THERMOCUBE II -26L
LIQUID - LIQUID

Product Manual

Solid State
COOLING SYSTEMS
Temperature Control... Precisely.

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Solid State COOLING SYSTEMS
*Temperature Control...***Precisely.**

CE Declaration of Conformity

We: Solid State Cooling Systems
167 Myers Corners Road
Wappingers Falls, NY 12590
USA

declare under our sole responsibility that the

ThermoCube II TC22, TC23, TC24, TC25, TC26, TC26L (All Models)

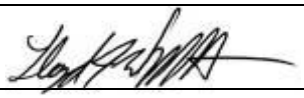
meets the provisions of the directives:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU
Low-Voltage (Safety) Directive 2014/35/EU
RoHS Directive 2015/863/EU – R: RoHS Option ONLY

Emissions:
EN 61326-1: 2013 per EN 55011:2009 + A1: 2010 Group 1 Class A

Immunity:
EN 61326-1: 2013 Electrical Equipment for Measurement, Control, and Laboratory Use - EMC
EN 61000-3-2:2014 Harmonics Emissions Class A
EN 61000-3-3:2013 Voltage Fluctuations and Flicker
EN 61000-4-2 Electro-Static Discharge
EN 61000-4-3 Radiated Radio Frequency (RF) Immunity
EN 61000-4-4 Electrical Fast Transient/Burst Immunity
EN 61000-4-5 Surge Immunity
EN 61000-4-6 Conducted RF Disturbance Immunity
EN 61000-4-11 Voltage Dips, Interruptions and Short Variations
EN 61000-6-2:2005 Electromagnetic Compatibility Part 6-2: Immunity for Industrial Environments

Safety:
EN 61010-1: 2010/AMD1:2019 Low Voltage Directive Safety requirements for electrical Equipment for measurement, control, and laboratory use.

Lloyd F Wright Chief Technology Officer	
Date	May 08, 2023

Solid State COOLING SYSTEMS
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FCC/ICES/ACMA/UL Declaration of Conformity

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Emissions:
CFR Title 47 FCC Part 15 Subpart B, Class A
ICES-003, Issue 7, Class A
ACMA AS/NZS CISPR 11:2009 + A1:2010 Group 1 Class A

Safety:
UL 61010-1:2012/A1:2018-11 Electrical Equipment for Measurement, Control, and
CAN/CSA C22.2 No. 61010-1:2012/R2019-07 Laboratory Use; Part 1: General Requirements)

Lloyd F Wright Chief Technology Officer	
Date	May 08, 2023

SAFETY PRECAUTIONS AND SYMBOLS

Read the SDS for the coolant used and follow **all** safety precautions listed in the SDS prior to removing coolant tubes or opening the fill cap as this could result in contact with the coolant inside.

Caution! Risk of electric shock. Disconnect the power cord prior to servicing. This includes changing a fuse or opening the cover for any reason.

CAUTION

- Never disassemble the chiller as irreparable damage may occur.
- Any attempt to open or repair the unit will void the warranty
- Never store the chiller over 70 °C.
- Never operate the chiller in ambient temperatures of 40 ºC or greater unless the unit has been customized for high ambient operation.
- Never operate the chiller within 5 ºC of the coolant's freezing point.
- Always use only proper coolants as specified in manual. Solid State Cooling Systems recommends Koolance LIQ-702CL-B (27% propylene glycol and water)
- Never ship the chiller with coolant inside the liquid cold plate as freezing temperatures may be encountered which would damage the unit. Always pump all coolant out of the chiller prior to shipping.

Symbols Used in this Manual

CAUTION

The red CAUTION equilateral triangle symbol appears throughout the manual. Please follow the important instructions accompanying this symbol to avoid significant damage to the chiller.

WARNING

The red WARNING equilateral triangle symbol appears throughout the manual accompanying certain maintenance and repair activities. Please follow the important instructions accompanying this symbol to avoid situations that could cause injury to the operator or other personnel.

Solid State COOLING SYSTEMS
*Temperature Control...***Precisely.**

THERMOCUBE II 200-500W THERMOELECTRIC CHILLER

PRODUCT MANUAL

SECTION 1
INTRODUCTION

ThermoCube II Model 26L is the water-cooled version of the second generation of Solid State Cooling Systems' popular ThermoCube thermoelectric recirculating liquid chiller. The ThermoCube II is the same size and has most of the same pump and cooling capacity options as the original ThermoCube. It has a redesigned power subsystem for even longer life, a more powerful controller that include fan speed control to minimize noise and pump speed control to set the desired flow rate, a back-lit display, and more communication options, including RS232, RS485, and Ethernet. Like the original ThermoCube, the Model 26L can deliver 600 watts of cooling capacity without the use of compressors or refrigerants. The system provides 1 to 5 liters per minute of constant temperature coolant, with PID control for both cooling and heating. With fewer moving parts, the system is highly reliable and energy efficient.

The ThermoCube II systems provide stable and precise temperature control for a variety of applications, including scanning electron microscopes, lasers, low-light CCD cameras, analytical equipment, medical equipment, testing, microelectronics production, and any other application requiring better than ±0.05°C control

The ThermoCube II recirculating chillers are highly customizable, with many different options available, which allow us to specifically configure the system for your particular application.

From conception, The ThermoCube II systems have been designed for long life and ease of use. The internal thermoelectric modules have lifetimes greater than 200,000 hours.

SECTION 2
SPECIFICATIONS

Operating Range (Set Point):	5°C to 50°C standard (down to -5°C with low temp option - LT) (up to 65°C with high temp option – HT, 60°C for centrifugal pumps)
Ambient Temperature Range:	10°C to 40°C non-condensing
Stability / Repeatability:	±0.02°C with constant load (even near ambient)
Cooling Capacity (typical[1]):	600 watts @ 20°C with 20°C plant cooling water (PCW)
Heating Capacity (typical):	1000 watts @ 20°C in 20°C ambient air (depending on model)
Noise Level (at 1 meter):	< 50 dBA, pump dependent
Coolant / Process Fluid:	Koolance (27% propylene glycol / water mix) or 27-50% ethylene glycol / water mix Options available for PAO, Fluorinert / Galden or HFE (contact SSCS for advice on other fluids)
Process Fluid Fittings:	1/4” John Guest standard (see options section for other fitting types)
Pumps:	Diaphragm, Centrifugal or Gear pumps available (see options section for pump types and specifications)
Tank Volume:	300 ml with level sensor
Wetted Materials:	Aluminum, stainless steel and polymers (Options available for Copper "-C" and Stainless Steel "S" cold plates)
Dimensions (L x W x H):	13” x 11” x 13” (32cm x 28cm x 32cm)
Weight:	34 lbs (15.5 kg) for the standard model
Power Input:	Universal Input: 100-240 VAC, 50/60 Hz, 9 amps max @ 90VAC, 3.2 amps max at 260VAC
Controls:	Digital PID controller for heating and cooling
Communications:	Keypad, RS232, RS485 or Ethernet
Alarms	Temperature, fluid level, system or component failure (display and RS232 option)
Standards	TUV listed to UL, CAN/CSA and EN 61010-1, CE 61010-1 (RoHS compatibility is available with the "-R" option)
Other Options	(see Section 7 for available options)
Warranty	2 years (diaphragm pumps are 1 year)

Note 1: Cooling and Heating Capacity shown is typical will vary depending on pump type and configuration options. Capacity will be degraded by as much as 15-20% with -C or -S options

Figure 1: ThermoCube II Water Cooled -26L Cooling Capacity

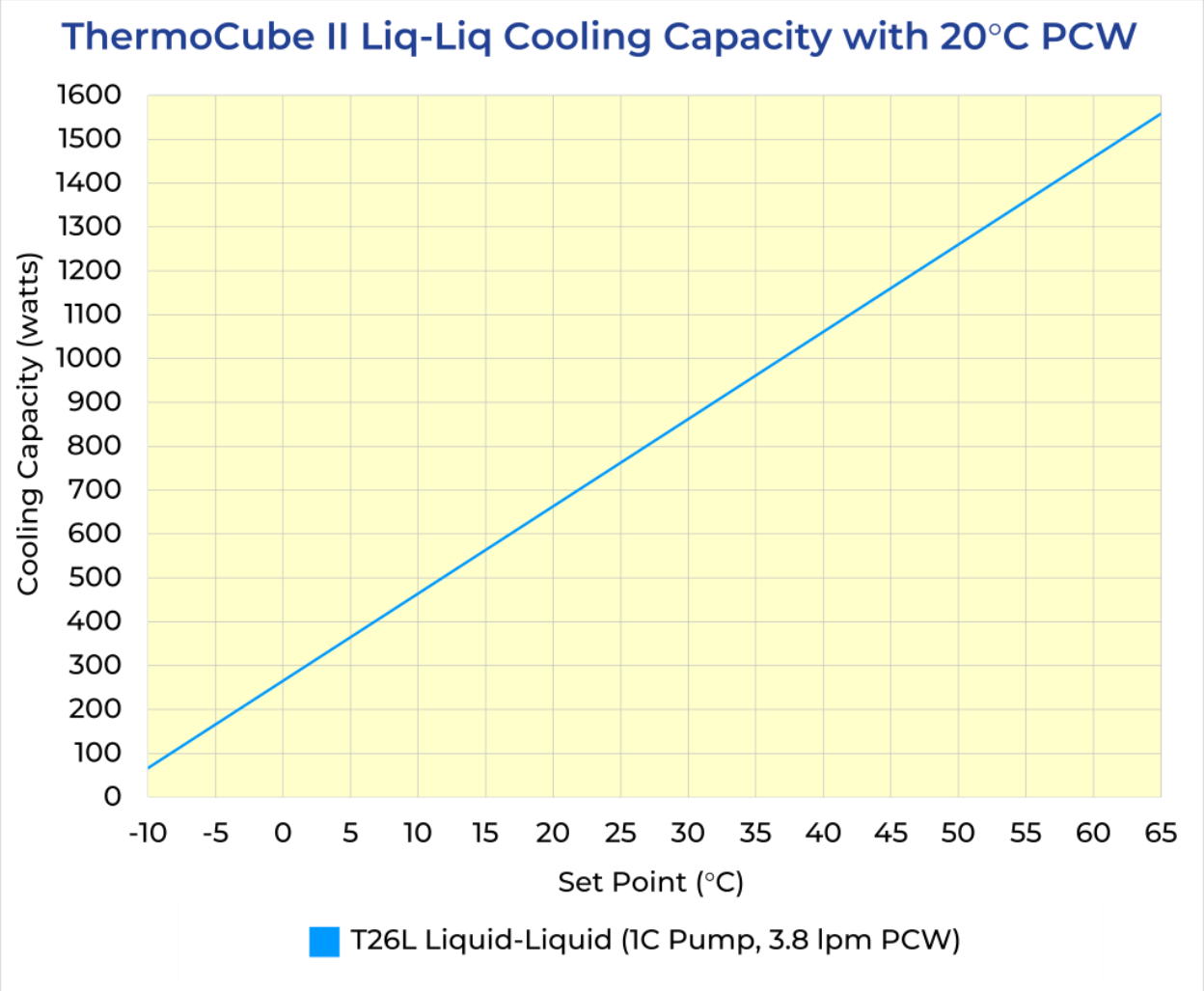
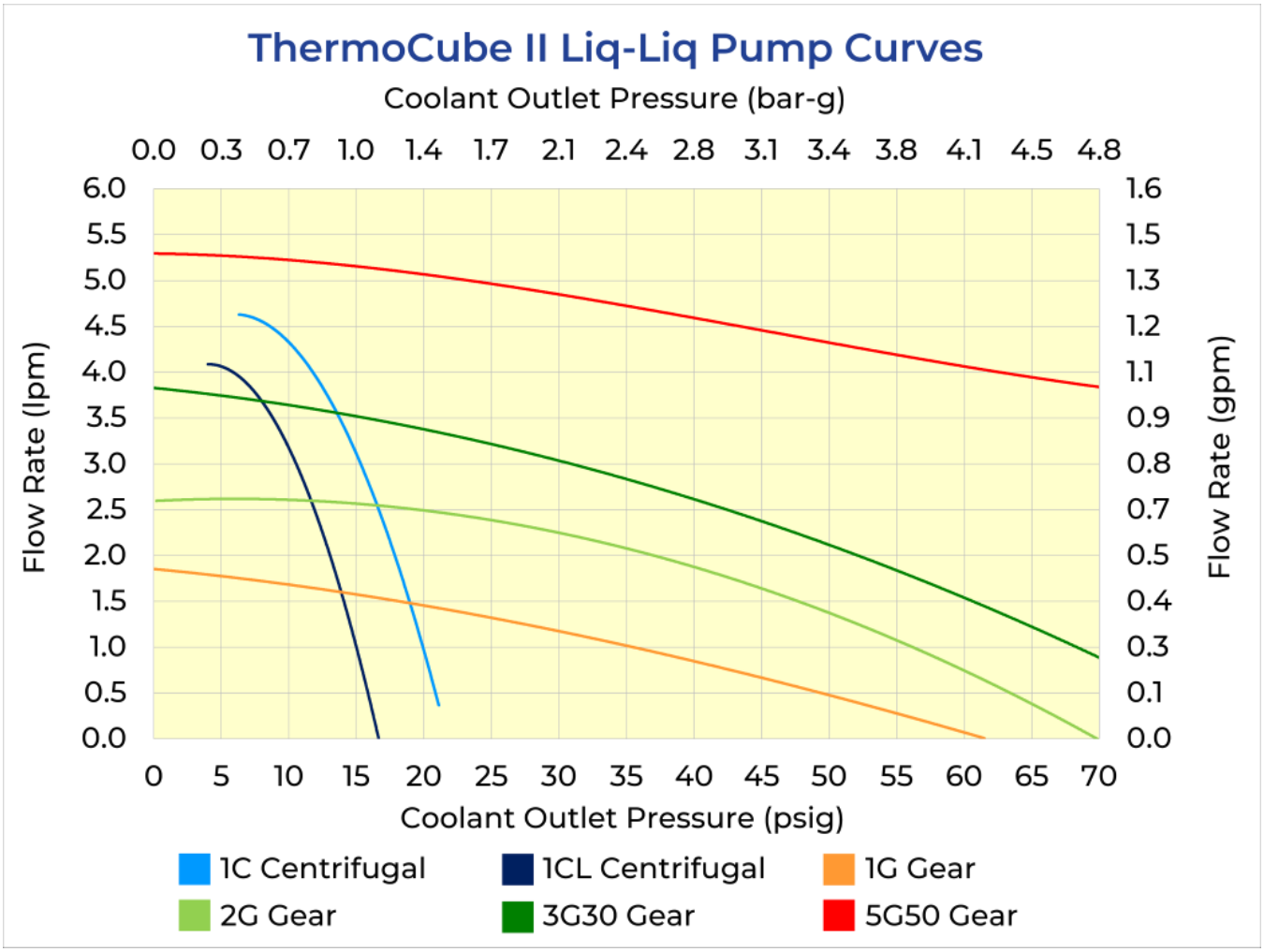


