

USER GUIDE  
UGH062-0522



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# ECW Series Variable Speed Chiller



Thank you for purchasing Conair equipment. This manual is addressed to operators and **qualified technicians** to ensure correct use of this Conair equipment.

ⓘ **IMPORTANT:** THIS MANUAL MUST BE READ BEFORE INSTALLATION. KEEP THIS MANUAL IN A PLACE ACCESSIBLE FOR ALL OPERATORS.

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date: \_\_\_\_\_

Manual Number: UGH062-0522 \_\_\_\_\_

Serial Number(s): \_\_\_\_\_

Model Number(s) \_\_\_\_\_

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## Foreword

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The central chiller consists of a refrigeration circuit to provide cooling water to coolant.

This manual is to serve as a guide for installing, operating, and maintaining the equipment. Improper installation, operation, and maintenance can lead to poor performance and/or equipment damage. Use qualified installers and service technicians for all installation and maintenance of this equipment.

This manual is for our standard product. The information in this manual is general in nature. Unit-specific drawings and supplemental documents are included with the equipment as needed. Additional copies of documents are available upon request.

Due to the ever-changing nature of applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment, we do not reference them in this manual.

The equipment uses a hydrofluorocarbon (HFC), trade named R-407c, as a chemical refrigerant for heat transfer purposes. This chemical is sealed and tested in a pressurized system containing ASME coded vessels; however, a system failure will release it. Refrigerant gas can cause toxic fumes if exposed to fire. Place these units in a well-ventilated area, especially if open flames are present. Failure to follow these instructions could result in a hazardous condition. We recommend the use of a refrigerant management program to document the type and quantity of refrigerant in the equipment. In addition, we recommend only licensed and EPA certified service technicians work on our refrigeration circuits.

## Safety Guidelines

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Observe all safety precautions during installation, start-up, and service of this equipment. The following is a list of symbols used in this manual and their meaning.



*General Warning*



*Electricity Warning*



*Sharp Element Warning*



*Hot Surface Warning*



*Flammable Material Warning*



*Explosive Material Warning*



*General Mandatory Action*



*Wear Eye Protection*



*Wear Protective Gloves*



*Wear Ear Protection*



*Disconnect Before Carrying Out Maintenance or Repair*



*Connect an Earth Terminal to Ground*

Only qualified personnel should install, start-up, and service this equipment. When working on this equipment, observe precautions in this manual as well as tags, stickers, and labels on the equipment.



**WARNING:** Any use or misuse of this equipment outside of the design intent may cause injury or harm.



**WARNING:** Vent all refrigerant relief valves in accordance to ANSI/ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. Locate this equipment in a well-ventilated area. Inhalation of refrigerant can be hazardous to your health and the accumulation of refrigerant within an enclosed space can displace oxygen and cause suffocation.



**WARNING:** This equipment contains hazardous voltages that can cause severe injury or death.



**WARNING:** This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.



**WARNING:** This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.



**WARNING:** The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.



**CAUTION:** Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Shut off the electric power at the main disconnect before opening access panels for repair or maintenance.



**CAUTION:** Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** The equipment will exceed 70 dBA sound pressure at 1 meter distance and 1 meter elevation when operating. Wear ear protection as required for personal comfort when operating or working in close proximity to the chiller.



**CAUTION:** Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

## Pre-Installation

### Receiving Inspection

When the unit arrives, verify the information on the unit nameplate agrees with the order acknowledgement and shipping papers. Inspect the equipment for any visible damage and verify all items shown on the bill of lading are present. If damage is evident, document it on the delivery receipt by clearly marking any item with damage as "unit damage" and notify the carrier. In addition, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage claim is the responsibility of the receiving party. Do not install damaged equipment without getting the equipment repaired.

Shipping damage is the responsibility of the carrier. To protect against possible loss due to damage incurred during shipping and to expedite payment for damages, it is important to follow proper procedures and keep records. Photographs of damaged equipment are excellent documentation for your records.

Start unpacking the unit, inspect for concealed damage, and take photos of any damage found. Once received, equipment owners have the responsibility to provide reasonable evidence that the damage did not occur after delivery. Photos of the equipment damage while the equipment is still partially packed will help in this regard. Refrigerant lines can be susceptible to damage in transit. Check for broken lines, oil leaks, damaged controls, or any other major component torn loose from its mounting point.

Record any signs of concealed damage and file a shipping damage claim immediately with the shipping company. Most carriers require concealed damages be reported within 15 days of receipt of the equipment. In addition, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage claim is the responsibility of the receiving party.

Chillers with an integral water-cooled ship with a full refrigerant charge. Chillers designed for use with a remote air-cooled condenser and the remote condensers themselves ship with a nitrogen holding charge. Check the remote condenser for signs of leaks prior to rigging. This will ensure no coil damage has occurred after the unit left the factory. The condenser ships with the legs removed. Mount the legs to the condenser using the provided nuts, bolts, and washers.

## Unit Storage

When storing the unit it is important to protect it from damage. Blow out any water from the unit; cover it to keep dirt and debris from accumulating or getting in, and store in an indoor sheltered area that does not exceed 145°F.

## Installation - Chiller

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### Foundation

Install the unit on a rigid, non-warping mounting pad, concrete foundation, or level floor suitable to support the full operating weight of the equipment. When installed the equipment must be level within ¼ inch over its length and width.

### Unit Location

The unit is available in many different configurations for various environments. Refer to the proposal and order acknowledgement document for the equipment to verify the specific design conditions in which it can operate.

To ensure proper airflow and clearance space for proper operation and maintenance allow a minimum of 36 inches of clearance between the sides of the equipment and any walls or obstructions. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service. In addition, ensure the condenser and evaporator refrigerant pressure relief valves can vent in accordance with all local and national codes.

### Rigging

The chiller has a frame to facilitate easy movement and positioning with a crane or forklift. Follow proper rigging methods to prevent damage to components. Avoid impact loading caused by

sudden jerking when lifting or lowering the chiller. Use pads where abrasive surface contact may occur.

## Process Fluid Piping

Proper insulation of chilled process fluid piping is crucial to prevent condensation. The formation of condensation adds a substantial heat load to the chiller.

The importance of properly sized piping cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping out to the process and reduce pipe size at connections as needed. One of the most common causes of unsatisfactory chiller performance is poor piping system design. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to water flow. When manifolds are required, install them as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system.

## Condenser Water Piping

(Water-Cooled Condenser Units Only)

The performance of a water-cooled condenser is dependent on the flow and temperature of the cooling water used. Insufficient cooling of the condenser will result in the reduction of cooling capacity of the chiller and under extreme conditions may result in the chiller shutting down due to high refrigerant pressure. Allowing the condenser to plug up from contaminants in the condenser water stream adversely affects performance. In order to reduce maintenance costs and chiller downtime, a water treatment program is highly recommended for the condenser cooling water. Contact our Customer Service Department for assistance in the proper procedure for cleaning out any plugged condenser.

The nominal water-cooled condenser is design for 85°F condenser cooling water supply. Under normal operation there will be about a 10°F rise through the condenser resulting in 95°F exiting water. To ensure proper water flow through the condenser, ensure the condenser water pump provides at least 25 psi or water at a flow rate of 3 gpm per ton of chiller capacity.

Each condenser has a two-way condenser water-regulating valve. The condenser water-regulating valve controls the amount of water allowed to pass through the condenser in order to maintain proper refrigeration pressures in the circuit.

To prevent damage to the condenser and/or water-regulating valve, the water pressure should not exceed 150 psig.

### Water Pressure Gauges

Install pressure gauges in the inlet and outlet of both the condenser and evaporator chilled water piping to provide the ability to read the pressure drop across the chiller and aid in preventive maintenance and troubleshooting.

### System Temperature Sensor

This section only applies to installations where multiple chillers are in a common system where one chiller is the primary chiller with the other chillers serving as secondary chillers. In those situations, a field-installed fluid-temperature sensor is required in the common process fluid supply and return piping. Install the sensor downstream of all individual chilled water supply streams. Position the temperature sensor to read the mixed supply temperature. The supply temperature sensor is normally the control sensor for the chiller system set point and determines the loading/unloading of the compressors of the system.

The temperature sensor comes from the factory with a ½" NPT male fitting thermowell for direct mounting in the field piping. Mount the temperature sensor in a minimum pipe size of 3". Wire the temperature sensor to the designated primary chiller electrical enclosure and land at the appropriate terminal blocks within the enclosure. See the chiller electrical schematic for further details.

### Chiller Flow Sensor

This section only applies to installations when the flow sensor option is present. In those situations, a field-installed chiller flow sensor is required. Mount the flow sensor in the process fluid supply piping in an area of pipe with a minimum of 10 pipe diameters of straight run after any valves or pipefittings. This ensures the stream of fluid is solid and stable for accurate flow measurement.

The flow sensor comes from the factory with a ½" NPT compression fitting for direct mounting in the field piping. Mount the flow sensor in a minimum pipe size of 2". Insert the stem of the sensor into the compression fitting so the tip of the sensor is at the approximate center of the pipe. The sensor requires five pipe diameters of straight run piping on both sides of the sensor. Wire the flow sensor to the chiller electrical enclosure and land at the appropriate terminal blocks with the enclosure. See the chiller electrical schematic for further details.

## Installation - Remote Condenser

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Chillers designed for use with a remote air-cooled condenser include a factory-selected remote condenser. The remote air-cooled condenser typically ships separately from a different location than the chiller.

### Location

The remote air-cooled condenser is for outdoor use. Locate the remote condenser in an accessible area. The vertical air discharge must be unobstructed. Allow a minimum of 48 inches of clearance between the sides and ends of the condenser and any walls or obstructions. For installations with multiple condensers, allow a minimum of 96 inches between condensers placed side-by-side or 48 inches for condensers placed end-to-end.

When locating the condenser it is important to consider accessibility to the components to allow for proper maintenance and servicing of the unit. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service.

Proper ventilation is another important consideration when locating the condenser. In general, locate the unit in an area that will not rise above 110°F.

Install the unit on a firm, level base no closer than its width from walls or other condensers. Avoid locations near exhaust fans, plumbing vents, flues, or chimneys. Fasten the mounting legs at their base to the steel or concrete of the supporting structure. For units mounted on a roof structure, the steel support base holding the condenser should be elevated above the roof and attached to the building.

