below 20°C (68°F), the Chiller must be protected with an antifreeze solution. Ethylene glycol (laboratory grade) and distilled water in a 50/50 mixture is satisfactory from +20° to -15°C (68° to 5°F). Select a fluid that is compatible with the Chiller's wetted parts (brass, copper, stainless steel, EPDM rubber, Alcryn, nylon, PVC, and polyethylene).



WARNING: Do not use caustic, corrosive, or flammable fluids.



WARNING: Operation below 20°C (68°F) requires antifreeze in the circulation fluid.

To prevent algae growth in the system, shield tubing from light. Insulation around the tubing will suffice. Use an algaecide in the cooling water to minimize algae growth.



WARNING: Do NOT use chlorine bleach as an algaecide.



WARNING: Do not use the following fluids

- Automotive antifreeze with additives**
- Hard tap water**
- Deionized water with a specific resistance > 1 meg ohm
- Any flammable fluids
- Concentrations of acids or bases
- Solutions with halides: chlorides, fluorides, bromides, iodides or sulfur
- Bleach (Sodium Hypochlorite)
- Solutions with chromates or chromium salts
- Glycerin
- 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 can hasten deposit build up.

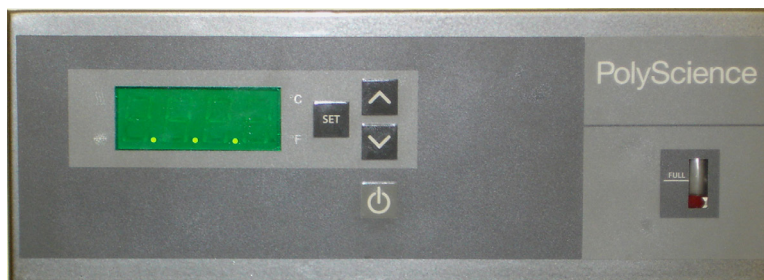
Filling the Reservoir

Unscrew the reservoir cap and carefully fill the reservoir with fluid. Leave the cap off and add additional fluid as instructed under Starting Process Fluid Flow, below.

Electrical Power

Plug the Chiller's power cord into an appropriate electrical outlet.

Place the Circuit Breaker/Power Switch on the rear of the instrument enclosure in the "On" position. Three decimal points will appear on the Temperature display.



Starting Process Fluid Flow

Press the Power Button on the front panel. The system startup sequence will begin and proceed as follows:

1. The pump will turn on and fluid will begin circulating through the system. The set point temperature will appear briefly on the Temperature display; after a few seconds, it will be replaced by the actual fluid temperature. Ninety (90) seconds after power up, the compressor will begin operating.
2. Check for leaks.
3. With the pump running, the reservoir's fluid level will drop as the process and/or process cooling lines fill with fluid.
4. Slowly add fluid to the reservoir until the liquid level as shown on the front panel fluid level gauge remains stable at the "Full" mark.
5. Replace the reservoir cap.



IMPORTANT NOTE An EFL error (see page 12) upon initial start-up or after a routine fluid change may be caused by an air bubble trapped in the pump. The problem can be resolved by turning the unit Off and On three times, so it will start and stop the pump to remove trapped air. Repeat this operation if large amounts of air are still present in the system. During this process, always verify that there are no fluid leaks, no fluid line restrictions, and monitor the fluid level in the reservoir as fluid level may drop.



IMPORTANT SPECIAL FEATURE: This Chiller equipped with the WhisperCool™ Environmental Control System, which increases/decreases fan speed based on heat load. You will notice that the fan speed changes during operation. This is particularly beneficial in an environment where low noise level is desirable.

Normal Operation

Selecting the Temperature Unit (°C or °F)

The LEDs adjacent to the Temperature Display indicate the unit (°C or °F) in which temperature is displayed. To change from °C to °F or vice versa, proceed as follows:

To change to °F — Place the Circuit Breaker/Power Switch on the rear of the instrument in the "Off" position. Press and hold the Down arrow button while returning the Circuit Breaker/Power Switch to the "On" position.

To change to °C — Place the Circuit Breaker/Power Switch on the rear of the instrument in the "Off" position. Press and hold the Up arrow button while returning the Circuit Breaker/Power Switch to the "On" position.