Figure 2 ThermoCube II Liquid to Liquid Pump Curves, Water @ 20°C



Recommended Pump Flow Operating Ranges:

Pump Model	Operating Flow Range	Maximum Operating Pressure
-1G 1 lpm Gear Pump	0.9 – 1.7 lpm	45 psig (3 bar)[1]
-2G 2 lpm Gear Pump	1.5 – 2.6 lpm	45 psig (3 bar)[1]
-3G30 3 lpm Gear Pump	2.5 – 3.4 lpm	60 psig (4 bar)[1]
-5G50 5 lpm Gear Pump	3.5 – 5.3 lpm	85 psig (6 bar)
-1C 1 lpm Centrifugal Pump	0.9 – 4.6 lpm	18 psig
-1CL 1 lpm Low Pressure Centrifugal Pump	0.9 – 2.6 lpm	15 psig

Notes:
1. Contact SSCS if higher pressure is required.
2. Koolance will increase gear pump pressure shown on Figure 2 at a given flow rate.
3. Only gear pumps are compatible with PAO or Fluorinert/Galden. These fluids will also increase gear pump pressure shown on Figure 2 at a given flow rate.
4. Operating at flow rates below the recommended values may lead to unstable temperature control.

SECTION 3
HOOK UP

Figure 3A

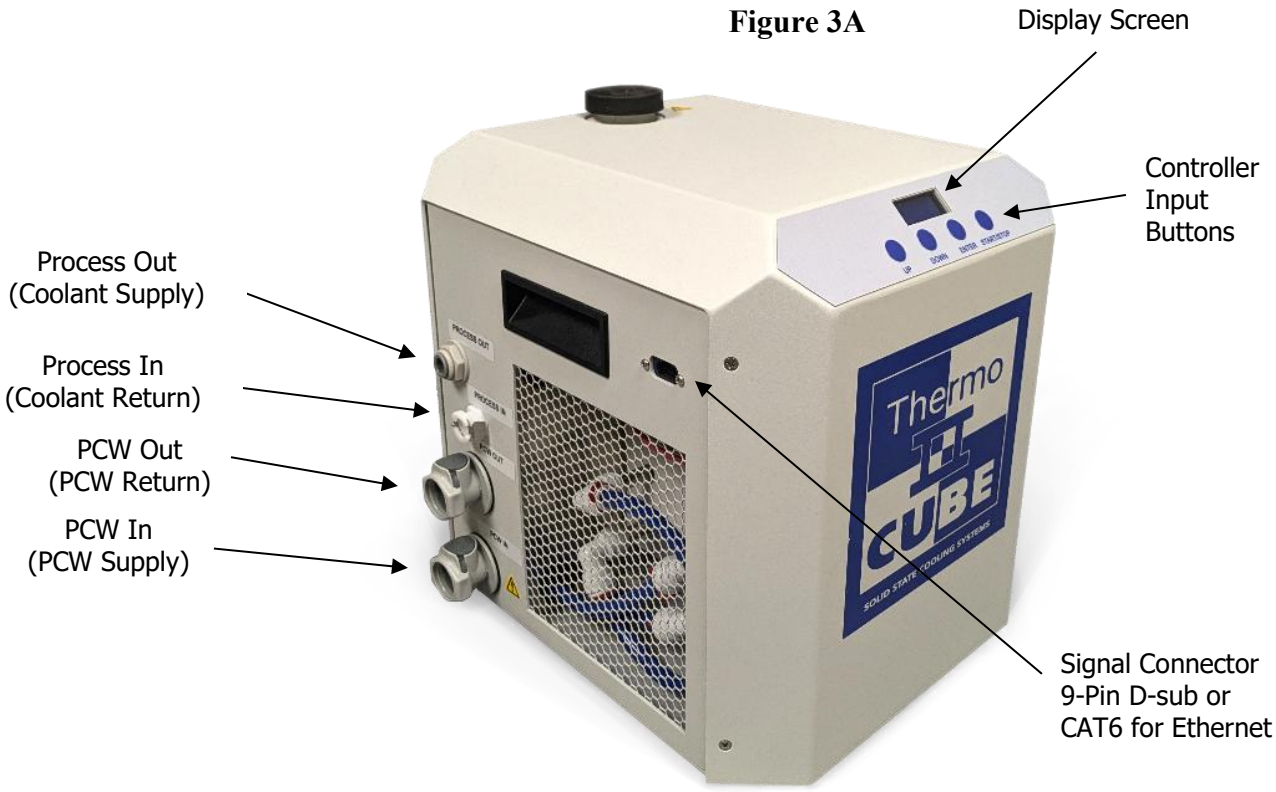
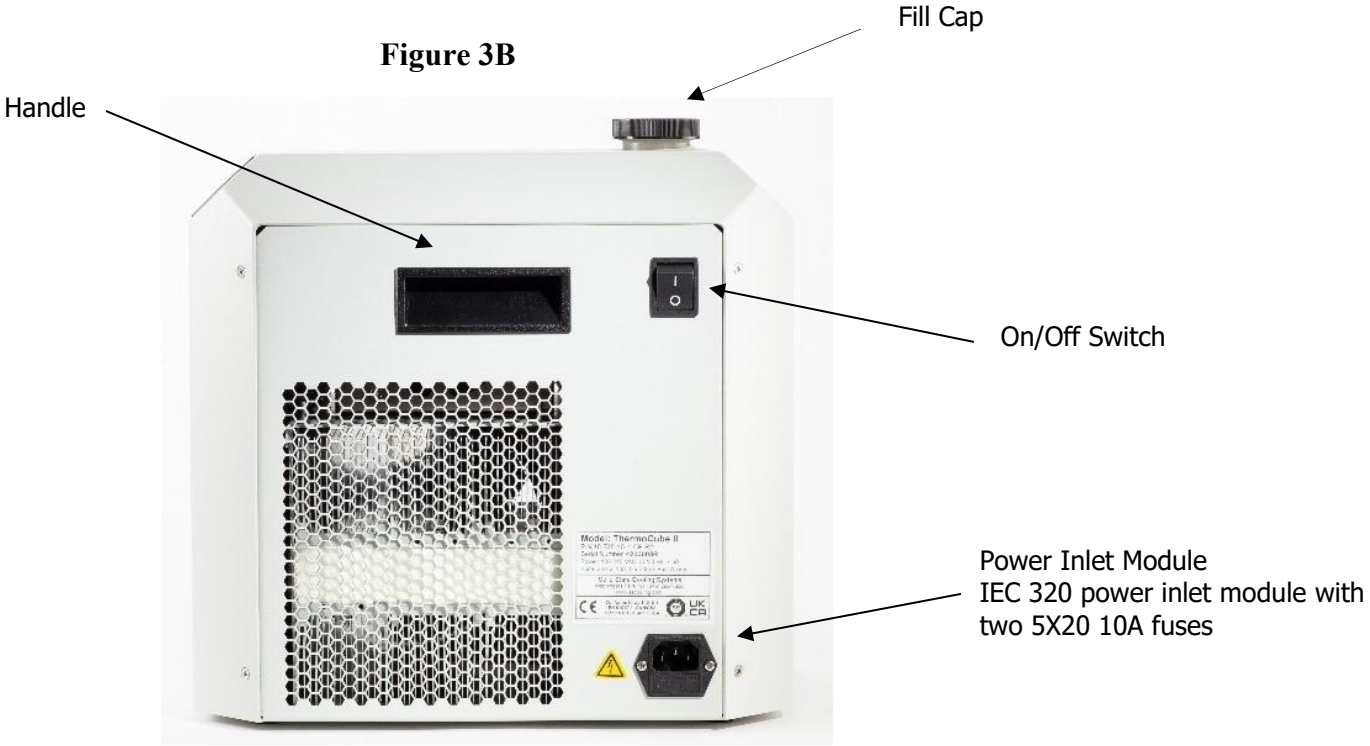


Figure 3B



3.1 ELECTRICAL CONNECTIONS (SEE FIGURE 3)

Electrical Shock Hazard: Never Plug in a Line Cord with Wet Hands

Power: The ThermoCube II AC power inlet is an IEC320-C14 socket. Plug the line cord provided into this socket and then into the appropriate 100-240 VAC 50/60 Hz wall outlet. Continuous current draw is rated at 8 amps at 100 VAC or 3.4 amps at 240 VAC (50/60 Hz). To ensure safe operation of the unit, it is important to ensure that the outlet is properly grounded. A wide variety of power cords are available to support universal power operation:

Country / Region	Part Number
USA/Canada	22-22333-1
Europe	22-22333-2
Japan	22-22333-3
UK	22-22333-4
Israel	22-22800-1
Australia	22-23213-1
Korean	22-23526-1
China (3 prong)	22-23661-1
NEMA 6-15 208 US Straight	16-23918-1
NEMA L6-15 208 US Twist	16-23918-2
Brazil	22-25122-1
India/South Africa 6A (Type D)	22-26025-1
India/South Africa 15A (Type M)	22-26025-2

Fuses: 10 amp (5mm x 20mm) GDB quick acting glass, meets IEC 127-2
Replacement Fuse: SSCS#20-22332-10, Allied Electronics #70149445.

RS-232: ThermoCube II comes with a RS-232 communications option. Connections are made via a 9-pin dsub connector (see section 7 for wiring and communications details).

RS-485: ThermoCube II comes with a RS-485 communications option. Connections are made via a 9-pin dsub connector (see section 7 for wiring and communications details).

Ethernet: ThermoCube II comes with an Ethernet communications option via a standard RJ-45 jack (see section 7 for details).

Dry Contact Alarms: ThermoCube II comes with two optional dry Contact alarms. See section 7 for details.

3.2 PLUMBING CONNECTIONS (SEE FIGURE 3)

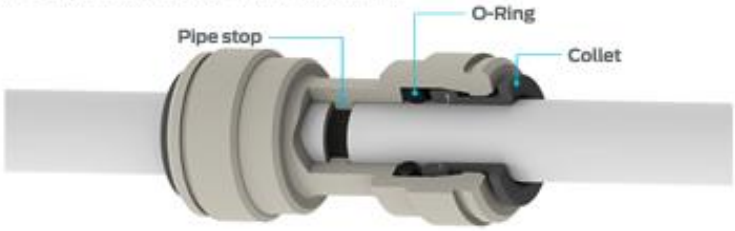
The standard process fluid inlet (coolant return) and outlet (coolant supply) connections, located on the left side, are 1/4" John Guest "push in" style fittings. See figure 4 for directions on using John Guest fittings. Other fitting options are available (see section 7).