Avoid areas that can create a “micro-climate” such as an alcove with east, north, and west walls that can be significantly warmer than surrounding areas. The condenser needs to have unrestricted airways so it can easily move cool air in and heated air away. Consider locating the condenser where fan noise and vibration transmission into nearby workspaces is unlikely.

The unit ships on its side with the legs removed to reduce shipping dimensions and provide more protection to the coil from possible damage caused by impact loading over rough roads and transit conditions.

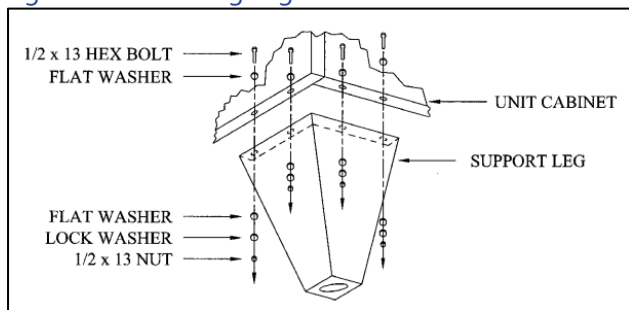
### Lifting

Lift the remote condenser using the leg support channels or the side lifting brackets for larger units. It is best to attach the unit mounted leg assemblies when the unit is flat, fans facing up, and when supported by the rigging. Take special care not to bump, hit, or otherwise stress the tubing, headers, or connections during the lifting and positioning of the unit. Under no circumstances use the coil headers or return bends in the lifting or moving of the condenser.

### Mounting Legs

Before rigging the unit, install the legs using the hardware provided. The standard legs are 22 inches. Optional 48 or 60 inches legs require a leg between every fan section and gusset for stability. 60 inch legs also require cross bracing, see the diagram provided with the unit for details. The following shows a typical leg mounting arrangement.

Figure 1 – Mounting Legs



### Interconnecting Refrigerant Piping

The chiller and remote condenser ship with a nitrogen holding charge. Evacuation of this charge is required before charging with refrigerant. The chiller is for use only with the air-cooled condenser provided with the unit. The following section covers the required piping between the chiller and the provided air-cooled condenser.

The discharge and liquid lines leaving the chiller have caps. These line sizes do not necessarily reflect the actual line sizes required for the piping between the chiller and the air-cooled condenser.

Refrigerant piping size and piping design have a significant impact on system performance and reliability. All piping should conform to the applicable local and state codes.



**CAUTION:** Use refrigerant grade copper tubing ASTM B280 only and isolate the refrigeration lines from building structures to prevent transfer of vibration. All copper tubing must have a pressure rating suitable for R-134a; tubing must be Type L rigid tubing.

Do not use a saw to remove end caps. This might allow copper chips to contaminate the system. Use a tube cutter or heat to remove the caps. When sweating copper joints it is important to evacuate all refrigerant present and flow dry nitrogen through the system. This prevents the formation of toxic gases, corrosive acids, and scale.



**CAUTION:** Do not use soft solders. For copper-to-copper joints use a copper-phosphorus braze alloy (BCuP per the American Welding Society) with 5% (BCuP-3) to 15% (BCuP-5) silver content. Only use a high silver content brazing alloy (BAg per AWS) for copper-to-brass or copper-to-steel joints such as a 45% (BAg-5) silver content. Only use oxy-acetylene brazing when soldering refrigerant piping.

### Refrigeration Piping Design

The system is configurable as shown in Figure 2 and Figure 3. The configuration and its associated elevation, along with the total distance between the chiller and the air-cooled condenser, are important factors in determining the liquid line and discharge line sizes. This will also affect the field refrigerant charges. Consequently, it is important to adhere to certain physical limitations to ensure the system operates as designed.

### General Design Considerations

1. The total distance between the chiller and the remote air-cooled condenser must not exceed 100 equivalent feet. Keep the distance as short as possible.
2. Liquid line risers must not exceed 15 feet in height from the condenser liquid line connection.
3. Discharge line risers cannot exceed an elevation difference greater than 85 actual feet or 100 equivalent feet without a minimum of 2% efficiency decrease.
4. To form a proper liquid seal at the condenser, immediately drop at least 15 inches down from the liquid outlet before routing the piping to the chiller. Make the drop leg before any bends or angles connecting to the remainder of the liquid connection piping.
5. Position the condenser at the same elevation or above the chiller.
6. Pipe condensers with dual circuits to assure equal refrigerant flow to each circuit.

Figure 2 – Condenser Located at Chiller Level

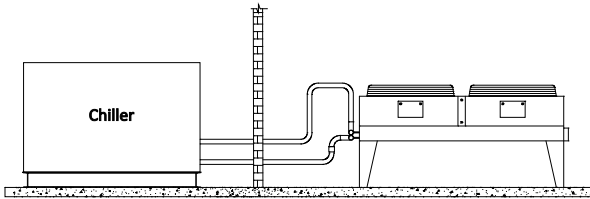
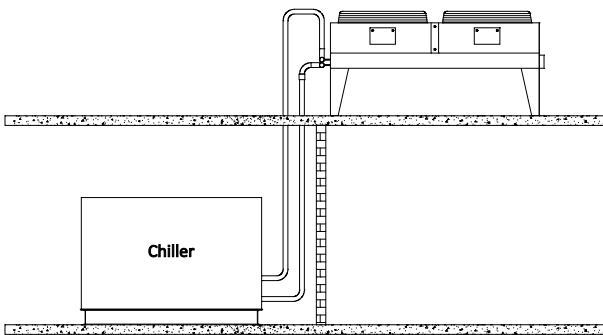


Figure 3 – Condenser Located Above Chiller Unit



Note: Liquid line sizing for each chiller capacity is in Table 2. These line sizes are listed per circuit and apply where leaving water temperature (LWT) is 40°F or higher. For applications where the LWT is below 40°F, size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.

### Determining Equivalent Line Length

To determine the appropriate size for field installed liquid and discharge lines, it is first necessary to establish the equivalent length of pipe for each line. The equivalent length is the approximate friction loss from the combined linear run of pipe and the equivalent feet of elbows, valves, and other components in the refrigeration piping. The sum total is the equivalent length of pipe that would have the same pressure loss. See the ASHRAE Refrigeration Handbook for more information.

#### Follow these steps when calculating line size

1. Start with an initial approximation of equivalent length by assuming that the equivalent length of pipe is 1.5 times the actual pipe length.
2. Determine approximate line sizes by referring to Table 2 for liquid lines and Table 3 for discharge lines.
3. Check the line size by calculating the actual equivalent length using the equivalent lengths as shown in Table 1.



CAUTION: When calculating the equivalent length, do not include piping of the chiller unit. Only field piping must be considered.

Table 1 – Equivalent Lengths of Elbows

| Line Size OD (in) | Equivalent Lengths of Refrigerant Pipe (feet) |                 |            |              |            |
|-------------------|---|-----------------|------------|--------------|------------|
|                   | 90° Standard                                  | 90° Long Radius | 90° Street | 45° Standard | 45° Street |
| 7/8               | 2.0   | 1.4             | 3.2        | 0.9          | 1.6        |
| 1 1/8             | 2.6   | 1.7             | 4.1        | 1.3          | 2.1        |
| 1 3/8             | 3.3   | 2.3             | 5.6        | 1.7          | 3.0        |
| 1 5/8             | 4.0   | 2.6             | 6.3        | 2.1          | 3.4        |
| 2 1/8             | 5.0   | 3.3             | 8.2        | 2.6          | 4.5        |
| 2 1/8             | 6.0   | 4.1             | 10.0       | 3.2          | 5.2        |
| 3 1/8             | 7.5   | 5.0             | 12.0       | 4.0          | 6.4        |
| 3 5/8             | 9.0   | 5.9             | 15.0       | 4.7          | 7.3        |
| 4 1/8             | 10.0  | 6.7             | 17.0       | 5.2          | 8.5        |

### Liquid Line Sizing

The liquid line diameter should be as small as possible while maintaining acceptable pressure drop. This is necessary to minimize refrigerant charge. The total length between the chiller unit and the air-cooled condenser must not exceed 85 actual feet or 100 equivalent feet. It is best to pipe the liquid line so that there is an immediate drop of at least 15 inches at the condenser outlets to make a liquid seal.

Liquid line risers in the system will require an additional 0.5 psig pressure drop per foot of vertical rise. When it is necessary to have a liquid line riser, make the vertical run immediately after the condenser before any additional restrictions. The liquid line risers must not exceed 10 feet in height from the condenser liquid line connection. The liquid line does not require pitching. Install a pressure tap valve at the condenser to facilitate measuring pressure for service.

Liquid lines do not typically require insulation. However, if exposing the lines to solar heat gain or temperatures exceeding 110 °F, there is a negative effect on sub-cooling. In these situations, insulate the liquid lines.

**Table 2 – Liquid Line Size/Circuit (inches OD)**

| Total Equivalent Length (Ft) | 60 Ton | 70 Ton | 80 Ton | 90 Ton | 100 Ton | 120 Ton |
|------------------------------|--------|--------|--------|--------|---------|---------|
| 25                           | 1 3/8  | 1 5/8  | 1 5/8  | 1 5/8  | 2 1/8   | 2 1/8   |
| 50                           | 1 5/8  | 1 5/8  | 2 1/8  | 2 1/8  | 2 1/8   | 2 1/8   |
| 75                           | 1 5/8  | 2 1/8  | 2 1/8  | 2 1/8  | 2 1/8   | 2 1/8   |
| 100                          | 2 1/8  | 2 1/8  | 2 1/8  | 2 1/8  | 2 1/8   | 2 1/8   |

### Discharge (Hot Gas) Line Sizing

The discharge line size is determined based on a pressure drop corresponding to a 2°F or less change in saturation temperature. It is important to minimize the line length and restrictions to reduce pressure drop and maximize capacity and efficiency. The discharge lines should pitch downward, in the direction of the hot gas flow, at the rate of ½ inch per each 10 feet of horizontal run. If the chiller unit is below the condenser, loop the discharge line to at least 1 inch above the top of the condenser. Install a pressure tap valve at the highest point of the hot gas line into the condenser to facilitate removal of inadvertently trapped non-condensable material.



