QSONICA
SONICATORS

Recirculating Chiller

Model #4900

Operation Manual

TABLE OF CONTENTS

CAUTION

* Never operate the chiller without water.

* Never disassemble the Chiller unit as irreparable damage may occur.

* Never store the Chiller over 60 °C.

* Never operate the Chiller in ambient temperatures of 40 ℃ or greater.

* Never operate the Chiller within 2 ℃ of the coolants freezing point.

* Always use only proper coolants as specified in manual.

* Never ship the Chiller with water inside the liquid cold plate as freezing temperatures may be encountered which would damage the unit. Always pump all water out of the Chiller prior to shipping.

Qsonica #4900

THERMOELECTRIC CHILLER

SECTION 1
INTRODUCTION _____

The Chiller is a thermoelectric temperature control system with full PID control of both heating and cooling. It provides 500 ml/min of constant temperature coolant for controlling the operating temperatures of lasers, medical equipment, semiconductor equipment, or any process requiring temperature control. It also has a cycling feature where two different temperature set points may be entered with a soak time at each temperature and the number of cycles desired. It does not use Freon or any other replacement gas. From conception, this Chiller has been designed for long life and ease of use.

The Chiller ships with the items listed below. Please locate them prior to discarding the shipping box.

(1) #4900 Recirculating Liquid Chiller
(2) 200 watt 13.5 VDC Table Top Power Supply
(3) AC Line Cord
(4) 250 ml Squirt Bottle
(5) Valve quick disconnect fittings, 1/8" hose barb
(6) In-line Filter Kit

EC Declaration of Conformity

We declare under sole responsibility that the #4900 Thermoelectric Chiller meets the intent of Directive 89/336/EEC and amendments 92/31/EEC, 93/68/EEC for Electromagnetic Compatibility and the Low Voltage Directive 2006/95/EEC. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

Emissions: EN55011 Group 1 Class A

EN 55011: 97 + A1:1999 + A2:2002 Radiated Emissions, Group 1 Class A
EN 55011: 97 + A1:1999 + A2:2002 Conducted Emissions, Group 1 Class A
EN 61000-3-2: 2006 Harmonics
EN 61000-3-3: 1995 + A1:2001 Flicker Meter

Immunity: IEC 60601-1-2

EN 61000-4-2: 1995 + A1 1998 + A2:2001 Electrostatic Discharge
EN 61000-4-3 +A1: 2002 Radiated Susceptibility (RF)
EN 61000-4-4: 2004 Electrical Fast Transient (EFT)
EN 61000-4-5: 1995 + A1:2001 Surge Susceptibility

EN 61000-4-6: 1996 + A1:2001 Conducted Disturbances Induced by RF Fields
EN 61000-4-8: 1993 + A1:2001 Power Frequency Magnetic Field Immunity
EN 61000-4-11: 12004 Voltage Dips and Interference (VDI)

Safety:

EN 61010-1: 2nd Edition (2001), Safety Requirements for Electrical Equipment for
Measurement, Control and Laboratory Use - Part 1: General

SECTION 2
SPECIFICATIONS _____

Set Point Range:	2°C to 45 °C
Control Accuracy:	± 0.1 °C
Coolant Type:	<u>Water only</u> with a cup horn/Sonicator device.

Ethylene Glycol and Water mixtures may be acceptable if the chiller is used with an alternate type of device. Consult the equipment manufacturer of the device for which the chiller will be used to cool.
Note: Methanol, Ethanol, or Isopropyl Alcohol may not be used as coolants, either by themselves or in water mixtures; use of these coolants voids the Chiller warranty.

Nominal Cooling Capacity:	180 watts @ 20°C in a 20°C ambient
Operating Voltage:	13.5VDC, 15 amps max
AC/DC Power Supply:	200 watt, 13.5 VDC; 100-240 VAC input
Safety Certifications: (with power supply)	CE/ UL (TUV)
Coolant Pump:	500ml/min brushless DC magnetically driven gear (See Figure 2 for pump curve)
Coolant Outlet Pressure (Water):	Nominal 5psi @ 500ml/min Maximum 35 psig
Coolant Fluid Connections:	1/8" quick disconnect with shut-off valves
Dimensions:	7.5" x 5" x 7" (L x W x H, plus fittings)
Chiller Weight:	8.1 lbs. (3.7 kg.)

SECTION 3
HOOK UP_____

3.1 ELECTRICAL CONNECTIONS (SEE FIGURE 1)

Power: Connect 13.5 VDC power (15 amps) to the 2-pin circular connector provided, (Kycon KPPX-4P), as follows:

13.5 VDC (+):	Pin 1
13.5 VDC (-):	Pin 2
13.5 VDC (+):	Pin 3
13.5 VDC (-):	Pin 4

Note: The 13.5 VDC power supply comes with this connector pre-wired to the power supply.