CAUTION: User settings (except local lockout, baud rate, and calibration offset) return to the original factory defaults when the unit in which temperature is displayed is changed. The Chiller's temperature set point and various alarm settings should be reset to the desired values.

Displaying and Adjusting the Set Point

Press the Set button on the front panel. The current set point temperature will be displayed and the decimal point at the bottom right of the display will flash, indicating the temperature can be changed.

Press the Up and Down arrow button to adjust the set point temperature. It may be set anywhere from -20° to +60°C. The default set point is +10°C. The setting is accepted after either pressing the Set button a second time or will be accepted automatically after a few seconds of inactivity.



IMPORTANT: While it is possible to set a temperature set point outside the temperature ranges outlined above, the Chiller will not be able to control at that temperature reliably.

Setting Operational Parameters

The Chiller's temperature limits and other operational parameters are user-adjustable.

Accessing Operational Parameters Menu Items: You can access and scroll through the operational parameter menu items by pressing and releasing the Up and Down arrow buttons simultaneously. The first menu item that will appear on the display is the High Temperature Limit value (shown as an H followed by the present setting; (e.g., H-71). To scroll to the next menu item, press and release the Up and Down arrow buttons again.

Changing an Operational Parameter: When the operational parameter you wish to change appears, wait until the decimal point on the right of the display flashes and then press the appropriate arrow button to change the displayed value.

Accepting an Operational Parameter Value: To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

Menu Item*	Description	Choices / Ranges / Comments	Default Setting
H-71	High Temperature Limit Set Point	1° to 71°C (33° to 159°F)	71°C (159°F)
L-46	Low Temperature Limit Set Point	-46° to -1°C (-50° to 31°F)	-46°C (-50°F)
A 30	Auto-Refrigeration Temperature	20°C – 90°C (always displayed/set in °C)	30°C
P.80	Specific Heat of Fluid	0.10 to 2.00	0.8
PC96	Communication Baud Rate x 100	24, 48, 96, 192	96
C0.0	Temperature Calibration	2.0° to -2.0°C (2.0° to -2.0°F)	0.0°C (0.0°F)
Pd00	Password	For factory use only	00

* The values shown after the Menu Item in the above table indicate how these menu items will appear as set by the factory. The actual numeric value(s) displayed will differ for any menu item(s) you change.

High Temperature Limit (H-##)

This menu item serves as a user adjustable high temperature limit. It limits how high the temperature set point may be set as well as the highest process fluid temperature at which the Chiller will operate. When this value is exceeded, the appropriate alarm or fault message will appear on the display (see *Display, Fault and Error Messages*, page 12).

To change the high temperature limit value, press the Up or Down arrow button until the desired high limit value is displayed on the temperature display.

To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

Low Temperature Limit (L-##)

This menu item serves as a user adjustable low temperature limit. It limits how low the temperature set point may be set as well as lowest process fluid temperature at which the Chiller will operate. When this value is exceeded, the appropriate alarm or fault message will appear on the display (see *Display, Fault and Error Messages*).

To change the low temperature limit value, press the Up or Down arrow button until the desired low limit value is displayed on the temperature display.


To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

Auto-Refrigeration Temperature (A ##)

This menu item allows you to select the temperature at which refrigeration is activated. When the set point exceeds the auto-refrigeration temperature by more than 1.0°C, the cooling and the fan are turned off.

To change the auto-refrigeration temperature, press the Up or Down arrow button until the desired auto-refrigeration temperature is displayed on the temperature display.

To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

	CAUTION: This value is always displayed/set in °C.
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Specific Heat (P.##)

This menu item allows you to adjust chiller performance to the specific heat of the cooling fluid, thus optimizing temperature control. It should be set to 0.80 for a 50% glycol / 50% water solution (the specific heat value for water is 1.00).

To change the specific heat setting, press the Up or Down arrow button until the desired low limit value is displayed on the temperature display.

To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

Communications Baud Rate (PC##)

This menu item allows you to set the baud rate of the chiller to match the device to which it is connected. It is functional only on Chillers equipped with the optional RS232 output.

To change the baud rate setting, press the Up or Down arrow button until the desired low limit value is displayed on the temperature display.

To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.

Temperature Calibration (C #.#)

The Chiller's temperature probe is accurate to $\pm 0.25^{\circ}\text{C}$. Therefore, if the displayed temperature is 15°C , the actual temperature will be between 14.75°C and 15.25°C .