Important Note: The ThermoCube II chiller should be located at approximately the same level or above the system it is cooling to avoid coolant draining back into the tank and overflowing after the ThermoCube is turned off.

Figure 4: Using John Guest Fittings

How To Make A Connection – Speedfit Range

To make a connection, the tube is simply pushed in by hand; the unique patented John Guest collet locking system then holds the tube firmly in place without deforming it or restricting flow. The Collet (gripper) has stainless steel teeth which hold the pipe firmly in position, while the O-Ring provides a permanent leakproof seal.



Making A Good Connection

Fittings and pipe should be kept in their original packaging to ensure they are clean and undamaged before use.

Prepare the pipe

Ensure the pipe is free of score marks. Cut the pipe square. We recommend the use of JG Pipe Cutters.

To prevent damage to the O-Ring, remove all burrs and sharp edges. When connecting Speedfit Pipe, use a Speedfit Pipe Insert. A twisting motion will aid insertion. The insert should only be used with Speedfit Pipe.

Push Up To Pipe Stop

Push the pipe into the fitting, to the pipe stop.
(about 5/8 inch)

Pull To Check Secure

Pull on the pipe to check it is secure.
Test the system before use.

Don't forget to push the pipe fully into the fitting, past both the collet (gripper) and the O-Ring.

To Disconnect

Push in collet and remove tube.

To disconnect, ensure the system is depressurized, push the collet square against the fitting. With the collet held in this position the tube can be removed.

3.3 COOLANT FILL

WARNING

Read the Coolant SDS
Prior to filling the chiller

CAUTION

Use only recommended coolants

The coolant fill cap is located at the top rear of the unit. Twist off the cap counter-clockwise to open. Fill reservoir prior to starting unit. Close cap before operating

Recommended Coolants:

Solid State Cooling Systems recommends using Koolance, a pre-mixed 27% propylene glycol/water based coolant containing an algaecide and corrosion inhibitors. Though it comes in several colors, SSCS recommends the colorless or blue versions in 700 ml bottles, part number: LIQ-702CL-B (clear) or LIQ-702B-B (blue), as the dyes in the other colored versions can form small particulates when not well mixed.

Contact Koolance for details:

Koolance USA
2840 West Valley Highway North
Auburn, WA 98001
(253) 893-7551

Water or ethylene glycol/water mixtures are also acceptable as coolants.

Note that algae growth can occur when water is used without at least 25% propylene or ethylene glycol.

SECTION 4
START UP

Note: In order to avoid injury or damage, operators must only use this product in the manner specified below.

WARNING

Electrical Shock Hazard: Never Plug in a Line Cord with Wet Hands

CAUTION

Running the ThermoCube II dry (no fluid) may damage the pump

Start-up the ThermoCube II using the following steps:

1) Connect coolant and PCW (plant cooling water) tubing to fluid connections located on the left side of the unit, labeled Process Out (Supply), Process In (Return), PCW In and PCW Out.
2) Connect Alarm Signal connector (if option chosen).
3) Remove the reservoir cap on top and fill the reservoir to just below the bottom of its neck with coolant. Replace cap.
4) Plug line cord into 100 - 240 VAC, 50/60 Hz.
5) Turn on switch located on the left side of the unit. The front display should read the current coolant temperature. If the front display reads "TANK LEVEL LOW", add more coolant to the reservoir until the display changes to read the coolant temperature.

Important Notes:

1) Be sure to connect plant cooling water (PCW) to the bottom two fittings labeled PCW In and PCW Out. Connecting PCW to the Process In or Process Out fittings can cause the tank to overflow and flood the area!
2) If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual.
3) If using an alcohol/water mixture, do not exceed 25% alcohol or the reservoir level float may not rise sufficiently when filled to turn off the tank level low alarm.

SECTION 5
OPERATION

ThermoCube II is operated via the control panel located on the front panel. The control panel has a 8x2 character LCD display and four input keys: UP, DOWN, ENTER, and START/STOP. 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 causes the chiller to change the display menu (see menu structure)
START/STOP	Pressing the START/STOP key turns on temperature control.
START/STOP	Pressing the START/STOP key while the chiller is operating turns off temperature control (Operating Mode = *).

5.1 SIMPLE OPERATION

The ThermoCube II comes with preset operating parameters that will work well for most applications. Once the tank is filled, follow the steps below to operate:

1) Turn on the ThermoCube II and wait for display to read TEMP.
2) Press the UP or DOWN keys to change SETTEMP to the desired set point.
3) Press ENTER to accept the value.
4) The Thermocube will automatically start controlling aPress the START/STOP key to begin controlling to the temperature just entered (SETTEMP1). The Operating Mode will now show “C” (cooling) or “H” (heating).
5) Pressing START/STOP while the unit is controlling temperature will stop temperature control. The Operating Mode will now show “*” for Standby (not controlling).*

Caution: Do not externally shut off the flow of coolant for more than a ten second period; pump damage will result if run deadheaded for extended periods of time.

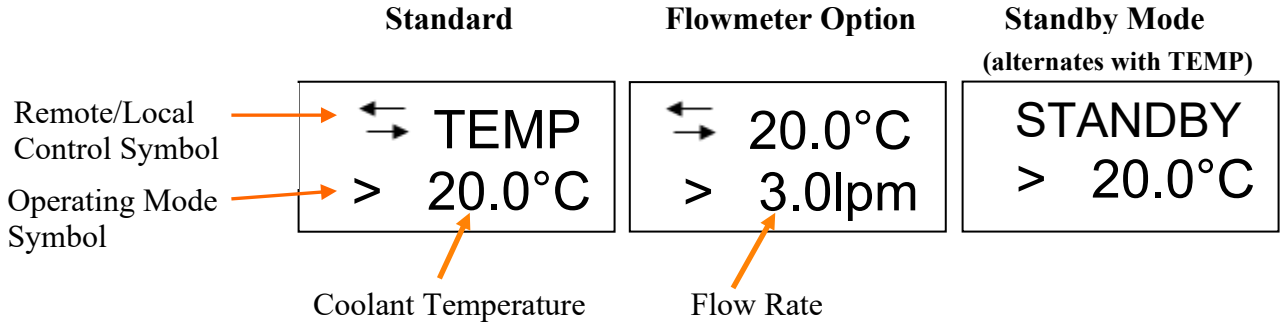
The ThermoCube II will now control to the set point temperature. To change the set point temperatures just press the UP or DOWN keys again to change SETTEMP to the new set point, followed by ENTER and then START/STOP. The Operating Mode will now show “C” (cooling) or “H” (heating). If the Operating Mode shows “*”, press START/STOP to begin controlling.

5.2 ADVANCED OPERATION

The chiller controller has two menus: the Status Menu and the Parameter Input Menu. The Status Menu shows the chiller operating status and current temperature of fluid leaving the chiller. The Status Menu also allows input of new coolant temperature set-points. The Parameter Input Menu allows input of the Alarm Range, the temperature Offset, and the Back Light on/off command.

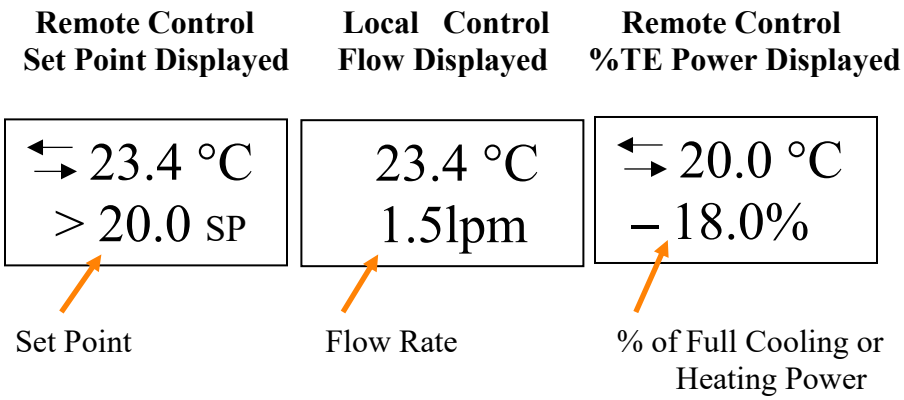
STATUS MENU: The status menu displays the chiller operating status and coolant temperature. The chiller operating mode is shown in the display's first character: (See Figure 4)

Figure 4A: ThermoCube II Display – Status menu (static screen)



Operating Modes:
STANDBY (*) = Standby mode, no temperature control. Pump runs if set to ON in Standby
> = Cooling mode, coolant temperature is above the alarm range
< = Heating mode, coolant temperature is below the alarm range
– = Cooling when % TE power is displayed
+ = Heating when % TE power is displayed
⇄ Indicates remote control via RS-232, RS-485, or Ethernet. This will lock out the keypad.

4B: ThermoCube II Display – Status menu (scrolling screen)



MENU STRUCTURE:

NOMENCLATURE:

▲UP or Increase Value ▼Down or Decrease Value

↵ Press Enter momentarily to scroll between menu items

⟶ Press & hold enter key for 3 seconds to enter or leave Parameter Input Menu

SIMPLE OPERATION		ADVANCED OPERATION
(STATUS MENU)	press and hold enter key	(PARAMETER INPUT MENU)
TEMP: XX.X°C (current temp)	⟶	PASSWORD XXXX [ENTER 0000] ↵
PRESS ▼OR ▲ (change set point)		ALRM +/- XX°C ↵
SETTEMP XX.X°C ↵		OFFSET X.X°C ↵
TEMP: XX.X°C (current temp)		TEMPUNIT °C/°F ↵
		LOW FLOW X.X LPM/GPM ↵
		FLOW ADJ LPM/GPM ↵
		FLOWUNIT LPM/GPM ↵
		BK LIGHT ON/OFF ↵
		POLARITY DC EN: LO/HI ↵
		MENU: STATIC/SCROLL ↵
		DECIMAL PLACES 1 / 2 ↵
		COM MODE: HEX/ASCII ↵
		PUMP SPEED[4] XX% ↵
		PUMP OFF ON STANDBY Y/N ↵
		COM MODE HEX /ASCII ↵
		BUZZER ENABLED/DISABLED ↵
		CHANGE PSWD? N ↵
		↵ (return to top of menu)

Notes:

1. If the user enters the temperature input or the parameter input menu and does not press a key for 10 seconds the display will revert back to the Status menu.
2. Parameters highlighted in yellow only appear in menu when that option has been purchased.
3. Fan Speed does not display on water-cooled systems
4. Pump Speed control is not available on Gear Pump units

PARAMETER INPUT MENU: The ThermoCube II has a parameter menu screen containing several user adjustable parameters. To access this menu, press and hold the ENTER button for 3 seconds and then enter password 0000 using the UP, DOWN and ENTER keys. The following table shows the parameters which can me set in this menu:

ALRM +/-: Alarm width, the acceptable coolant operating temperature range around set-point before an alarm is communicated via USB. For example, if set to 5°C with a 20°C set-point, an alarm will trigger if the coolant temperature rises above 25°C or falls below 15°C. **The factory default is 5.0°C**

OFFSET: This parameter raises or lowers the chiller temperature reading to match a user's external temperature sensor. Enter the difference between the external sensor and the display. For example, if the user has a temperature sensor reading of 22 °C when the chiller display shows 20°C, entering 22°C – 20°C = 2°C will cause the chiller to shift its temperature calibration scale up 2°C to match the external sensor. **The factory default is 0.0°C.**

TEMPUNIT: Sets temperature units in degrees Celsius or Fahrenheit. **The factory default is °C.**

LOW FLOW: This parameter sets the low flow limit that trips a flow alarm. **This feature is only available on units with the -FM option. The factor default is 0.7 lpm**

FLOW ADJ: This parameter adjusts the flow rate displayed. This can be used to match flow to an external flowmeter for calibration purposes. **This feature is only available on units with the -FM option. The factory default is 0.**

FLOWUNIT: This parameter sets the flow units in liters per minute (lpm) or gallons per minute (gpm). **This feature is only available on units with the -FM option. The factory default is lpm.**

BK LIGHT: This feature turns off the display backlight and is **only available on Custom Engineered Specials (CES). The factory default is ON.**

POLARITY DC EN: This feature sets the polarity for the remote Dry Contact input On/Off signal. (LO/HI). **This feature is only available on Custom Engineered Specials (CES). The factory default is LO.**

MENU: This feature changes the display from a static reading of the temperature to the upper line displaying the coolant temperature and the lower line scrolling between Set Point, % of full power, and Flow if the unit has the flowmeter option. **The factory default is Static**

DECIMAL PLACES: Sets the temperature display precision, 1 = 0.1°C or °F, 2 = 0.01°C or °F. **The factory default is 1.**

COM MODE: This sets the RS-232 communications mode. Options are HEX @ 9.6k or ASCII @ 57.6k. **The factory default is HEX.**

PUMP SPEED: Sets the maximum pump speed, range 50-100%. Used to reduce maximum pump pressure/flow. Lowering the Pump Speed will reduce the ThermoCube II's coolant flow. **Pump speed cannot be adjusted on Gear Pumps. The factory default is 100%**

PUMP OFF ON STANDBY: This option, when set to STANDBY, turns off the pump when the ThermoCube II is not cooling. **The factory default is NEVER.**

BUZZER: Triggers a loud (87dB) high-pitched sound when an alarm occurs when enabled. Options are: ENABLED or DISABLED. **This feature is only available on units with the -AA Option. The factory default is DISABLED.**
Note: when the Dry Contact option is chosen there can be no buzzer.