Alarms: The Chiller has one 250 VAC 1 amp dry contact relay to indicate a system alarm or temperature out of range. Connect to this dry contact on the 9-pin dsub connector as follows:

System/Temp Alarm:	Pin 1
Alarm Signal Return:	Pin 6

RS 232: The Chiller comes with a RS-232 communication link. Connections are made via a 9-pin dsub connector as follows:

9 Pin D-Sub Pin#	RS-232 Signal Description
2	Transmit Data (TXD)
3	Receive Data (RXD)
5	Ground

3.2 PLUMBING CONNECTIONS (SEE FIGURE 2)

The Chiller has two Colder Products 1/8" valved quick disconnect coolant fittings. Two mating valved quick disconnect inserts are provided with 1/8" ID hose barb fittings for convenience.

Figure 1

9-pin Dsub
For RS-232 &
Dry Contact Alarms

RS-232
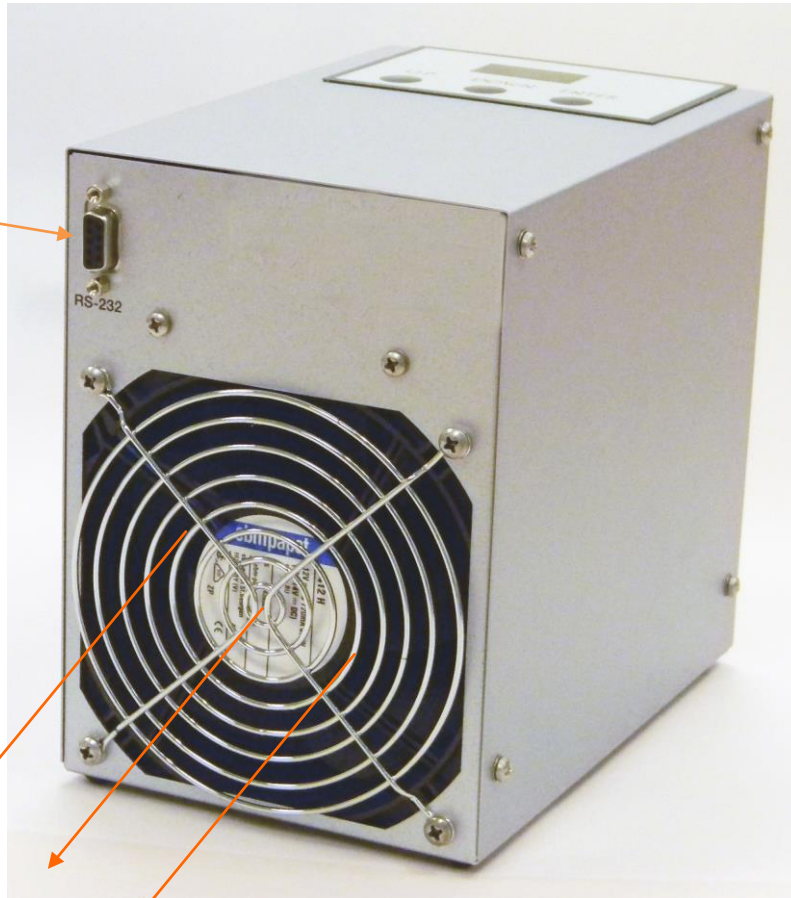
Airflow Outlet

Figure 2

ON/OFF Switch   Keypad   DC Power Connector

Coolant
Return

Coolant
Supply

Airflow Inlet

3.3 AIR CONSIDERATIONS

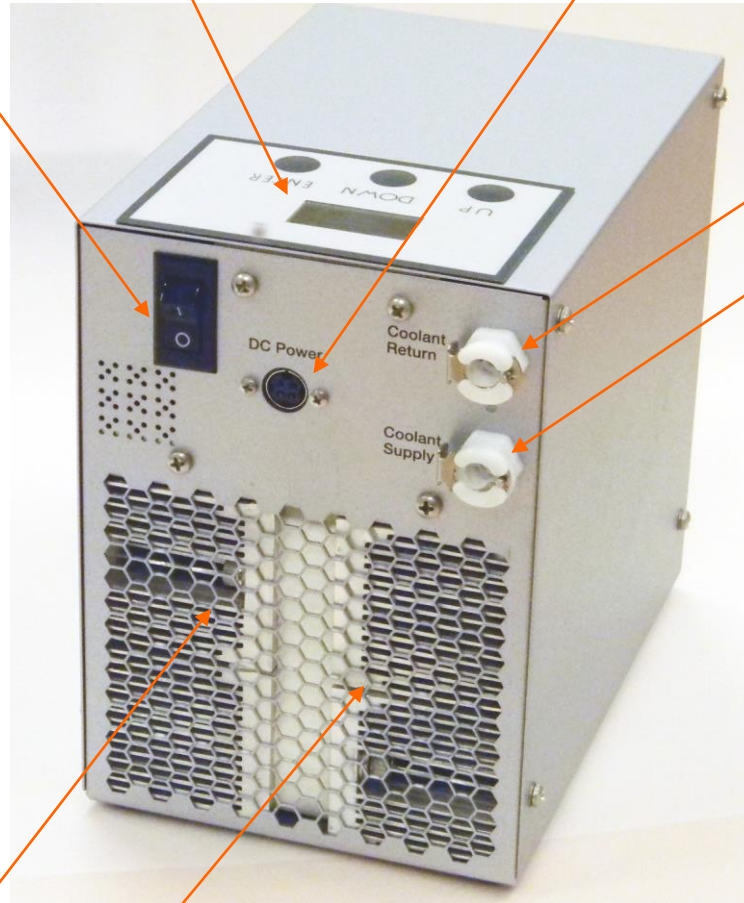Restricting airflow into or out of the Chiller will impair performance. Maintain at least 3" of clearance around the air inlet and outlet to ensure no restriction of airflow.

SECTION 4
START UP_____

4.1 START UP

Start-up the Chiller using the following steps:

1) Connect 1/8"ID hose to fluid connections located on the back side, labeled Coolant Supply and Coolant Return.
2) Ensure that the Filter kit is attached properly in-line on the Coolant Return tubing. *See Addendum for further instruction.*
3) Use the 250ml squirt bottle to add water to the Coolant Return and Coolant supply tubing. This will prime the chiller pump with water and ensure that it does not run dry during initial start up.