This menu item allows you to adjust the Chiller's temperature reading to match that of a traceable standard or another piece of equipment. It allows you to offset the displayed temperature value by as much as $\pm 2.0^{\circ}\text{C}$ ($\pm 2.0^{\circ}\text{F}$).

To change the calibration offset value, press the Up or Down arrow button until the desired low limit value is displayed on the temperature display.

To accept the displayed value and return to the main operational display, either press the Set button or allow the display to timeout (approximately 15-20 seconds). To accept the displayed value and advance to the next menu item, press the Up and Down arrow buttons simultaneously.



CAUTION: Positive offsets are denoted with a blank space between C and the offset value (e.g., C 0.3); negative offsets are denoted with a minus sign between C and the offset value (C-0.3).

Password (Pd00)

This menu item is reserved for factory use only.

Enabling/Disabling the Local Lockout (LLO)

This feature is used to prevent unauthorized or accidental changes to set point and other operational values. When enabled, the temperature set point and operational parameters can be displayed, but not changed.

To enable the local lockout, press and hold the Set button until LLO is displayed (approximately 5 seconds). Once enabled, LLO will appear momentarily when the Set button is pressed to display the set point.

To disable the local lockout, press and hold the Set button until CAn appears, indicating that the local lockout feature has been disabled.



CAUTION: The Local Lockout feature does not prevent set point changes entered via the optional RS232 interface.

Display, Error and Fault Messages

When certain conditions are detected, message codes flash on the display. Depending on the nature of the condition, power to various systems components is removed. When the condition is rectified, press the front panel Power button or turn power switch/circuit breaker Off then On to clear the fault or error.

Message Code	Description	Action Required
EHL E-HI	Error High Limit	Error — The set point temperature has been set higher than the high limit temperature. Chiller Operation — Chiller continues normal operation; display alternates between EHL, E-HI and the fluid temperature. Action — Decrease set point temperature or increase high limit temperature.
FHL	Fault High Limit	Fault — The fluid temperature has exceeded the high limit temperature for more than 25 seconds. Chiller Operation — Normal operation stops, with heating and cooling turned off and the pump remaining on. FHL displayed continuously. Action — Correct high fluid temperature problem or increase high limit temperature. (Power to the unit must be turned Off before making adjustment).
ELL E-LO	Error Low Limit	Error — The set point temperature has been set lower than the low limit temperature. Chiller Operation — Chiller continues normal operation; display alternates between ELL, E-LO and the fluid temperature. Action — Increase set point temperature or decrease low limit temperature.
FLL	Fault Low Limit	Fault — The fluid temperature has been below the low limit temperature for more than 25 seconds. Chiller Operation — Normal operation stops, with heating and cooling turned off and the pump remaining on. FLL displayed continuously. Action — Correct low fluid temperature problem or decrease low limit temperature. (Power to the unit must be turned Off before making adjustment).
EFL	Fluid Low Error	Error — Fluid flow is low. Chiller Operation — Chiller continues normal operation; display alternates between EFL and the fluid temperature. Action — Add fluid to the reservoir; check fluid lines for restrictions and correct as required. Also see IMPORTANT NOTE on page 8 regarding trapped air bubbles.
FFL	Fluid Flow Fault	Fault — The fluid flow has been low for more than 20 seconds. Chiller Operation — Normal operation stops, with heating, cooling, and pump turned off. FFL displayed continuously. Action — Add fluid to the reservoir; check fluid lines for restrictions and correct as required. (Power to the unit must be turned Off before making adjustment).
Ft3	Fault 3	Fault — One or all instrument settings are out of range. Chiller Operation — Normal operation stops, with heating, cooling, and pump turned off. Ft3 displayed continuously. Action — Contact manufacturer
FOt	Fault OTP	Fault — Heater over-temperature fault. Chiller Operation — Normal operation stops, with heating, cooling, and pump turned off. FOt displayed continuously. Action — Contact manufacturer.
Ft5	Fault 5	Fault — Heater Triac failure. Chiller Operation — Normal operation stops, with heating, cooling, and pump turned off. Ft5 displayed continuously. Action — Contact manufacturer.
Ft7	Temperature Probe Fault	Fault — The main temperature probe has failed. Chiller Operation — Normal operation stops, with heating, cooling, and pump turned off. Ft7 displayed continuously. Action — Contact manufacturer.

