400
Watts of Cooling Power

0
Global Warming Potential

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RoHS COMPLIANT

Nextreme™ Thermoelectric Chiller, NRC400

Specification and User Manual

Laird™
THERMAL SYSTEMS

www.lairdthermal.com

Table of Content

1. Revision History

User Manual Part Number: 387009443

REV	DATE	DESCRIPTION
00	06/30/2022	Initial release
01	03/08/2023	Updated connector from CPC -PLCD26006 to CPC - PLCD22006 under specifications

2. Introduction

The Nextreme NRC400 is a new generation recirculating chiller designed for precise temperature control of analytical instrumentation, industrial lasers and imaging. The NRC400 is a thermoelectric-based recirculating chiller with few moving parts offering solid-state construction and high reliability. It is also environmentally friendly as no hazardous refrigerants are used. Innovating heat dissipation technologies in conjunction with optimized thermoelectric cooler modules have been incorporated into the design to offer a compact solution with high cooling capacity. The pump offers sufficient flow with low pulsation for low pressure drop applications and uses ceramic bearings to assure long life operation.

This chiller offers an LCD touchscreen display for easy user interface to set temperature, alarm features and monitor coolant supply temperature. The programmable alarm offers freeze protection and can alert users when fluid level falls below normal operating conditions. If a critical component fails, such as the fan or pump, the unit will operate in a safe mode. This NRC400 uses a semi-closed system with a large reservoir tank to reduce the coolant maintenance and comes with quick disconnect liquid connections to simplify hood up to supply line.

This user manual provides necessary information to the customer for proper installation, operation, communication, and maintenance of the chiller.

3. Safety Precautions

This section provides an overview of all the important safety aspects for optimal protection of personnel as well as safe and trouble-free operation of the equipment.

The operating manual and warning instructions specified herein should be reviewed completely by all personnel prior to operating the unit. Disregarding instructions within this manual may result in considerable danger.

3.1 Guidelines for Safe Operation

3.1.1 Prevent Hazards

Hazards can be prevented by safety-conscious and anticipatory behavior of staff. Individuals working with the unit should keep the following in mind:

- Always keep a complete and legible copy of this operating manual (or the location at which it can be found) available at the installation site of the unit.
- Use personal protection equipment.
- Unit personnel must be familiar with all operating elements of the unit before starting work on the unit.
- Only use the unit for its intended purpose.
- Conduct inspections on a regular basis and ensure the unit is operational and free of damage.
- All unit warning and information signs must be kept in legible condition. If a warning or information sign is lost or illegible, it must be replaced.
- Unit repairs may be carried out by qualified personnel only.
- Any disruption or recognizable change concerning the unit should be reported to the responsible person.
- Adhere to the accident prevention regulations as well as any regional regulations.

3.1.2 Personal Protective Gear

To minimize health hazards, wearing personal protective gear is required when handling the unit. The following personal protective gear must always be worn when handling the unit:

	Protective footwear For protection from falling parts and to prevent slipping.

When cleaning or performing maintenance or repair work on the unit, the following specific personal protective gear is required:

	Protective gloves To protect the hands from rubbing, abrasions, cuts, or more serious injuries. To prevent burns when touching hot coolant.
	Protective eyewear To protect the eyes against flying parts or splashing coolant.

3.1.3 Guidelines Regarding Electrical Equipment

DANGER

Electrical danger

Work on electrical installations must be carried out only by trained and authorized electricians.

- Observe all regional regulations when connecting electrical equipment to mains. Be aware of the connection diagram information.
- Electrical shock hazards exist if the electrical installations are defective or the insulation fails during operation.
- Switch off and disconnect the unit from the electrical mains and follow Lockout-Tagout procedures whenever conducting service work.
- Ensure continuity to ground and isolation from power lines.
- Any changes regarding the operation of the unit can have an influence on safe operation. All intended changes should be authorized by the manufacturer prior to implementation.
- Keep unauthorized persons away from the working area.

3.1.4 Inadmissible Operating Conditions

Operating the unit under improper conditions is not permitted as the operator's safety cannot be guaranteed. Some operating conditions not permitted are the following:

- Using the unit for a purpose other than its intended use
- Using of the unit when any part of it is damaged, not working properly, the electrical installation is not correct, or the electrical insulation is damaged
- Protective or safety equipment is non-functional, defective, improperly installed, or missing
- The unit or operating parameters were modified without consulting the manufacturer
- Operation in areas exposed to explosion hazards
- Operation without a cooling media not recommended by the manufacturer
- Any equipment connected to RS-232 must be certified to IEC 61010-1/ IEC 60950-1/ IEC 62368-1 should be connected to the DB-9 port.
- Only Laird approved cable must be used to connect Flow meter to the unit. Refer to Spare Parts to order this cable.
- High Temperature Limit on Coolant Return - The maximum allowable coolant return (inlet) is 50°C. It is the responsibility of the customer to ensure that this limit is not exceeded. Laird Thermal Systems recommends a thermal shutoff be used in conjunction with the equipment being connected to the Recirculating Chiller. Methods include:
    - A method to turn off the heat load from injecting additional heat into the coolant. This will allow the Recirculating Chiller to reduce the temperature of the coolant further until stable.
    - A method that stops or restricts the coolant flow into the Recirculating Chiller. This will result in a Coolant High Pressure alarm, which will shut down the system for safety.
    - A method that interrupts the power to the Recirculating Chiller.

  If any of these methods are activated, please reference the Alarms section.

NOTE

The manufacturer is not liable for damage occurring when using the unit in a way it was not intended. This also voids Laird Thermal Systems' warranty.

3.1.5 Specialized Knowledge

NOTE

Authorized persons

Servicing the unit is limited to individuals with adequate knowledge and training pertaining to the required area of service. In some circumstances licensed professionals are required to perform the required service work.

The activities listed *Table 1* in may only be performed by personnel with specialized knowledge.

Table 1: *Activities and specialized knowledge*

Activities	Qualifications
Working on mechanical and / or hydraulic installations	Industrial technician or sufficiently instructed personnel who can work on the unit under the guidance of the manufacturer's technical support or installation instructions
Working on electrical installations and equipment	Skilled and licensed electrician
Working on refrigeration components and systems	Skilled and licensed refrigeration technician

3.2 Safety and Signaling Equipment Included in the Unit

The unit is equipped with the following safety equipment:

- The minimum coolant level in the system is detected by a 'low fluid level' alarm condition triggered by an optical level switch. When the coolant level drops below the LOW" level marking on the front of the chassis, the controller shuts off the entire unit.
- Controller has a freeze protection incorporated into the LCD. The default temperature selection that can be made is only 10C to 40C, when the coolant selected by the customer is water (default). Depending on the other coolant options selected the setpoint temperature can be selected to below 10C value. More details are given under Choosing the Coolant
- The coolant supply temperature is monitored by the controller. There are two temperature delta alarms monitoring this. The *low temperature delta alarm* alerts the customer if the coolant supply temperature is not within certain pre-specified temperature delta below the temperature set point in a specified amount of time, after starting the unit or changing the set point. Similarly, the *high temperature delta alarm* alerts the customer if the coolant supply temperature is not within certain pre-specified temperature delta above the temperature set point in a specified amount of time after starting the unit or changing the set point.

3.3 Guards

Direct access to hazardous parts or areas of the unit is prevented by the unit cover. The unit cover may only be removed for maintenance or repairs. It must be closed prior operating the unit. Note: warranty conditions before opening the guards.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

Figure 1: Guards

3.4 In Case of Accidents

Should you or another person be injured when working with the unit, do the following:

- Stay calm
- Perform first aid
- Always call the company's first aid personnel
- If necessary, call the applicable emergency number

3.5 Environmental Issues

Environmentally conscious and anticipatory behavior of staff helps avoid environmentally hazardous events. The following apply for environmentally conscious behavior:

- Environmentally hazardous substances must be stored in appropriate containers to avoid releasing them into the soil or drainage systems.
- Environmentally hazardous substances must be used or disposed of according to regional regulations.
- When dealing with working fluids, always be aware of the safety data sheet of the corresponding manufacturer.

4. Model Number Description

NRC400-T0-00-PC2

Basic Model No.	Cooling Engine	Electrical Configuration	Pump
NRC400 400 Watts	**T0** Air Cooled / Thermoelectric	**00** 115-230V~, 2.17-4.35 A, 1ph, 50/60Hz	**PC2** Plastic, Centrifugal Pump
See Laird Thermal Systems Online Wizard Configurator for Manufacturer's Part Number. **www.lairdthermal.com**			

5. Specifications

TECHNICAL SPECIFICATIONS	
	NRC 400
Performance	
Cooling capacity[1]	400 W
Setpoint Range	-10°C to 40°C
Temperature Stability	± 0.05°C
Flow Rate	1 lpm @ 0.88 bar
Maximum available pressure	1.18 bar
Storage	
Temperature (w/o coolant)	0°C to 50°C
Humidity	5% to 95%, non-condensing
Operation	
Coolant	Water or Water/Glycol
Temperature[2]	15°C to 40°C
Relative Humidity	35% to 85%
Altitude	< 2000 meters
Input	
Voltage	115-230 VAC
Frequency	50 / 60 Hz
Current Draw	2.17-4.35 A
Physical	
Dimensions (W x D x H)	413 X 274 X 400 mm^3
Weight (w/o coolant)	24 kg
Coolant Capacity	1 L
Fluid Connections	CPC -PLCD22006
Compliance	UL Mark for Laboratory Equipment (ANSI / UL / CSA / IEC EN 61010-1 Edition 3)

1. Nominal capacity rating is given at a 20°C (68°F) setpoint, 20°C (68°F) ambient temperature, sea level, and 60Hz operation.
2. For ambient conditions outside this range, please contact Laird Thermal Systems.