4) Connect the hoses to the Sonicator horn using the provided fittings/connections.
5) Fill the Sonicator reservoir with enough water to submerge the sample tubes.
6) Connect 13.5 VDC power to the 4-pin DIN connector (wired as per section 3.1).
7) Optional: connect the alarm signal to the 9-pin dsub connector as per section 3.1.
8) Turn on switch located to the left of the display. The front display should read the current coolant temperature.
9) Once the system is running the tubing will begin to fill and circulate water. This <u>may</u> lower the water level inside the Sonicator reservoir. Once water begins to flow, additional water may need to be added until the sample tubes are submerged to the desired level.
10) See Sonicator instructions for further advice with set up and operating parameters when sonicating along with the chiller.

Important Notes:
1) The Chiller performs a self-diagnostic check for 10 seconds after turn-on. If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual.

The Chiller is operated via the control panel located on the front panel. The control panel has an 8-character LCD display and three input keys: UP, DOWN, and ENTER. These keys work as follows:

Key	Action
UP	Pressing the UP key raises the parameter value displayed.
DOWN	Pressing the DOWN key lowers the parameter value displayed
ENTER	Pressing the ENTER key momentarily enters the parameter changed.
ENTER	Pressing and holding the ENTER key for 3 seconds changes the LCD display menu.