*Note: Discharge line sizing for each chiller circuit capacity is in Table 3. Line sizing shown is listed per circuit and applies where leaving water temperature (LWT) is 40°F or higher. For applications where LWT is below 40°F, size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.*

**Table 3 – Discharge Line Size/Circuit (inches OD)**

| Total Equivalent Length (Ft) | 60 Ton | 70 Ton | 80 Ton | 90 Ton | 100 Ton | 120 Ton |
|------------------------------|--------|--------|--------|--------|---------|---------|
| 25                           | 2 1/8  | 2 1/8  | 2 1/8  | 2 1/8  | 2 5/8   | 3 1/8   |
| 50                           | 2 1/8  | 2 5/8  | 2 5/8  | 2 5/8  | 2 5/8   | 3 1/8   |
| 75                           | 2 5/8  | 2 5/8  | 2 5/8  | 2 5/8  | 2 5/8   | 3 1/8   |
| 100                          | 2 5/8  | 2 5/8  | 2 5/8  | 3 1/8  | 3 1/8   | 3 1/8   |

### Calculating Refrigerant Charge

To determine the approximate charge, first refer to Table 4 and establish the required charge for the condenser and chiller. Then refer to Table 5 to determine the charge required for the field-installed piping per circuit. The approximate charge per circuit is therefore the sum of the values from Table 4 and Table 5.

The charge required for an air-cooled condenser using fan cycling and variable speed for head pressure control is indeterminate due to site and environmental variances. Because refrigerant density increases with decreasing temperatures, the low ambient operating charge is more (compared to the summer charge). In the worst case of -20°F, the charge may nearly double. The best way to assure proper charging is, on the coldest day of the year under full load, the charge should be up to the second sight glass from the bottom of the receiver with the electric expansion valve (EXV) sight glass clear. Prolonged periods of foaming in the sight glass may indicate a low refrigerant condition or a restriction in the liquid line.

*Note: Occasional bubbling in a sight glass may occur at a time when load conditions are changing and the expansion valve is adjusting to the new conditions. This momentary occurrence is a result of normal chiller operation.*

Use the sight glass to check if there is moisture in the refrigeration circuit. If there is moisture in the circuit, the green ring around the perimeter of the sight glass will turn yellow. If this occurs, service immediately.

**Table 4 – Total Summertime Refrigerant Charge**

| Chiller Model | Refrigerant Charge (Lbs. of 134a @ 60°F)<br>Combined Total of Chiller & Condenser |
|---------------|---|
| TCR300C       | 161   |
| TCR300D       | 188   |
| TCR300H       | 146   |
| TCR350K       | 167   |
| TCR350Q       | 223   |
| TCR350S       | 265   |
| TCR600C       | 321   |
| TCR600D       | 376   |
| TCR600H       | 293   |
| TCR700K       | 335   |
| TCR700Q       | 446   |
| TCR700S       | 530   |

**Table 5 - Field Piping R-134a Refrigerant Charges**

| Line Size OD<br>(inches) | Discharge Line | Liquid Line |
|--------------------------|----------------|-------------|
| 1 3/8                    | 3.0            | 63.4        |
| 1 5/8                    | 4.2            | 89.7        |
| 2 1/8                    | 7.4            | 156.9       |
| 2 5/8                    | 11.4           | 242.5       |
| 3 1/8                    | 16.3           | 345.6       |

## Installation - Electrical

All wiring must comply with local codes and the National Electric Code. Minimum circuit amps (MCA) and other unit electrical data are on the unit nameplate. A unit specific electrical schematic ships with the unit. Measure each leg of the main power supply voltage at the main power source. Voltage must be within the voltage utilization range given on the drawings included with the unit. If the measured voltage on any leg is not within the specified range, notify the supplier and correct before operating the unit. Voltage imbalance must not exceed two percent. Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. Voltage imbalance is determined using the following calculations.

$$\% \text{ Imbalance} = (V_{avg} - V_x) \times 100 / V_{avg}$$

$$V_{avg} = (V1 + V2 + V3) / 3$$

$V_x$  = phase with greatest difference from  $V_{avg}$

For example, if the three measured voltages were 442, 460, and 454 volts, the average would be:

$$(442 + 460 + 454) / 3 = 452$$

The percentage of imbalance is then:

$$(452 - 442) \times 100 / 452 = 2.2 \%$$

This exceeds the maximum allowable of 2%.

There is a terminal block for main power connection to the main power source. The main power source should be connected to the terminal block through an appropriate disconnect switch. There is a separate lug in the main control panel for grounding the unit. Check the electrical phase sequence at installation and prior to start-up. Operation of the compressor with incorrect electrical phase sequencing will result in mechanical damage to the compressors. Check the phasing with a phase sequence meter prior to applying power. The proper sequence should read "ABC" on the meter. If the meter reads "CBA", open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). Do not interchange any load leads that are from the unit contactors or the motor terminals.



**WARNING:** This equipment contains hazardous voltages that can cause severe injury or death.



**WARNING:** This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.



**WARNING:** This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.



**WARNING:** The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.



**CAUTION:** Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.



**CAUTION:** Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wire the unit ground in compliance with local and national codes.

## Compressor Control Logic

### Single Circuit

A single circuit chiller contains only one compressor. The chiller controls the leaving chilled water according to the chilled water set point. A temperature sensor is field installed in the supply water at the exit of the chiller and sends information to the PLC. When the temperature rises above the set point, the PLC will start the compressor when there is enough process heat load to support the operation of the compressor. The compressor, once running, will modulate its capacity to precisely control the to process water temperature. If the process heat load drops below the minimum loading capability of the compressor, the compressor will cycle off. Operation of the compressor will resume once adequate heat load exists.

### Dual Circuit

A dual circuit chiller contains two compressors with two independent refrigeration circuits. Each circuit is capable of operating independently with the other circuit disabled or as a pair in a lead/lag configuration.

The chiller controls the leaving chilled water according to the chilled water set point. A temperature sensor is field installed in the supply water at the exit of the chiller and sends information to the PLC. When the temperature rises above the set point, the PLC will start the lead compressor when there is enough process heat loads to support the operation of one compressor. The lead

compressor, once running, will modulate its capacity to control the supply water temperature. If the process heat load drops below the minimum loading capability of the lead compressor, the compressor will cycle off. Operation of the lead compressor will resume once adequate heat load exists.

The lag compressor will start if the process heat load continues to increase after the lead compressor is running and fully loaded. Both compressors will share the load and modulate their capacities in order to maintain the chilled water set point. If the process heat load drops to a level that one or both compressors are running at their minimum loading capability, the lag compressor will shut off. The lead compressor will then increase its capacity in order to handle the process heat load of the two previously running compressors. If the process heat load increases, the lag compressor will resume operation only once there is enough load to require both compressors to run at a capacity greater than their minimum loading capability.

The PLC controls the designation of the lead and lag compressors. When the PLC is in Auto Lead/Lag configuration, the lead circuit will switch on regular intervals to provide equal run time on each compressor.

### Primary/Secondary

It is possible to link together multiple chillers to form a single system, using single or dual compressor chillers with a maximum of six compressors connected. Any chiller can be setup to be a primary or a secondary. The primary chiller controls the compressor demand in order to maintain the common chilled water set point. A secondary chiller becomes dependent on the primary only for its compressor staging order and running demand. The secondary chiller PLC performs all other operations. The chilled water piping must be manifold together and the supply sensor must be positioned downstream of all individual chilled water streams to read a mixed water temperature. Wire the supply and return water temperature sensors in the common return chilled water piping to the chiller PLC designated as the primary.

## Control Operation

The units uses a Programmable Logic Controller (PLC) and color touch-screen operator interface display that serves as the Human to Machine Interface (HMI).

### Screen Navigation

The overall menus structure allows for quick access and navigation to each section of the control monitoring and control system. The following are the main buttons used to navigate through the various screens.



**Menu Button** – This button is located on the top left of the screen. Touch this button to go to Menu 1.



**Home Button** – This button is located on the bottom of the screen. Touch this button to go to the Home Overview Screen.



**Alarm Button** – This button is located on the bottom of the screen. This button shows the number of alarms active. Touch this button to go to the HMI Alarm Handler Screen.



**Alarm Reset Button** – This button is located on the bottom of the screen. Touch this button to acknowledge and silence active alarms.



**Start/Stop Button** – This button is located at the bottom right of the screen. Touch this button to start and stop the chiller. When stopped, the button outline is red, when running the button outline is green.



**Arrow Button** – These buttons appear in multiple areas of the screen. Touch these buttons to navigate forward, back, up or down in menus and screens.

Some screens are password protected to prevent unintended changes. There are two levels of security (*Username is case sensitive*):

“User” Level Password = 9999  
“Supervisor” Level Password = 7720

When navigating screens any user adjustable areas appear in a slightly different color. Touching one of these areas brings up a keypad. Use the keypad to enter the appropriate user and password to gain access.

The user-level password allows access to the most common functions; however, there are a few screens protected with a Supervisor-level password. Changing items in Supervisor-level menus without fully understanding the impact can lead to improper or poor performance of the unit. Contact our Customer Service department for assistance with any questions before making changes.

There is a master reset function to restore the factory default settings. When this is done you will need to follow the on-screen prompts to reconfigure the chiller based on the options present. For assistance with this process, please contact our Customer Service Department and have the unit Serial Number ready for reference.

### System Initialization

Upon power-up, the first screen to appear is the Start-Up Screen as shown in Figure 4. This screen will display while the Programmable Logic Controller (PLC) and Human Machine Interface (HMI) establish human communications. The PLC/HMI version shows on the screen.