Routine Maintenance and Troubleshooting

The Chiller is designed to require a minimum of periodic maintenance.

Magnetic Drive Centrifugal Pump

When used under continuous operating conditions, this pump should be oiled every six (6) months with SAE 20 oil. The pump incorporates two oil ports for this purpose.

To access the pump:

1. Turn both power switches off and unplug the power cord.
2. Remove the two screws securing the left side panel (as viewed from the front) of the housing to the frame.



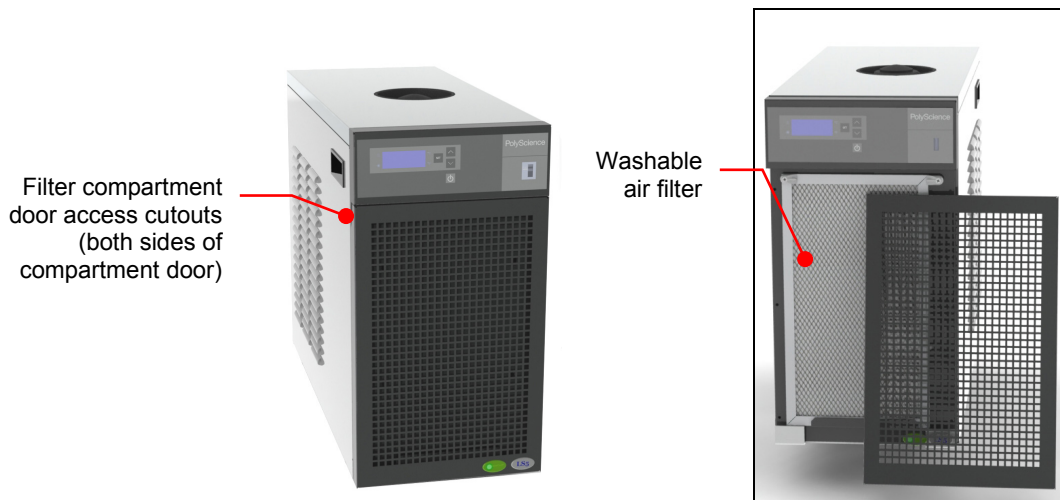
NOTE: If your Chiller is equipped with a turbine pump, no pump maintenance is required.

Condenser, Air Vents, and Reusable Filter

To keep the system operating at optimum cooling capacity, the condenser, the air vents, and reusable filter should be kept free of dust and dirt. They should be checked on a scheduled basis and cleaned as required.

To access the air filter, open the filter compartment door by placing your index finders in the cutouts on the sides of the compartment door (upper corners) and pulling towards you.

Remove the filter and remove accumulated dust and dirt. It may be cleaned by either vacuuming, blowing out with a clean air source, and/or washing with a mild detergent and water solution. If using a detergent/water solution, be sure to rinse and dry thoroughly before reinstalling.



Reusable air filter: Part number 750-758

Fluid Level

The fluid level gauge on the front panel of the Chiller should be periodically checked to determine if the fluid level needs to be topped off. Generally, fluid should be added whenever the level in the reservoir is below the “Full” mark.


Temperature Calibration


At times, there may be a minor temperature difference between the Chiller’s displayed temperature and the actual temperature as determined by a certified temperature measurement device. There may also be situations where you want the displayed temperature to match a particular value to have standardization between different instruments. These adjustments can be performed using the Chiller’s temperature calibration offset functions. See *Normal Operation, Temperature Calibration (C #.#)*, page 11.


Cleaning Exterior Surfaces

Only mild detergents and water or an approved cleaner should be used on the painted surfaces of the Chiller. Do not allow cleaning liquids or sprays to come in direct contact with the digital display.