5.1 SIMPLE OPERATION (RECOMMENDED)

The Chiller comes with preset operating parameters that will work well for many applications. If temperature control at one temperature is desired, follow the steps below.
1) Turn on Chiller and wait for display to read T XX.X C
2) Press the UP or DOWN keys to change SET 1 to the desired set point.
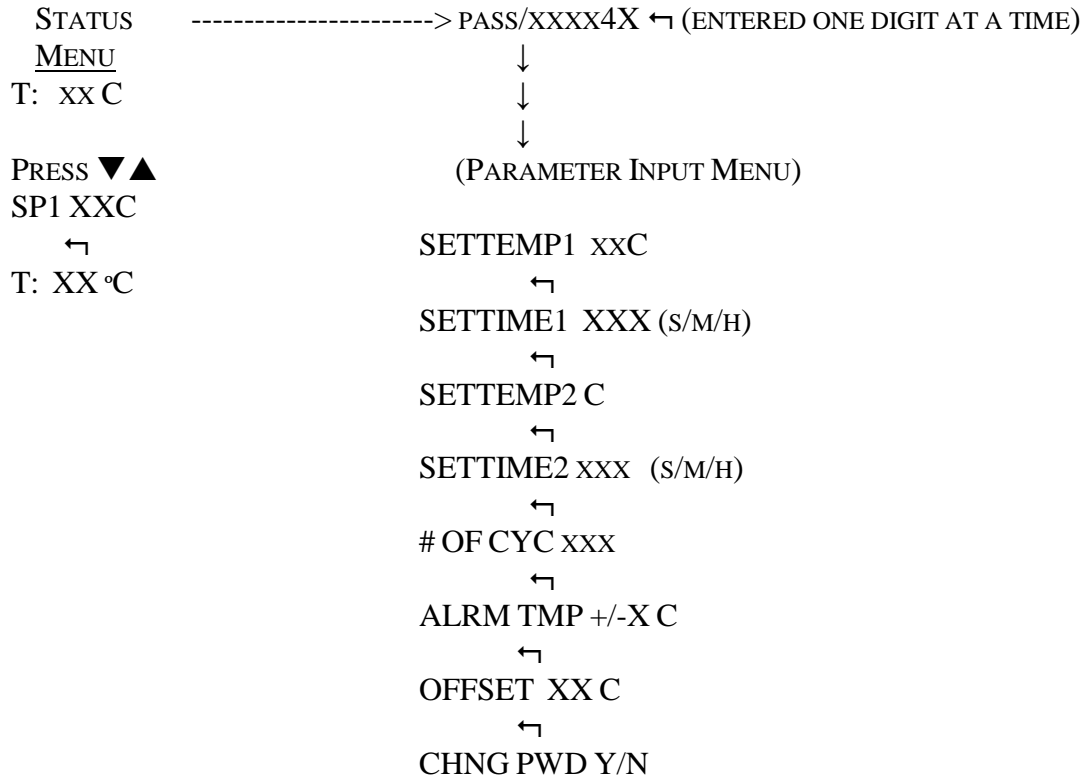3) Qsonica recommends 3^0C for most applications.
4) Press the ENTER key.
The Chiller will now control to the set point temperature. To change the set point temperature just press the UP or DOWN keys again to change SET 1 to the new set point, followed by the ENTER key.

5.2 ADVANCED OPERATION

The Chiller controller has two menus: the Status Menu and the Parameter Input Menu. The Status Menu shows the current temperature of coolant leaving the Chiller (see Figure 4). The Status Menu also allows input of new coolant temperature set points when the cycling feature is off. The Parameter Input Menu allows input of set point temperatures; soak times, number of cycles if cycling between two temperatures, an alarm temperature, a temperature offset, and a password to enter the Parameter Input Menu. (The default password is 0000 until changed by the user.) Press and hold the enter key for 3 seconds to enter the parameter menu.

Note: While in the Parameter Input Menu, if no keys are pressed for 30 seconds the display will revert to the status menu.

Figure 4   MENU STRUCTURE:

```
STATUS        -----------------------> PASS/XXXX4X ↩ (ENTERED ONE DIGIT AT A TIME)
MENU                              ↓
T:  XX C                          ↓
                                  ↓
PRESS ▼▲                   (PARAMETER INPUT MENU)
SP1 XXC
   ↩                       SETTEMP1  XXC
T:  XX ºC                        ↩
                           SETTIME1  XXX (S/M/H)
                                 ↩
                           SETTEMP2 C
                                 ↩
                           SETTIME2 XXX  (S/M/H)
                                 ↩
                           # OF CYC XXX
                                 ↩
                           ALRM TMP +/-X C
                                 ↩
                           OFFSET  XX C
                                 ↩
                           CHNG PWD Y/N


                           NOMENCLATURE:
                           ▲ UP
                           ▼ Down
                           ↩ Press Enter Momentarily
                           ---------> Press & Hold Enter Key 3 Sec

                           SETTEMP1            2 TO 45 ºC
                           SETTIME1            0 TO 999 SEC/MIN/HR
                           SETTEMP2            2 TO 45 ºC
                           SETTIME2            0 TO 999 SEC/MIN/HR
                           # OF CYC            0 TO 999
                           ALRM TMP            1 TO 9 ºC in 0.1ºC increments
                           OFFSET             -5 ºC TO 5 ºC in 0.1ºC increments
                           CHNG PWD           Y OR N
```

NOTE: If continuous control at one set-point temperature is desired, set # OF CYCLES to <u>zero</u>.

Status Menu: The status menu displays the current coolant temperature in °C or will display an alarm type should an alarm occur.

Pressing the UP or DOWN keys with # of cycles set to zero will change the set point temperature upon pressing the START key.

Parameter Input Menu: The parameter input menu allows input of operating temperatures, soak times, number of cycles desired, temperature units desired, time units desired, the alarm temperature range and an offset temperature to change the displayed temperature.

