Agilent

Agilent Recirculating Chillers

User Guide



Notices

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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Your Recirculating Chiller provides cooling power for demanding applications and serves as an economical alternative to tap water cooling systems. Extremely easy to use and maintain, it combines technological innovation with precise temperature control to deliver reliable heat removal for a wide variety of applications.

Here are some of the features that make your Chiller so user-friendly:

- Microprocessor-based temperature controller
- Large, easy to read touch screen display (temperature readout in °C or °F)
- Multi-Language Interface
- Touch keypad temperature set point adjustment
- Cool Command™ modulated refrigeration system for enhanced temperature stability and extended compressor life
- WhisperCool® Environmental Control System with variable speed fan to reduce operational noise and decrease energy consumption
- Chillers with standard reservoir configuration feature continuous level sensing for pump protection
- Diagnostic Self-Test routine allows operators to test the Chiller's performance against a factory baseline
- USB Port for data logging

This manual is designed to guide you quickly through the process of installing and operating your Recirculating Chiller. We recommend that you read it thoroughly before you begin.

General 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.

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

General safety recommendations



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

NOTE This text indicates 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.

Safety recommendations

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

CAUTION

- **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 installed 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. 61010-2-010:15 - Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-010: Particular requirements for laboratory equipment for the heating of materials

CAN/CSA C22.2 No. 61010-2-011- 2017 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-011: Particular Requirements for Refrigerating Equipment.

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

UL 61010-2-010:2015 - 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. 61010-2-011 (2017) – Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 2: Particular Requirements for Refrigerating Equipment.

Product meets CAN ICES-1/NMB-1 and FCC (Part 15)

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

CE (50Hz units)

Machinery Directive 2006/42/EC

EC Electromagnetic Compatibility Directive 2014/30/EU IEC 61010-1 / EN 61010-1:2010

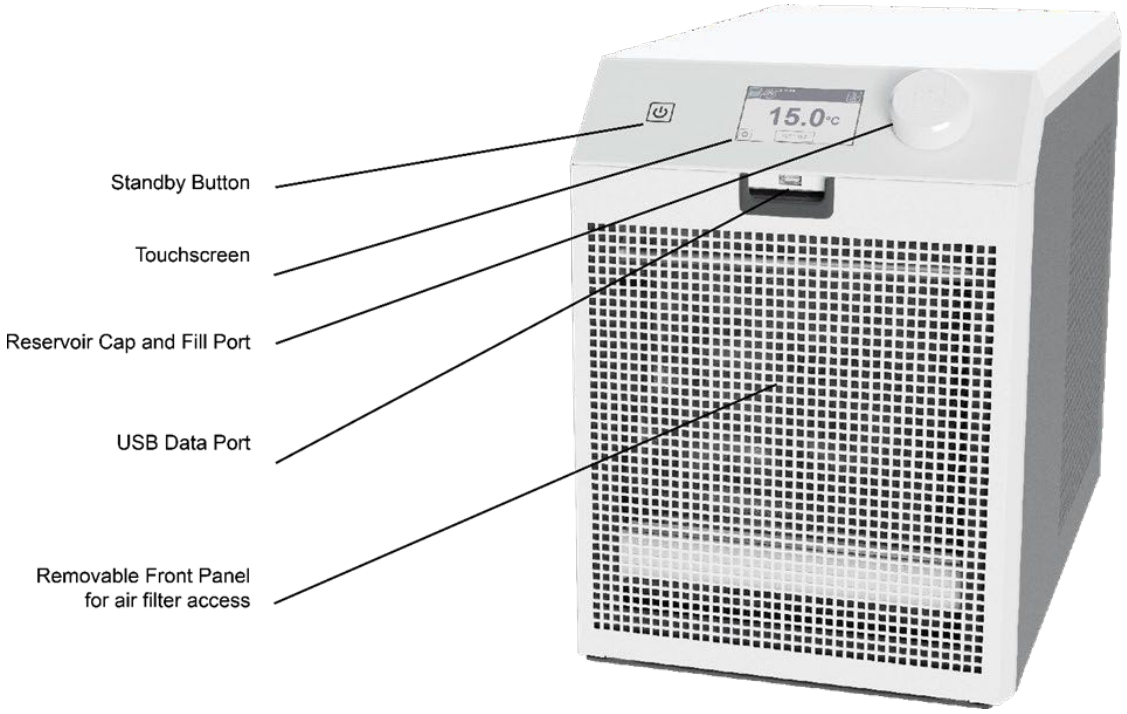
IEC 61010-2-011

IEC 61326:2012 / EN 61326:2013

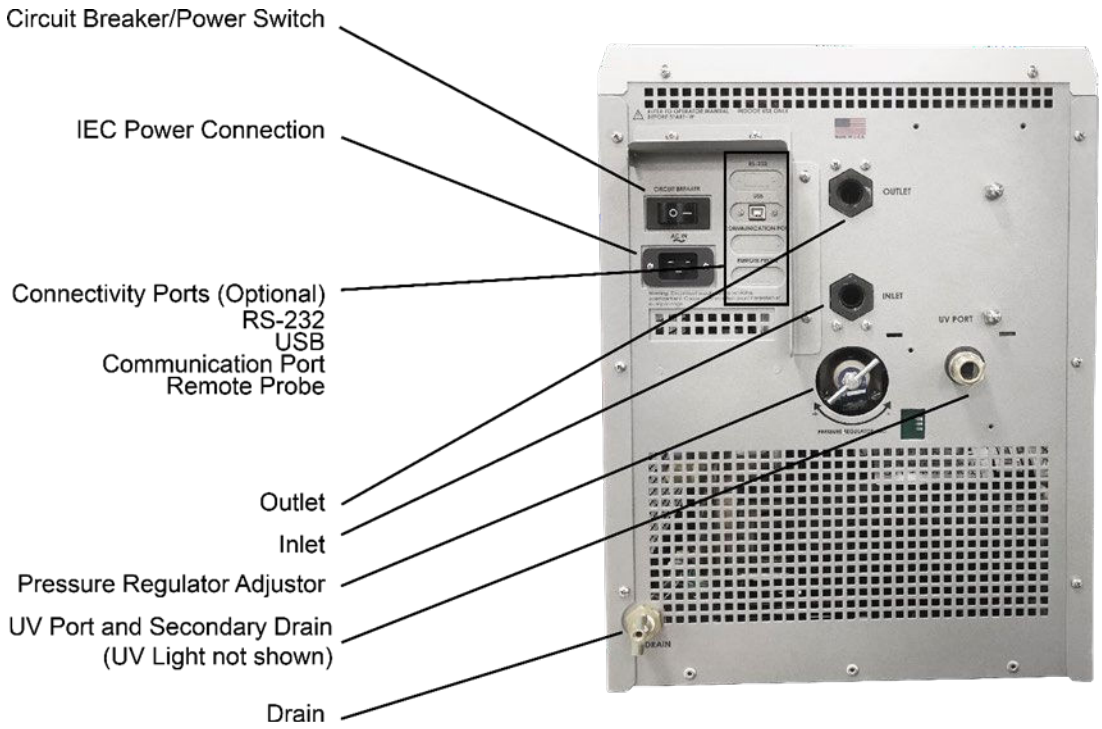
RoHS Directive 2011/65/EU

Controls and Components

Front View — Air-Cooled Models

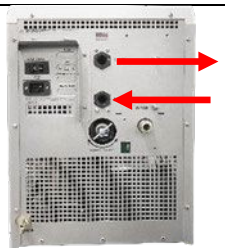
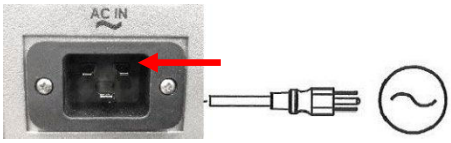


Rear View — Air-Cooled Models



Quick Start

See Installation & Startup for additional information.