6. Component Locations

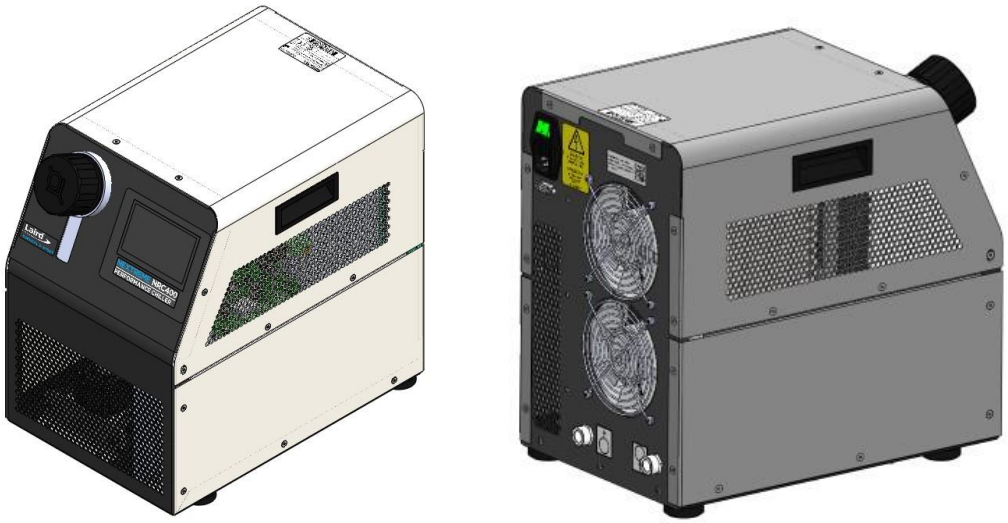


Figure 2: Isometric Views of Unit

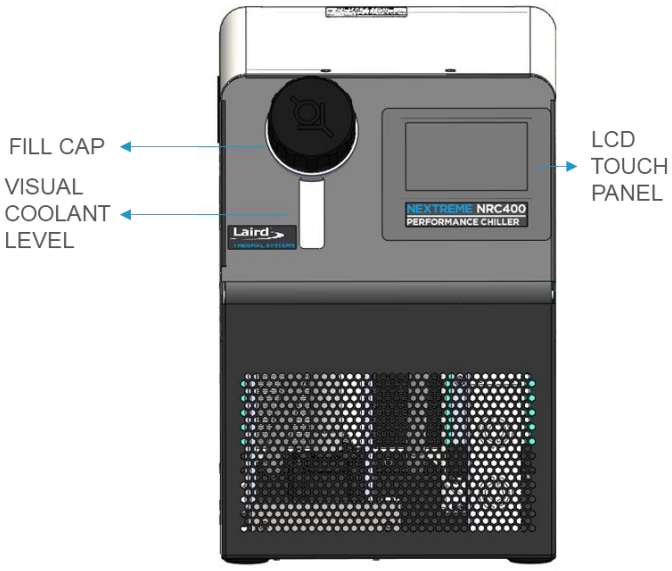


Figure 3 Front View

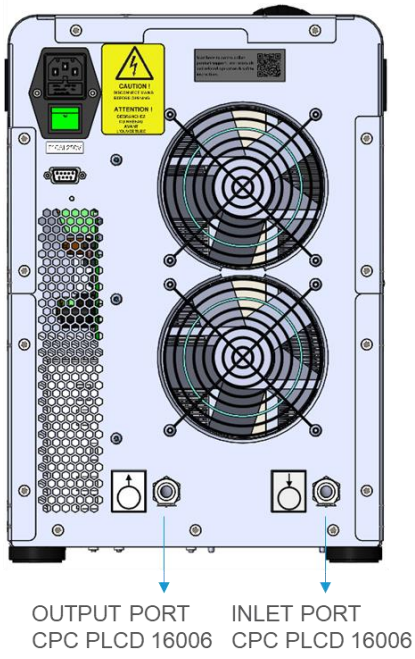


Figure 4 Rear View

7. Labels and Markings

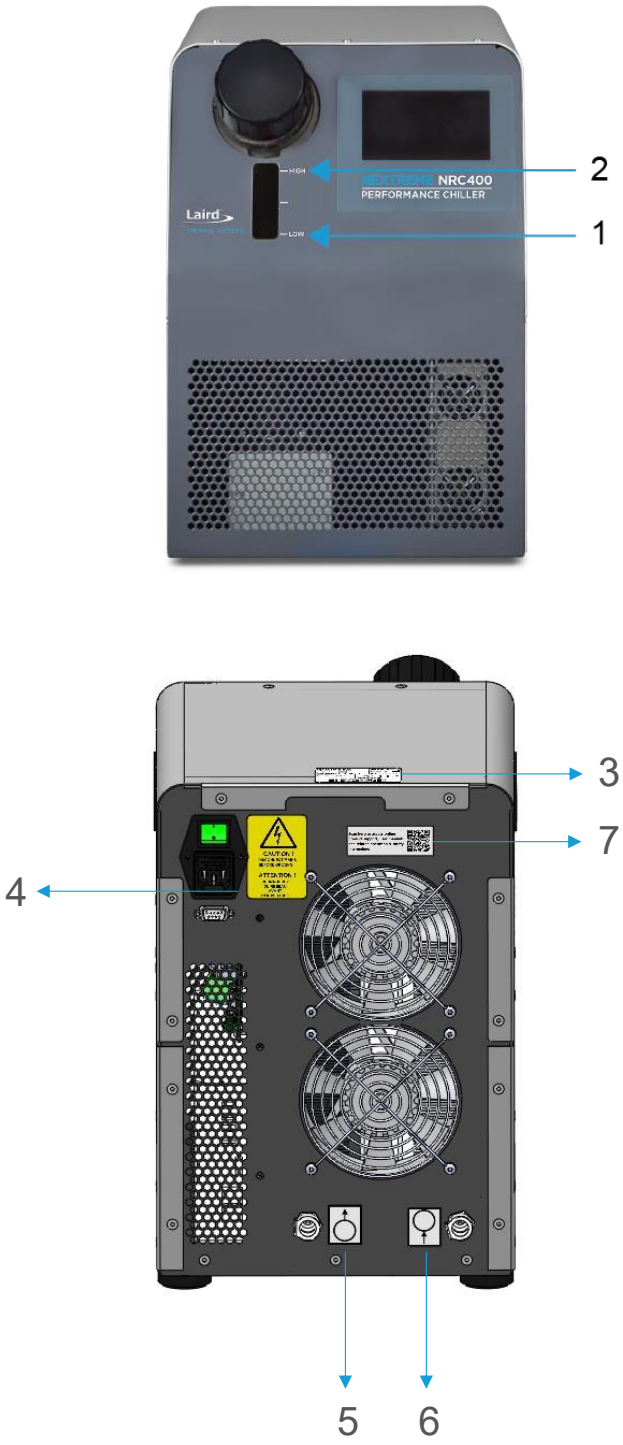


Figure 5: Marking on Unit

1 – Coolant level low marking

2 – Coolant level high marking

3 – Laird serial number label

4 – Caution hazardous voltage label: This label indicates location on the unit on the unit where power connections need to be made by the user. Caution labels on the unit such as this must always be easily readable. Illegible caution labels must be immediately replaced.

5 – Coolant supply label (from the unit)

6 – Coolant return label (to the unit)

7 – QR Code

8. Transport, Packaging and Storage

8.1 Safety

WARNING

Damage due to improper transportation

Injuries to persons and significant damage to property can occur in the case of improper transportation.

- When unloading the packed unit on delivery, including in-house transport, proceed very carefully and obey the symbols and instructions on the packaging.
- Do not remove the packaging until immediately before installing the unit.

NOTE

Risk of damage through improper transportation

The mounting suspensions of different components inside the unit are not secured with transportation locks. In the case of improper transportation, these can be damaged and would need to be replaced.

- Transport the unit upright.
- Unit is not to be subjected to mechanical impact.

8.2 Checking the Delivery Condition

Check the delivery immediately upon receipt for possible transport damage and missing parts.

If any transport damage is noticed, do the following:

- Refuse the delivery or accept it with reservation.
- Note extent of damage on the transport documents or on the delivery note.
- Inform the manufacturer immediately of any damage incurred during transport.

8.3 Symbols on the Packaging

The symbols listed in *Table 2* attached to the packaging:

Table 2: *Packaging symbols*

Symbol	Meaning
	Top The arrows mark the top of the package. The package must be stored and transported in such a way that the arrows always point upwards.
	Fragile, Handle with Care This symbol indicates fragile, easily breakable goods. Goods marked with this symbol must be handled carefully and should never be rolled or tied tightly.
	Keep dry This symbol indicates goods which are sensitive to moisture/humidity. Goods marked with this symbol must be protected from overly high air humidity levels.

Symbol	Meaning
	Do not stack This symbol indicates that goods are sensitive to stacking
	Handle with care This symbol indicates that package must be handled with care
	Team lift This symbol indicates that two or more persons must be used for lifting as the package is heavy
	Keep Upright This symbol indicates the goods are sensitive to tilt Goods marked with this symbol must not be tilted. If the symbol turns red, that means goods were tilted beyond 80° angle

8.4 Packaging

NOTE

Hazard for environment due to improper disposal

Packaging materials are valuable raw materials which can be reused in many cases or reconditioned and recycled.

- Dispose of packaging materials in an environmentally friendly way.
- Follow the locally valid waste disposal regulations. If necessary, employ a special waste disposal company to dispose of packaging materials.

The unit is packed according to the anticipated transportation conditions (such as packed in sealed plastic or cardboard box on a transport pallet). The packaging function is to protect the unit against damage and corrosion until installation. The packaging material should remain on the unit until just prior to installation. Packaging includes integrated ramp.

8.5 Unpacking

Before unpacking the unit, use appropriate safety measures to make sure no person is injured in this process. Unit may be heavy.

8.6 Handling the Unit While in the Packaging

WARNING

Danger due to lifting and carrying heavy loads

Manual handling of the loads (lifting, pushing, and carrying) must be avoided.

- Unit weight – Refer to Specifications.
- Use only suitable means of transport (such as industrial truck or lift truck).

WARNING

Danger of injury due to tipping or falling loads

Bruises. Bone fracture.

When handling with industrial truck, observe the following basic rules:

- Wear personal protective gear (such as protective footwear and protective gloves).
- Do not walk or stand under a suspended load.
- Use only suitable means of transport (such as an industrial or lift truck).
- Use only industrial trucks with appropriate capacity for loading. Unit weight – Refer to Specifications.
- Secure the unit so that it cannot tip or fall.

8.7 Storing the Unit

These storage conditions apply to the following:

- New units
- Units that were already in operation but will be temporarily out of operation. Refer to Temporary Placing Out of Operation.

Store the units as follows:

- Completely drained of coolant to prevent possible damage due to freezing.
- Dry, dust-free environment, protected against direct sunlight
- According to required storage temperature and relative humidity. Refer to Specifications.
- For storage that exceeds three months, it is recommended that the unit is placed inside its original packaging.

8.8 Preparing the Unit for Further Transport

For detailed information and specific instructions on how to prepare the unit, refer to Safety Precautions.

NOTE

Risk of damage due to improper transportation

A coolant that has not been drained or packaging with inappropriate dimensions may cause damage during transport.

- Drain the coolant before transporting the unit. Refer to Draining Procedure.
- Use proper packaging.

8.8.1 Transporting the Unit (after use)

Requirements

- Unit is switched off and disconnected from the electrical power source

- Unit and coolant cooled to the ambient temperature
- Coolant is drained. Refer to Draining Procedure.
- Coolant hoses disconnected from the unit. Refer to Disconnect Hoses.