Figure 4 – Start-Up Splash Screen



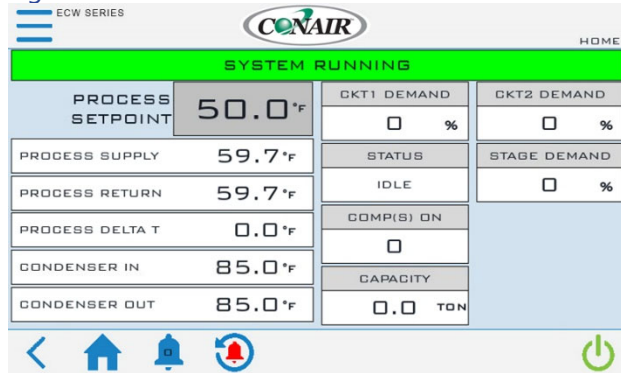
Once control communication is established, the HMI screen automatically switches to the Home Screen.

## Home – Chiller Home Screen

### System Overview






This screen provides an overall synopsis of the chiller system, quick links to other views, as well as other additional information.

Figure 5 – Chiller Home Screen



Note: This is an example of a chiller with the most extensive set of options; your screen may appear slightly different based on your actual chiller configuration.

Table 6 – System Overview Functions

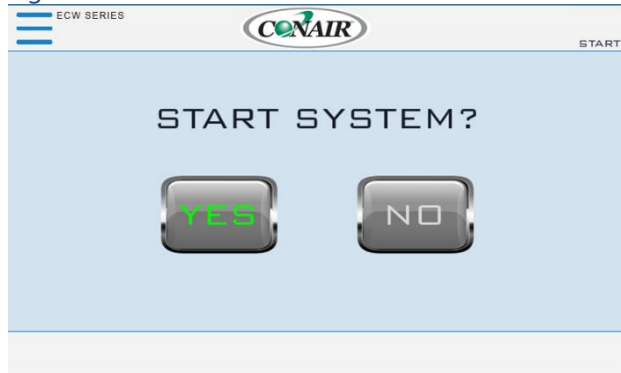
| Function         | Description  | Screen Reference  |     |
|------------------|--|---|-----|
| CKT Demand       | Informs the operator of the compressors in operation in each circuit   | None  |     |
| Status Messaging | Provides information about any warnings or alarms which may have occurred.   | None  |     |
| Setpoint         | Modify the Setpoint by touching the current Setpoint on the HMI. An authorized security level password is required to enter a new Setpoint.      | None  |     |
| Menu Button      | Changes to the Menu 1 screen   | Figure 8  |     |
|                  |   | N/A   |     |
| Alarms           | A listing of active and prior alarm history. The number displayed on the bell indicates the number of active alarms.                             | Figure 10<br>Figure 11  |     |
|                  |   | N/A   |     |
| Alarm(s) Reset   | Will both silence and reset any alarms   | None  |     |
|                  |   | N/A   |     |
| Start / Stop     | Pressing the Start button will provide the ability to start or stop the chiller as well as any other networked chillers attached to this system. | Figure 7<br>Figure 7  |     |
|                  | System Off   |  | N/A |
|                  | System Running   |  | N/A |

## Starting and Stopping the Chiller

### Starting the Chiller

This screen provides the ability to start chiller operation.

Figure 6 – Chiller Start



### Stopping the Chiller

This screen provides the ability to stop chiller operation.

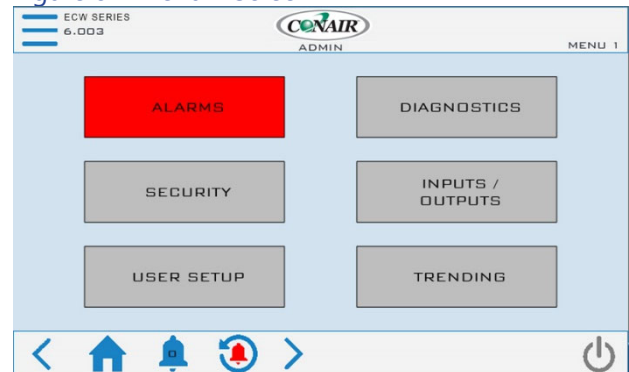
Figure 7 – Chiller Stop



## Menu 1 - Overview

Figure 8 - Menu 1 Screen contains buttons to allow navigation to various sections of the control system. Some parameters are password protected. The main User level password is for gaining access to changing the main system set point and various other warning and alarm settings. A few higher-level areas require a high-level "Supervisor" password. Contact our Customer Service Department for assistance in accessing any restricted menus.

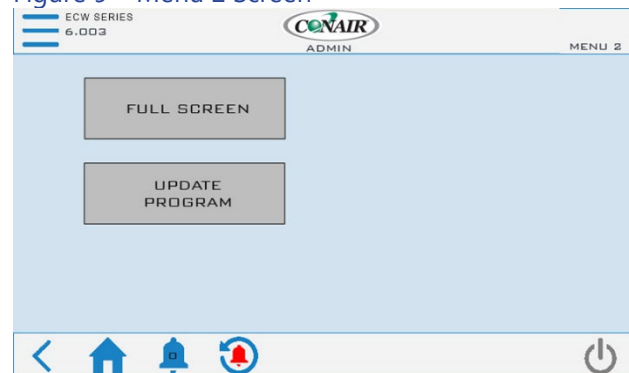
Figure 8 – Menu 1 Screen



## Menu 2 - Overview

Figure 9 - Menu 2 Screen contains additional functionality. This includes the ability to show a full screen view as well as updating the HMI program via thumb drive.

Figure 9 – Menu 2 Screen

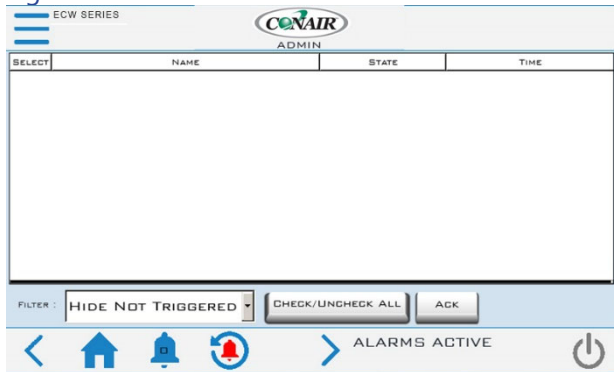


## Menu 1 - Alarms

### Alarms Active

When a critical system fault occurs, the controller logs the faults to the HMI alarm handler. To silence this alarm, press the ALARM SILENCE button. If multiple alarms are active at once, use the DOWN and UP buttons to view all alarms. All alarms must be resolved and then reset using the RESET ALARM button.

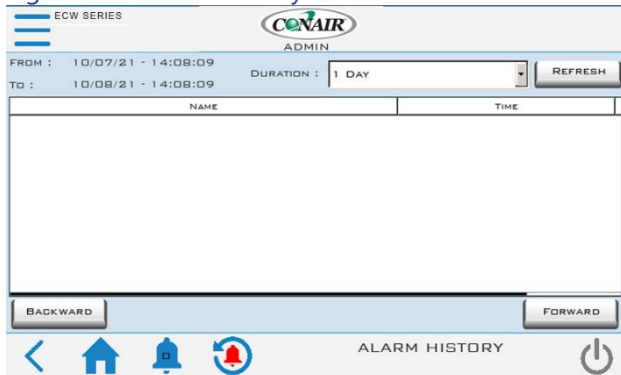
Figure 10 – Alarms Active Handler



Note: The above shows there are no alarms; if an alarm condition were present, it would appear in this window.

### Alarms History

Figure 11 – Alarm History

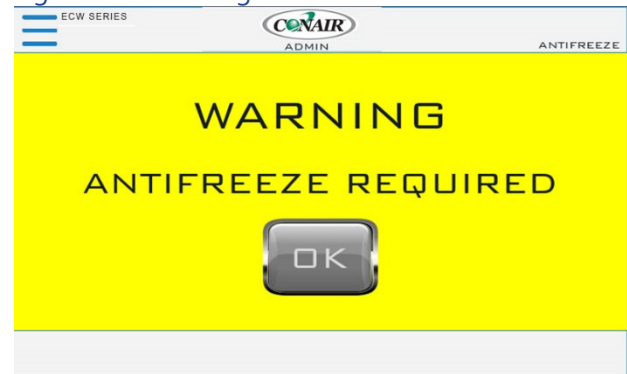


Note: The above shows there are no alarms in history; if an alarm condition previously existed, it would appear in this window.

### Warning Glycol

If the Chiller Setpoint goes below 45°F, the Glycol Warning Screen will appear as in Figure 12. The amount of antifreeze will vary depending on the actual desired operating conditions and should be enough to provide freeze protection to temperatures 15°F colder than the coldest temperature anticipated. Use only antifreeze solutions designed for heat exchanger duty. Do not use automotive antifreeze due to the potential for fouling that can occur once its relatively short-lived inhibitors break down. Verify the proper Glycol solution is used and acknowledge "OK" the Warning.

Figure 12 – Warning Antifreeze



# Menu 1 – Diagnostics

## Diagnostics Menu

The diagnostics screens provide detailed information about the various portions of the system.