1	**All models:** Connect all process lines.	 Air-Cooled Models	
2	Remove reservoir cap and fill reservoir with coolant.		
3	Connect electrical power cord to Mains.		
4	Turn Power Switch / Circuit Breaker ON.		
5	Press Standby Button on front panel.		
6	Add coolant to reservoir as process lines fill. Replace cap.		
7	Enter temperature set point.	Press "SET = " to enter Set Point Screen. 	Use numeric keypad to enter desired set point. Press ✓ to save set point and return to Home Screen. 

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Site Requirements

WARNING **Electrical Hazard**
Be sure all power is off before proceeding.



Ambient Temperature and Relative Humidity

The Chiller is designed for indoor installation in ambient temperatures between 5° and 40°C (41° and 104°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 as possible to the process requiring cooling.
- It should not be installed closer than 4 feet (1.4 meters) 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.
- Do not place it where access to the disconnecting device is impeded.
- For ease of positioning and maneuverability, the Chiller is supplied with casters. The front wheels can be locked to keep the Chiller in place while in use.
- 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.

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, and rear of the Chiller for access to connections and components. The front and rear vents of the Chiller must be a minimum of 24 inches (61 cm) away from walls or vertical surfaces so air flow is not restricted.

Electrical Power

An IEC power cord is provided with the Chiller for select models. 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.

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.

CAUTION

DO NOT plug the Chiller into the electrical outlet until the unit is ready for startup (see *Startup* on page 17).

Optional Signal Inputs/Outputs

External Control / Ambient Tracking Temperature Probe

This option allows you to control the cooling fluid temperature using an external temperature measurement (ambient room/machine temperature or process temperature). A 9-pin connector is provided on the rear panel for connecting the external probe.

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.

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 50 feet (15 meters). A 9-pin D-connector is provided on the rear of the instrument enclosure for this connection.

Remote I/O Port

This option allows you to use a dry contact closure to turn the Chiller on and off. Chiller status is also available from this port. A 15-pin D-connector is provided on the rear of the instrument enclosure for this optional connection. See schematic at the end of this manual.

USB Serial / TMC Output

This option allows you to remotely control the Chiller and/or output temperature readings to an external recorder or other auxiliary device. The port can be changed to behave as either a virtual com port, or as a USB TMC device by making the appropriate selection in the Menu. A type B connector is provided on the rear of the instrument enclosure for this optional connection.

Plumbing

Process Piping

The Chiller has two internally threaded (1/2 inch ID NPT) fittings on the rear of the instrument housing for the process water connections.

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.
  - For "T" Series (turbine pump) Chillers, this is 100 psi (689 kPa).
- 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 ½ inch ID can be used if desired. However, keep in mind that using smaller diameter hosing increases pressure in the circulating system.
- 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.

Drain

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

External Water Filter

An optional water filter is available that can be connected to the Chiller's fluid inlet or fluid outlet. Consult supplier for additional information.

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.

Open Bath System Setup

Position the external tank at least two feet (0.6 meter) above the Chiller's inlet.

Install a shutoff valve on both the inlet and outlet of the Chiller. Place the valves in the closed position.

Connect the shutoff valves to the external tank using the tubing of equal diameter (1/2 inch minimum) and length. Use the same size fittings on both the inlet and outlet; this will ensure a balanced flow.

Cut the external end of the suction (inlet) 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 (inlet) tubing must have a wall thickness that will not collapse under vacuum, particularly when going around bends.

Fill the external bath (see *Startup, Process Coolant* on page 12 for suitable fluids).

Fill the Chiller reservoir to the bottom of the reservoir's fill port neck and install the cap. Tighten the cap until it is securely sealed.

3 Startup

Process Coolant

Your Chiller must be operated with fluid in the reservoir. Always fill the reservoir before operation, to prevent damage to your unit. This section will provide you information on the selection and use of compatible fluids for your specific process.

Suitable Fluids

WARNING

- **Only use fluids that will satisfy safety, health, and equipment compatibility requirements.**
- **Do not use caustic, corrosive, or flammable fluids.**
- **Operation below 10°C (50°F) requires antifreeze in the circulation fluid.**

CAUTION **Always select a fluid that is compatible with the Chiller's wetted parts (brass, stainless steel, polyethylene, EPDM rubber, and nylon).**

NOTE For storage purposes, a very small amount (below 25mL) of laboratory grade propylene glycol is added to the unit to avoid freezing damage to the pump. While this small amount will have no impact when mixed with other fluids, please refer to Routine Maintenance and Troubleshooting, Draining fluid on Page 28 for information on draining the pump.

WARNING **Do not use the following fluids:**

- **Automotive antifreeze with additives****
- **Hard tap water****
- **Deionized water with a specific resistance > 1 meg ohm (except units with the DI water compatible plumbing**
- **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**

** Additives or mineral deposits can adhere to internal components. If deposits are allowed to build up damage may result to components such as the pump or heat exchanger. Higher temperatures and higher concentrations of additives can hasten deposit build up.

Recommended Fluids

We recommend the following fluids be used with Chillers.

Fluid	Temperature Range	Recommended Maintenance
Agilent Cool Clear (distilled water plus clarifier and corrosion inhibitor)	+10° to +90°C (+50° to +194°F)	Verify fluid level monthly or more frequently per application needs. Replace fluid every 12 months.

Filling the Reservoir

Remove the filler cap from the reservoir and, using a funnel, add fluid until it reaches the bottom of the reservoir's fill port. Once the reservoir is full, remove the funnel but do not replace the cap at this time.

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. A standby screen will appear on the Chiller's display.

Starting Process Fluid Flow

NOTE When adding fluid to the unit for the first time, prime the pump by pressing the Standby Button "On" and letting the Chiller run for 3 seconds and then pressing the Standby Button again to turn power "OFF". Repeat this "On" and "Off" procedure three times.

Press the Standby 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 Home Screen will now be shown on the display. Fifteen to twenty 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. Add fluid as follows:
4. Closed Systems: Slowly add fluid to the reservoir until the liquid level remains stable
5. Open Bath Systems:
   - **a** Open the inlet and outlet valves on the Chiller; the suction created by the pump should begin drawing fluid through the inlet tubing into the Chiller reservoir.
   - **b** Once flow is established (no air bubbles in inlet tubing), close the inlet and outlet valves and turn the Chiller "Off".
   - **c** Remove the reservoir cap and check the level of the fluid in the reservoir. Add coolant until it is level with the bottom of the reservoir's fill port neck.

CAUTION **Always close the inlet and outlet valves before turning power to the Chiller "Off" or removing the reservoir cap to prevent the external reservoir from flooding the Chiller.**

   - **d** Replace the reservoir cap, open the inlet and outlet valves, and restart the Chiller.
   - **e** Observe the liquid level in the external reservoir; adjust the valve on the Chiller outlet as required to maintain a stable fluid level.