Procedure

Pack the unit according to the transport conditions that can be expected.

Laird advises to use original packaging, if available, or an equivalent packaging.

1. Mark the packaging with the appropriate symbols. Refer to Symbols on the Packaging.
   The unit can now be transported.

9. Installation Requirements

1. Minimum Clearance from obstructions is required as shown to ensure that air intake and air discharge is not blocked as this could affect cooling capacity.

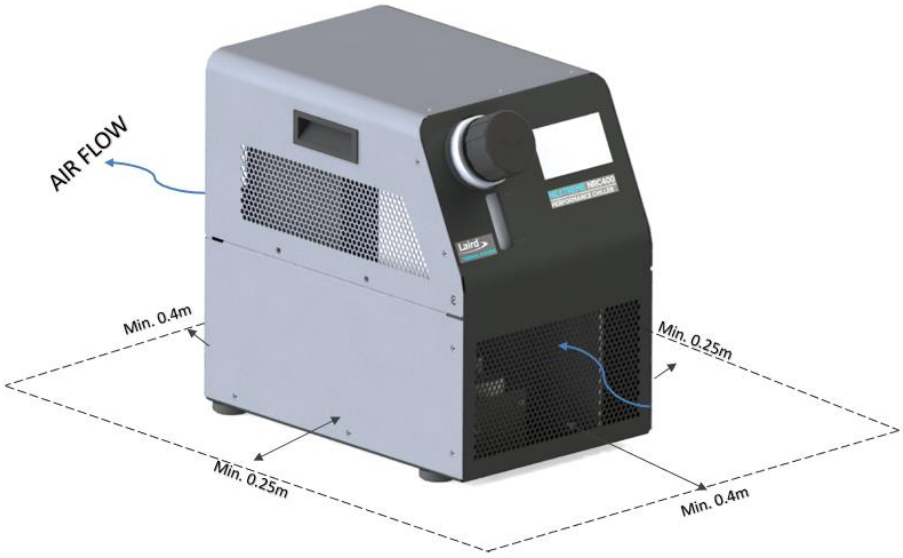


Figure 6: Minimum Clearance required for Unit Installation

2. The location must be level
3. When choosing the installation location, the following must be kept in mind:
    a. The flow of the cooling air must not be restricted.
    b. Coolant inlet and coolant outlet connections must be easily accessible.
    c. Power Cord must be easily accessible.
    d. All hoses must be installed without sharp bends.

10. Installation Procedure

10.1 Connect Hoses

NOTE

Risk of damage by using improper or faulty coolant hoses

This may lead to damage to persons, damage to property, or corrosion damage.

- When choosing coolant hoses pay attention to burst pressure and compatibility with coolant.
- Only use coolant hoses without any signs of damage.
- If water is being used as coolant, ensure that non-transparent hoses are used to prevent algae growth in the water. Otherwise, appropriate additives must be used.

NOTE

When connecting the coolant hoses pay attention to flow direction. Follow the documentation released by the manufacturer of the unit to be cooled.

Transparent coolant hoses increase algae growth and biofouling of the components in the unit, and this reduces the performance of the unit. Thus, only use non-transparent coolant hoses.

The coolant hoses are connected to the unit by means of quick disconnect couplings from Colder Products. Coolant inlet and coolant outlet are labeled with respective symbols.

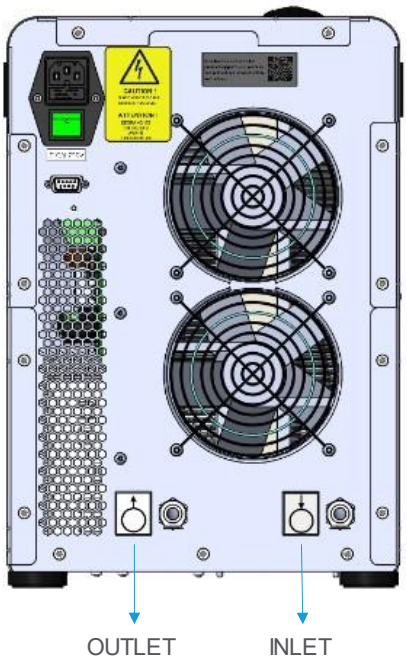


Figure 7 Connecting Hoses

Requirements

- Unit prepared for maintenance. Refer to Preparing the Unit for Maintenance
- Hoses

Procedure

1. Remove the protection caps from the coolant inlet and coolant outlet connections of the unit.
2. Connect an appropriate coolant hose to the coolant inlet and coolant outlet respectively.
3. Connect the coolant hoses to the corresponding connections of the unit to be cooled.

The coolant hoses are now connected to the unit.

10.2 Disconnect Hoses

The coolant hoses are connected to the unit at the coolant inlet and coolant outlet connections, labeled with respective symbols.

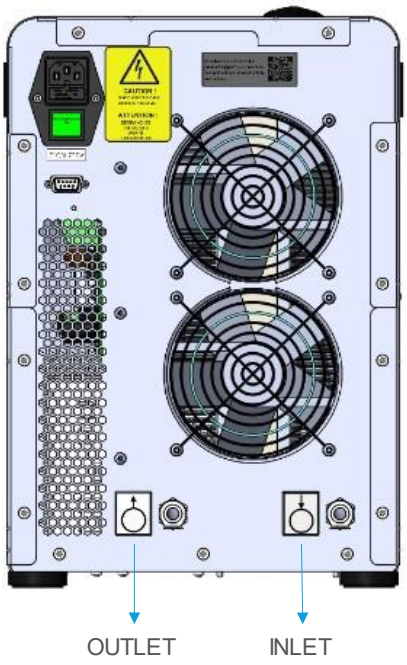


Figure 8 Disconnecting Hoses

Requirements

- Unit prepared for maintenance. Refer to Preparing the Unit for Maintenance.
- Coolant cooled to the ambient temperature.

Required Tools and Materials

- Absorbent cloth
- Bonding agent
- Protection caps

Procedure

1. The coolant inlet and outlet fittings have quick disconnects installed. Disconnect the hoses from coolant inlet and outlet fittings on the back of the unit.

The coolant hoses are now disconnected from the unit.

10.3 Connecting Power

Requirements:

- The unit construction provides protection against the risk of electrical shock by grounding appropriate metal parts. The protection will not function unless the power cord is connected to a properly grounded outlet. It is the user's responsibility to assure a proper ground connection is provided.
- Power Cord with C13 connector (**not supplied by Laird Thermal Systems**)
- Use cable rated for 20A 250V with IEC320-C13 receptacle. The customer side of the cable must follow required standard for the country of installation

Procedure

1. Cable with a C13 Connector should be connected to the IEC power connection on unit as shown below.
2. Turn the Power Switch ON.
3. When the Power Switch is ON, the Power Switch should light up as well as the LCD Panel.

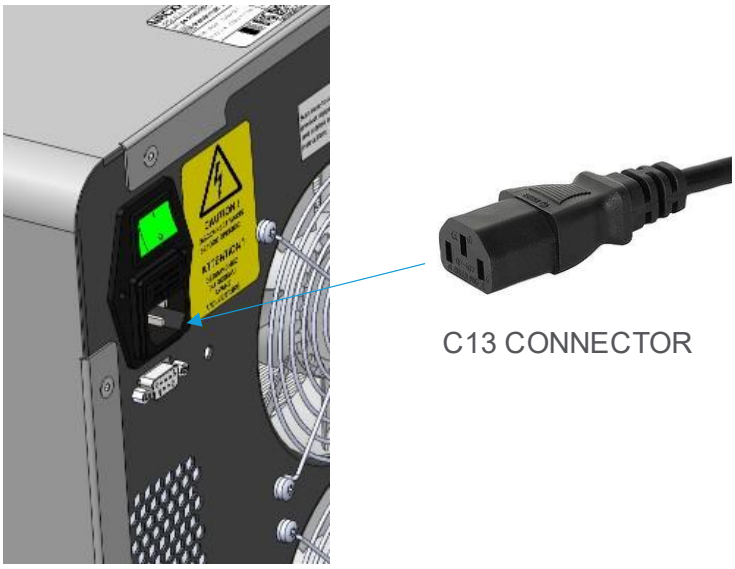


*Figure **9** Connecting Power*

10.4 Adding Coolant and Priming Unit

The unit is not intended for use with corrosive fluids. Automotive Antifreeze should never be used as a freezing point depression or corrosion protection fluid. Automotive antifreeze contains additives that can damage system components and will void the warranty.

Approved fluids and their normal operating temperature ranges are:

- Filtered/Single Distilled water, +10°C to +40°C
- Up to 30% Inhibited Ethylene Glycol (EG) /Water, -5°C to +40°C
- Up to 30% Inhibited Propylene Glycol (PG) /Water, -5°C to +40°C

It is important to maintain the proper mixture of EG or PG and water over time. Instruments are available on the market for measure glycol content and should be used periodically and when refilling the system to check the coolant mixture ratio.

Inhibited EG or PG should be used when the coolant is being exposed to aluminum components in order to prevent galvanic corrosion.

Suggested Contaminant Limits:

	PPM
Organics	
Algae, Bacteria, etc.	0
Inorganic Chemicals	
Calcium	<10
Chloride	<25
Copper	<1.0
Iron	<0.2
Lead	0
Magnesium	<5
Manganese	<0.05
Nitrates \ Nitrites	<10
Potassium	<2
Silicate	<5
Sodium	<4
Sulfate	<25
Hardness	<1
Total Dissolved Solids	<25
Other Parameters	
pH	6.8. 7.5
Resistivity	<0.1 MΩ-cm

Requirements

- Unit prepared for maintenance. Refer to Preparing the Unit for Maintenance.
- Power connected to unit.
- Coolant hoses connected to the unit (Make sure the hoses are corrected to the correct ports).

Required Tools and Materials

- Filling funnel
- Measuring cup
- Absorbent cloth

Procedure

1. Remove the Fill Cap.
2. For information regarding coolant to be used and quantity, refer to Specifications. Use a filling funnel to avoid moistening any current-carrying components with coolant.
   Note: If refilling coolant, go to last step.
3. Add coolant up to required level. Ideal coolant level is just below the 'HIGH' marking on the front view port of the tank.
4. Press the 'PUMP' button on the LCD panel to fill the coolant lines to the application.
5. When the tank level starts reducing, continue adding coolant through the fill port, until the ideal coolant level is reached with the pump continuously running.
6. Note: Do not let the pump run dry as it can be damaged.
7. Mount the coolant cap again.

The coolant is now added.