Figure 13 – Diagnostics Menu 1 Screen

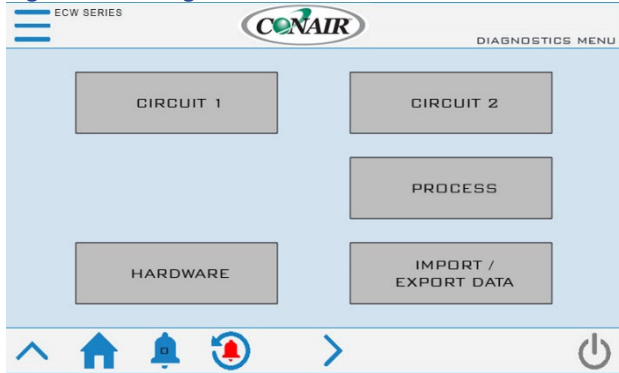


Figure 14 – Diagnostics Menu 2 Screen



Figure 15 – Diagnostics Circuit Details Screen

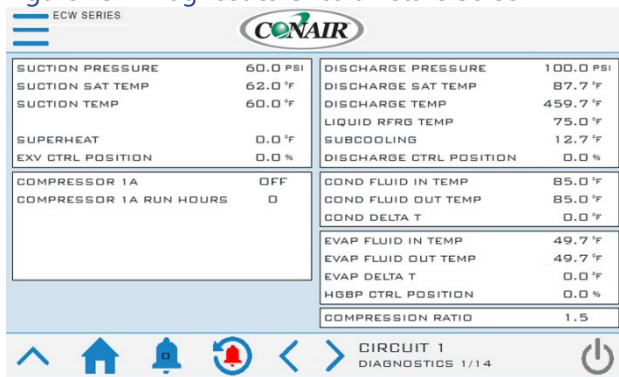


Figure 16 – Diagnostics Circuit Turbocor Screen

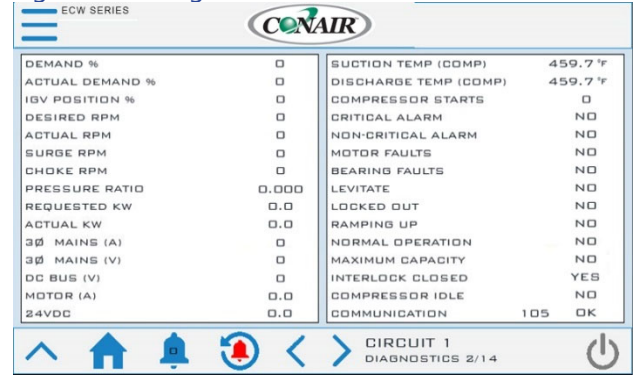


Figure 17 – Diagnostics Circuit Interlock Screen

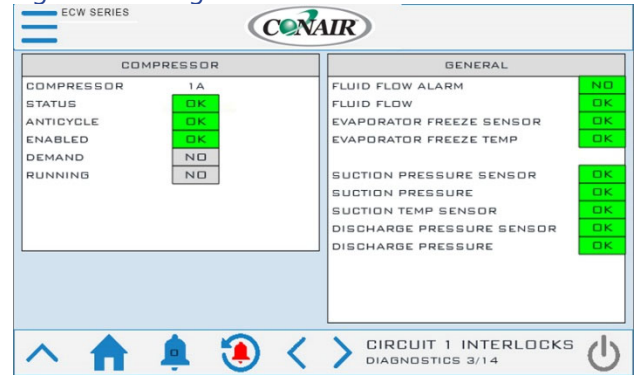


Figure 18 – Diagnostics Process Screen

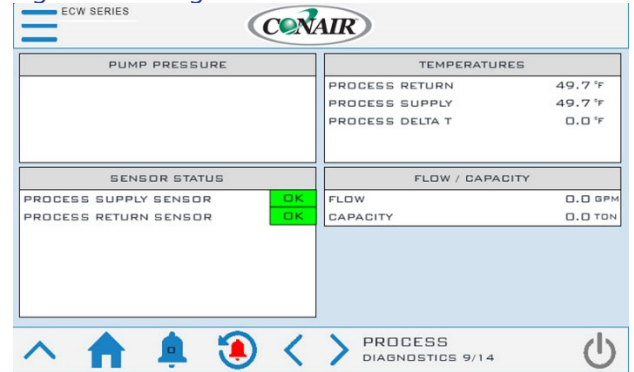


Figure 19 – Diagnostics Hardware Screen

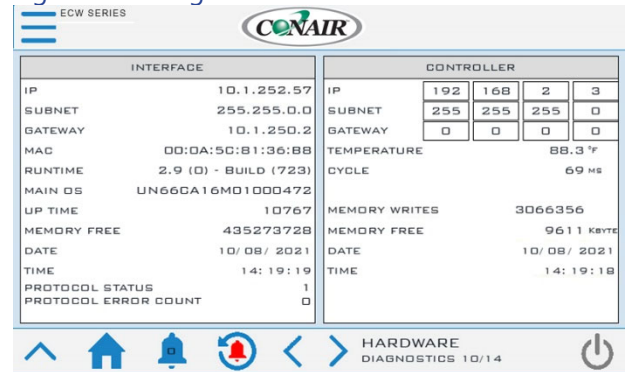


Figure 20 – Diagnostics Import/Export Data Screen

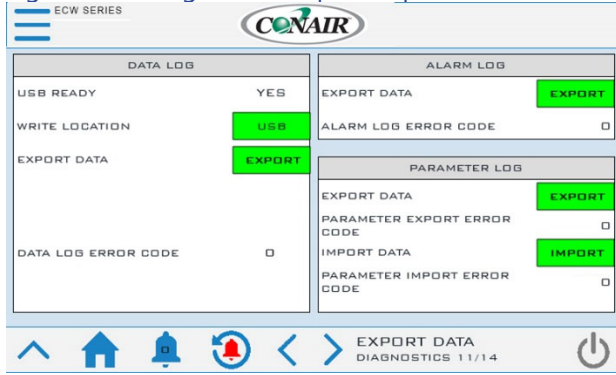


Figure 22 – Security Menu

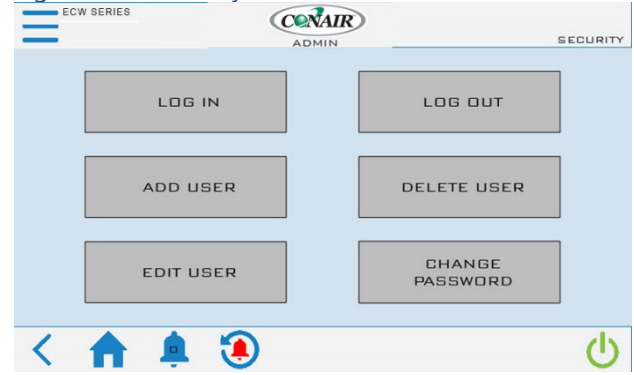


Figure 21 – Diagnostics Overview Screen

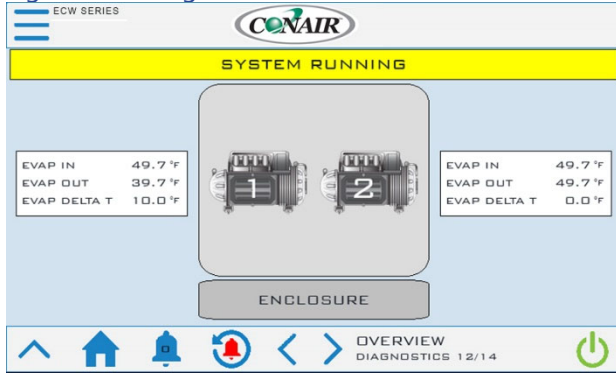
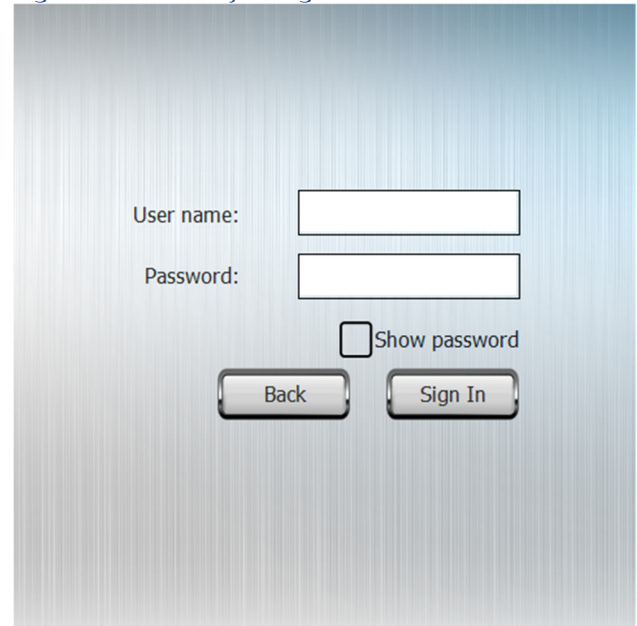


Figure 23 - Security – Log In Screen



## Menu 1 – Security

### Security Menu

To add protection to sensitive areas of the control program and provide some level of supervisory control to some operating parameters, the control system includes some security level protections. If you are attempting to access an area where neither of these passwords is accepted, you may require a technician level password. For access to these areas of the program, contact our Customer Service Department for assistance.

Figure 24 - Security – Add User Screen

User name:

Password:   Show password

Group:

Comments:

---

User must change his initial password

Inactivity logoff time (Min)

Figure 26 - Security – Delete User Screen

User name:

Group:

Figure 25 - Security – Edit User Screen

User name:

Password:   Show password

Group:

Comments:

---

User must change his initial password

Inactivity logoff time (Min)

Figure 27 - Security – Change Password Screen

Old password:

New password:

Confirm password:

Show password

Table 7 Security – Users and Passwords

| User Name  | Password       | Screen Reference |
|------------|----------------|------------------|
| User       | 9999           | None             |
| Supervisor | 7720           | None             |
| Admin      | Contact Conair | None             |

# Menu 1 – Inputs / Outputs

The Input / Output screens display the status of the various system inputs and outputs. This provides a detailed level of information for monitoring system operation and for diagnosing any performance issues or alarms that arise.