CAUTION **When running an open loop system for extended periods, the fluid level in the Chiller reservoir should be checked periodically to avoid low fluid conditions.**

To check the reservoir fluid level, close the inlet and outlet valves, turn the Chiller 'off', and remove the reservoir cap. Slowly open the inlet and outlet valves and allow fluid to drain from the external reservoir into the Chiller reservoir. Close the valves when the fluid level within the Chiller reservoir reaches the top of the filler neck. Add fluid to the external reservoir as required. Replace the reservoir cap, open the inlet and outlet valves, and turn the Chiller back on.

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4 Normal Operation

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This section provides information on all basic functions and normal operations involved in the daily use of your Chiller. Please familiarize yourself with all screens and functions before operating.

NOTE Air-cooled Chillers are equipped with the WhisperCool® Environmental Control System, which controls fan speed based on the heat load. You will notice the fan speed changing gradually during operation. This is especially beneficial in an environment where a low noise level is desirable.

Standby Screen

After energizing the Chiller, the Chiller will enter Standby Mode. In Standby, the fluid pump, refrigeration compressor, and condenser fan are all disabled. You may adjust Chiller settings in this mode by pressing ⚙ from this screen. Press the Chiller's Standby Button to begin operation. You will be taken to the Home Screen, and the Chiller's fluid pump, refrigeration and fluid temperature control functions will all be enabled.

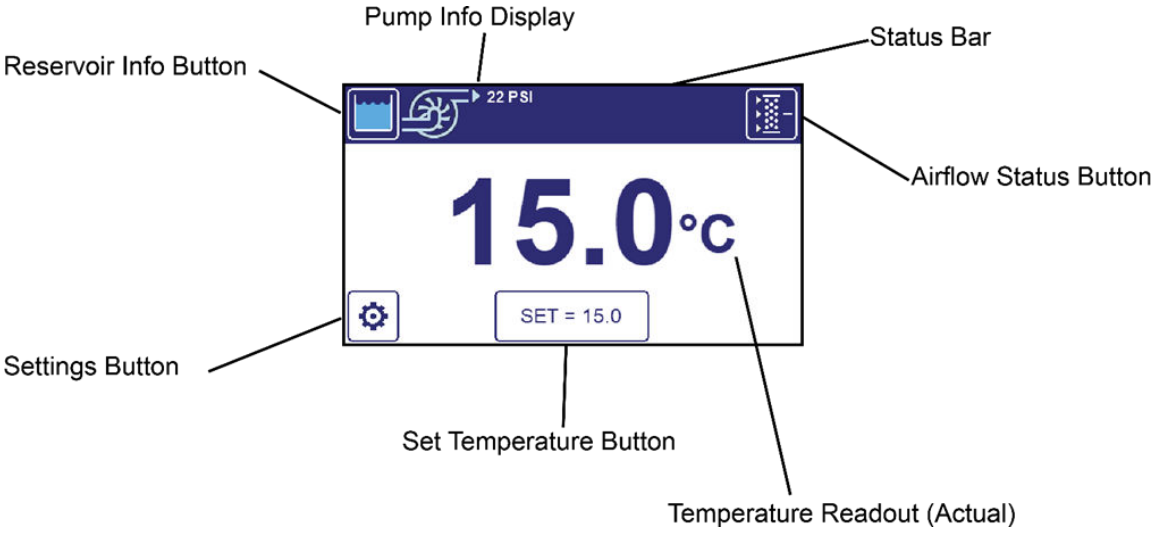


Home Screen (Default Operation with Internal Probe Only)

The Chiller's Home Screen displays the readout of fluid temperature, temperature unit of measure, temperature set point, Chiller fluid pressure at the outlet, reservoir fill level, and airflow status. If there is an active Alarm or Warning, it will be displayed in the Status Bar.

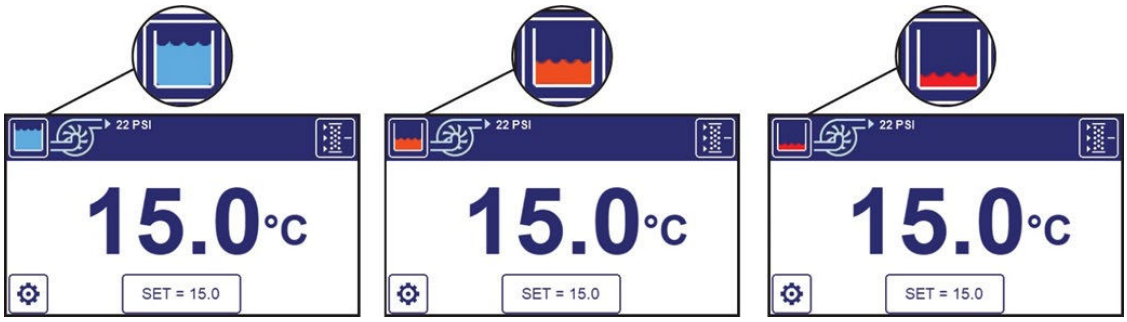
Press the Set Temperature Button to adjust the fluid temperature set point.

Press the Settings Button ⚙ to adjust other operating parameters such as Fahrenheit/Celsius selection.



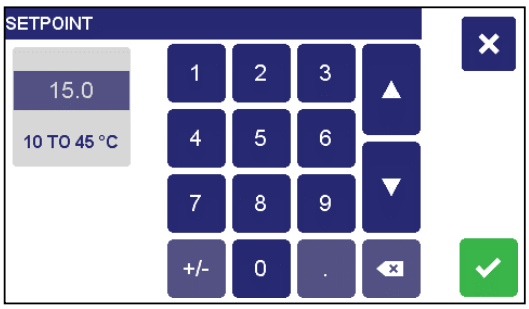
Liquid Level Sensor

The reservoir icon at the top of the Home Screen indicates reservoir fill level. When the fluid display is orange, the fill level is lower than normal, but the pump and compressor will continue to run. When the fluid display is red, the pump and compressor will stop running because the reservoir fluid level is critically low. If the reservoir fluid level is low, check for leaks and re-fill the reservoir.



Setting a Temperature

Press the Set Button from the Home Screen. Alternatively, you may adjust the set point from the Menu. A numeric keypad will be displayed on the screen.

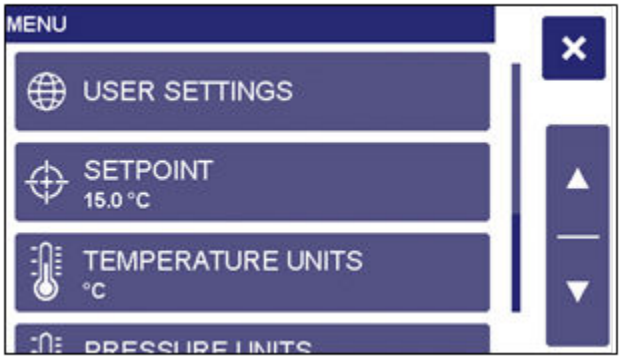


Enter the desired temperature set point. The value will be reflected in the left box. If you wish to set a value less than zero, press the +/- button to switch between positive and negative set point values. The set point limits are displayed underneath the set point. Values outside of the set point limits will not be accepted. You may also use the arrows to raise or lower the set point without using the number pad. Acknowledge and save the selection by pressing ✓, or discard the selection by pressing ×.