SETTEMP1 = Set point of first control temperature.   If # OF CYCLES is set to zero, this is the control temperature.

SETTIME1 = Soak time at temperature 1.   Not used if # OF CYCLES is set to zero.

SETTEMP2= Set point of second control temperature. Not used if # OF CYCLES is set to zero.

SETTIME2 = Soak time at temperature 2.   Not used if # OF CYCLES is set to zero.

OF CYC = Number of cycles between temperature1 and temperature2.   If set to zero, the CHILLER will control at temperature SP1.

ALRM TMP = +/- Alarm temperature set point.   If the current temperature is outside of the set point +/- the dry contact alarm will open.

OFFSET = Used to adjust the current temperature displayed. Entering 5 °C will increase the displayed temperature by 5 °C. Typically used to match temperatures with an external sensor. Also adjusts RS-232 temperature reported.

CHG PWD = Y/N Entering Y allows user to change the password allowing entry into the parameter input menu.

5.3 ALARM SIGNAL

The Chiller has one normally closed dry contact alarm for temperature out of range or system failure, located on pins 1 & 6 of the 9-pin dsub connector.

A list of system failures causing the dry contact alarm to open can be found in Section 6. In the event of a failure, the alarm type will be shown on the front display.

The Chiller has three system alarms that when triggered will show on the display. When an alarm is displayed the system will not attempt to heat or cool the coolant.

RTD OPEN or RTD SHORT: The temperature sensor has failed or its connector has come loose. *Turn off the* Chiller *and disconnect the DC power cord. Call customer service for support.*

PUMP FAIL: The pump motor speed is not within normal limits, indicating no coolant is flowing and/or the pump is damaged.

Note: Upon initial start-up or after the pump has been drained for cleaning, the system tubing must be primed. If there is no water in the tubing or chiller pump an alarm may sound and the unit may stop functioning. Turn the chiller off. Use the squeeze bottle to add water to the coolant return tubing. Turn the system back on and operate the system again. If the problem persists Call customer service for support.

After priming if the alarm persists either the pump has failed or the internal/external coolant lines are blocked. Check that there are no obstructions/closed valves or kinks in the coolant lines. Also check that the coolant lines are fully inserted into the valved connectors on the Chiller. If the external lines are not blocked the chiller may clogged. Follow the instructions in the Addendum to unclog the chiller. If the coolant lines are not blocked and the chiller has been primed, contact customer service for a RMA number to return the unit for pump replacement.

Important: The tank level low alarm will automatically reset when the tank is filled. The RTD and Pump failure alarms will not reset until the system power is turned off.

OTHER ISSUES:

COOLING CAPACITY INSUFFICIENT: *If the* Chiller *is not providing sufficient cooling, check that the air inlet and outlet are not restricted and that the fan is running. If airflow is not restricted, contact technical support.*

RS-232 COMMUNICATION NOT WORKING: *If the RS-232 communications does not seem to be working try cycling the power to reset the communications. If the problem persists, call technical support.*

The Chiller comes with a modified (pin-out) RS232 communication port. The Chiller uses this port to communicate a comprehensive set of control parameters with a Host PC - these parameters are outlined in Table 1 and Table 2. This port is a 9-pin female d-subminiature connector and is found on the top of the Chiller cover.

Note also that pins 1 and 6 on this port are connected to a dry contact relay and thus the RS-232 connecting cable must be customized. This relay is "closed" when the Thermistor temperature is within the Alarm range and "open" when it is outside the range.

Table 1 Signal definition and wiring:

Host/Master 9-Pin D-sub Pin#	Chiller 9-Pin Female D-sub Pin#
2 (Receive - Rx)	2 (Transmit - Tx)
3 (Transmit - Tx)	3 (Receive - Rx)
5 (Ground)	5 (Ground)

SPECIFICATION:

Speed:	9600 baud
Data Flow Control:	Manually set RTS (no "hardware handshaking")
Data Format:	8-bit serial
Number of Stop bits:	1
Parity:	None
Transmission Breakdown:	One command byte followed by zero, one, or two data bytes depending on data type.
Master/Slave:	The Chiller is always the SLAVE
Interrupts Reported:	None, must be polled for status
Transmission Length:	$\leq$ 15 meters
Minimum Time Required Between Host Command Transmissions	0.500 sec

Chiller RS232 Communication Protocol

Definitions in this document -

- SOT: start of text '*' (2A hex)   h: hex
- EOT: end of text '^' (5E hex)   d: decimal
- LB: low byte   na: not applicable
- MB: middle byte
- HB: high byte
- LS bit: least significant bit

Data Type and Formatting -

All commands and data passed between the Host PC and the Chiller are binary (Hex) numbers - i.e. non ASCII except for one; the "Get SW Version" D7(hex) command which returns the sixteen character software version in ASCII (see Table 3).