Troubleshooting

	<p>NOTE: Many problems can be resolved by restoring the factory defaults. If this solves the problem, be careful when restoring your operational settings in order not to repeat the problem.</p> <p>To restore the factory default settings:</p> <ol style="list-style-type: none"> 1. Place the Power Switch/Circuit Breaker on the rear of the unit in the OFF position. 2. Press and hold either the Up (for °C) or Down (for °F) arrow button while returning the Circuit Breaker/Power Switch to the On position.
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	<p>WARNING: Refer servicing to qualified service personnel.</p>
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	<p>WARNING: When electrical power is On, dangerous voltages exist within chassis components. Use extreme care when measuring voltages on live circuits.</p>
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Problem	Possible Causes	Corrective Action
Unit does not run (digital displays blank)	No power to unit	Check that the electrical cord is secure and connected to an operating electrical outlet. Check that Power Switch / Circuit Breaker on rear of unit is ON.
Unit does not run (three decimal points appear on temperature display, two decimal points on pressure/flow rate display)	Unit in Standby mode	Press Power Button on front panel.
No fluid circulation	Insufficient fluid in reservoir Blockage in circulating system Pump is not operating	Add fluid to reservoir. Remove blockage. Replace pump.
Pump cycles On and Off at startup; EFL flashes on display	No flow condition detected due to insufficient fluid in reservoir or blockage in circulating system	Add fluid to reservoir as required. Remove blockage as required.
Insufficient circulation	Fluid viscosity too high External tubing diameter too small Restrictions in fluid lines Low line voltage	Replace with lower viscosity fluid. Replace with larger diameter tubing. Check and correct as required. Check and correct as required.
Unit does not cool or cooling is insufficient	Dust build up on air filter or condenser Blocked air ventilation screens Excessive heat load Ambient air temperature too high Low or high line voltage	Clean air filter and/or condenser as required. Remove blockages as required. Check that heat load does not exceed capacity of chiller; correct as required. Decrease ambient air temperature. Check and correct as required.

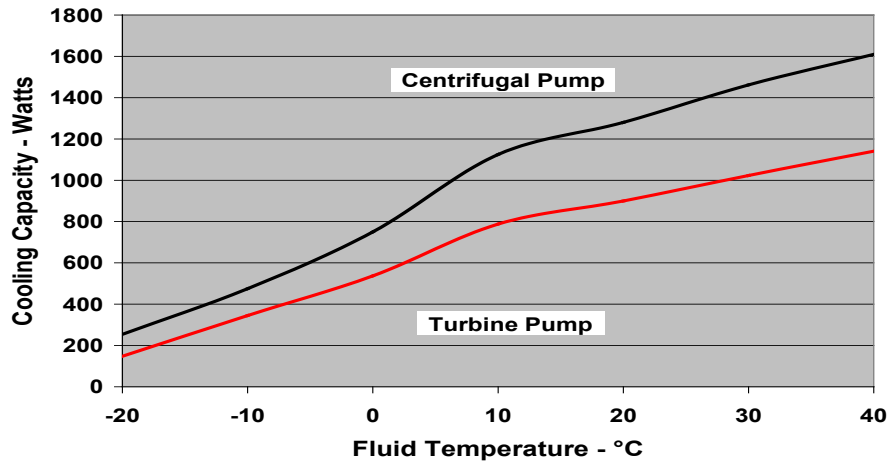
Technical Information

Model LS51/LS53 60Hz Compact Chiller Specifications

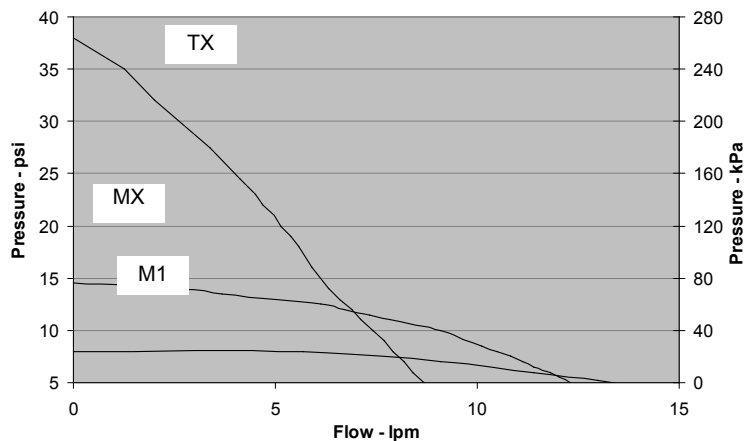
Performance 120/230V, 60Hz

Working temperature range ¹	-20° to +40°C / -4° to +104°F						
Operating temperature range ²	-20° to +60°C / -4° to +140°F						
Temperature Stability	±0.1°C (±0.18°F)						
Cooling capacity	Ethylene Glycol & Water (50/50 mix)						
Pump	MX Centrifugal		M1 Centrifugal		TX Turbine		
@	Watts	BTU/Hr	Watts	BTU/Hr	@	Watts	BTU/Hr
-20°C	260	888	230	785	-20°C	150	512
-10°C	475	1622	435	1486	-10°C	345	1178
0°C	750	2561	680	2322	0°C	540	1844
+10°C	1130	3859	1030	3518	+10°C	790	2698
+20°C	1290	4406	1160	3962	+20°C	900	3074
+30°C	1460	4986	1380	4713	+30°C	1020	3483
+40°C	1610	5498	1550	5294	+40°C	1140	3893