Access Settings and Other Functions in the Menu

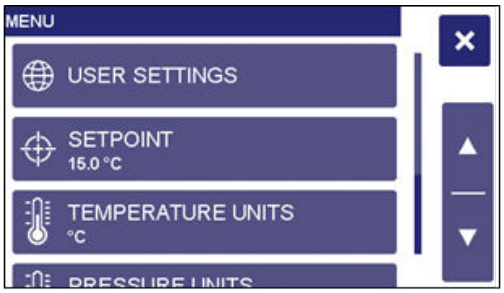
Access the Menu by pressing from the Home Screen or Standby Screen. In the menu, you will see the active settings for various parameters such as Temperature Units, Display Language, Set Point Limits, Alarm Settings, and Maintenance Reminders. Data Logging, Diagnostics and Chiller Self Test are all accessible from the Menu.

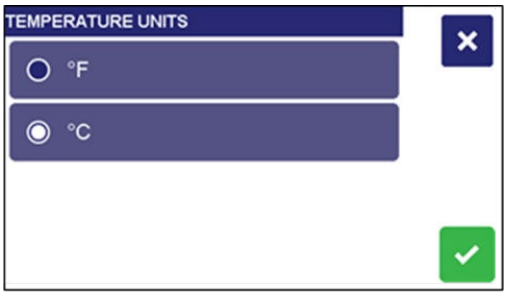
Press any of the Menu items to access and adjust functions associated with that item. Use the up and down arrow keys to display additional Menu items. Press to return to the Home Screen.



Selecting the Temperature Unit (°C or °F)

Access the Menu by pressing from the Home Screen or Standby Screen. The active Temperature Units selection will be displayed in the menu. Press "TEMPERATURE UNITS" to access the Temperature Units Selection Screen. Press the desired selection. Acknowledge and save the selection by pressing , or discard the selection by pressing .





List of Chiller Menu Parameters

Menu Items and Settings	Description
User Settings	Access User Settings Menu
Setpoint	Adjust the Chiller's set temperature
Temperature Units	Select Celsius or Fahrenheit display
Pressure Units	Select PSI or kPa display
Air Filter	Access air filter maintenance screen. Use this screen to setup maintenance reminders for the passive air filter.
Fluid Maintenance	Access fluid maintenance screen. Use this screen to set maintenance reminders for fluid and water filter.
Setpoint Limits	Set the high and low limits for the Chiller set temperature
Temperature Alarms	Continuous Chiller operation outside of these settings will cause the Chiller to alarm. These settings can be used to protect equipment connected to the Chiller, or the fluid, from extreme temperatures.
Fluid Pressure Alarms	Continuous operation outside these settings will cause the Chiller to alarm. These settings can be used to protect equipment connected to the Chiller.
Specific Heat Capacity	If the Chiller's process fluid has a specific heat that is vastly different than water, temperature stability may be affected. The operator can improve stability by adjusting the Chiller's Specific Heat Capacity setting to match that of the fluid.
Remote Control Switch	The operator may choose how a remote contact is used to start and stop the Chiller. The operator can choose to disable remote control, start the Chiller when the remote contact opens, or start the Chiller when the remote contact closes.
External Monitor / Control	This setting determines how a remote P2 probe or the internal ambient P3 probe are used. When only the ambient P3 probe is present with no external probe, the operator may use "P3 SETPOINT MODE" so that the set temperature tracks the ambient temperature. When a remote P2 probe is connected, the operator may select the following additional modes: "MONITOR MODE" displays the P2 reading without using it for control. "CONTROL MODE" uses the external P2 sensor as the process temperature. In Control Mode, the Chiller will act to maintain the P2 reading at setpoint. This will typically be used when the Chiller is connected to reactors, jacketed vessels, heat exchangers, and similar equipment. "P2 SETPOINT MODE" will use the external P2 sensor to determine set temperature. This is commonly used for ambient tracking applications.
Setpoint Offset	This setting is only used in P2 SETPOINT MODE or P3 SETPOINT MODE. The Setpoint offset is added to the P2 or P3 reading, resulting in the effective set temperature. The Setpoint Offset may be positive or negative.
| P1 – P2 | Max	This setting is only used in CONTROL MODE when controlling with an external P2 sensor. This setting helps establish the cooling/heating rate when the remote temperature control probe is being used. The higher the setting, the more rapidly the Chiller will achieve the external temperature set point. Low differential temperature settings minimize the amount of temperature overshoot/undershoot that occurs when the measured external temperature reaches the external set point temperature.
Calibration OFFSET P1 INTERNAL	This menu item allows you to adjust the Chiller's internal temperature reading to match that of a traceable standard.
Calibration Offset P2 External	This menu item allows you to adjust the Chiller's external temperature reading to match that of a traceable standard.
Maintenance Reminder	The operator may set a periodic maintenance reminder for any purpose.
Ambient Air Alarms	Measured air temperature outside these settings will cause the chiller to alarm.
Diagnostics	Enter Diagnostics menu. View operating conditions, including compressor and pump current draw, line voltage and frequency, ambient temperature, relative humidity, barometric pressure, cumulative running time, number of on/off cycles, fluid level, remote control switch status, and firmware version. From the Diagnostics Menu, the operator may run a Diagnostic Self Test, View the last Diagnostic Self Test, and perform a Factory Reset to default settings.

User Settings	Description
Language Selection	Sets the language used throughout the Chiller's interface.
Data Log	Sets the frequency at which data is logged to a USB drive
Fluid Level Sensor Enabled	Certain fluids and operating points may affect the performance of the level sensor. In this case the level sensor may be disabled. If the sensor is disabled, the operator must be responsible for maintaining fluid level.
Buzzer Enabled	The operator may disable the audible indication of alarms.
USB Device Mode	When fitted with the optional USB-B port, this setting will determine whether the port acts as a USB Virtual Serial Port or a USBTMC device.
Screen Brightness	The operator may adjust the screen's brightness level.
RS232	Sets the baud rate for RS232 communications.

Adjusting the High Pressure Bypass Setting

The Chiller incorporates a bypass pressure regulating valve to limit the outlet fluid pressure of the Chiller. This valve is adjustable and is accessible from outside of the Chiller. It is located on the rear of the Chiller housing.

CAUTION **Discharge of high pressure fluid and fluid spills may result from over-pressurization. Personal safety hazard and damage to equipment, material, or facilities may result from the discharge of high pressure fluid and spills. The pressure regulator should only be adjusted by personnel familiar with the piping, hoses, equipment that are connected to the Chiller, and their maximum working pressures.**

The high-pressure bypass is adjusted as follows:

1. Completely block the Chiller's outlet flow. This should cause the outlet pressure to rise.
2. Rotate the handle on the pressure valve until the desired maximum pressure setting is shown on the Home Screen.

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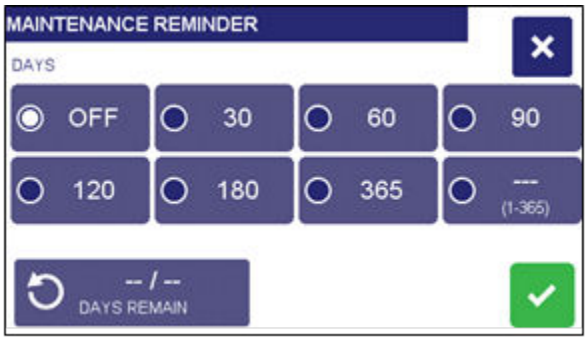
5 Routine Maintenance and Troubleshooting

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Routine Maintenance

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

For convenience, a maintenance reminder can be set on the unit. This can be found by navigating to the Maintenance Reminder item in the menu. Select one of the preset values or create your own using the Custom option. Press to reset an existing timer.