Figure 28 - Inputs/Outputs - Menu Screen

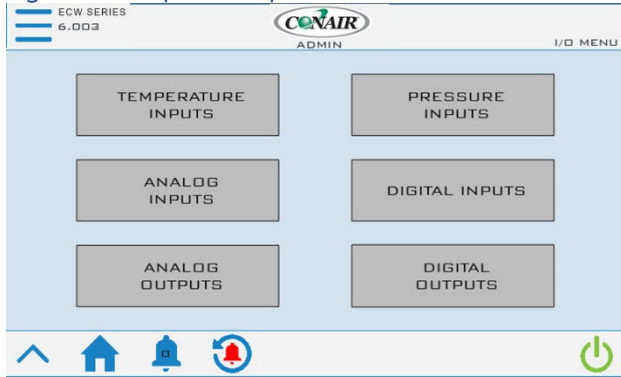


Figure 29 - Inputs/Outputs – Temperature Inputs Screen

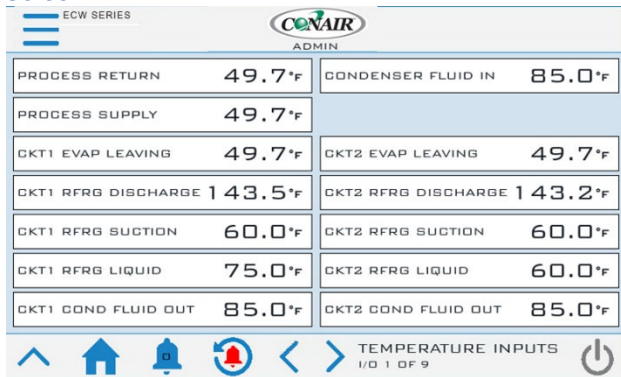


Figure 30 - Inputs/Outputs – Pressure Inputs

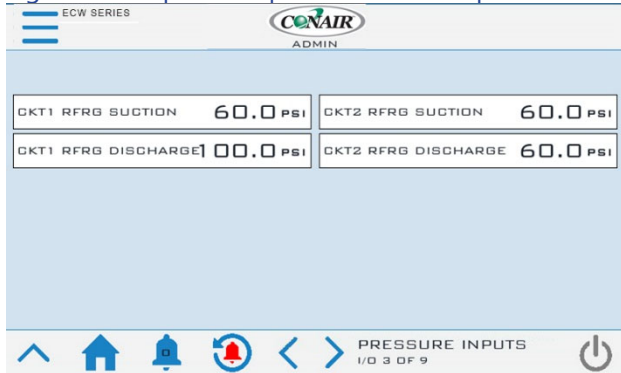


Figure 31 - Inputs/Outputs – Analog Inputs Screen

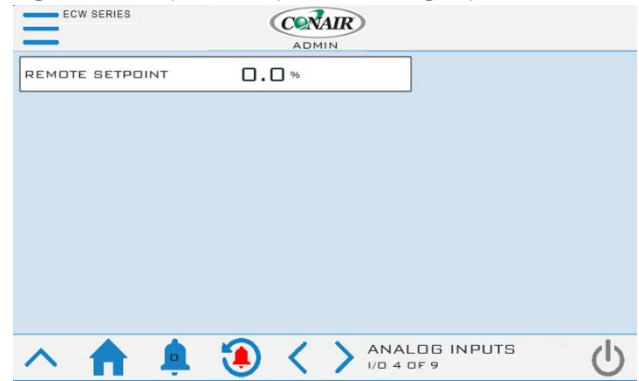


Figure 32 - Inputs/Outputs – Digital Inputs Screen

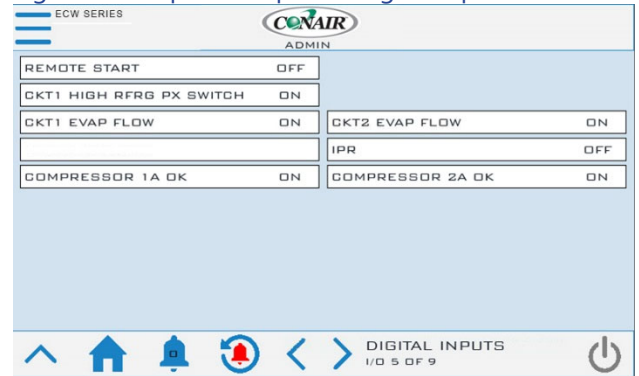


Figure 33 - Inputs/Outputs – Analog Outputs Screen

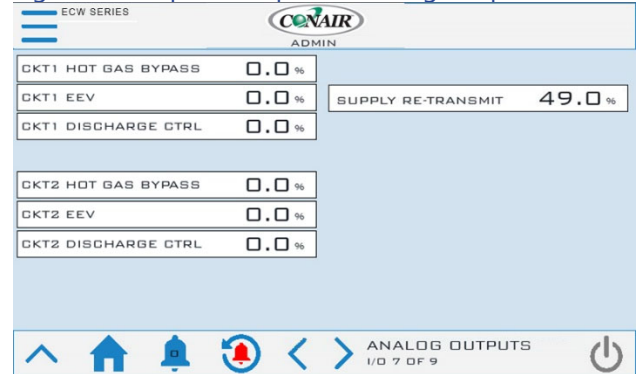


Figure 34 - Inputs/Outputs – Digital Outputs Screen

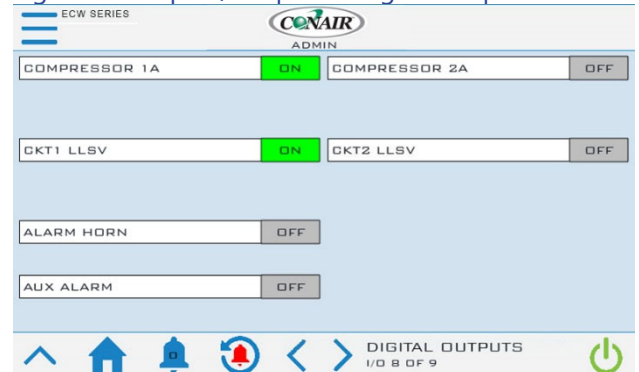
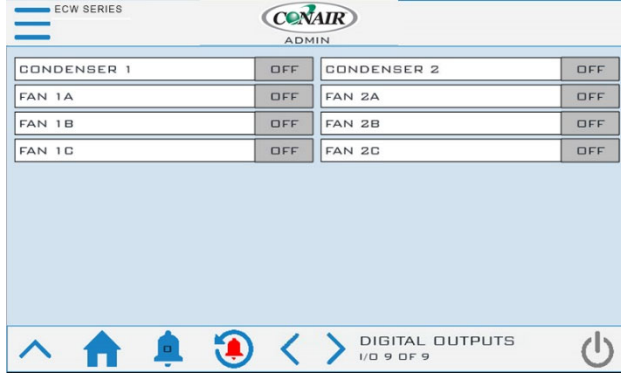


Figure 35 - Inputs/Outputs – Digital Outputs Screen



Note: This is an example of a chiller with an air-cooled condenser; your screen may appear slightly different based on your actual chiller configuration.

## Menu 1 – User Setup

The control system allows for customization and adjustment of many parameters. In most cases, the factory default settings are sufficient; however, adjustment of parameters and settings is possible through the User Setup menus.

Figure 36 - User Setup - Menu 1 Screen

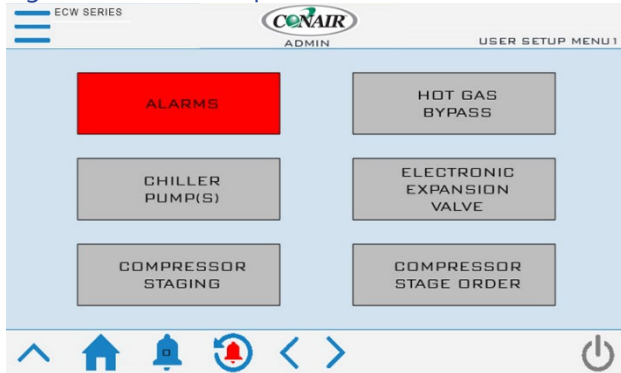


Figure 37 - User Setup - Menu 2 Screen

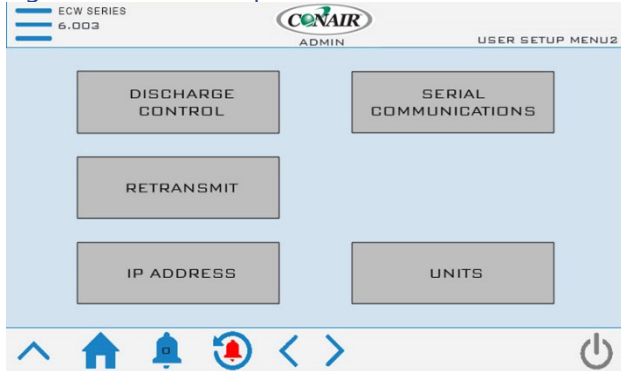


Figure 38 - User Setup - Menu 3 Screen

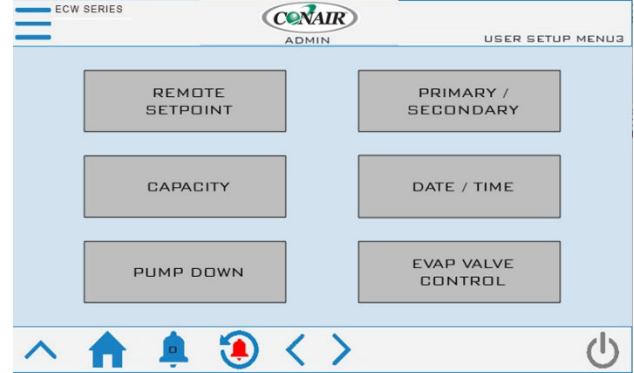


Figure 39 - User Setup - Menu 4 Screen

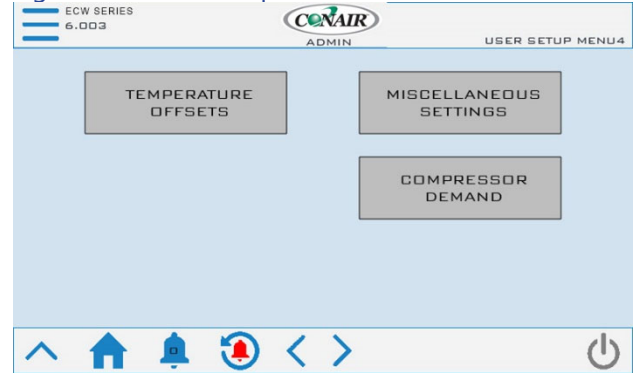


Figure 40 - User Setup - Menu 5 Screen



## User Setup – Alarm Setup

Figure 41 - User Setup - Alarm Setup Screen

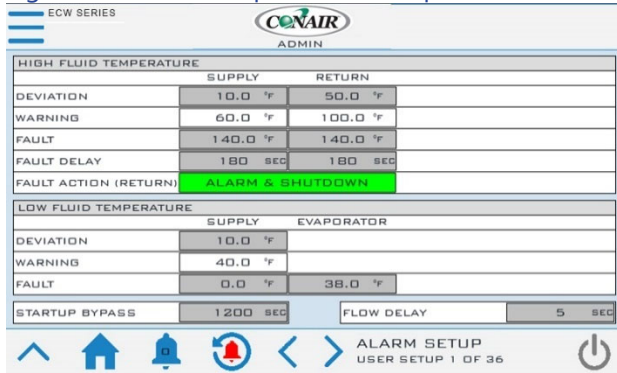


Table 8 – Alarm Setup Parameters

| Menu Item                     | Description   | Default Value                  |
|-------------------------------|---|--------------------------------|
| <b>High Fluid Temperature</b> |   |                                |
| Deviation                     | This deviation determines the warning trigger above chiller setpoint                      | Supply 10.0°F<br>Return 50.0°F |
| Warning                       | Displays the calculated setpoint for the warning based on the deviation setpoint          |                                |
| Fault                         | Absolute Temperature which the fault trigger will occur                                   | 140°F                          |
| Fault delay                   | Delay before the alarm will take action   | 180 sec.                       |
| Fault Action                  | Action takes when high return fluid alarm occurs  | Alarm & Shutdown               |
| <b>Low Fluid Temperature</b>  |   |                                |
| Deviation                     | This deviation determines the warning trigger below chiller setpoint                      | Supply 10.0°F                  |
| Warning                       | Displays the calculated setpoint for the warning based on the deviation setpoint          |                                |
| Fault                         | Absolute Temperature which the fault trigger will occur                                   | Supply 0.0°F<br>Evap 38.0°F    |
| Startup Bypass                | Delay time once the system has started before monitoring High and Low temperature Alarms. | 1200 sec.                      |
| Flow Delay                    | Flow Sensor fault delay timer   | 5 sec.                         |