CHANGEPWD: Sets the password required to enter this menu. **The factory default is 0000.**

5.3 ALARMS

Alarms are displayed on the front screen, and communicated through RS-232, RS-485, or ethernet. A list of system failure modes can be found in Section 6. In the event of a system failure, the alarm type will be shown on the front display.

5.4 DRAIN PROCEDURE

WARNING

Read the Coolant SDS prior to draining the chiller

1. Attach a hose to the "Process Out" port of the chiller and place the end of it in a container with at least a 3 liter capacity.
2. Turn the unit on (making sure to hold the drain hose in place) and run it until air starts to shoot out of the hose.
3. Attach the drain hose to the "Process In" port of the chiller
4. Remove the tank cap and allow the liquid in the chiller's lines to drain out.
5. Replace and tighten the tank cap, then remove the drain hose.
6. Dispose of the coolant in a manner consistent with local regulations.

SECTION 6
SYSTEM ALARMS/TROUBLESHOOTING

WARNING

Electrical Shock Hazard: Always unplug the unit before removing the cover.

WARNING

Do not attempt to service or repair the unit beyond the troubleshooting checks described in this section without first contacting Solid State Cooling Systems

The ThermoCube II has multiple 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.

Alarms:

Tank Level Low: Liquid reservoir level is too low. *Unless filling for the first time, check all outside plumbing lines for leaks. Once all leaks are sealed, remove the cap and add more coolant until the alarm disappears.*

RTD Fault: The temperature sensor has failed or its connector has come loose. *Turn off the chiller and disconnect the AC power cord. Contact SSCS for a replacement RTD, or for a RMA number to return the unit for RTD replacement.*

Flow FLT/CHK Lines: The coolant flow rate has dropped below 0.7lpm on the internal flowmeter, or the cold plate temperature is much different than the coolant temperature, or operation outside the normal 5°C to 50°C coolant temperature (without –LT or –HT options). This indicates a pump failure or a blockage in the external plumbing lines. *Verify that no kinks or blockages exist in the plumbing line outside of the ThermoCube. If no coolant flow blockages exist, contact SSCS for a replacement pump, or for a RMA number to return the unit for pump replacement.*

Pump Fault: The pump current it too low, indicating a pump failure, a blockage in the external plumbing lines. *Verify that no kinks or blockages exist in the plumbing line outside of the ThermoCube. If no coolant flow blockages exist, contact SSCS for a replacement pump, or for a RMA number to return the unit for pump replacement.*

PCW Flow Low: The flow rate of plant cooling water (PCW) is too low for the ThermoCube to reject the heat needed to maintain its set point temperature. *Verify that no kinks, blockage, or closed valves exist in the PCW plumbing line outside of the ThermoCube. If possible, verify the PCW flow rate is 1 gpm (4lpm) or greater. If the PCW flow rate is ok, contact SSCS technical support.*

No Display: If the liquid crystal display does not illuminate upon turning on the ThermoCube II, the internal 24VDC power supply has failed, the diaphragm pump has failed, or the LCD display has failed. *Contact SSCS for a RMA number to return the unit for replacement of the power supply, diaphragm pump, or display.*

Temperature Control Poor: If no other alarms are present, poor temperature control indicates the heat load is too great for the chiller, the TE cooling/heating engine is not receiving power, the PID constants have been corrupted or the chiller needs repair. *First check the PID constant values shown section 5.2 match the factory defaults. If not, change the values to the default values. Otherwise, contact SSCS for technical support.*

Leak Detected: A leak has been detected by the leak sensor on the base of the plumbing section. *Turn off the chiller and disconnect AC power. Contact SSCS technical support for troubleshooting or an RMA number to return the chiller for repair.* **This alarm is only available when the leak detection option -LD is purchased.**

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

SECTION 7
THERMOCUBE II OPTIONS

7.1 THERMOCUBE II LIQUID TO LIQUID OPTIONS AND PART NUMBER

This page shows all ThermoCube II Liquid to Liquid configuration options

ThermoCube P/N: 10 – CCC – PP – X – YY ZZ – OO

Cooling Capacity | Pump Type | Power Cord | Process Fittings | PCW Fittings | Other Options

PP = Pump Type (choose one):	
PP	Description
-1G	>1 lpm @ 35 psig magnetic drive gear pump, low vibration
-2G	>2 lpm @ 35 psig magnetic drive gear pump, low vibration
-3Gxx	>3 lpm @ 30 psig magnetic drive gear pump, Adjustable Flow setting xx = 30 for 3 lpm, 20 for 2 lpm, 10 for 1 lpm
-3GRF	>3 lpm @ 30 psig magnetic drive gear pump with two speed Run/Fill switch
-5Gxx	>5 lpm @ 30 psig magnetic drive gear pump, Adjustable Flow setting xx = 30 for 3 lpm, 20 for 2 lpm, 10 for 1 lpm
-1C	Standard centrifugal pump ~2 liter/min @ 15 psig ~1 lpm @ 17 psig
-1CL	Low flow centrifugal pump ~2 liter/min @ 10 psig

X = Power Cord (select one)		
X	*Country / Region*	*SSCS Part No.*
0	*No Power Cord*	*N/A*
1	*USA/Canada*	*22-22333-1*
2	*Europe*	*22-22333-2*
3	*Japan*	*22-22333-3*
4	*UK*	*22-22333-4*
5	*Israel*	*22-22800-1*
6	*Australia*	*22-23213-1*
7	*Korean*	*22-23526-1*
8	*China (3 prong)*	*22-23661-1*
9	*NEMA 6-15 208 US Straight*	*16-23918-1*
10	*NEMA L6-15 208 US Twist*	*16-23918-2*
11	*Brazil*	*22-25122-1*
12	*India/South Africa 6A (Type D)*	*22-26025-1*
13	*India/South Africa 15A (Type M)*	*22-26025-2*

YY = Process Fluid Fitting Options:	
YY	Description
JG	John Guest 1/4" x 1/4" Bulkhead
J2	John Guest 3/8 x 3/8" Bulkhead
CP	1/4" CPC valved (≤ 2lpm only)
AP	1/4" APC valved (≤ 2lpm only)
CP2	**NOT AVAILABLE**
SW	1/4" swage kit
S2	3/8" swage kit
FN	1/4" Female NPT Bulkhead

ZZ = Facility Water (PCW) Fitting Options:	
YY	Description
J2	John Guest 3/8 x 3/8" Bulkhead
CP2	3/8" CPC valved (1 – 3 lpm)
S2	3/8" swage kit
FN	1/4" Female NPT Bulkhead
Other 1/4" fittings not supported for PCW	

OO = Other Options:	
OO	Description
-R2	RS232 interface (9,600 Baud Rate) Default mode: Hex (configurable as ASCII)
-R5	RS232 interface (57,600 Baud Rate) Default mode: ASCII (configurable as Hex)
-R4	RS485 interface
-EN	Ethernet communications interface
-TT	TTL Signals (same as original ThermoCube) **(Cannot be combined with DC or AA)**
Unit can only be configured for one of the above options	
-EF	5 micron external liquid filter
-SS	Stainless steel tank and plumbing. Must use SW, S2, CPM or FN fittings **(Only available with gear pump)**
-ST	Stainless steel tank
-LT	Low temperature operation down to -5°C
-HT	High temperature up to 65 °C (60 °C maximum for centrifugal pumps)
-DC	Dry contact alarm signals **(No TT or AA)**
-AA	Audio Alarm Buzzer **(No TT or DC)**
-VD	Vibration dampening material added
-FM	Integrated flow meter (0-10 lpm)
-LD	Integrated leak detector
-FL	Set up for Fluorinert or Galden[2] (Gear pumps only)
-C	Copper coldplate[3] **(Cannot be combined with 1D, SS, or FL)**
-S	Stainless steel coldplate[3] **(Cannot be combined with 1D, SS, or FL)**
-###	Custom Engineered Special (sequential number assigned by Engineering)

Note 3: Cooling capacity with -FL option is reduced as much as 10-15%, depending on configuration.

Note 4: Cooling capacity with -C or -S options is reduced as much as 15-20%, depending on configuration.

7.2 RS-232 COMMUNICATIONS

ThermoCube II can be configured with RS-232. ThermoCube II comes with two configurable communications protocols: the original ThermoCube Hex commands or an alternative set of ASCII commands. The chiller uses this port to communicate a comprehensive set of control parameters with a Host PC - these parameters are outlined in Section 7.2. This port is a 9-pin female d-sub connector and is found on the rear panel of the chiller (see Figure 3C and 3D).

7.2.1 RS-232 Communication Specifications

Wiring: Proper wiring depends upon whether the equipment being cooled (the Host) is wired as Data Computer Equipment (DCE) or Data Terminal Equipment (DTE)

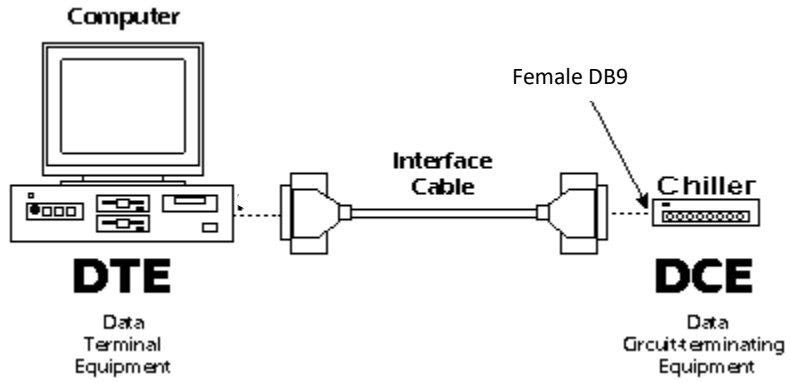


Table 1A: Signal definition and wiring for Host wired as DTE

Computer/Host/Master Male 9-Pin D-sub Pin #	**Chiller / Slave** Female 9-Pin D-sub Pin#
2 (Receive – RXD)	2 (Transmit – TXD)
3 (Transmit – TXD)	3 (Receive – RXD)
5 (Ground)	5 (Ground)

Communication Specification

Speed:	9600 baud for HEX, 57,600 for ASCII
Data Flow Control:	None
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:	ThermoCube II is always the SLAVE (DTE)
Interrupts Reported:	None, must be polled for status
Transmission Length:	≤ 15 meters
Data Update Frequency:	Once per second
Maximum Polling Frequency:	Three commands per second

7.2.2 RS-232 HEX Command Communication Protocol

Table 2: Command and Data Bytes

	Bit Position	Description	Bit =1	Bit = 0
Command Byte	Bit 7 (MSB)	Set Remote Control	remote control	local control (chiller)
	Bit 6	Remote On/Off	chiller On	chiller in standby
	Bit 5	Communication Direction	remote to chiller (command from master)	chiller to remote (status from chiller)
	Bits 4 – 0	Parameters being communicated (see table 2)		
Data Bytes	1 or 2 bytes depending on parameter (see tables 3-6)			

Table 3: Control Parameter

Bits 4 – 0	Parameter	No of Data Bytes
00001	Chiller set point 1 temperature	2
01001	Current fluid temperature at chiller coolant output	2
01010	Flowrate (-FM flowmeter option)	2
01000	Faults from chiller (fan, pump, RTD failure, etc.)	1
11110 with Bit 5 = 0	% Cooling or Heating in Hex (Byte 1) 80 if Cooling and 00 if Heating (Byte 2)	2
11110 with Bit 5 = 1	Clear Alarms and Restart	0

Table 4: Temperature Data Bytes (2 bytes)

The 2 data bytes for the temperature set point and transmission of the current temperature represent the value of the temperature in 0.1°F increments.