To create a custom reminder, select the button marked "---" and enter a value from 1 up to 365 days. Once you have selected a custom value, the "---" value will be replaced with the selected value. Select that button again to choose a different custom maintenance interval.

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 regular basis and cleaned as required.

Air Filter Access

To access the filter, grasp the handle at the top of the Chiller's front access panel and pull outwards. The filter is located behind the panel.

Passive Filter

This filter should be checked on a regular basis and cleaned as required. Use a mild detergent and water solution to wash off any accumulated dust and dirt. Rinse and dry thoroughly before reinstalling.



Fluid Level Sensor

Your Chiller is equipped with a sensor that continuously monitors fluid level in the reservoir. The fluid level will be shown on the Home Screen. Generally, fluid should be added whenever the display fluid level indicates “LOW FLUID LEVEL”.

Fluid Properties

The circulating fluid in your Chiller is the vital to the cooling system. If you are using an antifreeze fluid, it should be checked regularly to ensure that it hasn't lost any of its cooling and/or antifreeze properties. In certain applications, dirt and other particulate can make its way into the circulating fluid of your Chiller. This is bad for the Chiller, especially for the pump. If large amounts of debris are present the fluid should be drained and the Chiller flushed.

Draining the fluid

Disconnect the Chiller from the process, aim the outlet tube down a drain or into a collection container, and pump the fluid out following instructions on draining the fluid.

1. Ensure the pump is not run dry.
2. Flush the system with clean tap water to wash out remaining deposits. Do not use hard water or water with solid particulates to flush the system. If clean tap water is not available, use distilled water.
3. It may be necessary to flush abundantly with clean tap water first and then run a longer closed cycle clean up with distilled water.
4. If algae growth is present, run a closed cycle (connect a hose between the inlet and the outlet to circulate the fluid inside the chiller) with Agilent Cool Clear.

Once the system is clean, reconnect the chiller to the process and fill the reservoir with clean fluid. Turn the Chiller on, and continue to fill until the fluid returns to the reservoir.

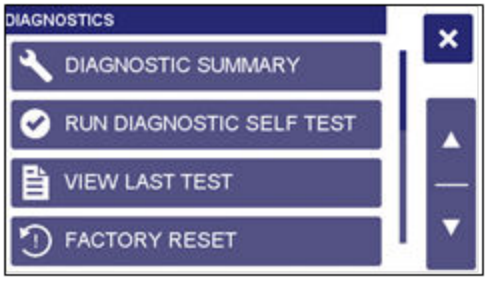
Temperature Calibration

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 internal and/or external temperature calibration offset functions.

Diagnostic Self Test

You may periodically wish to check the performance of your Chiller against its original metrics. To start the Diagnostic Self Test, select "DIAGNOSTICS" from the main menu. In the Diagnostics menu, select "RUN DIAGNOSTIC SELF TEST" and follow the on-screen prompts. If you wish to save your test data, you may insert a USB Storage Device in the front port at the beginning of the test process.





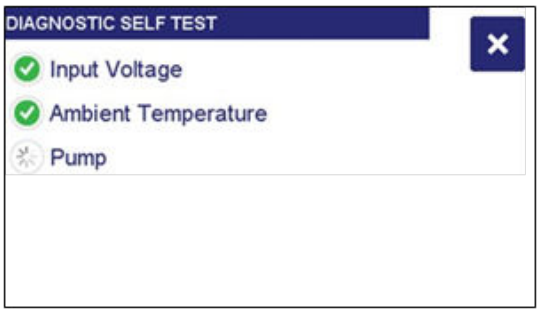
A series of prompts will guide you through the process. The Diagnostic Self Test process will take approximately 20 minutes. During this time, pump flow stop and temperature control to your process will be interrupted.

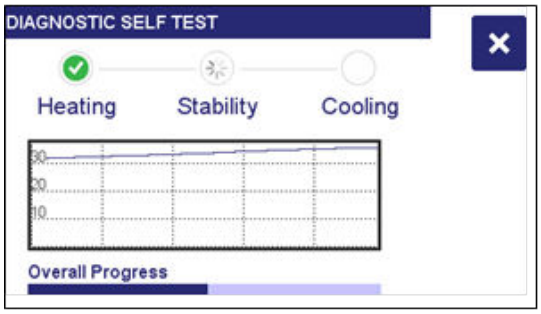
CAUTION **Do not start the Diagnostic Self Test if the equipment or process being cooled by the Chiller is running or if it may start. Damage may result if the equipment being cooled is allowed to run during a Diagnostic Self Test.**

Once the Diagnostic Self Test has stopped pump flow, you will be asked to connect a short piece of hose (about 1m or 3.3ft) between the inlet and outlet of the Chiller. This allows for Chiller performance to be measured in isolation from external equipment or long lengths of process tubing.

NOTE If you do not connect the inlet directly to the outlet, the results of the Diagnostic Self Test may not be valid.

Test progress will be indicated on screen:



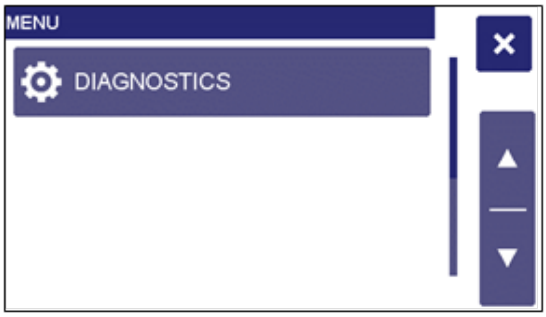


Troubleshooting

Restoring Factory Default Settings

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.

Factory Default settings can be restored through the Menu Screen. The Chiller must be in Standby in order to restore factory defaults.



In the main menu, select "DIAGNOSTICS"



Select "FACTORY RESET"



Recommended Troubleshooting Procedures

CAUTION **Refer servicing to qualified service personnel.**

WARNING **Electrical Hazard**
When electrical power is ON, dangerous voltages exist within chassis components.
Use extreme care when measuring voltages on live circuits.



	Possible Causes	Corrective Action
Unit does not run (display is 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 (display shows "Press ⏻ to start")	Unit in Standby mode	Press Standby 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. Check fuse and replace as necessary. Check for electrical short circuits before replacing fuse. Replace pump.
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 (air-cooled models)	Clean air filter and/or condenser as required.
	Blocked air ventilation screens (air-cooled models)	Remove blockages as required.
	Excessive heat load	Check that heat load does not exceed capacity of Chiller; correct as required.
	Ambient air temperature too high	Decrease ambient air temperature. Check and correct as required.
	Low or high line voltage (should be within +/- 10% of nameplate)	Check fuse and replace as required.
	Blown fuse	Check for electrical short circuits before replacing fuse.
	Faulty temperature sensor	Check the temperature sensor readings (see "Diagnostic Mode" on page 33). If any of these temperature readings is "–", the sensor needs to be replaced. Perform a Diagnostic Self Test (refer to "Diagnostic Self Test" on page 28).