1. The temperature that the chiller can reach without an external heating or cooling source.
2. The temperature range in which the chiller can control temperature, limited by electronics.



Pump option	MX - Centrifugal	M1 - Centrifugal	TX - Turbine
Maximum Flow	13.2 lpm / 3.5 gpm	14.8 lpm / 3.9 gpm	9.8 lpm / 2.6 gpm
Maximum Pressure	14.5 psi / 0.99 bar	9 psi / 0.62 bar	43.4 psi / 2.99 bar
Maximum Head	10.2 m / 33.5 ft H ₂ O	5.6 m / 18.5 ft H ₂ O	26.75 m / 87.8 ft H ₂ O



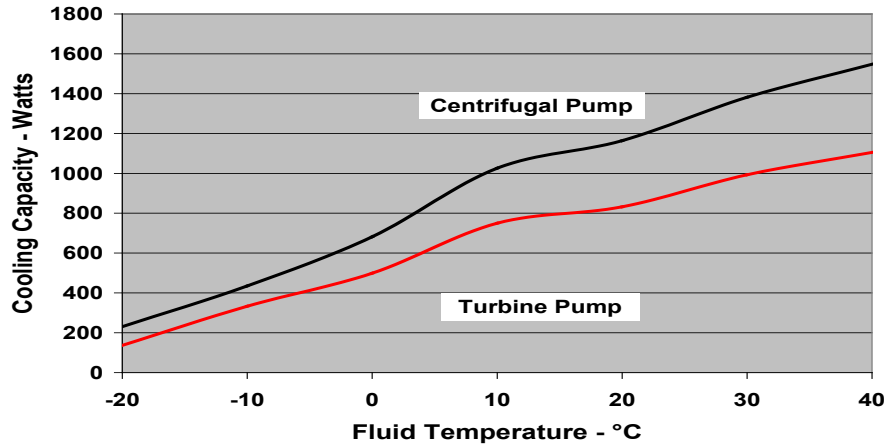
Specifications are subject to change. Performance data based on 120V or 230V, 60hz input power, 20°C ambient temperature and a 50/50 mix of Ethylene Glycol and distilled water as coolant.

Model LS52 50Hz Compact Chiller Specifications

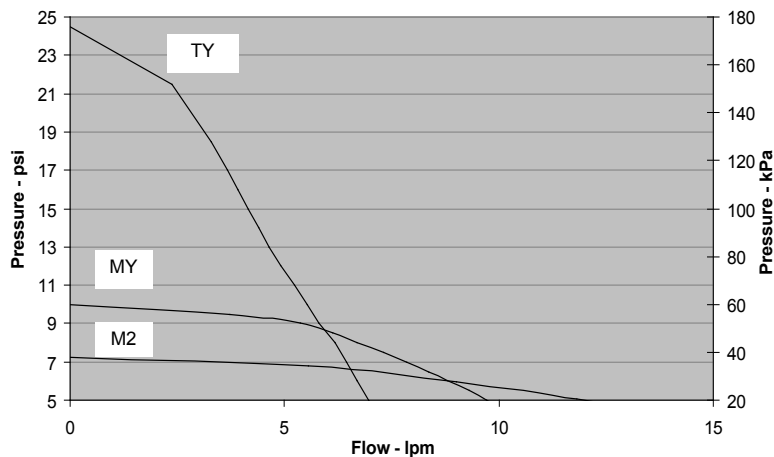
Performance 240V, 50Hz

Working temperature range ¹		-20° to +40°C / -4° to +104°F					
Operating temperature range ²		-20° to +60°C / -4° to +140°F					
Temperature Stability		±0.1°C (±0.18°F)					
Cooling capacity:		Ethylene Glycol & Water (50/50 mix)					
Pump	M2 Centrifugal		MY Centrifugal		TY Turbine		
@	Watts	BTU/Hr	Watts	BTU/Hr	@	Watts	BTU/Hr
-20°C	230	785	240	820	-20°C	140	478
-10°C	435	1485	460	1571	-10°C	330	1127
0°C	680	2322	700	2391	0°C	500	1708
+10°C	1030	3518	1070	3996	+10°C	750	2561
+20°C	1160	3962	1190	4064	+20°C	830	2835
+30°C	1380	4713	1420	4850	+30°C	990	3381
+40°C	1545	5276	1580	5396	+40°C	1105	3774