Plumbing & Refrigeration Diagram

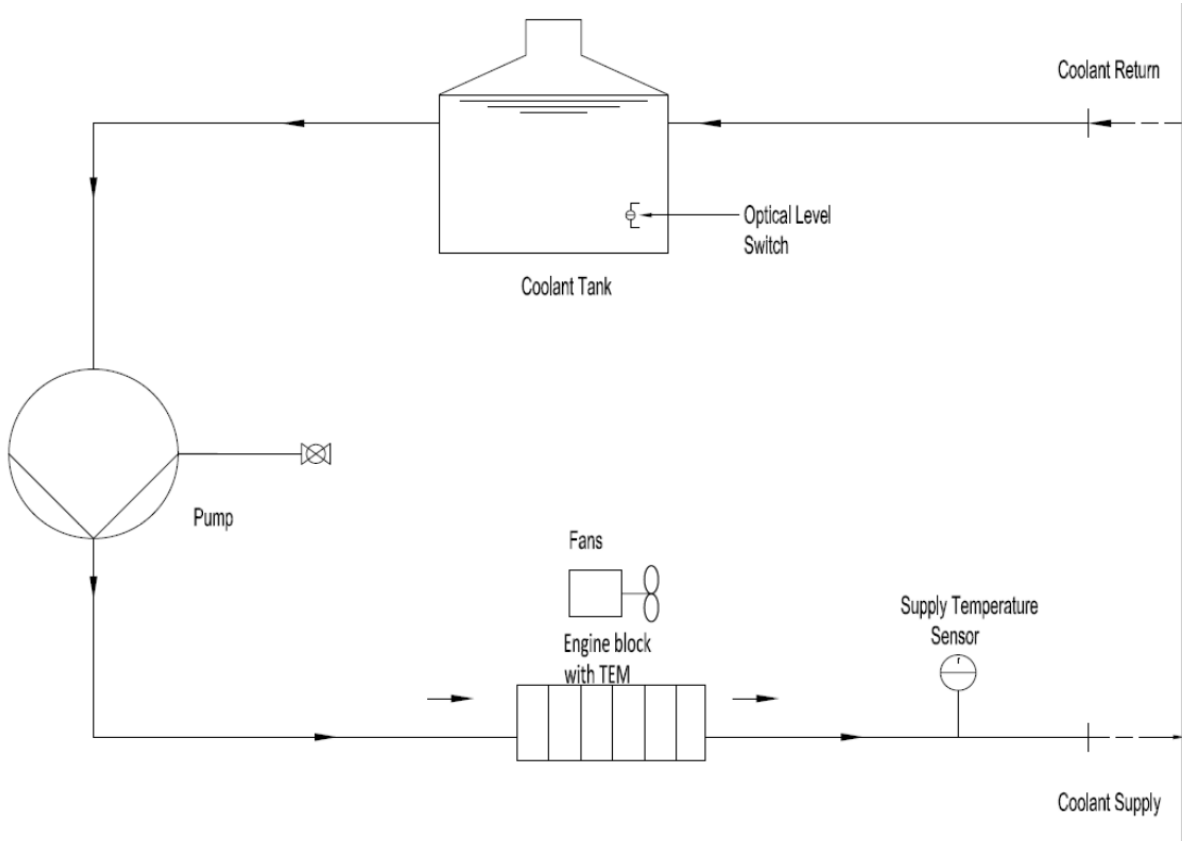


Figure 10: Plumbing and Refrigeration Diagram

11. Performance Graphs

11.1 Thermal Performance

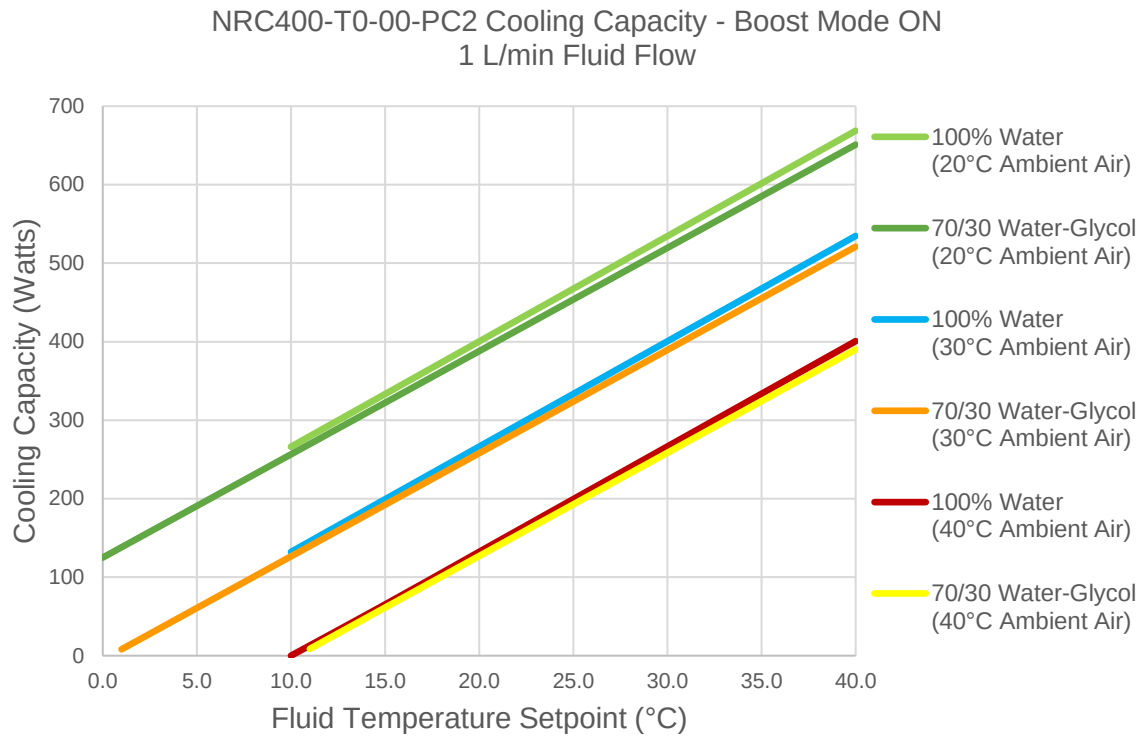


Figure 11 Cooling Capacity - Boost Mode ON with Cooling Fluids: Water and 70/30 EGW

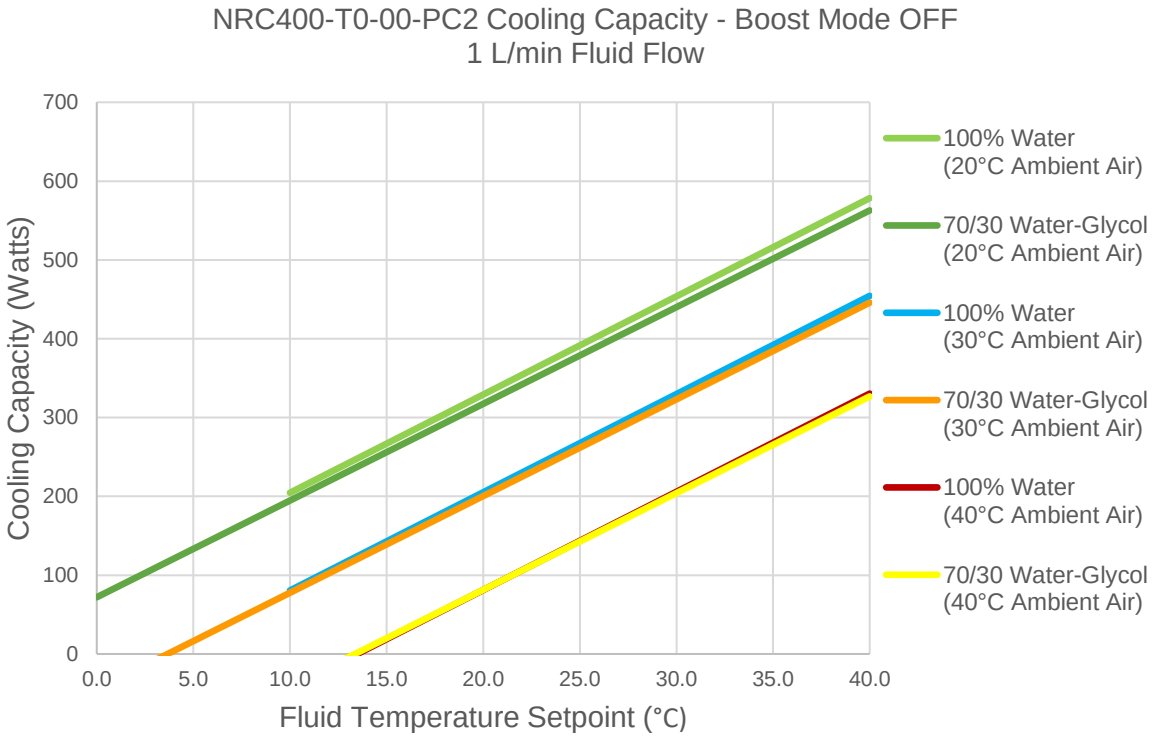


Figure 12 Cooling Capacity - Boost Mode OFF with Cooling Fluids: Water and 70/30 EGW