Display, Alarm, and Error Messages

Error Message	Warnings and Faults	Corrective Actions	Device Behavior	Fault Code for Remote Communications
DISCHARGE TEMPERATURE SENSOR FAILURE	Discharge temperature sensor has failed.	Replace the discharge temperature sensor	Warning only	1
SUCTION PRESSURE SENSOR FAULT	Suction pressure sensor has failed.	Replace the suction pressure sensor	Compressor, fan, and pump are turned off.	2
P1 FAILURE	P1 temperature sensor has failed.	Replace the internal fluid temperature sensor	Compressor, fan, and pump are turned off.	3
P2 FAILURE	P2 temperature sensor has failed.	Check connection Replace the external temperature sensor	Compressor, fan, and pump are turned off.	4
P3 FAILURE	P3 temperature sensor has failed	Replace the P3 sensor assembly	Compressor, fan, and pump are turned off.	5

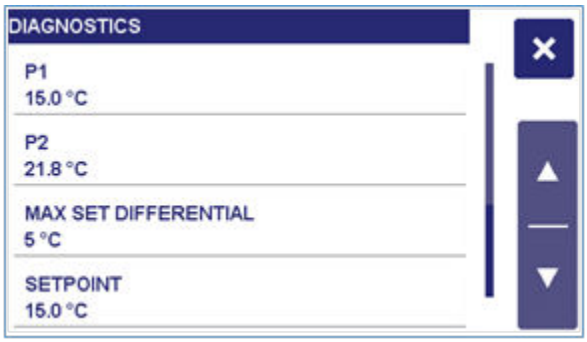
Error Message	Warnings and Faults	Corrective Actions	Device Behavior	Fault Code for Remote Communications
SETPOINT ABOVE HIGH TEMPERATURE SETTING	Temperature set point is higher than the high temperature limit.	Lower the set point or raise the High Temperature Alarm	Warning only	6
SETPOINT BELOW LOW TEMPERATURE SETTING	Temperature set point is lower than the low temperature limit.	Raise the set point or lower the Low Temperature Alarm	Warning only	7
LOW FLUID LEVEL	Liquid level in the reservoir is below 35% for over 10 seconds.	Check the fluid connections for leaks Add fluid to the reservoir	Compressor, fan, and pump are turned off.	8
LEVEL LESS THAN 35% ON STARTUP	Fluid level is less than 35% on startup.	Check the fluid connections for leaks Add fluid to the reservoir	Compressor, fan, and pump remain off.	9
LOW FLUID FLOW	Internal fluid flow has fallen below the factory determined minimum rate for more than 10 seconds.	Check pump fuse, and replace as necessary Check that the fluid being used is appropriate for the operating temperature Check that the stepper motors are functioning properly	Compressor, fan, and pump are turned off.	10
HIGH FLUID PRESSURE	Fluid outlet pressure has exceeded the high pressure limit for more than 10 seconds.	Check process fluid lines for restrictions Increase the high fluid pressure alarm setting Increase the output regulated pressure valve setting (if applicable)	Compressor, fan, and pump are turned off.	11
LOW FLUID PRESSURE	Fluid outlet pressure has fallen below the low pressure limit for more than 10 seconds.	Check the pump fuse Lower the low fluid pressure limit	Compressor, fan, and pump are turned off.	12
HIGH FLUID TEMPERATURE	Fluid temperature is higher than the high temperature limit value.	Check the compressor fuse Check that the stepper motors are functioning properly Raise the high limit	Compressor, and fan are turned off; pump remains on.	13
LOW FLUID TEMPERATURE	Fluid temperature is lower than the low temperature limit value.	Check that the stepper motors are functioning properly Lower the low limit	Compressor, and fan are turned off; pump remains on.	14
FILTER MOTOR FAILURE	Dynamic air filter motor has failed.	Replace dynamic air filter assembly	Warning only	15
MAINTENANCE REMINDER	Maintenance reminder timer has expired.	Reset as necessary	Warning only	16
CHECK FILTER REMINDER	External fluid filter timer has expired.	Check the external fluid filter and replace as needed	Warning only	17
REPLACE FLUID REMINDER	Fluid replace timer has expired.	Change the fluid	Warning only	18
MANUAL AIR FILTER REPLACEMENT REMINDER	Manual air filter timer has expired	Clean the air filter	Warning only	19
AUTO ADVANCE FILTER REMOVED	Automatic air filter removed from unit.	Replace the dynamic air filter assembly	Warning only	20
UV LED FAILURE	UV module has failed.	Replace the UV module	Warning only	21

Error Message	Warnings and Faults	Corrective Actions	Device Behavior	Fault Code for Remote Communications
DYNAMIC AIR FILTER LOW	Dynamic air filter has 30 days or less remaining.	Consider ordering a replacement dynamic air filter assembly	Warning only	22
HEATER OVER TEMPERATURE SAFETY ACTIVE	The safety device on the optional electrical heater has tripped.	Contact factory	Warning only	23
HIGH AIR TEMPERATURE	Ambient air temperature is above the high ambient air alarm.	Lower the ambient air temperature Raise the high ambient air alarm Check the refrigeration fan	Warning only	24
LOW AIR TEMPERATURE	Ambient air temperature is below the low ambient air alarm.	Raise the ambient air temperature Lower the low ambient air alarm	Warning only	25

Diagnostic Mode

The Chiller incorporates a display of diagnostic information. To access Diagnostics, enter the Menu and press the DIAGNOSTICS item.

NOTE Diagnostic items are display values only; they cannot be changed.



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6 Technical Information

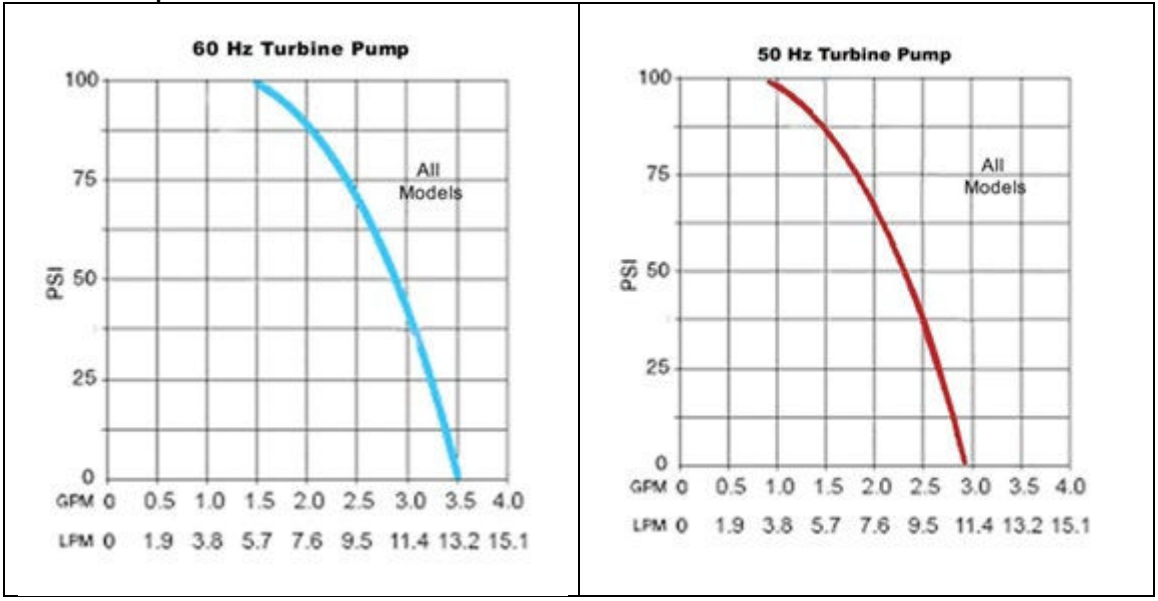
General Specifications (all Chillers) 35
Pump Performance 35
Performance Specifications — 60Hz Chillers 36
Performance Specifications — 50Hz Chillers 36
Communications 37
Certificate of Compliance 41