For example:

Temperature (examples)	Low Byte (Binary)	High Byte (Binary)	Hexadecimal as Sent
0.1 °F	00000001	00000000	01 00
1.0 °F	00001010	00000000	0A 00
10.0 °F	01100100	00000000	64 00
20.0 °F	11001000	00000000	C8 00
30.0 °F	00101100	00000001	2C 01
40.0 °F	10010000	00000001	90 01
50.0 °F	11110100	00000001	F4 01
60.0 °F	01011000	00000010	58 02
70.0 °F	10111100	00000010	BC 02

Table 5: Faults Data Byte (1 byte)

0 = OK, 1 = Fault

Bit Position	Fault Assigned	Hex value when fault is present
0	Tank Level Low	01
1	PCW Flow Low	02
2	Flow Fault (Flowmeter Option Only)	04
3	Pump Fail	08
4	Leak Detected (Leak Detect Option Only)	10
5	RTD	20
6	Stop (chiller in standby)	40
7	Unassigned	N/A

Table 6: % Cooling or Heating Examples (hex)

Temperature (examples)	Low Byte (Binary %)	High Byte (Binary heat or cool)	Hexadecimal String as Sent
20% Cooling	00010100	00100000	14 80
80% Cooling	00005000	00000000	50 80
20% Heating	00001400	00000000	14 00
80% Heating	00005000	00000000	50 00

Table 7: Flowrate Data 2 bytes in 1/100 lpm (even if display is gpm, lpm is reported)

Flowrate (examples)	Low Byte (Binary %)	High Byte (Binary heat or cool)	Hexadecimal String as Sent
2. 0 lpm	11001000	00000000	C8 00
3.85 lpm	10000001	00000001	81 01
0.9 gpm (3.41 lpm)	01010101	00000001	55 01

Notes:

1) Each data set is independent and can be run separately
2) The command byte is always active, so be careful when sending that the three most significant bits (bits 5-7) are set correctly. Bit 7 is remote operation (1 = remote), bit 6 is ON/OFF (1 = ON = unit controlling temp), bit 5 is Data direction (1 = host to controller, e.g. host sends set point to controller).
3) The ThermoCube II can handle up to 3 commands per second evenly spaced in time (333 msec).
4) The ThermoCube II does not echo back commands from the host.
5) If RS-232 communication does not seem to be functioning, cycle the main power to reset.
6) Windows operating systems require a \r\n at the end of each command sent. Linex and Apple OS require only \n.

7.2.3 RS-232 Communication Examples:

Table 8 HEX RS-232 communications examples

Example	Communications Sequence
1) Send set point of 50°F (10°C) to chiller	Host sends command byte = E1 (hex) Host sends LOW data byte = F4 (hex) Host sends HIGH data byte = 01 (hex)
2) Receive chiller set point	Host sends command byte = C1 (hex) Chiller sends LOW data byte = set point value in hex (LB) Chiller sends HIGH data byte = set point value in hex (HB)
3) Receive RTD temperature	Host sends command byte = C9 Chiller sends LOW data byte = actual temp in hex (LB) Chiller sends HIGH data byte = actual temp in hex (HB)
4) Receive the faults table	Host sends command byte = C8 Chiller sends faults data byte = fault data in hex
5) Receive % Cooling or Heating	Host sends command byte DE Chiller sends the % of full cooling or heating in hex, followed by 80 if cooling or 00 if heating
6) Receive Flowrate	Host sends command byte = CA Chiller sends LOW data byte = flowrate/100 in hex (LB) Chiller sends HIGH data byte = flowrate/100 in hex (HB)
7) Send Remote Start only	Host sends command byte = E0
8) Send Remote Stop only	Host sends command byte = A0
9) Clear Alarms and Restart	Host sends command byte = FE

7.2.4 RS-232 ASCII Communications Protocol

Table 9: ASCII RS-232 Commands

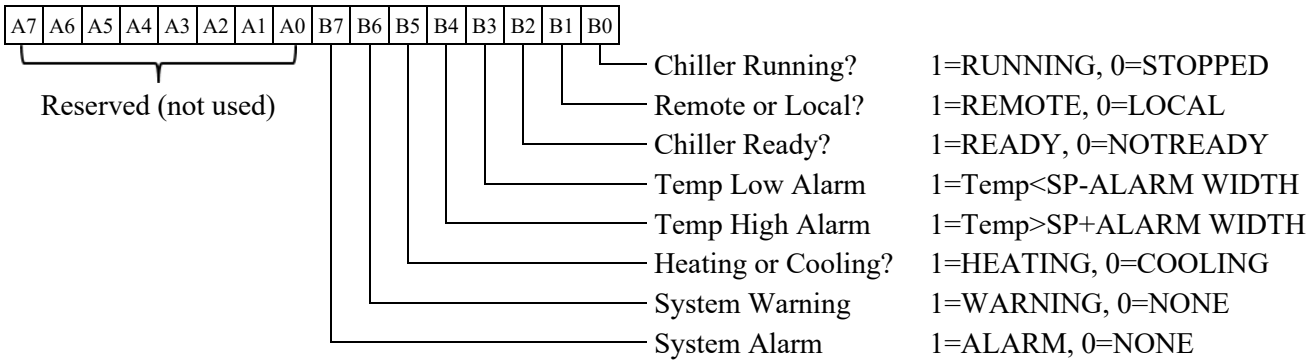
PARAMETER	GET Data Command	Response	PUT Data Command	Response
Show chiller identification information	IDN	Product Name, Model#, Software Number & Revision, Serial Number		
Put chiller in LOCAL mode			LOCAL	
Chiller: run, stop (Standby)	RUN?	RUNNING or STOPPED	RUN, STOP	
RTD temp	TEMP?	(-)XX.X[1]		
Set-point Temperature	SETTEMP?	(-)XX.X[1]	SETTEMP	(-)XX.X
Temperature Alarm width (+/-)	WIDTH?	XX.X	WIDTH	XX.X
RTD offset	RTDOFFSET?	(-)XX.X[1]	RTDOFFSET	(-)XX.X
Display backlight on/off	-		BLON, BLOFF	
Flow Rate (-FM option only)	FLOWRATE?	X.X		
Pump temperature	PUMPTEMP?	(-)XX.X[1]		
Actual TE PWM %	PWM?	(-)XX.X[1]		
Status word 1 (5 ASCII bytes)	STAT1A?	0 - 65535		
Faults word 1 (5 ASCII bytes)	FLTS1A?	0 - 65535		
Reset All Alarms and Restart			RESTART	

Notes: 1) A minus symbol, - , will precede negative temperature values or PWM% when cooling.
2) The RTDOFFSET sets the OFFSET parameter described in section 5.2 page 14.
3) Set points outside of the allowable range are ignored
4) The ThermoCube II handle up to 3 commands per second evenly spaced in time (333msec).
5) If RS-232 communication does not seem to be functioning, cycle the main power to reset.
6) Windows operating systems require a \r\n at the end of each command sent. Linux and Apple OS require only \n.

Table 10: Parameter Ranges

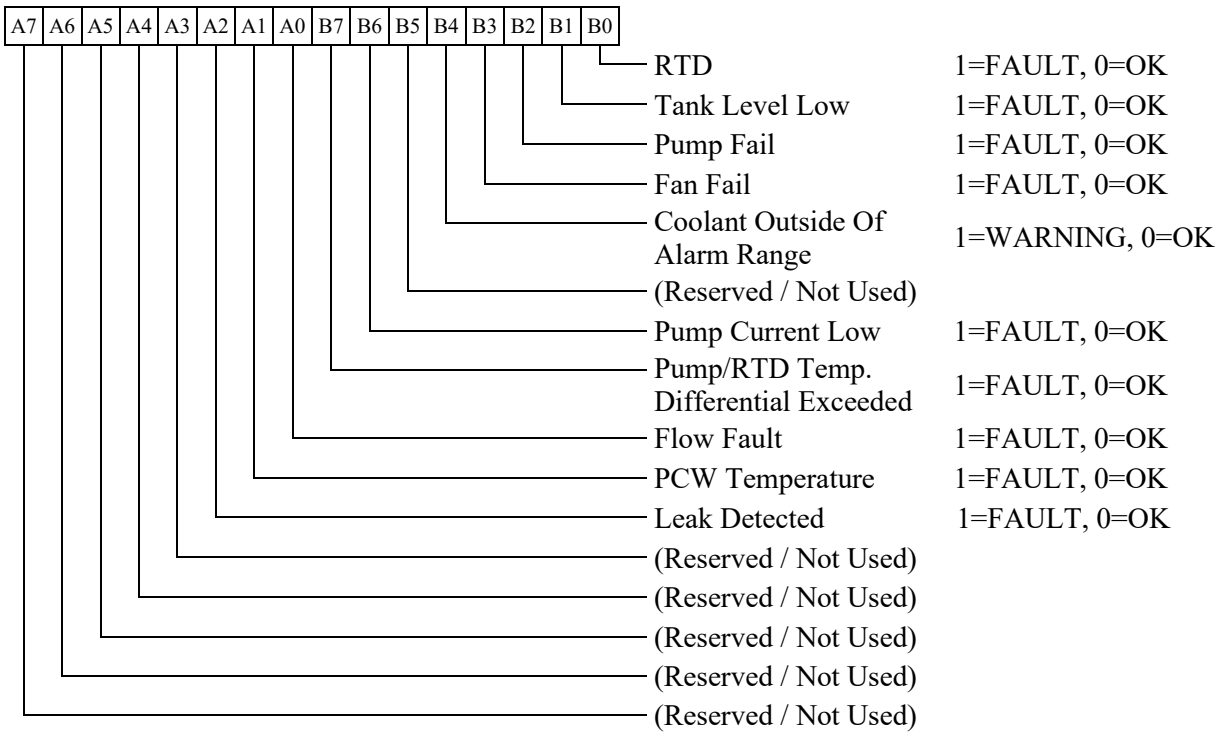
Data	Description	Format	Units	Range
TEMP?<Cr>	Coolant Temperature	(-)XX.X	°C	-10.0 – 65.0
SETTEMP<Cr>	Set Point Temperature -LT Option -HT Option	XX.X	°C	5.0 – 50.0 -5.0 – 50.0 5.0 – 65.0
FLOWRATE	Coolant Flow Rate in lpm or gpm, -FM option only	X.X	lpm or gpm	0.00-9.9
PUMPTEMP<Cr>	Cold Plate Temperature used to verify proper pump flow	XX.X	°C	-10.0 – 70.0
PWM<Cr>	% of Maximum Cooling (-) or Heating	XX.X	%	0 – 100.0
FANPWM<Cr>	Fan Speed in % of Full Speed	XX.X	%	40-100
STAT1A<Cr>	Status bits, See STAT1A Chart p. 26	XXXXX	none	0 - 65535
FLTS1A<Cr>	Fault bits, See FLTS1A Chart p. 26	XXXXX	none	0 - 65535

STAT1A Bit Field Definition: convert decimal number sent into binary, read as follows:



The Warning bit is triggered by tank level low and a temperature outside of the +/- alarm width.
The Alarm bit is triggered by an RTD fault, a pump fault, or a fan fault.
Stopped and Standby are the same.

FLTS1A Bit Field Definition (Fault="1") convert decimal number sent into binary, read as follows:



NOTES:

1. All commands terminate with a carriage return (0x0Dh)
2. All commands are case insensitive
3. Faults are non-recoverable and require fixing AND a power-cycle Or an RS232 ***CLEARALARMS<Cr>*** text message sent to the Chiller to return to normal operation.

7.3 RS-485 COMMUNICATIONS

ThermoCube II RS-485 communications use the same commands as the RS-232 protocols listed in Sections 7.2.1 and 7.2.2. The RS-485 communications specification is shown below.