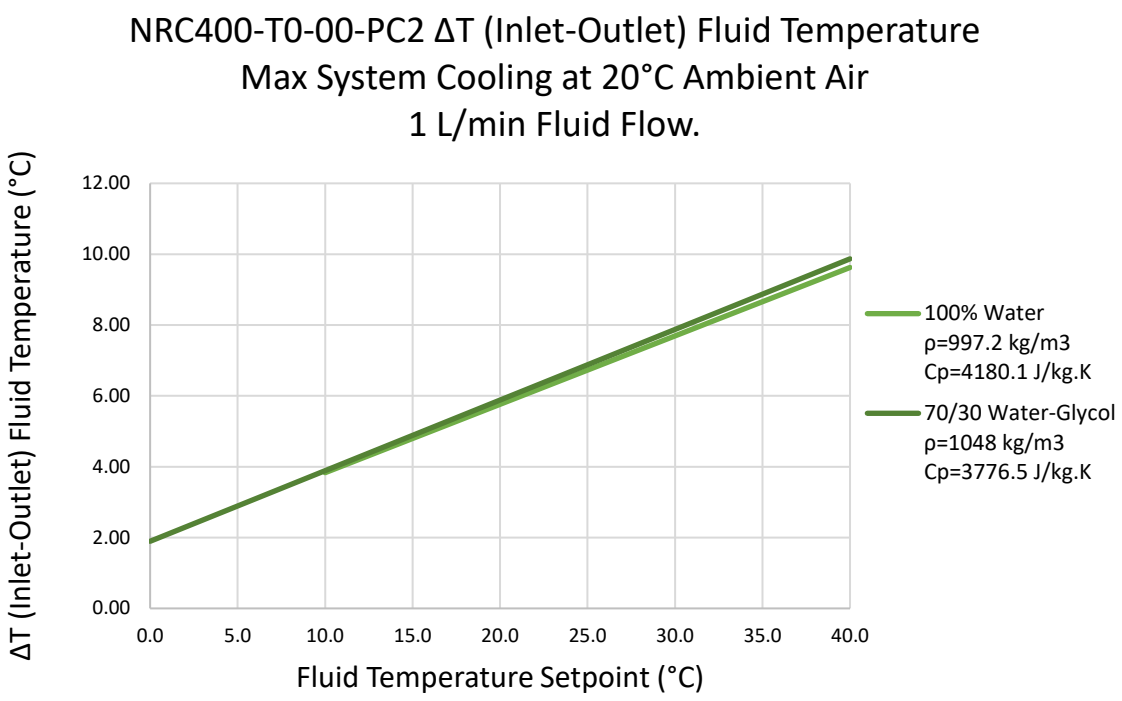


Figure 13: Thermal Performance of NRC400 with Cooling Fluids: Water & 30% EG/W

11.2 Pump Performance

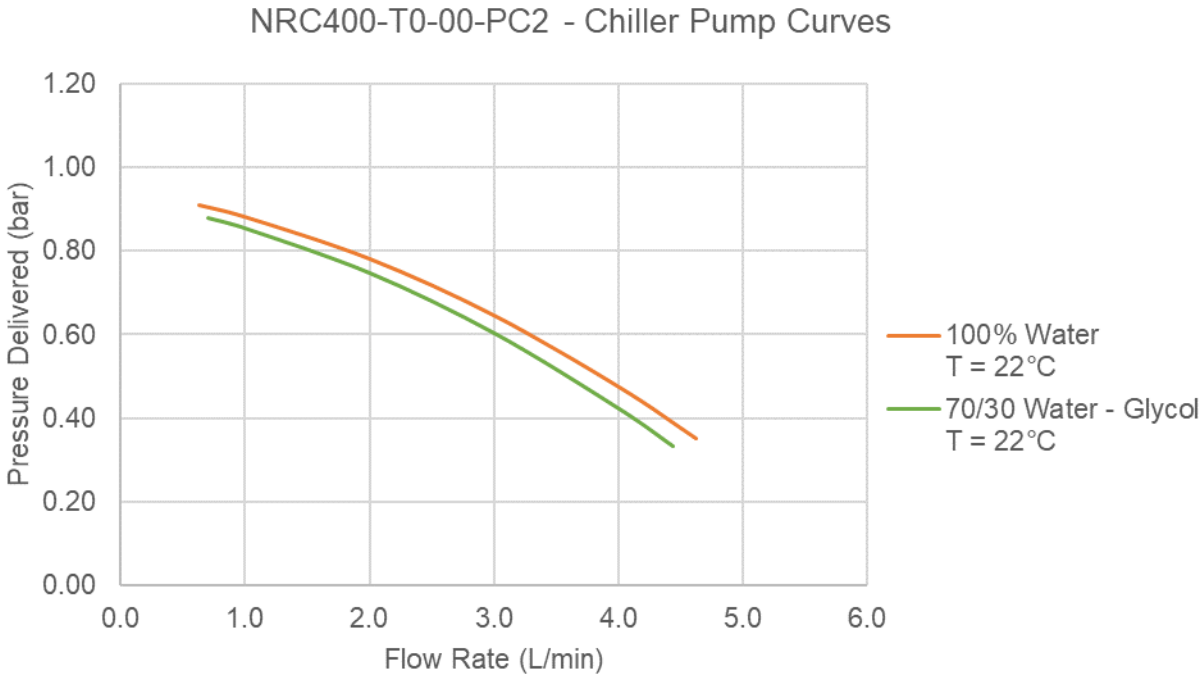


Figure 14: Pump Performance with Cooling Fluids: Water & 30% EG/W NRC 400-T0-00-PC2

12. Chiller Dimensions

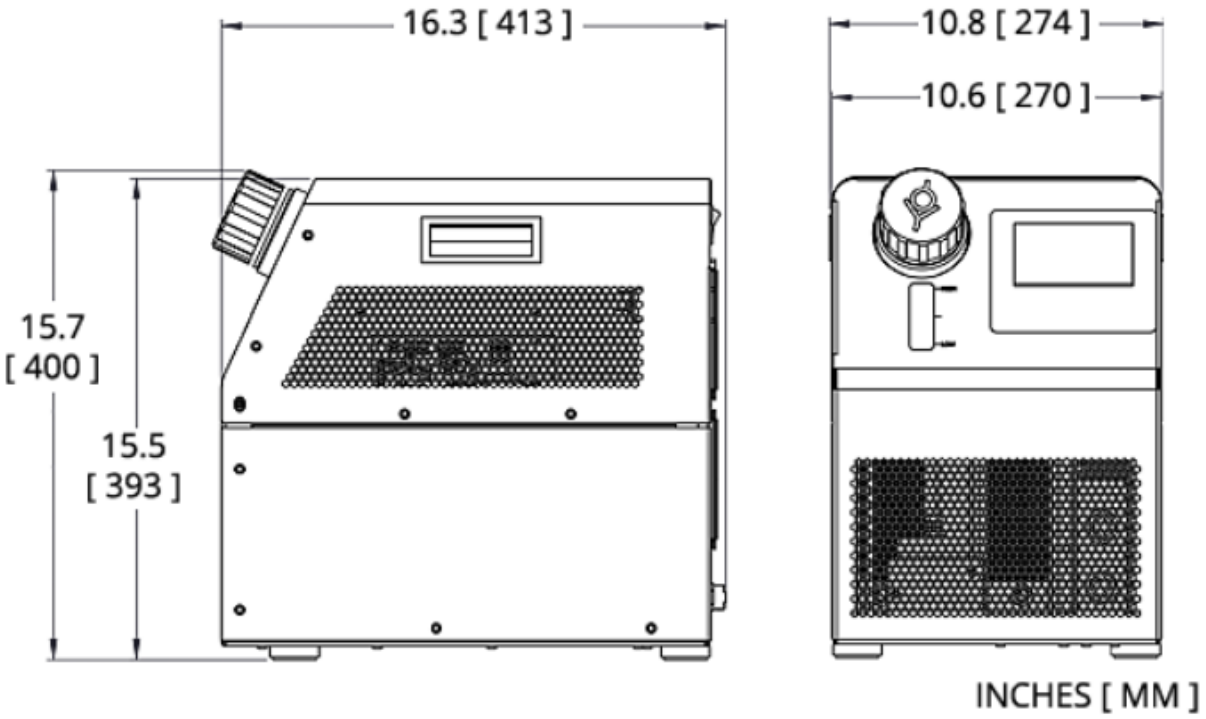


Figure 15: NRC400 Chiller Overall Dimensions

13. Controller Display Panel Functions

13.1 Startup Screen

When the unit is first powered on, the touch panel shows this screen for 10 seconds.

Figure 16: Start-up Screen

13.2 Main Screen

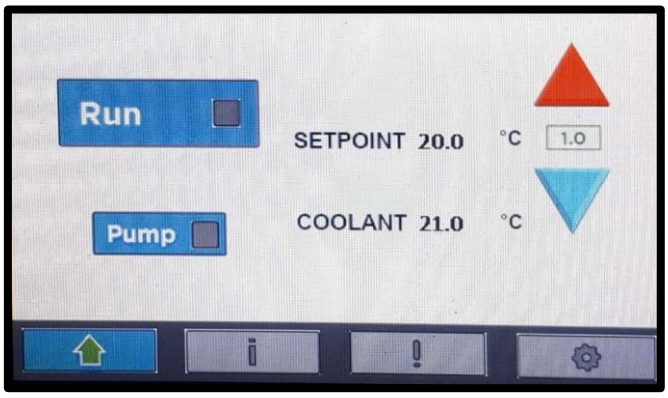
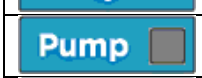
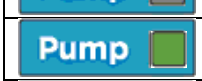
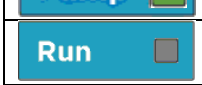
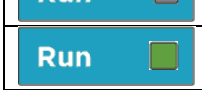
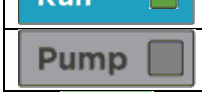


Figure 17: Main Menu

Buttons	Description
	Main Menu is selected
	Information Menu is selected
	Alarm menu is selected
	Settings menu is selected
	Pump is OFF
	Pump is ON
	Chiller is OFF
	Chiller is running
	Pump Button is disabled since Chiller is running
	Setpoint increments/decrements in 0.1

1.0	Setpoint increments/decrements in 1.0
	Increase setpoint by selected increment level
	Decrease setpoint by selected decrement level
	Stores set point in flash memory

13.2.1 Running the Pump

The pump can be switched on by pressing the PUMP button on screen. The box will turn from grey to green which indicates that the pump is on. By clicking the PUMP button again, the pump will switch off turning the box back to grey.

Note: Pump ON/OFF function is disabled during running of machine.

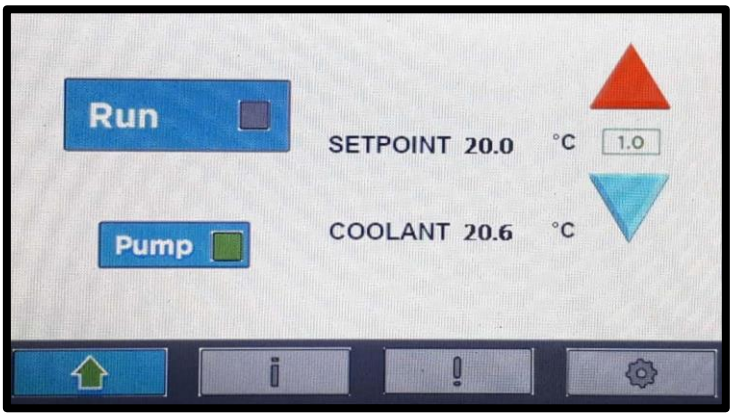


Figure 18: Running Pump

13.2.2 Choosing the Coolant Setpoint

The Coolant setpoint can be set by choosing values using the arrows and changing the increments accordingly. By clicking on the increments, the increment can be changed from 0.1 to 1.0 and vice versa.

13.2.3 Running the system

The system can be run by pressing the RUN button on screen. The box will turn from grey to green which indicates that the machine is running. To switch OFF the machine, click the button again.