General Specifications (all Chillers)

Temperature Set Point Resolution	0.1°C
Temperature Stability	±0.1°C
Temperature Units	°C or °F
Pressure Units	psi or kPa
Pressure Display Resolution Pressure Display Accuracy	1 psi / 6.9 kPa ±3.5% of full scale (100 psi)
Pump Inlet and Outlet	½ inch NPT

Pump Performance

Turbine Pump



Performance Specifications — 60Hz Chillers

Air-Cooled 1-HP Chillers

Pump		Turbine Pump (60Hz)	
Compressor		1 HP	
Operating Temperature		-10° to 70°C	
Cooling Capacity @	20°C 10°C 0°C	2900 watts 1925 watts 1000 watts	9904 BTU/hr 6574 BTU/hr 3415 BTU/hr
Flow Rate @ 0 psi		3.5 gpm / 13.2 lpm	
Pump Pressure (adjustable)		20 to 90 psi 138 to 621 kPa	
Reservoir Capacity		1.1 gal / 4.2 liters	
Shipping Weight		177 pounds 80.3 kg	
Voltage Range		182-264 V	
Full Load Amps		13.5 A	

Specifications subject to change without notice.

NOTE

- Refer to the serial number plate on the rear of the Chiller for model and electrical data.
- Cooling capacity (watts x 3.41) = BTU/hour.
- Performance specifications determined at ambient temperature of 20°C (68°F).
- External pressure reducing assembly (Cat. No. 060302) steps down high outlet pressure to 10 to 45 psi.

Environmental Conditions

- Indoor use only
- Maximum Altitude: 2000 meters
- Operating Ambient: 5° to 40°C
- Relative Humidity: 80% for temperatures to 40°C
- Installation Category II
- Pollution Degree: 2
- Sound Level: Less than 70 dB(A) A-weighted emission sound pressure level

Performance Specifications — 50Hz Chillers

Air-Cooled 1-HP Chillers

Pump	Turbine Pump (50Hz)
Compressor	1 HP
Operating Temperature	-10° to 70°C

Pump	Turbine Pump (50Hz)	
Cooling Capacity @ 20°C 10°C 0°C	2650 watts 1900 watts 1000 watts	9050 BTU/hr 6489 BTU/hr 4098 BTU/hr
Flow Rate @ 0 psi	2.9 gpm / 11 lpm	
Pump Pressure (adjustable)	20 to 75 psi 138 to 517 kPa	
Reservoir Capacity	1.1 gal / 4.2 liters	
Shipping Weight	177 pounds / 80.3 kg	
Voltage Range	180 to 264V Category II Over Voltage	
Full Load Amps	12.0 A	

NOTE

- Refer to the serial number plate on the rear of the Chiller for model and electrical data.
- Cooling capacity (watts x 3.41) = BTU/hour.
- Performance specifications determined at ambient temperature of 20°C (68°F).

Environmental Conditions

- Indoor use only
- Maximum Altitude: 2000 meters
- Operating Ambient: 5° to 40°C
- Relative Humidity: 80% for temperatures to 40°C
- Installation Category II
- Pollution Degree: 2

Communications

Connector Pinout

Front USB – A full-size, female USB-A socket is located at the front of the Chiller below the display. It is intended for datalogging and firmware upgrades and should not be used for charging external devices.

Pin #	Functionality
1	+5Vdc
2	Data -
3	Data +
4	Ground

Rear USB – An optional full size, female USB-B socket will be located on the rear panel of the Chiller. It is intended for communicating with a PC.

Pin #	Functionality
1	+5Vdc
2	Data -
3	Data +
4	Ground

Remote Control Switch and Status – An optional 15-pin male d-sub connector will be located on the rear panel of the Chiller. It contains connections for a dry contact input for turning the unit off and on and for the status relay. The functionality of the dry contact input (open or close to turn the Chiller on) can be configured in the Menu, see page 24 for more information. The status relay is energized when the Chiller is running normally and de-energized when a fault condition is detected or the unit is placed in Standby. Only the pins listed below are needed.

Remote Control Switch (dry contact)	
Pin #	**Functionality**
1	Dry contact input #2
2	Dry contact input #1
3	Status relay Normally Open Contact
5	Status relay Normally Closed Contact
8	Dry contact input #1 alternate
11	Status relay Common contact
15	Dry contact input #2 alternate

Status relay		
	Pin 3 to Pin 11	**Pin 5 to Pin 11**
Power Off		X
Standby		X
Alarm		X
Running	X	

RS-232 – An optional 9-pin female d-sub connector will be located on the rear panel of the Chiller. Only the pins listed below are needed.

Pin #	Functionality
2	Data read (data from computer)
3	Data transmit (data to computer)
5	Signal ground

External Probe – An optional 9-pin male d-sub connector will be located on the rear panel of the Chiller. This port is only intended for connecting to a 4-wire 100-ohm platinum RTD sensor with a temperature coefficient of resistance of 0.00385 ohm/ohm/°C. Only the pins listed below are needed.

Pin #	Functionality
3	Shield
6	RTD Element Side 1
7	RTD Element Side 1
8	RTD Element Side 2
9	RTD Element Side 2

Serial Port Protocol Definitions and Commands

RS-232 Protocol — The Chiller uses the following protocol:

- Data bits — 8
- Parity — none

- Stop bits — 1
- Flow control — none
- Baud rate — Adjustable (2400, 9600*, 19200, 38400, 57600, or 115200)
  *default

Virtual Serial Port Protocol — The Chiller uses the following protocol:

- Data bits — 8
- Parity — none
- Stop bits — 1
- Flow control — none
- Baud rate — N/A (any baud rate selection on the PC will work)

RS-232 and Virtual Serial Port Commands — Commands must be entered in the exact format shown. Do not send a [LF] (line feed) after the [CR] (character 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] or ?[CR]
Set on / off	SOi[CR]	On: i = 1 Off: i = 0	![CR] or ?[CR]
Set set point	SS(x)(x) x (.)(x)[CR]	x = ASCII digit	![CR] or ?[CR]
Read set point temperature	RS[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read temperature	RT[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read probe 1 temperature	R1[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read probe 2 temperature	R2[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read temperature units	RU[CR]	C = °C, F = °F	C[CR] or F[CR]
Read status	RW[CR]	1 = Run 0 = Standby	1[CR] or 0[CR]
Read pressure in PSI	RP[CR]	x = ASCII digit	+ xxx.x[CR]
Read pressure in kPa	RK[CR]	x = ASCII digit	+ xxx.x[CR]
Read flow in GPM	RG[CR]	x = ASCII digit	+ xxx.x[CR]
Read flow in LPM	RL[CR]	x = ASCII digit	+ xxx.x[CR]
Read line voltage	RV[CR]	x = ASCII digit	+ xxx.x[CR]
Read remote probe temperature	RR[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read ambient temperature	RA[CR]	x = ASCII digit	+xxx.x[CR] or - xxx.x[CR]
Read fluid level status	RX[CR]	0 = fluid level is ok 1 = fluid level is low	0[CR] or 1[CR]
Read fluid level	RFL[CR]	x = ASCII digit	+(x)(x)x.x[CR]
Read compressor amperage	RCA[CR]	x = ASCII digit	+(x)x.x[CR]
Read pump amperage	RPA[CR]	x = ASCII digit	+(x)x.x[CR]
Read relative humidity	RRH[CR]	x = ASCII digit	+(x)x.x%[CR]
Read barometric pressure	RBP[CR]	x = ASCII digit	+(x)xxx.x[CR]