## User Setup – Hot Gas Bypass

Figure 42 - User Setup – Hot Gas Bypass Setup Screen

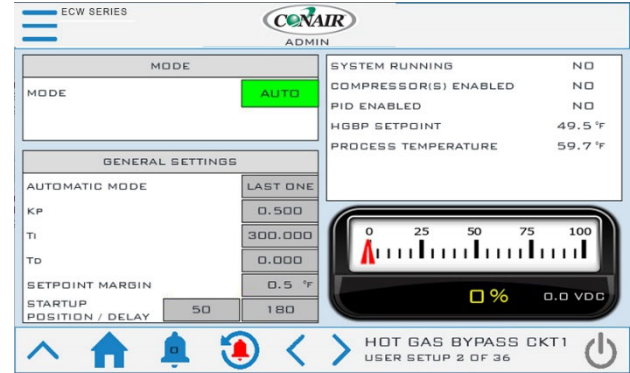


Table 9 – Hot Gas Bypass Valve Setup Parameters

| Menu Item                | Description   | Default Value |
|--------------------------|---|---------------|
| Mode Selection           | AUTO = Follow Automatic Mode<br>MANUAL = The manual mode value percent will be the output to the valve.   | AUTO          |
| Automatic Mode Selection | OFF = The valve will always be closed (zero output)<br>LAST ONE = The valve will only respond relative to the demand PID when operating with the last compressor running<br>ALWAYS = The valve will always respond relative to the demand PID regardless of how many compressors are running. | Last One      |
| Kp                       | Proportional PID value  | 0.500         |
| Ti                       | Integral PID value  | 300.000       |
| Td                       | Derivative PID value  | 0.000         |
| Setpoint Margin          | Temperature deviation below chiller setpoint to be used for hot gas bypass control setpoint   | 0.5°F         |
| Startup Position         | The starting hot gas bypass position  | 50%           |
| Startup delay            | The starting hot gas bypass delay time  | 180 sec.      |

## User Setup – EEV Control

The electronic expansion valve meters the amount of refrigerant into the evaporator in the precise quantity in order to maintain superheat. The difference between the saturated suction temperature and the suction line temperature is the superheat.

Figure 43 - User Setup – EEV Control Setup Screen

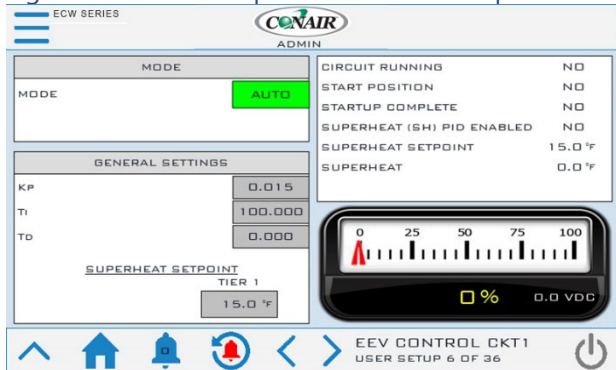


Table 10 – EEV Control Setup Parameters

| Menu Item          | Description  | Default Value |
|--------------------|--|---------------|
| Mode Selection     | In Auto Mode, the control system adjusts the valve to maintain Super Heat. In manual mode, the system drives the valve to a fixed position and holds it there for service diagnostic purposes. | AUTO          |
| Superheat Setpoint | The superheat setpoint. Only a trained refrigeration service technician should adjust this value.  | Tier 1: 15.0  |
| Kp                 | Proportional PID value   | 0.015         |
| Ti                 | Integral PID value   | 100.000       |
| Td                 | Derivative PID value   | 0.000         |

## User Setup – Compressor Staging

Figure 44 - User Setup – Compressor Staging Setup Screen

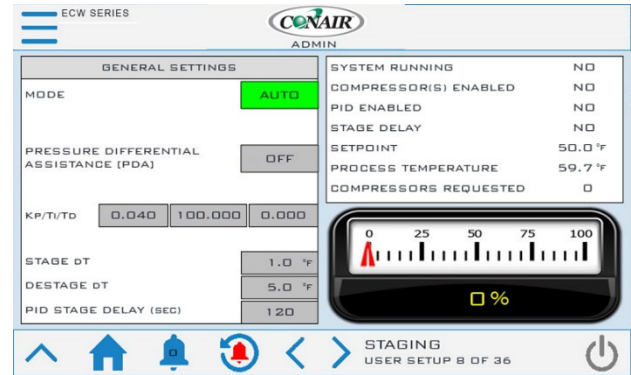


Table 11 – Compressor Staging Setup Parameters

| Menu Item                              | Description  | Default Value |
|--|--|---------------|
| Staging Mode                           | In Auto Mode, the control system adjusts the number of staged compressors relative to the demand and available compressors. In manual mode, the number of staged compressors depends on the Manual Mode Value relative to available compressors. | AUTO          |
| Pressure Differential Assistance (PDA) | Pressure Differential Assistance will energize all compressors when the circuit first starts for the time specified in the PDA Delay parameter.  | OFF           |
| Kp                                     | Proportional PID value   | 1.000         |
| Ti                                     | Integral PID value   | 100.000       |
| Td                                     | Derivative PID value   | 0.000         |
| Stage ΔT                               | If the process value rises above the set point by this differential, the first compressor will turn on.  | 1°F           |
| Destage ΔT                             | If the process value drops below the set point by this differential, all compressors turn off.   | 5°F           |
| Stage to Stage Delay                   | This is the minimum delay duration between stages on multiple compressors. During this time delay, the demand percent calculation ceases to allow the impact of the newly staged compressor to influence the system.                             | 120 sec       |

## User Setup – Stage Order

### Compressor Stage Order Screen

The Compressor Stage Order Screen [Figure 45](#) depicts the stage order of the local chiller. The stage order calculation uses the hours entered in the auto-stage threshold parameter. The intent is to run the compressors with the least amount of hours first to help equalize the run hours of all the compressors

Figure 45 - User Setup – Stage Order Setup Screen

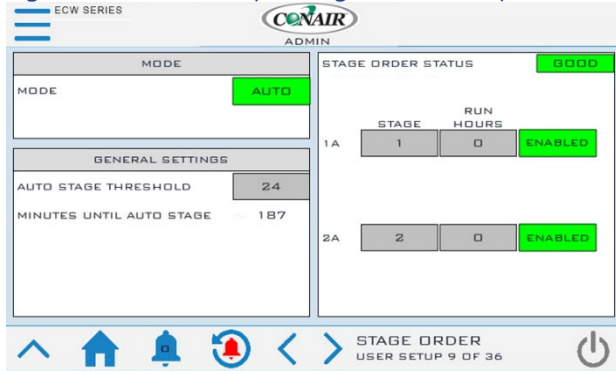


Table 12 – Stage Order Setup Parameters

| Menu Item                | Description   | Default Value |
|--------------------------|---|---------------|
| Stage Mode               | Automatic: calculates the stage order by the AUTO STAGE THRESHOLD parameter<br>Manual: Manually enter the stage order | AUTO          |
| Auto Stage Threshold     | The number of run hours before recalculating the stage order  | 24 HOURS      |
| Minutes Until Auto Stage | Minutes remaining until the stage calculation occurs  | N/A           |

## User Setup – Discharge Control Setup

### Discharge Control Setup Screen

An electric condenser water-regulating valve is standard on chillers with a water-cooled condenser. The valve is a butterfly type valve with a modulating actuator and is located in the condenser water piping at the outlet of the condenser. The valve regulates the flow of cooling water through the condenser in order to maintain the discharge refrigerant pressure set point.

On remote air-cooled chillers with EC fan control, the analog output will ramp all fans up and down simultaneously in order to achieve discharge pressure setpoint.

Figure 46 - User Setup – Discharge Control Setup Screen

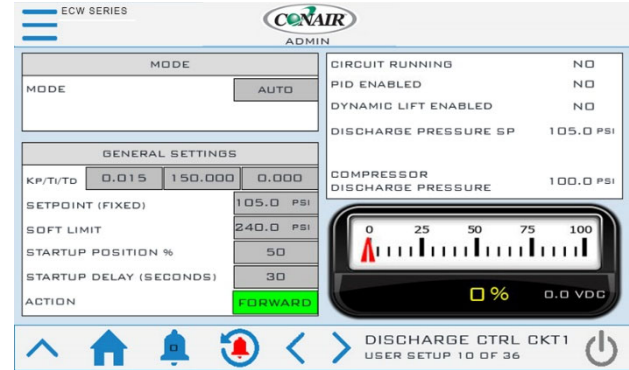


Table 13 – Discharge Control Setup Parameters

| Menu Item        | Description  | Default Value |
|------------------|--|---------------|
| Mode             | In Auto Mode, the fans adjust to maintain optimum performance. In manual mode, it holds to the Manual Mode Position input valve. | AUTO          |
| Kp               | Proportional PID value   | 0.015         |
| Ti               | Integral PID value   | 150.000       |
| Td               | Derivative PID value   | 0.000         |
| Setpoint         | Discharge Setpoint Value   | 105 PSIG      |
| Soft Limit       | Discharge pressure alarm limit   | 240 PSIG      |
| Startup Position | The starting discharge position  | 50%           |
| Startup delay    | The starting discharge delay time  | 30 sec.       |
| Action           | Control action<br>Forward/Reverse  | Forward       |

On remote air-cooled chillers with fixed fan stages and a variable header fan, the analog output will ramp the variable header fan up and down and activate the fixed fan stages in order to achieve discharge pressure setpoint.