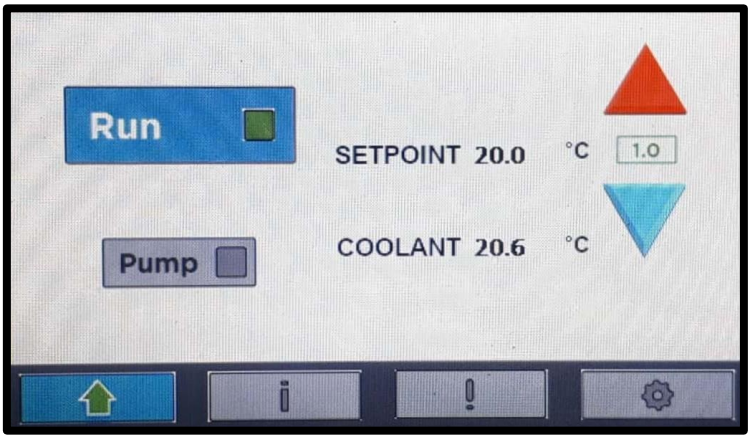


Figure 19: Running the Machine

13.3 Sleep Screen

Touch panel goes to sleep when the screen has been inactive for 3 minutes and shows coolant supply temperature. The system does not go to sleep screen when the information screen is being displayed or when the unit is not running.

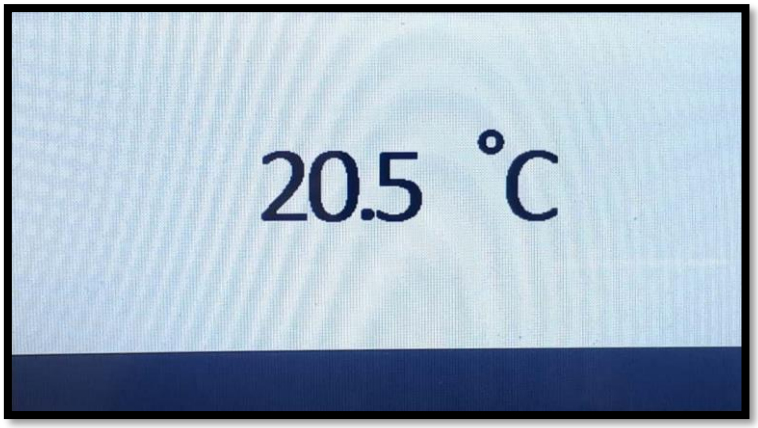


Figure 20: Sleep Screen

13.4 Information Screen

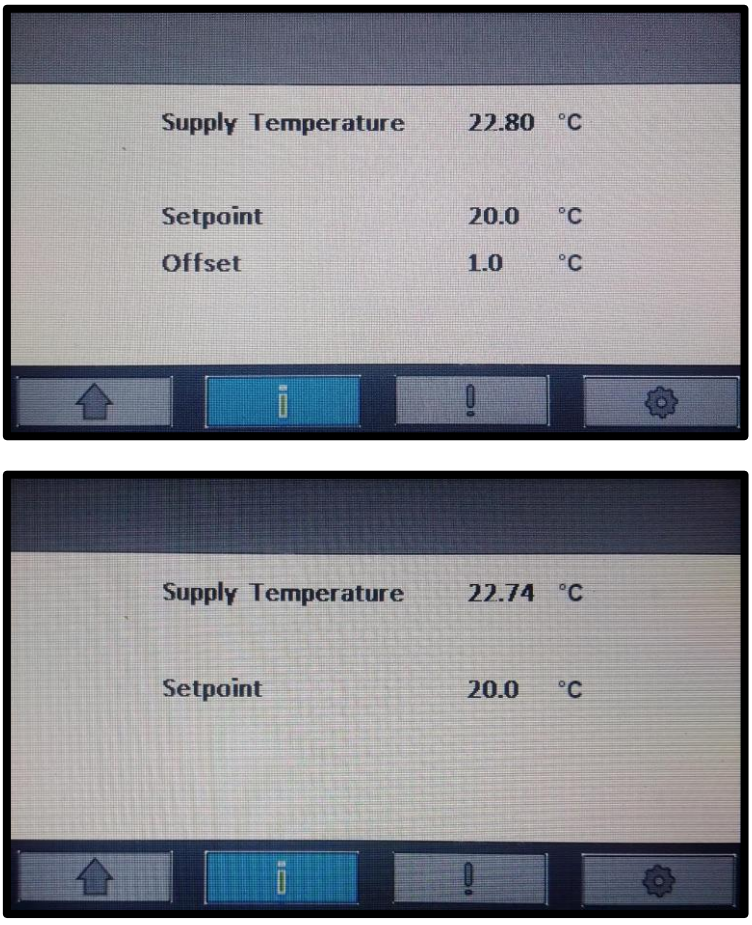


Figure 21: Information Screen

To see information related to Coolant Supply, click on the Information Menu.

The following information is displayed:

	Information	Description
Coolant Supply	Temperature	This is the Supply Temperature from the chiller to the application
	Temperature setpoint	This is the Temperature Setpoint set by User in the Main Menu
	Offset	This is the Setpoint Offset set by the User in the Settings Menu

13.5 Alarms Display Screen

If the system is not in an alarm condition, then the alarms tab doesn't show any alarm.

Figure 22: Alarm screen with no active alarms

If the system experiences an alarm condition, the alarm button changes on the home screen to indicate this.

Figure 23: Home screen with an active alarm

13.5.1 Acknowledging Alarms

Alarms can be acknowledged individually by selecting them and then pressing the ACKNOWLEDGE button. When there are multiple alarms, they can be acknowledged together by pressing the SELECT ALL button and then the ACKNOWLEDGE button.

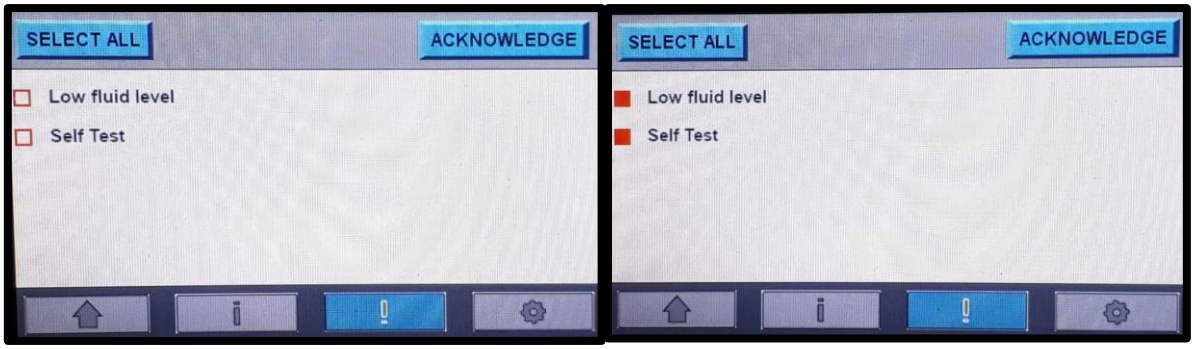


Figure 24: Acknowledging Alarms

Buttons	Description
	Alarm has been set
	Amber alarm
	Amber alarm Selected
	Red Alarm
	Red Alarm Selected

Red alarms are used to indicate an abnormal system condition and is usually associated with the shutdown of a component or the whole system. There is an audible alarm for this condition and requires an action from the customer for the system to restart.

Amber alarms are warnings to indicate an abnormal system condition, but the system or components are not shut down. There is no audible alarm for this condition.

For specific alarm conditions and troubleshooting information, refer to section Alarms

13.6 Settings Screen

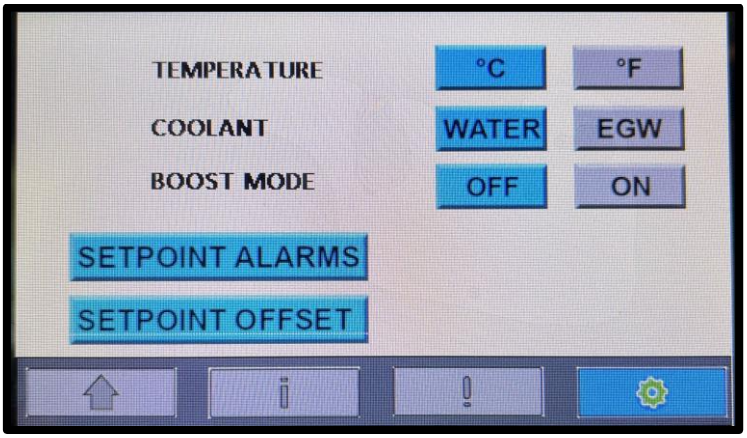


Figure 25: Settings Menu

13.6.1 Setting Units

The unit of measure for temperature can be selected in the Settings Menu. The options available for temperature are °C/°F.

13.6.2 Choosing the Coolant

The coolant (Water/ Ethylene Glycol) can be chosen on the Settings Menu. The Ethylene Glycol Percentage can be chosen once the EGW button is pressed. This selection limits the temperature set point value that the customer can select. Below are the temperature range for different glycol

percentages. Note that selecting the correct coolant is the responsibility of the customer and should match what is filled in the system by the customer. Selecting the wrong coolant may cause damage to the equipment.

Water: 10°C to 40°C
10% Ethylene Glycol: 5°C to 40°C
20% Ethylene Glycol: 0°C to 40°C
30% Ethylene Glycol: -5°C to 40°C

Figure 26: Choosing the Coolant

13.6.3 Boost mode

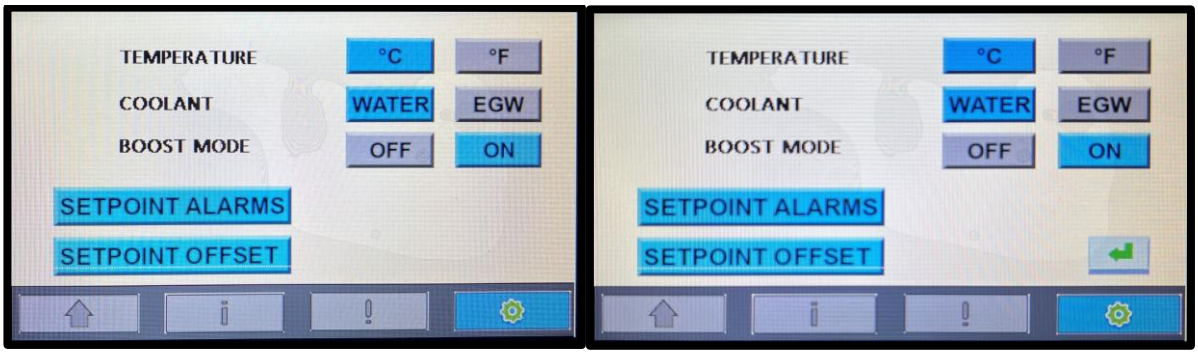


Figure 27 Boost mode

The unit comes with an option to increase chiller performance using Boost Mode, if required. With the Boost Mode ON, the fans run at a higher speed and increase the cooling capacity of the unit. Boost Mode is turned OFF by default. To activate Boost Mode, press ON and store the selection by pressing the green arrow button.