Except for the "Get SW Version" command, data passed between the Host and the Chiller is from one to three bytes with the first byte always the command byte. Note the decimal and integer formats in the table below. If the data format has a decimal point (XX.X) then the Chiller will interpret the resolution of the Least Significant Bit as 0.1 (a tenth) of the parameter unit specified. Otherwise if the data is XX or XXX then it is an integer value.

NOTE: The Chiller responds to every Host communiqué with at least an echo of the command sent followed by data - if applicable to the parameter.

Command Byte Specification:

Command Byte: Bit 7 (MSB) remote control active (1 = remote control, 0 = local control) Bit 6 remote on/off (1 = Chiller running, 0 = Chiller in standby mode) Bit 5 communication direction (1 = remote to Chiller [command from master], 0 = CHILLER to remote [status from Chiller]) Bits 4 thru 0 parameter being communicated per tables 2 & 3

Data Byte(s) Specification

Data consists of 1 to 3 bytes following the command byte. See Tables 2 and 3.

If the data format in the table below is "XX.X", then the Chiller interprets the LS bit as being 0.1 (a tenth) of the unit specified.

Example for Setpoint, Thermistor temperature, and Proportional (P) parameters:

High Byte	Low Byte		Hex	
00000000	00000001 =	0.1	00	01
00000000	00001010 =	1.0	00	0A
00000000	10110100 =	18.0	00	B4
00000001	10010000 =	40.0	01	90

See the specific parameter for interpretation of other data formats: "X", "XX", and "XXX".

Table 2 Put Commands.

PUT Commands	No. Bytes Sent	Command Byte(h), Data Bytes(h)	Received(h)	Data Format	Value of LS bit	Units	Data Range
Setpoint	3	E1, LB, HB	E1 (ack)	XX.X	0.1	°C	{0, 500d}[1]
Fault Reset	1	FF	FF (ack)	X	na	na	na

Table 3 Get Commands

GET Commands	No. Bytes Sent	Command Byte(h)	Received(h)	Data Format	Value of LS bit	Units	Data Range
Setpoint	1	C1	C1, LB, HB	XX.X	0.1	°C	{0, 500d}[1]
SW Version	1	D7	D7, SOT, <16 ASCII bytes[2]>, EOT	19 bytes	na	na	na
Coolant Temp	1	C9	C9, LB, HB	XX.X	0.1	°C	{0, 500d}[1]
% Cool or Heat	1	DE	DE, sign, lsB, msB Byte Description: byte1 DE - cmd echo byte2 bit7(sign): 1 = heating, 0 = cooling byte3 = lsByte data byte4 = msByte data %pwm = sign * (61787 - (lsByte + msByte*256)) *100/1275	XXX.X	0.195	%	{61787d, 60512d} NOTE: 61787 = 0%pwm 60512 = 100%pwm
Fault Byte	1	C8	C8, <Fault Byte> bit 0 = Tank Level Low bit 1 = Tach Fail bit 2 = Thermistor Temp > Alarm bit 3 = PCW Low bit 4 = Thermistor Fault bit 5 = Pump Fault bit 6 = (not used) bit 7 = Thermistor Temp < Alarm	XX "1" = Asserted	na	na	na

1) The Chiller can store 8 bytes of transmission. It is recommended that the transmissions be limited to 1 data exchange of one, two, or three bytes (depending upon the data being communicated), until the master has received the acknowledgement from the Chiller.

2) An acknowledgement of the transmission will be sent back to the master when the Chiller reads the data. In the case of data transmitted to the Chiller Controller only, the acknowledgement will be the command byte. In the case of data requested by the master, the acknowledgement will be the command byte plus the data byte(s) requested.

3) For software that requires data types to be specified:
   Format of command bytes: number, "word", unsigned, MSB first
   Format of sent data bytes: number, "word", unsigned, LSB first
   Format of received data bytes: variable length string

4) If RS-232 communications does not seem to be functioning, cycle the main power to reset.

5) ASCII bytes = software part number and revision. For Chiller 300L = 60-12663-2 revXX. Where XX = software revision level.

6) % Cool or Heat command: a positive value implies heating and a negative value (2's compliment) implies cooling.

SECTION 8
MAINTENANCE _____

Proper care and cleaning is important to prevent mold growth in the chiller, filter kit and tubing. It is recommended to treat the water used inside the chiller with Clear Bath® (Spectrum Labs) or a similar, non-reactive product.