Wiring: Proper wiring depends upon whether the equipment being cooled (the Host) is wired as Data Computer Equipment (DCE) or Data Terminal Equipment (DTE)

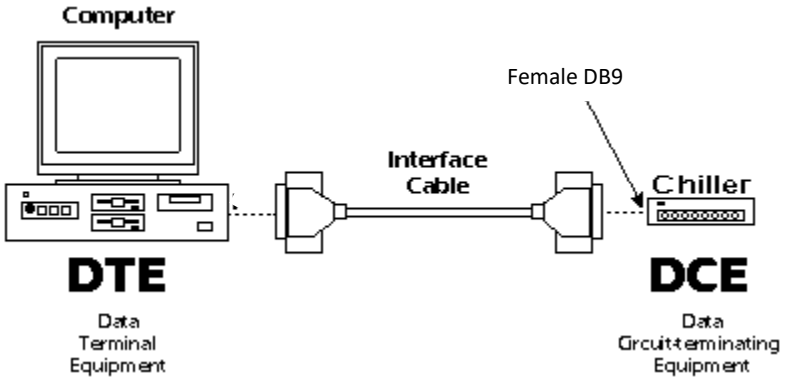


Table 1: Signal definition and full duplex wiring for Host wired as DTE

ASML/DTE Male 9-Pin D-sub Pin #	**ThermoCube/Chiller/DCE** Female 9-Pin D-sub Pin#
2 T1 (Transmit – T+)	2 T1 (Transmit – T+)
7 T2 (Transmit – T-)	7 T2 (Transmit – T-)
3 R1 (Receive – R+)	3 R1 (Receive – R+)
8 R2 (Receive – R-)	8 R2 (Receive – R-)
5 (Ground)	5 (Ground)

Communication Specification

Speed:	9600 baud for HEX, 57,600 baud for ASCII
Data Flow Control:	None
Data Format:	8-bit serial
Data Transmission	Wired for full duplex, but transmissions must be half duplex (no simultaneous requests/transmissions)
Number of Start bits	1
Number of Stop bits:	1
Parity:	None
Master/Slave:	The ThermoCube is always the SLAVE (DCE)
Interrupts Reported:	None, must be polled for status
Transmission Length:	100 meters
Data Update Frequency:	Once per second
Maximum Polling Frequency:	One command every 200msec
Maximum Response Time:	200msec
Data Format:	See Sections 7.2.1 and 7.2.2

7.4 ETHERNET COMMUNICATIONS

ThermoCube II may be configured to communicate via Ethernet using the same commands as RS-232. When this option is selected, the communications port changes from a 9-pin dsub to a standard CAT-5 ethernet jack. The default Ethernet settings are listed below:

IP Address:	192.168.2.125
Subnet Mask	255.255.255.0
Gateway:	192.168.2.1
IP Configuration:	Static
User Name:	admin
Password:	admin
Port Number:	10001

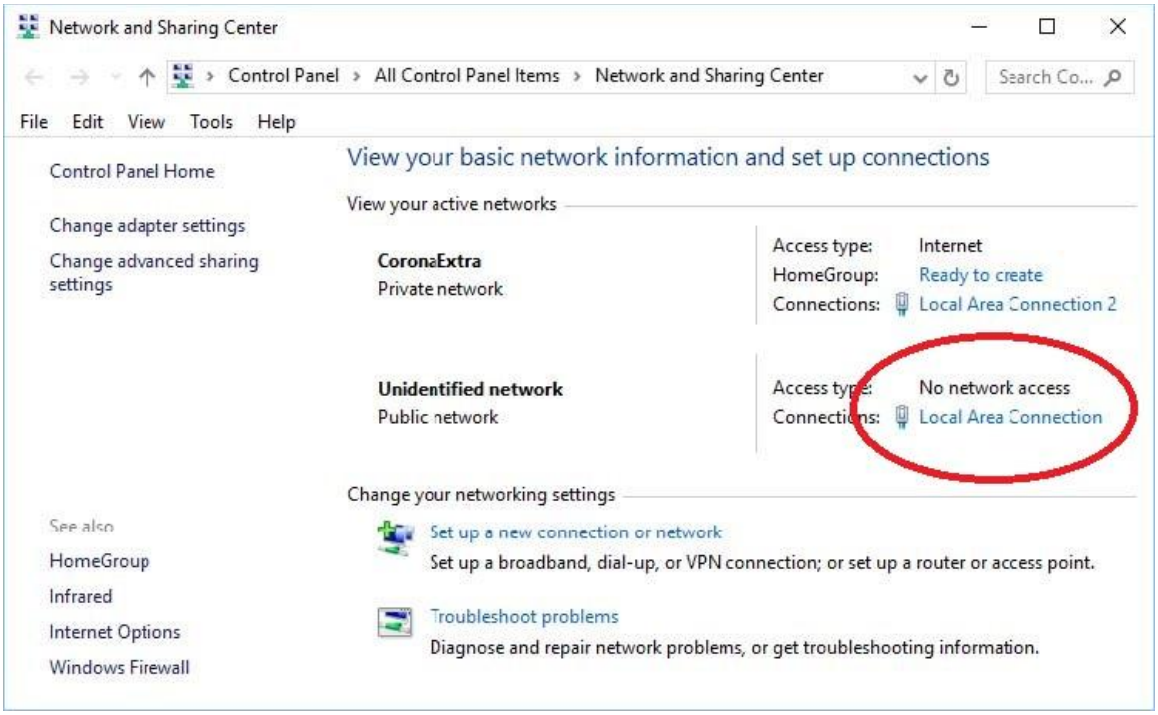
Use the following procedure to re-configure the Ethernet settings to match your system requirements:

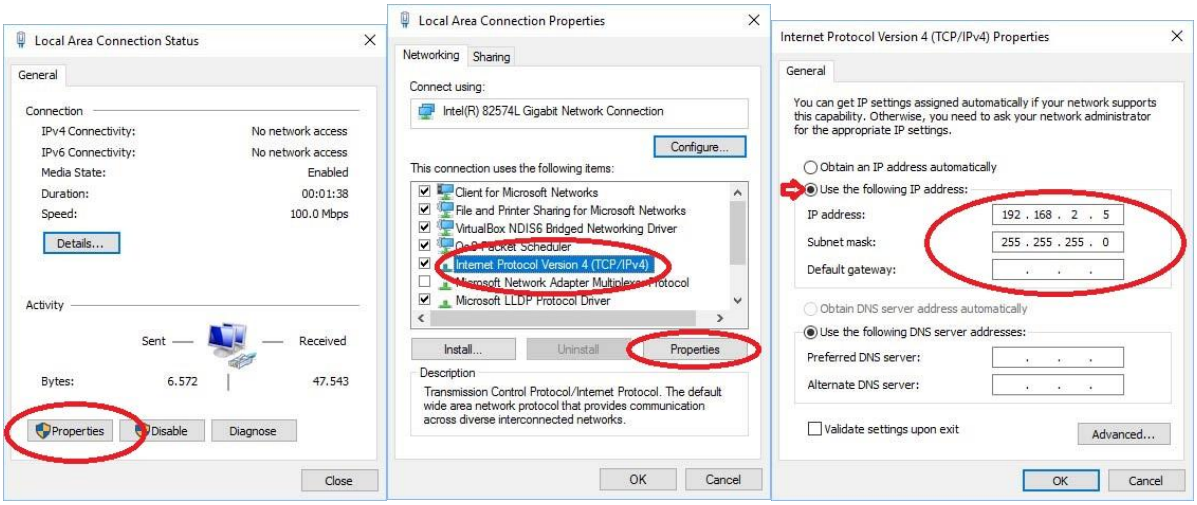
1. Connect the XS1200 to your computer using a standard cross over cable (EIA/TIA T568B) LAN cable.
2. Connect the XS1200 to the power supply and turn on the power.

Assigning a static IP address

The XS1200's IP address is **192.168.2.125**. For your computer to be able to find the XS1200 you need to assign a static IP address in the 192.168.2.2 to 192.168.2.254 range to the network connection to where you connect the XS1200:

1. Click Start and go to: Control Panel\All Control Panel Items\Network and Sharing Center.
2. Click on 'Local Area Connection' (this is the connection where the XS1200 is connected). If you have not connected the XS1200 to your computer, or if the cable is incorrectly connected you might not be able to see this 'Local Area Connection', so make sure the XS1200 is properly connected to your computer:

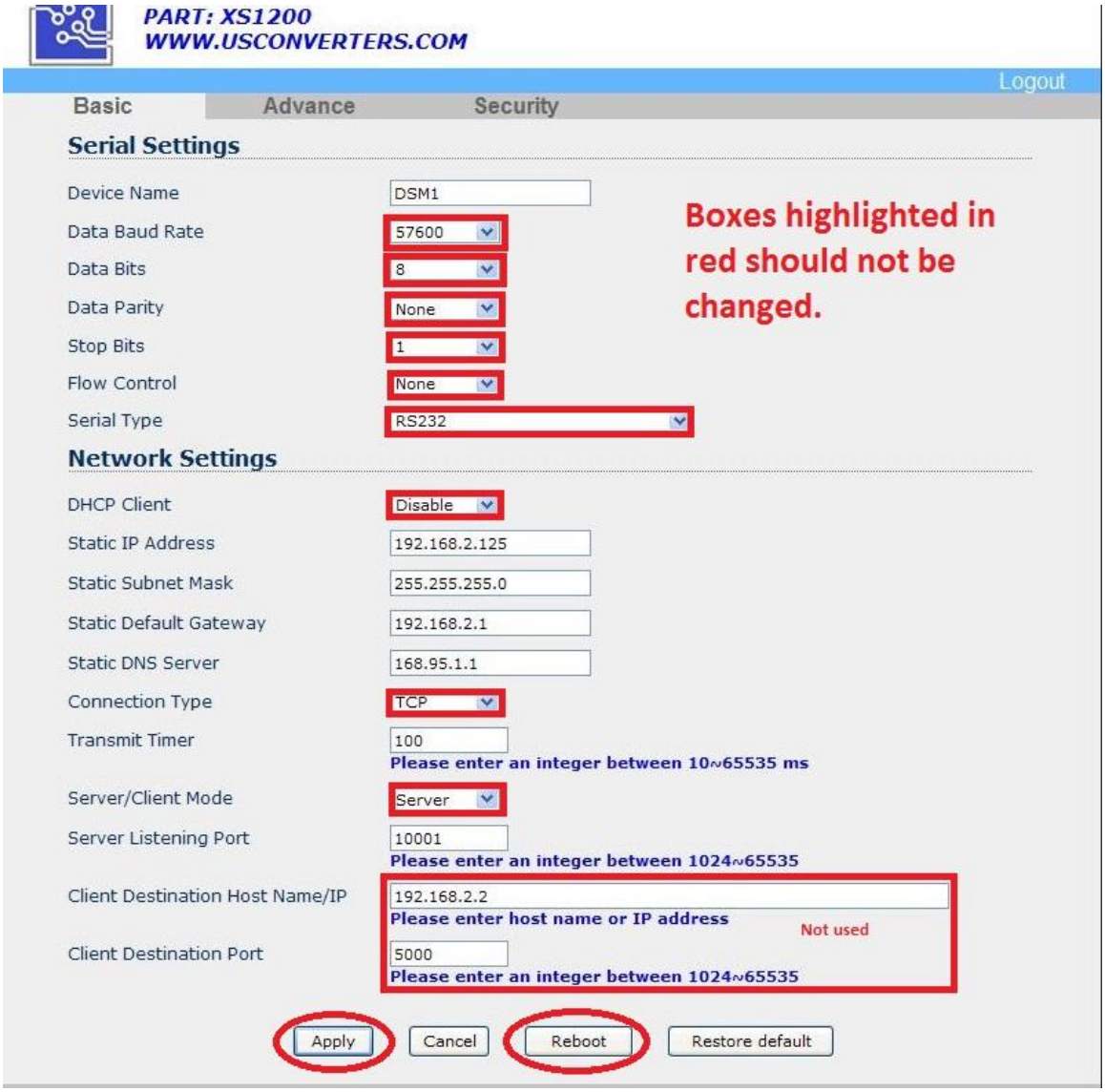




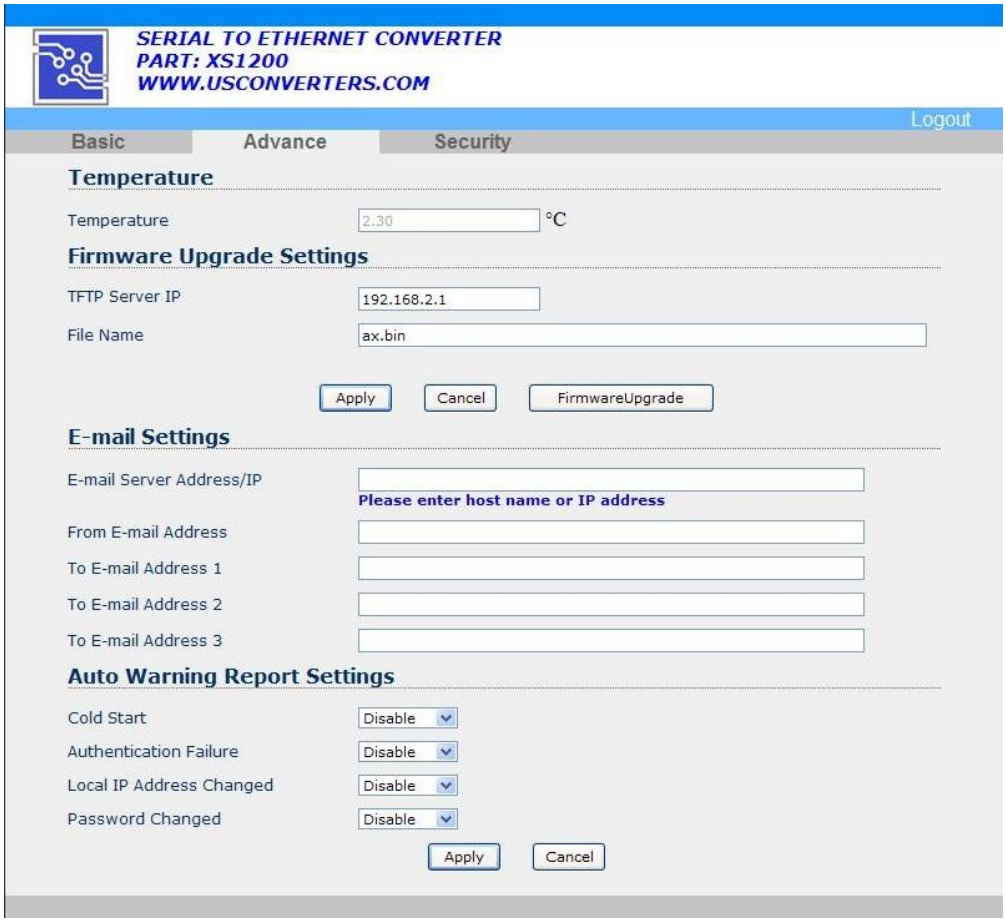
3. Local area connection status, Click on ‘Properties’.
4. Local area connection properties, Highlight the ‘Internet Protocol Version 4’ and click ‘Properties’.
5. Internet protocol Version 4 (TCP/IPv4) properties, Click the radio button “Use the following IP address”.
Enter a static IP address in the 192.168.2.2 to 192.168.2.254 range (except 192.168.2.125 which is the XS1200’s IP address) and a Subnet mask of 255.255.255.0 and click OK. Click OK at the Local Area Connection Properties window and close the Local Area Connection Status window.
You have now assigned a static IP address to the network connection where to the XS1200 is connected.