13.6.4 Customer Configurable Alarms

Figure 28: Setpoint Alarms

Alarms such as Low Temperature Δ and High Temperature Δ can be set in the Setting Menu Each Alarm can be turned ON or OFF as required and the value can be changed by clicking on the number.

Low temp delta

This alarm is to alert the customer if the coolant supply temperature doesn't come within this specified deltaT from below the set point in a set amount of time. This alarm is disabled by default. If the customer enables this alarm, then the default value of delta T is 1 and default time is 30 minutes.

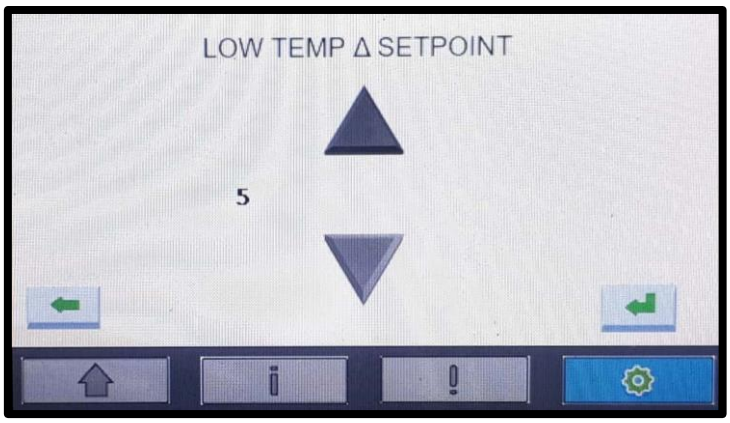


Figure 29: Low Temperature Delta

High temp delta

This alarm is to alert the customer if the coolant supply temperature does not come within this specified deltaT from above the set point in a set amount of time. This alarm is disabled by default. If the customer enables this alarm, then the default value of delta T is 1 and default time is 30 minutes.

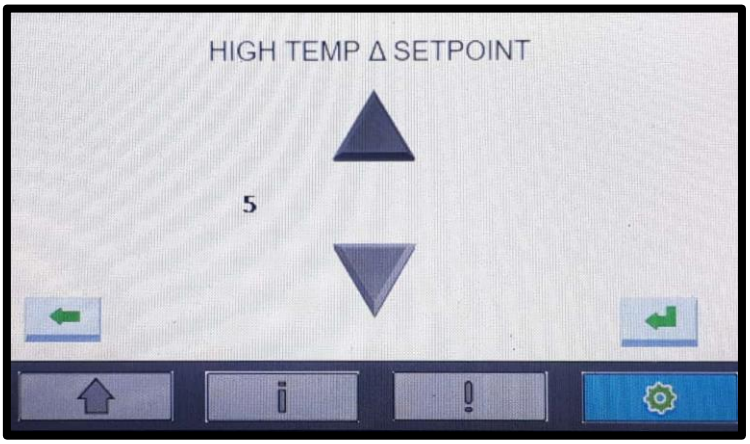


Figure 30: High Temperature Delta

13.7 Setting Offset

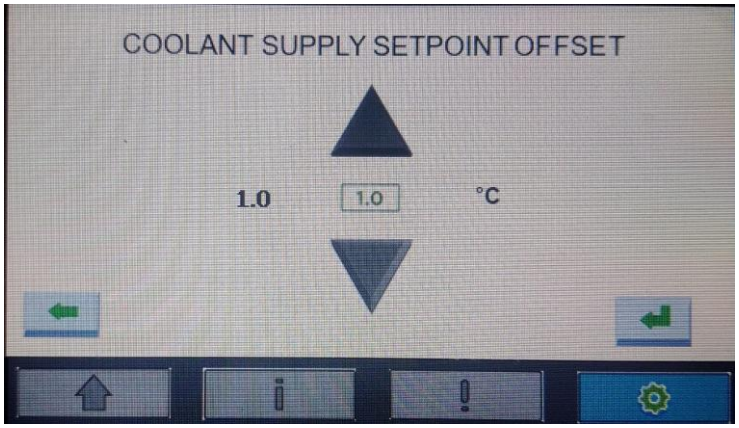


Figure 31: Setting Menu

Setting Offset
This setting allows you to offset the displayed temperature from the measured temperature.

14. Troubleshooting

For troubleshooting, use the following:

- Alarm status screen
- Wiring diagram
- Plumbing Diagram
- Troubleshooting table (below)

Issue	Possible Cause	Corrective Measures	Clearance By
Unit does not start	Power not applied. Electrical connection not correct or no mains connection	Check power supply and ensure proper voltage in the line. Check connection, insert mains plug.	Operator
	Coolant level too low. Alarm for low coolant will be active	Check coolant level and top off, if necessary. Refer to Adding Coolant	Operator
	Main switch not turned on	Turn main switch on	Operator
Unit running but cooling capacity is too low	Buckled or pinched coolant hoses	Install the hoses with a larger radius to avoid sharp bends.	Operator
	Improperly placed unit	Required clearance with the wall of the unit. Refer to Installation Requirements.	Operator
	Blocked Heat sink	Clean Heat sink. Refer to Cleaning the Heat sink.	Operator
	Coolant level too low	Check coolant level and top up, if necessary. Refer to Adding Coolant.	Operator
	Disconnected coolant hoses	Connect the coolant hoses. Refer to Connecting the Coolant Hoses.	Operator
	Dirty coolant filter	Clean or replace filter. Refer to Replace filter.	Operator

Issue	Possible Cause	Corrective Measures	Clearance By
	No flow in cooling circuit	Check system for blockage or lack of fluid	Operator
	Fan does not rotate	Check to determine if the fan is rotating.	Operator
	Ambient air temperature too high	Operate unit within allowable ambient temperature range.	Operator
	Pump mode turned on, but cooling mode turned off	Ensure cooling mode turned on. Refer to Controller Display Panel Functions.	Operator
	Incorrect coolant mixture	Make sure mixture is withing guidelines. Refer to Adding Coolant and Priming Unit.	Operator
	TE engine	Confirm that all alarm conditions are cleared.	Operator
Noise	Blocked cooling circuit	Ensure that cooling circuit is not blocked.	Operator

15. Alarms

*- **Red: Critical with Stop, Amber: Notify, Green: Status**

	Alarm	Criticality	Alarm Description	Cause	Effect	Action Required/ Troubleshooting
	Low fluid level	Red	Coolant fluid level is low.	Possible leak in the coolant line	Entire system stops running	Check to see if the coolant level is at the recommended level on the front fill port. Add coolant if necessary and acknowledge the alarm on the LCD screen. This will clear the alarm. Now run the unit. If the problem persists, contact LTS customer service.
	Coolant supply temperature sensor failure	Red	Coolant supply temperature sensor is not working properly	Coolant supply temperature sensor is not working properly	If this happens during system stat-up, unit will not Run. If this happens while the system is running, then the entire system shuts down.	Turn off the power switch to the unit off. Wait 5 seconds to turn the power switch on again and Run the unit. If the problem persists, contact LTS customer service.
	Coolant supply high temp	Red	Coolant supply temperature is too high	If the coolant supply temperature is 50 ºC and above	Entire system stops running	Check to see if the heat load is too high. Reduce the heat load to see if the temperature falls to 40ºC or below. Now acknowledge the alarm on the LCD screen. This will clear the alarm. If the problem persists, contact LTS customer service.
	Coolant supply high temp Δ	Red	Alerts the customer if the coolant supply temperature is not within certain pre-specified temperature delta above the temperature set point, within a specified amount of time after starting the unit or changing the set point	High load on the system than the specified capacity or ambient temperature is too high	Unit alarms to indicate customer the condition. Unit continues running.	Check if the ambient temperature is too high or above operating limits. If possible, check if the load on the system is beyond the specified capacity for specific operating temperatures. After fixing above issue, acknowledge the alarm on the LCD screen. This will clear alarm. If the problem persists, contact LTS customer service.
	Coolant supply low temp Δ	Red	Alerts the customer if the coolant supply temperature is not within certain pre-specified temperature delta below the temperature set point, within a specified amount of time, after starting the unit or changing the set point	Hot gas bypass heating loop is not functioning properly, or ambient temperature is too low	Unit alarms to indicate customer the condition. Unit continues running.	Check if the unit has been sitting in ambient temperature below the specified operating temperature. If so, move the system to recommended operating ambient temperature and wait for few minutes for the system refrigerant to warm up. After fixing above issue, acknowledge the alarm on the LCD screen. This will clear alarm. If the problem persists, contact LTS customer service.
Self-Test	Self-Test	Red	Controller checks whether all the sensors are functioning properly after the power switch is turned on	Sensors not connected properly or component failure	System would not Run if self-test fails	Check if there are any other alarms listed in the alarms page of the LCD screen along with this alarm. Check if those issues can be resolved using the guidelines above. After fixing the issue, acknowledge the alarm on the LCD screen. This will clear the alarm. Now Run the unit. If the problem persists, contact LTS customer service.
Current alarms	High pump current	Red	Controller checks if the pump current exceeds 2.5A	Blocked coolant line, locked impeller or rotor	Entire system stops running	Check to make sure there is no blocked coolant line. After fixing the issue, acknowledge the alarm on the LCD screen. This will clear the alarm. Now run the unit. If the problem persists, contact LTS customer service.

	Alarm	Criticality	Alarm Description	Cause	Effect	Action Required/ Troubleshooting
	High TEM Current	Red	Controller checks if the TEM current exceeds 20A	Heat load is too high, or TEM is not working properly	Entire system stops running	Check to see if the heat load is too high. Reduce load and acknowledge alarm on the LCD screen. This will clear the alarm. Now run the unit. If the problem persists, contact LTS customer service.
Fan speed	Fan 1 low tach speed alarm	Red	Controller checks whether fan 1 is spinning above 1800 rpm	Fan1 is not working properly or blocked fan	Stops the pump, fan and TEM	Check to see if fan 1 is running properly. If there is an obstruction that is preventing the fan from running, then remove the obstruction and acknowledge the alarm. This will clear the alarm. Now the run the unit. If the problem persists, contact LTS customer service.
	Fan 2 low tach speed alarm	Red	Controller checks whether fan2 is spinning above 1800 rpm	Fan2 not working properly or blocked fan	Stops the pump, fan and TEM	Check to see if fan 2 is running properly. If there is an obstruction that is preventing the fan from running, then remove the obstruction and acknowledge the alarm. This will clear the alarm. Now the run the unit. If the problem persists, contact LTS customer service.