1. The temperature that the chiller can reach without an external heating or cooling source.
2. The temperature range in which the chiller can control temperature, limited by electronics.



Pump option	M2 - Centrifugal	MY - Centrifugal	TY - Turbine
Maximum Flow	12.9 lpm / 3.4 gpm	11.7 lpm / 3.1 gpm	8.3 lpm / 2.2 gpm
Maximum Pressure	5.5 psi / 0.38 bar	10.5 psi / 0.72 mbar	32 psi / 2.2 bar
Maximum Head	4 m / 12.8 ft H ₂ O	7 m / 23 ft H ₂ O	17 m / 56.5 ft H ₂ O



Specifications are subject to change. Performance data based on 240V, 50hz input power, 20°C ambient temperature and a 50/50 mix of Ethylene Glycol and distilled water as coolant.

General Information & Specifications

Safety

Auto-restart on power failure	Yes
Low flow alarm and power cutoff	Yes
High temperature safety	Yes
High temperature limit	Yes (user adjustable)
Low temperature limit	Yes (user adjustable)

Compliance

TUV (Canada, US)	Yes
CE	Yes
WEEE	Compliant
RoHS	Compliant

Construction

Outer case	Epoxy powder coated steel
Wetted parts	Brass, Copper, Stainless Steel, EPDM Rubber, Alcryn, Nylon, PVC, and Polyethylene
Unit dimensions (L x W x H)	60.7 x 25.4 x 48.3 cm / 23.9 x 10 x 19 in.
Unit weight	46.3 kg / 102 lbs
Reservoir volume	2.65 L / 0.7 gal
Heat exchanger	Stainless steel copper-brazed plate
Noise Rating (measured at .9 m from the unit)	53 dBA
Compressor	Hermetic
Refrigerant type	R-404a

Controller

Display type	Digital, LED
Temperature stability	±0.1°C
Display resolution	0.1°
Temperature Units	°C or °F
User calibration	Temperature

Setup

Recommended fluid(s)	50/50 mix of distilled water and ethylene glycol
Incompatible fluids	Corrosive or flammable fluids; Deionized water package available
Ambient temperature operating range	5° to 35°C / 41° to 95°F
Maximum relative humidity	80% non-condensing
Operating power requirements	103 - 127V, 12A, 60Hz (LS51) 208 - 253V, 6A 60Hz (LS53) 216 - 264V, 6A, 50Hz (LS52)
Fluid inlet/outlet	0.5 inch female brass NPT
Recommended tubing I.D.	0.375 inch / 9.5 mm (minimum)

Specifications subject to change without notice.

Environmental Conditions	Indoor use only
	Maximum Altitude: 2000 meter
	Operating Ambient: 5° to 35°C (41° to 95°F)
	Relative Humidity: 80%, non-condensing
	Installation Category: II
	Pollution Degree: 2

RS232 Serial Communications (Optional)

This option allows you to remotely control the Chiller and/or output temperature readings to an external recorder or other auxiliary device. The maximum communications distance for Chillers equipped with the RS232 option is 15 meters (50 feet).

Serial Connector — A 9-pin D-connector is provided on the back panel of the Chiller for RS232 data communication. A serial cable that uses only the following pins should be used to connect the Chiller to the computer:

- Pin #2 — data read (data from computer)
- Pin #3 — data transmit (data to computer)
- Pin #5 — Signal ground

RS232 Protocol — The Controller uses the following RS232 protocol:

- Data bits — 8
- Parity — None
- Stop bits — 1
- Flow control — None
- Baud rate — Selectable (Chiller and PC baud rates must match).

Communications Commands — 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 Chiller 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 Chiller before another command can be sent. All responses are terminated with a single [CR].