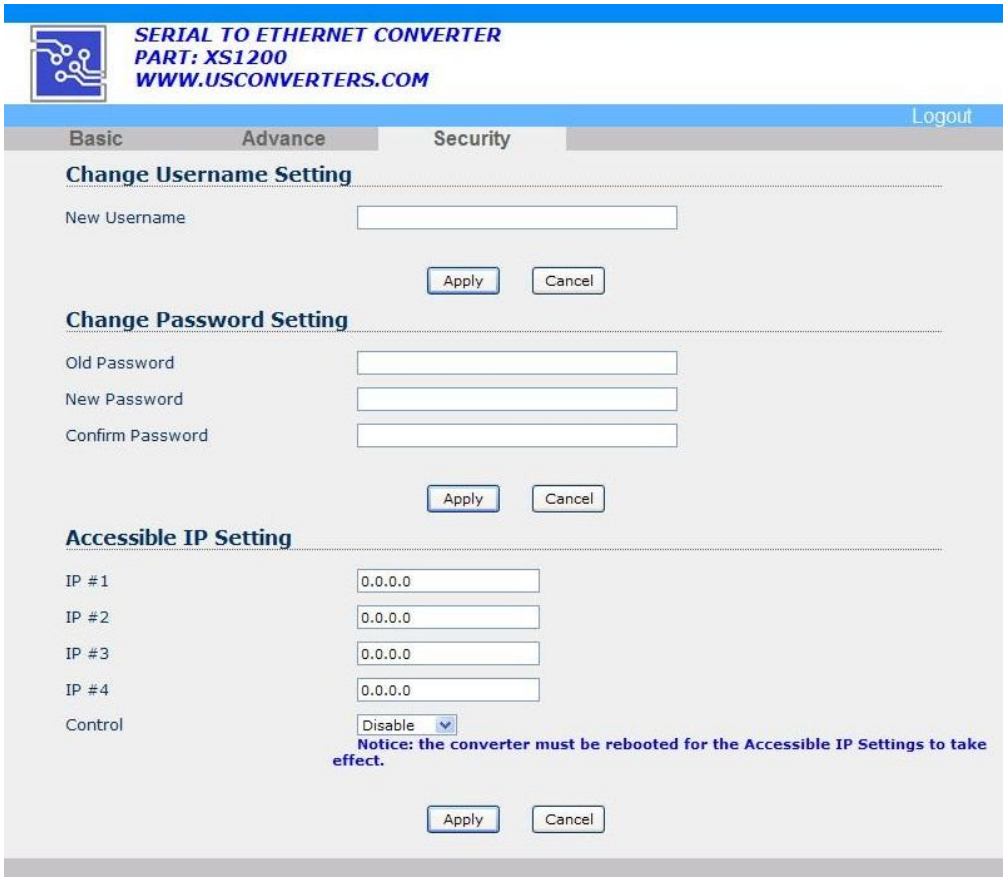
6. Type the address into the browser as shown.

7. The user name and passwords are both: admin.



8. Adjust parameters on the Basic Tab according to your needs.
9. Click “Apply” then “Reboot” to save the new parameters.
10. The Advance and Security Tabs are as follows.


SERIAL TO ETHERNET CONVERTER
PART: XS1200
WWW.USCONVERTERS.COM
Logout
Basic
Advance
Security
Temperature
Temperature
2.30
°C
Firmware Upgrade Settings
TFTP Server IP
192.168.2.1
File Name
ax.bin
Apply
Cancel
FirmwareUpgrade
E-mail Settings
E-mail Server Address/IP
Please enter host name or IP address
From E-mail Address
To E-mail Address 1
To E-mail Address 2
To E-mail Address 3
Auto Warning Report Settings
Cold Start
Disable
Authentication Failure
Disable
Local IP Address Changed
Disable
Password Changed
Disable
Apply
Cancel


SERIAL TO ETHERNET CONVERTER
PART: XS1200
WWW.USCONVERTERS.COM
Logout
Basic
Advance
Security
Change Username Setting
New Username
Apply
Cancel
Change Password Setting
Old Password
New Password
Confirm Password
Apply
Cancel
Accessible IP Setting
IP #1
0.0.0.0
IP #2
0.0.0.0
IP #3
0.0.0.0
IP #4
0.0.0.0
Control
Disable
Notice: the converter must be rebooted for the Accessible IP Settings to take effect.
Apply
Cancel

7.5 OTHER OPTIONS

-AA: Audio Alarm (Buzzer) Option

Audio alarm option. The ThermoCube II can come with an 87dB buzzer that sounds when an alarm occurs.

-C: Copper Cold Plate Option

It is very important to match the wetted metals of the system the ThermoCube II is controlling, to minimize any risk of corrosion. If your system uses any copper or brass parts, we recommend the "-C" option to match wetted metals. Note that cooling capacity will be degraded by as much as 15-20% with this option, depending on configuration.

-DC: Dry Contact Alarm Option

The ThermoCube II can be configured with two normally closed 1 amp 250V dry contact alarm relays instead of the standard TTL alarms, one for system faults and one for temperature exceeding the alarm range. These contacts are wired to the 9-pin dsub connector as follows:

System Fault Alarm Common:	Pin 6
System Fault Alarm:	Pin 7
Temperature Alarm Common:	Pin 8
Temperature Alarm:	Pin 9

If the RS232 option is chosen with dry contact alarm option, then the dry contacts are wired to the 9-pin female dsub connector as follows:

System Fault Alarm Common:	Pin 6
System Fault Alarm:	Pin 1
Temperature Alarm Common:	Pin 9
Temperature Alarm:	Pin 4

-EF: External Filter Option

This option adds an external 5 micron filter to the ThermoCube II coolant outlet for systems sensitive to particulate matter in the coolant. Note that this option also dampens coolant flow pulses, producing a smoother coolant flow.

-FL: Fluorinert or Galden

CAUTION

This option is selected to configure the ThermoCube II for perfluorinated or hydro fluorinated ether process fluids such as Fluorinert or Galden. Cooling capacity will be degraded by approximately 10-15% with this option, depending on configuration. CAUTION: Make sure this option is included in your ThermoCube II configuration if you plan to use these process fluids.

-FM: Flow Meter Option

This option adds a 0.3 to 10.0 lpm flow meter and reports the coolant flow rate on the front display and via remote communications.

-HT: High Temperature Operation Option

The ThermoCube II normally has set point limits of 5°C and 50°C along with a thermistor on its liquid cold plate that shuts off heating at a temperature of 55°C to protect against hot coolant damaging the operator's equipment. The –HT option changes this shut down temperature to 70°C and adds insulation to allow operation up coolant temperatures of 65 °C. Note: The Maximum specified temperature for standard Centrifugal pumps (-1C and -1CL) is 60 °C.

-LD: Leak Detect Option

This option adds an optical leak detector and sealed dam under the plumbing section, triggering a fault if any coolant is detected.

-LT: Low Temperature Operation Option

The ThermoCube II normally has set point limits of 5°C and 50°C along with a thermistor on its liquid cold plate that shuts off cooling at a temperature of 2°C to prevent freeze damage when using water as a coolant. The –LT option allows set points down to -5°C, adds insulation to allow operation below the freezing point of water (0°C), and changes the shut-down temperature to -10°C. When selecting this option, the operator must ensure coolants are selected that will not freeze within 5°C of set point. Repairs to thermoelectric heat exchangers damaged by freezing water in ThermoCube II units with this option selected will not be covered by warranty.

-RF: Run/Fill Switch Option for 3G (3 lpm Gear Pump)

ThermoCube II chillers with -3G pumps with the RF option come with a Run/Fill switch located above the signals connector. This switch allows the user to run the pump at low speed (Fill) during initial filling and then, once all air-bubbles are out of the plumbing lines, increase the pump speed (Run) for normal operation. Failure to run the pump in the fill mode after initial hook-up or with drained plumbing lines can result in water being blown out of the tank from compressed air bubbles in the lines.

Note: The coolant flow rate in the fill mode is approximately 1.3 liters/minute.

-S: Stainless Steel Cold Plate Option

It is very important to match the wetted metals of the system the ThermoCube II is controlling, to minimize any risk of corrosion. We recommend using a stainless steel cold plate if you are uncertain about the wetted metals. Note that cooling capacity will be degraded by as much as 15-20% with this option, depending on configuration.

-SS: Stainless Steel Plumbing and Tank Option

With this option the standard tank and plumbing are replaced with all stainless steel tank and plumbing. Note: This configuration option is only available with gear pumps.

-ST: Stainless Steel Tank Option

With this option the standard tank is replaced with a stainless steel tank.

-TT: TTL Alarm Option

This option provides two 5VDC TTL signals for alarms, one when temperature is out of range and the other for system alarms. Alarm signals are TTL signals, normally high (>4 VDC), located on the 9-pin d-subminiature connector as follows:

System Alarm:	Pin 7
Alarm Signal Return:	Pin 8
Temperature Alarm:	Pin 9

Note: This option is not available with the -DC or -AA options.

-VD: Vibration Dampening Option

This option adds vibration dampening material to interior sheet metal surfaces for applications such as scanning electron microscopes that are highly sensitive to vibrations from pumps and fans. This option is usually combined with the –EF external filer option which dampens vibrations in the coolant flow.

SECTION 8
CLEANING YOUR CHILLER

The exterior surfaces of the ThermoCube II may be cleaned with a non-shedding wipe dipped in isopropyl alcohol.

SECTION 9
TECHNICAL SUPPORT

Delighting our customers is our highest priority. Please contact us immediately for technical assistance whenever you have questions or concerns.

Hours: 8 a.m. to 5 p.m. Eastern Time, Monday - Friday
Telephone: (845) 296-1300
Fax: (845) 296-1303
E-mail: info1@sscooling.com

SECTION 10
SDS FOR COOLANTS
10.1 KOOLANCE (27% PROPYLENE GLYCOL/WATER)

Safety Data Sheet – Last updated May 2016

1. IDENTIFICATION

Product: LIQ-702xx Coolant Fluid ("xx" signifies liquid color)
Manufacturer: Koolance Korea
Address: Koolance Bld, 40, Deokcheon-ro 34, Manan-gu, Anyang-si, Gyeonggi-do, Korea 14088
Telephone: (U.S.) +01 253-249-7669, Fax: (U.S.) +01 253-249-7453

Appearance: Liquid for cooling systems. Available in various colors and shipped in plastic bottles or containers.
Usage: For use in cooling systems only. Do not use in foodstuffs, beverages, or in other applications.

2. HAZARD IDENTIFICATION

Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

- Physical Hazard: Not applicable
- Health Hazard: Skin Irritation – Category 2
  Eye Irritation – Category 2
- Environmental Hazard: Not applicable

Label elements including precautionary statements.

Symbol: Signal word: Warning

Hazard statement: H315 – May cause irritation to the skin.
H319 – May cause serious irritation to the eyes.

Prevention: P264 - Wash thoroughly after handling
P280 - Wear protective gloves, clothing, and eye protection.

Responses:

- P302+P352 If on skin: Wash exposure area with plenty of water and soap.
- P305+P351+P338 If in eyes: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
- P337+P313: If skin or eye irritation persists, seek medical attention immediately.
- P362: Remove contaminated clothing and wash before reuse.