16. Communications Interface

16.1 Instructions for Setup

RS-232 serial communication is available. They are accessible via the DB-9 connectors on the rear of the chiller. Refer Inadmissible Operating Conditions to avoid any safety hazards.

A Terminal Emulator or other comparable device will need to be connected to the DB-9 to allow command to be entered.

Terminal Settings:

Baud Rate 115200, Data – 8-bit, Parity – none, Stop – 1 bit, Flow Control - none

16.2 Commands and responses:

Command	Description	General Response
COL	Set/Get Coolant type	Coolant Percentage (returns "xx")
CST	Coolant Supply Temp	Coolant Supply Temperature query (returns “xxx.xx C/F”)
CTL	Set/get control loop	System Control Loop [R {Run}, S {Stop}]
DAT	Set/Get date	Set/Get Date (returns "xx/xx/xx)
LVL	Coolant level sensor	Coolant Level Switch status query (returns “LOW”, “OK”)
MOD	Model	Displays the model number
PMP	Pump on//off	Control Power to Pump [ON, OFF] (default = OFF)
SCF	Degrees C or F	Select °C or °F [C, F] (default = C)
SSN	System serial number	Serial number is displayed
TIM	Set/Get time	Time [00:00:00-23:59:59] (default = 00:00:00)
TSP	Temp setpoint	Control Temperature Set Point [-10.0 to 40.0] (default = 20)
VER	Get firmware version	Version query (returns “FIRMWARE VERSION X.X”)

Command entry format

$[2-character source ID] [3 Character Command], [Data Field if required]

Command strings without contents in Data Field will be interpreted as a query.

Source ID

PC Serial link to a PC or external digital serial interface

Command Structure Examples

$PCCST (Requests current Temperature of Fluid Supply Line via PC)

25.38 C (Response from controller reporting Coolant Supply Temperature)

$PCVER (Returns [TEA FIRMWARE VERSION x.x.x])

17. System Maintenance and Service

Diligent maintenance is the prime factor for assuring an error-free and efficient operation of the unit. All the maintenance tasks contained in this chapter must be performed according to the maintenance intervals.

17.1 Safety

All safety and warning instructions must be reviewed completely by all personnel prior to maintenance work of the unit. Refer to Safety Precautions.

Improper Maintenance

WARNING

Danger of injury due to improperly performed maintenance.

Improper maintenance can lead to personal injury or material damage.

- Disconnect the unit from all sources of power during maintenance work.
- Ensure that there is enough working area at the beginning of the maintenance work.
- Provide all components and tools required for maintenance work.
- Keep the working area clean and tidy. Loose components and tools, which are lying on each other or lying around, are sources of accidents.
- Check all components for soiling and damage. Do not use damaged or incorrect components.
- Handle the components with care, to avoid damage.
- Assemble components properly. Comply with specified screw tightening torques.
- Secure components, to prevent them from falling or tipping over.
- Only perform maintenance work using conventional tools. Improper or damaged tools can result in personal injury.

Handling Coolant

CAUTION

Danger of slipping or endangering the environment due to spilled coolant.

Spilled coolant can cause slipping and endanger those working in the environment.

- Do not spill coolant.
- Immediately remove the spilled coolant with an appropriate bonding agent.
- Dispose the bonding agent and coolant mixture in accordance with regional regulations.

NOTE

Testing and replacing external coolant hoses.

Coolant hoses can become brittle through age and must be checked at regular intervals.

- Observe the specifications of the coolant hoses manufacturer.

Environmental Issues

NOTE

Danger to the environment due to improper handling

Environmentally conscious and anticipatory behavior of staff avoids environmentally hazardous impacts.

The following principles apply for environmentally conscious behavior:

- Environmentally hazardous substances must not get into the soil or into the drains. They should be kept in appropriate containers.
- Environmentally hazardous substances must be used and disposed according to regional regulations.
- When dealing with working fluids, remain aware of the safety data sheet of the corresponding manufacturer.

Personnel

Unless otherwise noted, all maintenance tasks described in this chapter can be performed by the operator of the unit.

Other maintenance tasks must be performed by specially trained qualified personnel. This is specially noted in the description of the single maintenance task.

Personal Protective Gear

The following personal protective gear for all maintenance work must be worn:

- Protective footwear
- Protective gloves
- Protective eyewear

17.2 Maintenance Schedule

Follow maintenance task described in table 3 to ensure proper operation of the unit.

The interval between maintenance are only recommendations and may vary depending on use of the unit and operating environment.

Table 3: *Maintenance*

Interval	Required Activities	Criteria	Personnel
Regularly	Clean heat exchanger. Refer to Cleaning the Heat Exchanger.	Plate fins and ventilation grids polluted	Skilled employee
	Check the coolant level and replenish it, if necessary. Refer to Adding Coolant and Priming Unit.	Coolant level at or below “Low” level	Operating personnel
	Inspect coolant hoses, connections and pipes for cracks and for leaks (visual inspection)	Coolant hoses, pipes and connections are leaking	Operating personnel
	Inspect the coolant quality (visual inspection)	Turbidity, airborne particles	Operating personnel

17.3 Preparing the Unit for Maintenance

All necessary safety measures must be taken to prevent accidents when carrying out the maintenance. The following preparations must be made:

- Terminate the cooling operation.
- Let the unit and its coolant cool down to the ambient temperature.
- Switch off the unit.
- Disconnect the unit from mains by pulling the mains plug.
- Secure the unit against being switched on again.
- Verify that the unit is de-energized.
- Keep unauthorized persons away from the working area.
- Place the unit on a level surface.

17.4 Verification of Safe State after Maintenance

- Ensure that all screws are securely fastened
- Make sure that there are no loose electrical connections.
- Ensure that the controller completes the diagnostic.

17.5 Draining Procedure

NOTE

Risk of Damage to the pump

When the coolant level in the coolant tank is too low and if it runs the pump dry, the pump can be damaged or destroyed.

- Avoid running the pump dry to prevent damage

Requirements

- Unit prepared for maintenance. Refer to Preparing the Unit for Maintenance.
- Coolant hoses disconnected from the unit. Refer to Disconnect Hoses.
- Coolant cooled down to the ambient temperature.

Required Tools and Materials

- Collection container/Hose – Note, unit holds approximately 1-2 liters of fluid.

Procedure

- First you may tip it over and drain the reservoir. If this cannot be done then, first connect a fitting to the inlet and allow the reservoir to drain. Next, connect a fitting to the outlet. It might be best to have some hose on this one to allow gravity to help drain the engine. A light burst of air 5-10 PSI into the reservoir could help to push the liquid from the engine.
- The coolant is now drained.

17.6 Coolant Maintenance

Periodically inspect the coolant for contamination. Replace if the coolant becomes dirty/contaminated.

17.7 Cleaning the Heat Exchanger

Cooling capacity is heavily reduced if the heat exchanger is contaminated. The heat exchanger must be checked for contamination (particulates) regularly and be cleaned, if required.

The cleaning of the heat exchanger must be performed in accordance with the maintenance intervals.

DANGER

The use of water/chemicals for cleaning the heat exchanger can cause short circuit and damage the fan

The use of water/chemicals for cleaning the heat exchanger can damage the fan and result in a short circuit. In this case persons are in danger to get an electric shock.

- Do not clean the heat exchanger with water/chemicals.

NOTE

Damage to the fins of the heat exchanger due to improper handling of the unit.

Damaged fins of the heat exchanger lead to a reduced cooling capacity.

- Take care not to damage the fins of the heat exchanger when cleaning the heat exchanger.
- Air pressure used to clean the fins must be controlled to prevent damage to the fins.

- If the fins of the heat exchanger are not in a suitable condition, the unit must only be used again once the damage has been rectified.

Requirements

- Unit prepared for maintenance. Refer to Preparing the Unit for Maintenance.

Required Tools and Materials

- Vacuum cleaner
- Compressed air pistol/pressurized air spray
- Hand brush
- Brush

Procedure

1. Clean the heat exchanger and grill with a vacuum cleaner, or compressed air.
2. Care must be taken not to damage the fins.

18. Spare Parts

NRC400 (385901-002)

Name	Part No.
Pump	387008261-SP
Fan	157005314-SP
Tank Cap	387002004-SP
Temp Sensor	387005808-SP

19. Decommissioning and Disposal

20.1 Temporarily Placing Out of Operation

DANGER

Electrical danger

Work on electrical installations may be carried out by trained and authorized electricians only.

- Switch off the unit before starting your work.
- Disconnect the unit from mains by pulling the mains plug.
- Secure the unit against being switched on again.
- Verify that the unit is disconnected.
- Carry out necessary earthing connections.
- Keep unauthorized persons away from the working area.

The decommissioned unit must be stored in a dry and dust-free room.

For recommended storage conditions, refer to Storing the Unit.

Prior to Decommissioning

Procedure

1. Finish the cooling operation.
2. Disconnect the unit from mains.
3. Let the unit and the coolant cool down.
4. Disconnect coolant hoses from the unit. Refer to Disconnect Hoses.
5. Drain the coolant. Refer to Draining Procedure
6. Clean the unit. Refer to System Maintenance and Service.
7. Secure the coolant inlet and coolant outlet connections with protection caps against soiling.

The unit has now been decommissioned.

20.2 Returning the Unit to Service After Decommissioning

Procedure

1. Thoroughly clean the unit. Refer to System Maintenance and Service.
2. Check that the unit is in operating condition.
3. Install the unit and put it into operation. Refer to Installation Procedure.

20.3 Final Decommissioning or Disposal

Final decommissioning or disposal of the unit must be performed in accordance with the regulations of the country of use.

Contact Laird Thermal Systems to return end-of-life units through the official website at https://www.lairdthermal.com/contact or contact a company specializing in the disposal and recycling of equipment.

20.4 Disposal of Operating Materials

The operating materials of the unit can be hazardous to the environment and to health.

- Make sure the operating materials are disposed of or recycled according to local regulations.
- Also, the safety specifications of the coolant manufacturer must be obeyed.

20.5 Return of the Unit to Laird

Declaration of decontamination

Before re-shipment of the unit a declaration of decontamination must be sent to Laird Thermal Systems.

20. Return Procedure

All returns must be assigned a Return Materials Authorization number (RMA#) in advance. To start a return process, simply fill out the form at https://www.lairdthermal.com/about/product-return-policy

Returns received without RMA # may be refused. All returns must be securely packed to prevent shipping damage and must be clearly marked with the RMA# on the box. Consignor shall pay freight charges on all returns.

This product is made by Laird Thermal Systems Shenzhen Limited.

Address: Room 201, Dejin industrial park, No 34, Fuyuan 1 Road, Heping Community, Fuhai street, Baoan district, Shenzhen City, Guangdong Province, PRC.

For any questions, please contact us via the website https://www.lairdthermal.com/contact

21. List of figures