Please note solvents cannot be used with the chiller when connected to a cup horn sonication device. Cup horns are made from acrylic and will be damaged by solvents.

Tubing should be replaced on a scheduled basis to ensure cleanliness. If the chiller will not be used for an extended time period it must be drained.

The Filter Kit (Part #4934) will prevent contaminants from clogging the Chiller's internal components. The kit comes with all necessary valved connectors to make attaching and detaching the Filter Assembly easy when cleaning. The Polyethylene (PE) filter membrane (Part #4935- Package of 5 Filters; Part #4936 – Package of 10 Filters) should be replaced once it is clogged, by contacting QSonica.

Please contact us immediately for technical assistance whenever you have questions or concerns.

Telephone: 203-426-0101
Fax: 203-426-7026
E-mail: info@sonicator.com

THIS CHILLER IS COVERED UNDER A ONE-YEAR PARTS AND LABOR WARRANTY.

WARRANTY

Products with defects in components or manufacturing which are reported to Qsonica before the end of the warranty period will be repaired or replaced at no cost (see "How to Obtain Service" below). The warranty period begins on the date the product was initially shipped from Qsonica's factory.

Excluded from Warranty:

Excluded from warranty is any damage caused to the product occurring during, but not limited to, such events as shipment, installation, storage, or non-normal usage, or usage in a situation specifically cautioned against or noted in the product manual.

Specific situations, which invalidate the warranty, include (but are not limited to):
- Removing the serial number label.
- Any disassembly (partial or complete) of the Chiller.
- Subjecting the Chiller to temperatures over 60 °C or operating it in ambient temperatures greater than 40 ℃.
- Subjecting a heat exchanger to unfiltered water or coolants not specified in the manual.
- Subjecting any product to temperature, voltage, current, or pressure (internal or external) greater than that specified in the product manual.
- Any actions prohibited in the "Caution" section of the product manual.
- Using voltages above 14 VDC.

How To Obtain Service

1. Note the product's serial number and call Customer Service at 203-426-0101 during business hours, 8:30 a.m. to 5 p.m. Please note that the serial number is mandatory to receive warranty service.
2. Customer Service will collect the serial number and contact and shipping information and provide an RMA number.
3. All shipments, including warranted repairs, to customer sites outside the U.S.A. will be freight collect (including all duty, taxes, etc.) via the customer's desired carrier.
4. For units in warranty: The customer is responsible for paying shipping of the Chiller back for service. We will pay return shipping of all units in warranty.
5. For units out of warranty: A standard repair price quote will be issued. The Chiller may be shipped to the manufacturer under the assigned RMA number; however, repair work cannot begin until a purchase order is received.

Over time, as the ultrasonic horn naturally wears, titanium particles will be released into the coolant water being recirculated through the Recirculating Chiller (Part #4900). These particles can clog the chiller's internal components if a filter is not used.

Note: *It is highly recommended that the coolant water is changed after every sonication run/program.*

The Filter Kit (Part #4934) will prevent contaminants from clogging the Chiller's internal components. The kit comes with all necessary valved connectors to make attaching and detaching the Filter Assembly easy when cleaning. The Polyethylene (PE) filter membrane (Part #4935- Package of 5 Filters; Part #4936 - Package of 10 Filters) should be replaced once it is clogged, by contacting QSonica.

Parts

There are three main portions of the filter assembly:

The Filter kit comes with the following connectors and tubing:

Hosebarbed   Female Fittings   ¼"ID x 3/8"OD
Male Fitting   Tygon Tubing

Assembly

The filter kit is shipped fully assembled. After cleaning, the kit can be re-assembled as follows:

The PE filter membrane slides easily into the Filter Top. The Clear Bowl with o-ring can be screwed into place on the Top.

The Filter Assembly will come with female valved connectors already installed on the Top of the Filter Housing. The male connectors will be installed on either end of the labeled tubing. Ensure one side of the tubing assembly is connect to the 'Filter outlet' side of the Top. Connect the other side of the tubing assembly to the Coolant Return port on the Chiller.

The tubing that comes from the Coolant Return line of the Ultrasonic Horn should be connected to the 'Filter Inlet' side of the filter assembly.