Command Description	Command Format	Values	Return Message
Read hours of operation	ROC[CR]	x = ASCII digit	(x)(x)(x)(x)x[CR]
Read on/off cycle counter	RCC[CR]	x = ASCII digit	(x)(x)(x)(x)x[CR]
Read fault status (see Display, Alarm, and Error Messages)	RF[CR]	00 = System OK 01 – 25 = Warning or Fault	xx[CR]

USBTMC – The Chiller is also compliant with subclass 488 of the USBTMC class of instruments. Changing the menu selection from Serial to USBTMC will allow the unit to use the rear USB-B port to enumerate as a USB Test & Measurement Class Device.

The following commands can be sent with or without a newline termination. Multiple commands may also be sent at once, but must have a [;] separating each.

Command Description	Command Format	Values	Return Message
Set on / off	RUNi\n	On: i = 1 Off: i = 0	N/A
Set set point	SET(x)(x) x (.)(x)\n	x = ASCII digit	N/A
Read set point temperature	SET?\n	x = ASCII digit	+xxx.x\n or - xxx.x\n
Read probe 1 temperature	TP1?\n	x = ASCII digit	+xxx.x\n or - xxx.x\n
Read probe 2 temperature	TP2?\n	x = ASCII digit	+xxx.x\n or - xxx.x\n
Read temperature units	TUNITS?\n	C = °C, F = °F	C\n or F\n
Read status	RUN?\n	1 = Run 0 = Standby	1\n or 0\n
Read pressure in PSI	PRES?\n	x = ASCII digit	+ xxx.x\n
Read flow in GPM	FLW?\n	x = ASCII digit	+ xxx.x\n
Read line voltage	VAC?\n	x = ASCII digit	+ xxx.x\n
Read remote probe temperature	TP2?\n	x = ASCII digit	+xxx.x\n or - xxx.x\n
Read ambient temperature	TAMB?\n	x = ASCII digit	+xxx.x\n
Read fluid level	LVL?\n	x = ASCII digit	+(x)(x)x.x\n
Read fault status (see Display, Alarm, and Error Messages)	ERR?\n	00 = System OK 01 – 21 = Warning or Fault	xx\n
Read Unit ID	*IDN?\n	x = ASCII digit	PolyScience,Chiller,xxxxxxx[1],xx.xx.xx[2]\n
Self-test query	*TST?\n	n/a	OK/n
Read event status enable register value	*ESE?\n	x = ASCII digit	x\n
Read event status register value	*ESR?\n	x = ASCII digit	x\n
Read operation complete status	*OPC?\n	1 = Complete 0 = Not Complete	1\n or 0\n
Read status byte register	*STB?\n	x = ASCII digit	xx\n
Clear status structure	*CLS\n	No Effect	
Set status enable register contents	*ESE\s(x)(x)x\n	No Effect	
Set operation complete bit	*OPC\n	No Effect	
Set service request enable register	*SRE\n	No Effect	
Read service request register	*SRE?\n	0	0\n
Individual status query	*IST?\n	0	0\n
Reset the device	*RST\n	No Effect	
Execute trigger function	*TRG\n	No Effect	
Wait to continue	*WAI\n	No Effect	

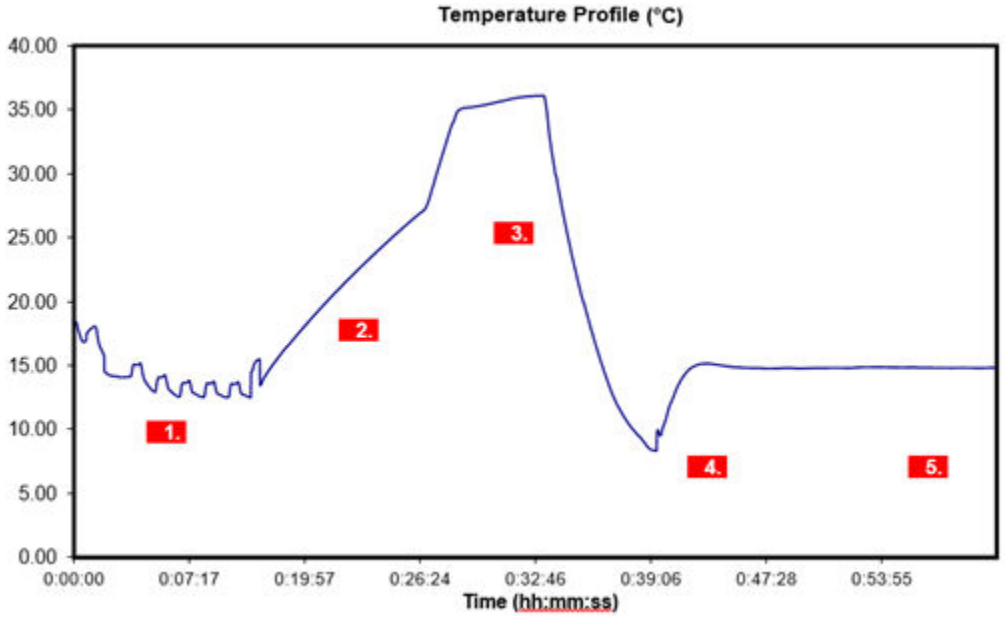
Command Description	Command Format	Values	Return Message
Parallel poll enable register	*PRE\n	No Effect	
Pass control back	*PCB\n	No Effect	

1 - Unique ID number

2 - Firmware version

Certificate of Compliance

All Chillers are tested after assembly to ensure that the product meets or exceeds published mechanical and safety specifications as well as your satisfaction. The Certificate of Compliance is included with the Chiller. The following graph explains the steps involved in a typical test.



1 Unit runs an On/Off cycle.
2 Heat performance of unit measured.
3 Cooling performance of unit measured.
4 Heat load applied to Chiller to simulate real application conditions. The heat load applied is based on the Chiller's cooling capacity.
5 Temperature stability of unit measured.

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7 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

It is recommended to perform a Diagnostic Self Test as part of the troubleshooting process. The Diagnostic Self Test will determine if the Chiller is able to match its factory validated performance in the installation environment, and the Self Test is useful for isolating the Chiller from external factors such as process piping. The Diagnostic Self Test will also provide a data log file that can be sent to and analyzed by Customer Service. Refer to Diagnostic Self Test.

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In this manual:

- Introduction
- Installation
- Startup
- Normal Operation
- Routine Maintenance and Troubleshooting
- Technical Information
- Service and Technical Support

This information is subject to change without notice.

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