Command Description	Command Format	Values	Return Message
Set Command Echo	SEi[CR]	Echo: i = 1 No Echo: i = 0	![CR]
Set On / Off	SOi[CR]	i = 1 to turn on i = 0 to turn off	![CR]
Set Set Point	SSxxx[CR]	x = ASCII digit	![CR]
Read Set Point Temperature	RS[CR]		+xx.x[CR] or -xx.x[CR]
Read Temperature	RT[CR]		+xx.x[CR] or -xx.x[CR]
Read Temperature Units	RU[CR]	C or F	C[CR] or F[CR]
Read Status	RW[CR]	1 = Run 0 = Standby	1[CR] or 0[CR]
Read Compressor Discharge Temperature (°C)	RUT[CR]		xxx.x[CR]
Read fault status	RF[CR]	00 = System OK Faults	![CR]
Read Evaporator Inlet Temperature (°C)	REI[CR]		xxx.x[CR]
Read Evaporator outlet temperature (°C)	REO[CR]		xxx.x[CR]
Output continuous data stream, one set per second Set on/off	RDi[CR]	i = 1 to turn on i = 0 to turn off	![CR]

RD command results in a continuous data stream. Headers are:

Min.sec, software version, temperature units, temperature setpoint, fluid temperature, remote probe temperature, not used, compressor discharge temperature, evaporator inlet temperature, evaporator outlet temperature, heat %, cool %, fan %. Temperatures are always in degrees Celsius.

Equipment Disposal (WEEE Directive)



or



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

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

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

Service and Technical Support

If you have followed the troubleshooting steps and your Recirculating Chiller 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)
- Date of purchase and your purchase order number
- Suppliers' order number or invoice number
- A summary of your problem

Replacement Parts and Accessories

Description	Part Number
Reservoir Cap	300-460
Reservoir Spill Cup	300-575
Centrifugal Pump, M1 (120 V, 60 Hz)	525-782
Centrifugal Pump, M2 (230/240 V, 50/60 Hz)	525-783
Centrifugal Pump, MX (120 V, 60 Hz)	525-784
Centrifugal Pump, MY (230/240 V, 50/60 Hz)	525-785
Turbine Pump, TX (120 V, 60 Hz)	525-780
Turbine Pump, TY (230/240 V, 50/60 Hz)	525-781
Condenser	750-763
Compressor (120 V, 60 Hz)	750-369
Compressor (230 V, 60 Hz)	750-769
Compressor (240 V, 50 Hz)	750-370
Fan Motor (60 Hz)	215-642
Fan Motor (50 Hz)	215-643
Circuit Breaker (50/60 Hz)	215-330
Buna N Tubing, ½" (13 mm); 1 m (39") length	060308
Viton Tubing, ½" (13 mm); 1 m (39") length	060316
Viton Tubing, 3/8" (10 mm); 1 m (39") length	060319
Insulation for all ½" (13 mm) tubing; 1 m (39") length	060311
Tube Clamp for ½" (13 mm), 5/8" (16 mm), and ¾" (18 mm) O.D. tubing, 1 each	400-898
Fitting, ½" male NPT to 3/8" (9.5 mm), hose barb, brass, straight	776-196
Fitting, ½" male NPT to 3/8" (9.5 mm), hose barb, brass, elbow	775-047
Fitting, ½" male NPT to 5/8" (16 mm), hose barb, nylon, straight	300-131
Fitting, ½" male NPT to ½" (13 mm), hose barb, nylon, straight	300-096
Fitting, ½" male NPT to ¾" (19 mm), hose barb, nylon, straight	776-197
Fitting, ½" male NPT to M16x1 13 mm (½"), brass, straight	775-048
Manifold Kit, 2 ports with shutoffs	510-665
Manifold Kit, 4 ports with shutoffs	510-664
Air Filter	750-758
Operator's Manual	110-445

PolyScience Chiller Fluids

Circulating Bath Fluids	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 / 4.5 liter	060340
polycool PG -20 (propylene glycol)	1 gal / 4.5 liter	060320
polycool HC -50 (water-based heat transfer fluid)	1 gal / 4.5 liter	060330
polycool MIX -25 (50/50 blend polycool EG -25 / H ₂ O plus polyclean CLARIFIER)	Five 0.5 gal / 2.27 liter bottles	004-300060

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 the manufacturer, or other causes not arising out of defects in material or workmanship.

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

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

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

Manufactured by:

PolyScience

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