Storage / Disposal: P501: Refer to all federal, provincial, state, and local regulation prior to disposition of container and unused contents by reuse, recycle, or disposal.

NFPA Rating (estimated)
Health: 1
Flammability: 1
Reactivity: 0
Water Reactivity: 0

3. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients	CAS No.	EINECS No.	Conc. %
Distilled Water	7732-18-5	231-791-2	70 – 75
Propylene glycol	57-55-6	200-338-0	25 – 30
Others (Proprietary)	-	-	0.2 – 2.0

4. FIRST AID MEASURES

- In case of eye contact: Rinse thoroughly with plenty of water for at least 20 minutes. If irritation remains, consult a medical doctor immediately.
- In case of skin contact: Remove contaminated clothing. Wash with soap and plenty of water for at least 20 minutes. If irritation remains, consult a medical doctor immediately.
- If inhaled: Move person to fresh air. If not breathing, give artificial respiration and immediately contact emergency medical assistance.
- If ingested: Never give anything by mouth to an unconscious person. Rinse mount with water and consult a medical doctor immediately.

Other medical attention: Medical persons should be aware of protective measures for handling.
Potential health effects: May be harmful or fatal if swallowed.

5. FIRE-FIGHTING MEASURES

- Flash Point: 118°C (Cleveland open cup)
- Suitable extinguishing media: Water spray, alcohol-resistant foam, dry chemical, carbon dioxide
- Specific hazards arising from the chemical: No data available
- Special protective equipment for fire fighters:
  - Use water spray to cool unopened containers.
  - Fire fighters should enter area wearing respiratory protection and protective equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:

- Ensure adequate ventilation.
- Remove all sources of ignition.
- Avoid contact with skin and eyes.
- Avoid inhalation of vapor, mist, or gas.

Environmental Precautions:

- Follow local regulations.

Methods and materials for containment and clean-up:

- Collect with non-combustible absorbent materials (sand and soil).

7. HANDLING AND STORAGE

Precautions for safe handling:

- Wear protective gloves, clothing, and eye/face protection.
- Do not spray on an open flame or other ignition source.
- Provide forced air ventilation in tanks and confined spaces.
- Avoid contact with skin and eyes.
- Avoid inhalation of vapor, mist, or gas.
- Keep away from sources of ignition. No smoking.

Conditions for safe storage:

- Keep container tightly closed.
- Keep in a dry and well-ventilated place.
- Keep cool.
- Avoid direct sunlight, heat sources, and strong oxidizing agents.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Conditions for safe storage:

- KOSHA: No data available
- US ACGIH: No data available

Appropriate engineering controls:

- Respiratory protection: Approved respirator equipped with cartridge for organic vapors
- Eye protection: Protective goggles
- Hand protection: Chemical resistant gloves

9. PHYSICAL AND CHEMICAL PROPERTIES

- State: Liquid at 20°C
- Flash Point: 118ºC (Cleveland open cup). No flash occurred under 93ºC (Tag closed cup)
- pH: 7.0 – 8.0 at 20°C; Sample H2O = 1:5 (V/V)
- Viscosity: 2.3 mPa x s (cP) at 20°C
- Density: 1.03 at 20°C
- Water solubility: Soluble at 20°C
- Explosive properties: No self-reaction hazard; UN TDG test & criteria – Test E3
- Autoignition temperature: No spontaneous combustion under 300°C
- Boiling point (initial): >98ºC
- Melting range: No data available
- Vapor pressure: No data available
- Oxidizing properties: No data available
- Partition coefficient (n-octanol/water): No data available
- Evaporation rate: No data available
- Decomposition temperature: No data available
- Lower explosion limit / Upper explosion limit: No data available

10. STABILITY AND REACTIVITY

Chemical stability:

Stable under recommended storage conditions.

Conditions to avoid:

Direct sunlight, heat, flames, and sparks.

Materials to avoid:

Strong oxidizing agents.

Hazardous decomposition products:

Carbon oxides

11. TOXICOLOGICAL INFORMATION

- Acute toxicity (Calculated):

Oral	rat	LD50 : 23,779 mg/kg
Skin	rabbit	LD50 : 38,021 mg/kg
Inhalation	rat	LC50 : 145 mg/kg

- Skin irritation: Irritating (Calculated, Category 2)
- Eye irritation: Irritating (Calculated, Category 2)
- Respiratory sensitization: No data available
- Skin sensitization: No data available
- Germ cell mutagenicity: No data available
- Carcinogenicity: Not classifiable; from IARC / EC ESIS
- Reproductive Toxicity: No data available
- Specific target organ toxicity – single exposure (GHS): No data available
- Specific target organ toxicity – repeated exposure (GHS): No data available
- Aspiration hazard: No data available

12. ECOLOGICAL INFORMATION

- Acute toxicity (Calculated):

Fish	LC50 : 8,700mg/l 96hr Pimephales promelas
Crustacean	LC50: 7,921mg/l 48hr Daphnia magna
Bird	EC50: 1,634mg/l 72hr Selenastrum capricornutum

- Persistence and degradability: No data available
- Bioaccumulative potential: No data available
- Mobility in soil: No data available
- Other adverse effects: No data available

13. DISPOSAL CONSIDERATIONS

Disposal consideration:

Observe all environmental regulations.

Disposal precaution:

Avoid disposing in the environment.

14. TRANSPORT INFORMATION

- TSCA: All ingredients are listed on the TSCA inventory
- DOT Classification: Not a DOT controlled material (U.S.)
- UN TDG: Not dangerous goods
- IMDG: Not dangerous goods
- IATA: Not dangerous goods
- Marine pollution: Not applicable
- Special precaution:
  - Fire EmS Guide: F-E (Recommendation)
  - Spillage EmS Guide: Not dangerous goods

15. REGULATORY INFORMATION

- Korea Industrial Safety and Health Act (GHS): Eye irritation – Category 2
- Korea Industrial Safety and Health Act (GHS): Skin irritation – Category 2
- Korea Hazardous Materials Safety Control Act: Not hazardous material
- Korea Toxic Chemicals Control Act: Not a toxic chemical
- Korea Persistent Organic Pollutants Control Act: Not applicable
- US OSHA Hazards (GHS): Eye irritation
- US OSHA Hazards (GHS): Skin irritation

16. OTHER INFORMATION

Last Updated: March, 2015

References:

- GHS Classification: EC ESIS, US NLM
- Physical and chemical properties: EC ESIS, US NLM
- Transport information: EC ESIS, US NLM
- Toxic and ecological information: OECD SIDS, IUCLID, US NLM, IARC, EC ESIS, CCRIS

Acronyms and Websites:

- EC ESIS : European chemical Substances Information System, http://esis.jrc.ec.europa.eu/
- IUCLID : International Uniform Chemical Information Database, http://esis.jrc.ec.europa.eu/
- US NLM : U.S. National Library of Medicine, http://chem.sis.nlm.nih.gov/chemidplus/
- HSDB : US Hazardous Substances Data Bank, http://toxnet.nlm.nih.gov/
- CCRIS : US Chemical Carcinogenesis Research Information System, http://toxnet.nlm.nih.gov/
- IARC : International Agency for Research on Cancer, http://monographs.iarc.fr

This SDS is composed with reference to documents and criteria provided by KOSHA. The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Koolance be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Koolance has been advised of the possibility of such damages.

10.2 ETHYLENE GLYCOL

ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date: 02-Feb-2010 **Revision Date:** 17-Jan-2018 **Revision Number** 4

1. Identification

Product Name **Ethylene glycol**

Cat No. : **E177-4; E177-20**

CAS-No 107-21-1
Synonyms Monoethylene glycol; 1,2-Ethanediol

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTRECÒ, Inside the USA: 800-424-9300
CHEMTRECÒ, Outside the USA: 001-703-527-3887

2. Hazard(s) Identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2

Label Elements

Signal Word
Warning

Hazard Statements
Harmful if swallowed
May cause drowsiness or dizziness
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Reproductive Harm - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene Glycol	107-21-1	>95

4. First-aid measures

Eye Contact — Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact — Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.

Inhalation — Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention immediately if symptoms occur. If not breathing, give artificial respiration.

Ingestion — Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms and effects — Breathing difficulties.

Notes to Physician — Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available
Flash Point 111 °C / 231.8 °F
Method - DIN 51758

Autoignition Temperature 413 °C / 775.4 °F

Explosion Limits
Upper 15.30 vol %
Lower 3.20 vol %
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO2)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	1	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Ensure adequate ventilation. Do not breathe vapors or spray mist. Avoid contact with skin, eyes and clothing.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
ethylene glycol	TWA: 25 ppm STEL: 50 ppm STEL: 10 mg/m^3	(vacated) Ceiling: 50 ppm (Vacated) Ceiling: 125 mg/m^3		Ceiling: 100 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Viscous liquid Liquid
Appearance	Colorless
Odor	Odorless
Odor Threshold	No information available
pH	5.5-7.5 50% aq. sol
Melting Point/Range	-13 °C / 8.6 °F
Boiling Point/Range	196 - 198 °C / 384.8 - 388.4 °F @ 760 mmHg
Flash Point	111 °C / 231.8 °F
Method -	DIN 51758
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.30 vol %
Lower	3.20 vol %
Vapor Pressure	0.12 mmHg @ 20 °C
Vapor Density	2.14 (Air = 1.0)
Specific Gravity	1.113
Solubility	miscible
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	413 °C / 775.4 °F
Decomposition Temperature	> 500°C
Viscosity	21 cP (20°C)
Molecular Formula	C2 H6 O2
Molecular Weight	62.06

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Hygroscopic.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Strong oxidizing agents, Strong acids, Strong bases, Aldehydes
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO2)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological Information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LD50 Inhalation
Ethylene glycol	7712 mg/kg (Rat)	9530 µL/kg (Rabbit) 10600 mg.kg (Rat)	Not listed

Toxicologically Synergistic Products No information available
Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation May cause eye, skin, and respiratory tract irritation

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene glycol	107-21-1	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver

Aspiration hazard No information available

Symptoms/effects, both acute & delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological Information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene glycol	EC50: 6500 - 13000 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: = 16000 mg/L, 96h static (Poecilia reticulata) LC50: 40000 - 60000 mg/L, 96h static (Pimephales promelas) LC50: = 40761 mg/L, 96h static (Oncorhynchus mykiss) LC50: = 41000 mg/L, 96h (Oncorhynchus mykiss) LC50: 14 - 18 mL/L, 96h static (Oncorhynchus mykiss) LC50: = 27540 mg/L, 96h static (Lepomis macrochirus)	Not listed	EC50: = 46300 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Ethylene glycol	-1.93

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene glycol	X	X	-	203-473-3	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 Threshold Values %
Ethylene glycol	107-21-1	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene glycol	X		-

OSHA Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene glycol	5000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene glycol	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Slight risk, Grade 1

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 02-Feb-2010
Revision Date 17-Jan-2018
Print Date 17-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

WARRANTY POLICY

This ThermoCube II is covered under a two-year parts and labor warranty from the date of shipment, assuming proper use and maintenance of the unit. All warranty work shall be performed at Solid State Cooling Systems' facility, currently located in Wappingers Falls, NY, USA and requires pre-authorization by SSCS. Malfunctioning products should be returned to Solid State Cooling Systems by the method described below. Solid State Cooling Systems will provide a Failure Analysis Report to the customer and will determine if the problem is covered under the warranty.

Warranty Coverage:

Products with defects in components or manufacturing which are reported to Solid State Cooling Systems before the end of the warranty period will be repaired or replaced at no cost (see below for reporting requirements). The warranty period begins on the date the product was initially shipped from Solid State Cooling Systems' 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 usage occurring during a situation specifically cautioned against or noted in the product manual.

Specific situations, which invalidate the warranty, include (but are not limited to):

- Operating the unit outside the stated specification ranges
- Removing the serial number label.
- Any disassembly (partial or complete) of the product.
- Changing any components of the product.
- Subjecting the product to temperatures below the freezing point of the coolant used.
- 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.

Returned Goods Procedure and Reporting Requirements

Before a failed product is returned to the factory, a Returned Materials Authorization (RMA) number must be obtained from Customer Service at (845) 296-1300. The date the RMA is requested will be the reporting date noted and relevant to the warranty. Products, which have received an RMA, must be received at SSCS's factory, within 30 days or the reporting date will be moved ahead 30 days and a new 30-day waiting period will begin. Customers shall pay shipping cost of returning any unit to SSCS and SSCS shall pay shipping cost of returning any unit repaired under warranty to the customer.

All out of warranty returned goods will require an evaluation purchase order prior to receipt at Solid State Cooling Systems. The evaluation costs will depend on product model and will be deducted from the cost of any repairs required.