Filter Kit Assembly:
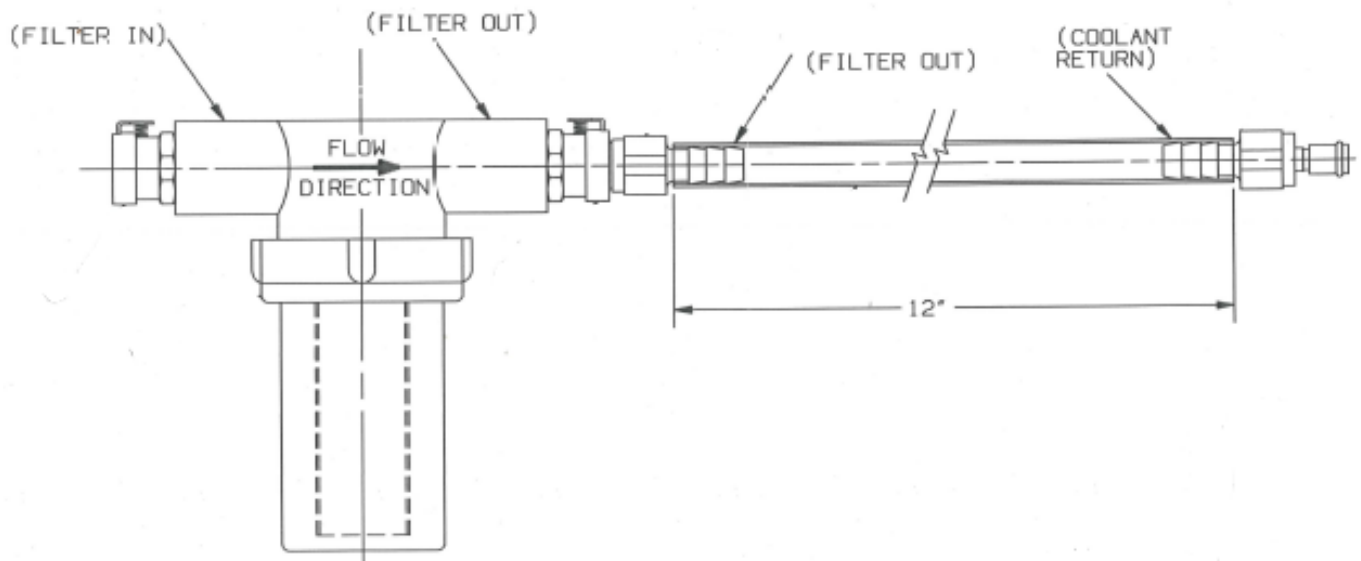
The arrow on the Black Top of the filter will indicate the correct direction of the coolant water flow. Ensure that the arrow is facing the proper direction during installation.

Cleaning and Maintenance

Note: *To extend the life of your filter, rinse the filter bowl and filter after each use.* The valved connectors will prevent water from leaking when disconnected. *Change the coolant water in the cup reservoir and tubing after each Sonication run. This will extend the life of your Chiller and Cup Horn.*

Over time the PE Filter Membrane (Part #4935) will become dirty and require replacement. This can be monitored through the clear bowl of the filter assembly.

The filter can also be cleaned with a soft brush (i.e. tooth brush) while submerged in water or 'blown out' with compressed air to help extend the life of the filter. With proper maintenance the PE filter membrane will last for many months depending usage.

Note: *If the tubing on either side of the filter compresses or flattens, the PE Filter membrane MUST be changed. This is a sign of a clogged filter and can damage the Chiller. Please pause the Sonication program and replace the Filter membrane immediately.*

If the chiller internal tubing is clogged, turn off the chiller.
Disconnect the coolant supply tubing from the chiller.
Connect a fitting and tubing with an open end to the coolant return port. Put the open end of the tubing into a sink or bucket.

Fill the squeeze bottle with DI water. Insert the squeeze bottle nozzle into the Coolant Supply port valve to open it. Push hard on the bottle to force water inside and unclog the chillers' internal tubing. Refill the squeeze bottle and repeat as necessary until the water coming out of the chiller is clean.

Connect fitting and hose with open end. Put open end in a sink or bucket.

Insert squeeze bottle into port. Push hard on bottle to force water inside and unclog unit. Try several times.
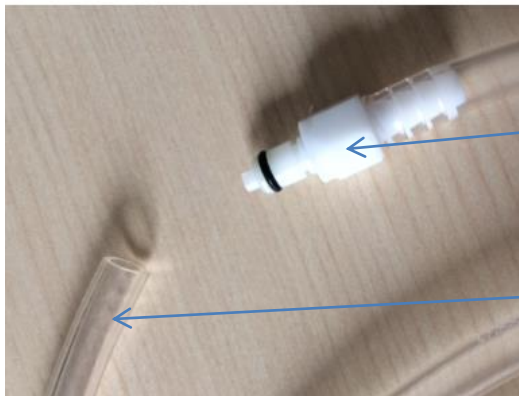
This end goes into the Coolant Return on the chiller as described above.

 The open end goes into a bucket or sink.