Figure 47 - User Setup – Discharge Control Setup Screen (Remote Air Cooled)

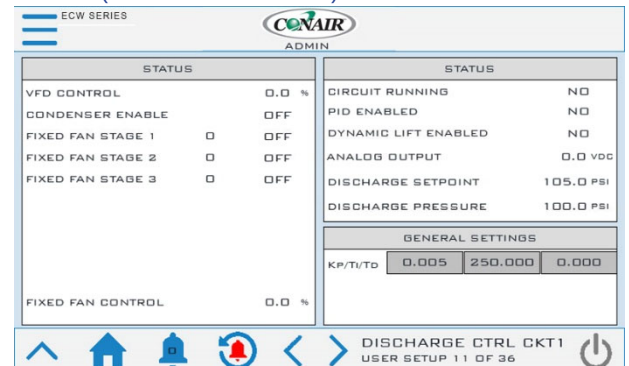


Table 14 – Discharge Control Setup Parameters

| Menu Item | Description            | Default Value |
|-----------|------------------------|---------------|
| Kp        | Proportional PID value | 0.005         |
| Ti        | Integral PID value     | 250.000       |
| Td        | Derivative PID value   | 0.000         |

## User Setup – Dynamic Lift Setup

### Dynamic Lift Setup Screen

The Dynamic Lift control logic adjusts the chiller head pressure to improve energy efficiency.

Figure 48 - User Setup – Dynamic Lift Setup Screen

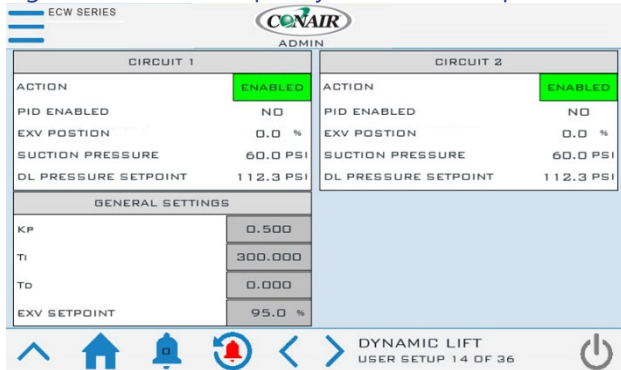


Table 15 – Dynamic Lift Parameters

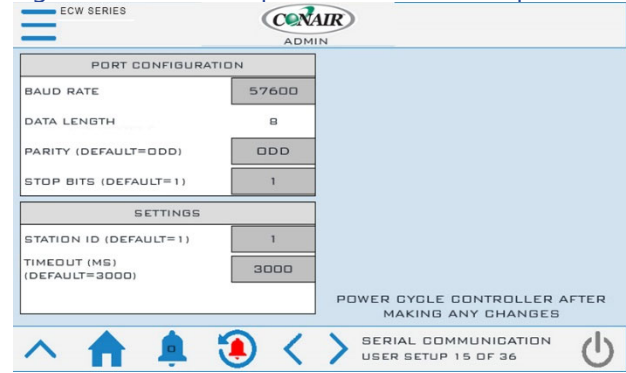
| Menu Item    | Description                                | Default Value |
|--------------|--|---------------|
| Action       | Enable or Disable the Dynamic lift feature | ENABLED       |
| Kp           | Proportional PID value                     | 0.500         |
| Ti           | Integral PID value                         | 300.000       |
| Td           | Derivative PID value                       | 0.000         |
| EXV Setpoint | Optimal EXV target position                | 95%           |

## User Setup – Serial Communications Setup

### Modbus RTU Setup Screen

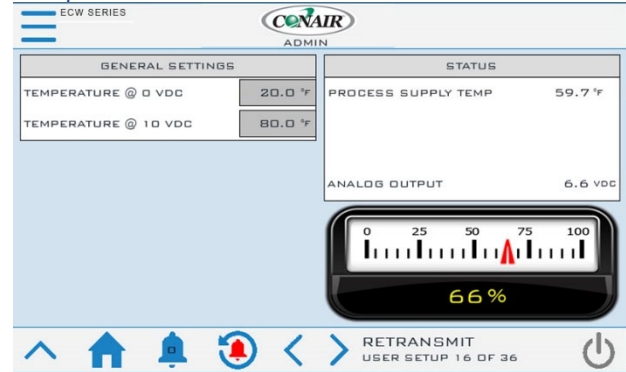
This Modbus RTU Setup Screen Figure 49 provides the ability to modify communication parameters. Default Modbus RTU Settings: Baud-57600, Data Length-8, Parity-Odd, Stop Bits-1.

Figure 49 - User Setup – Modbus RTU Setup Screen



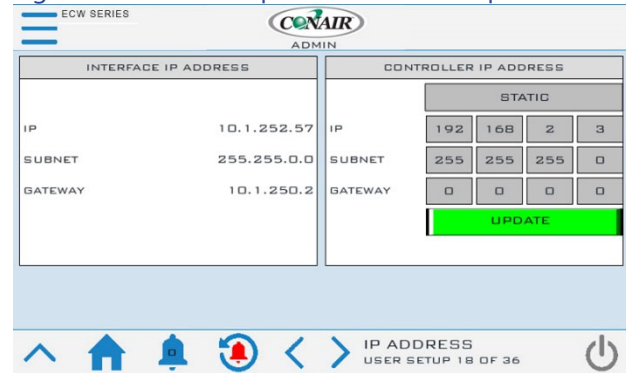
## User Setup – Temperature Retransmit

Figure 50 - User Setup – Temperature Retransmit Setup Screen



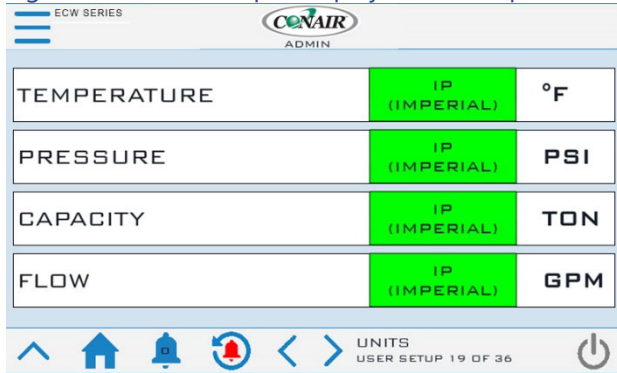
## User Setup – IP Address

Figure 51 - User Setup – IP Address Setup Screen



## User Setup – Units

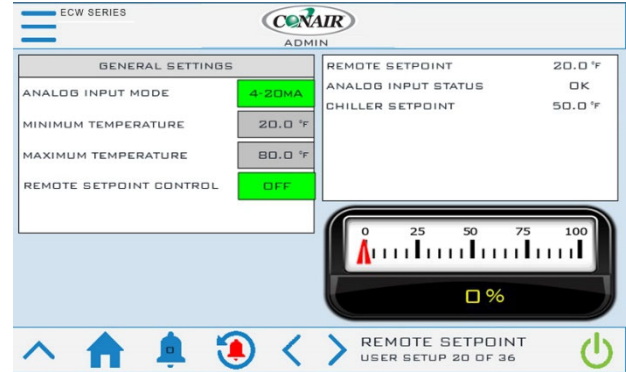
Figure 52 - User Setup – Display Units Setup Screen



## User Setup – Remote Setpoint

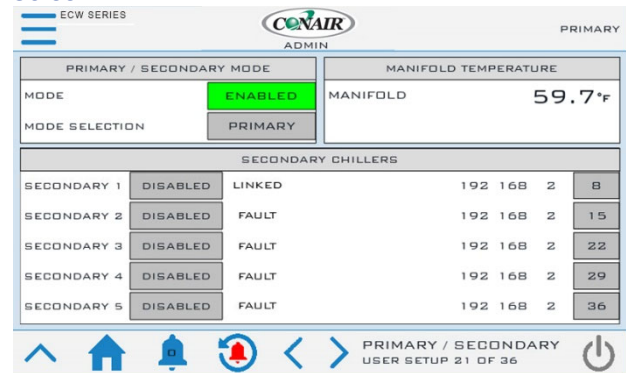
When the remote setpoint option is active, an incoming 4-20mA or 0-10VDC signal controls the setpoint of the master chiller. The signal will span from the MINIMUM TEMPERATURE to the MAXIMUM TEMPERATURE as defined in the following figure.

Figure 53 - User Setup – Remote Setpoint Setup Screen



## User Setup – Primary / Secondary

Figure 54 - User Setup – Primary / Secondary Setup Screen

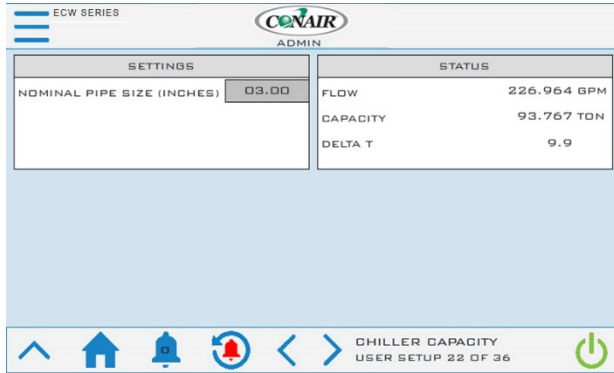


## User Setup – Chiller Capacity

### Chiller Capacity Screen

This screen is necessary to adjust the nominal pipe size that the flow sensor is inserted into.

Figure 55 - User Setup – Chiller Capacity Setup Screen

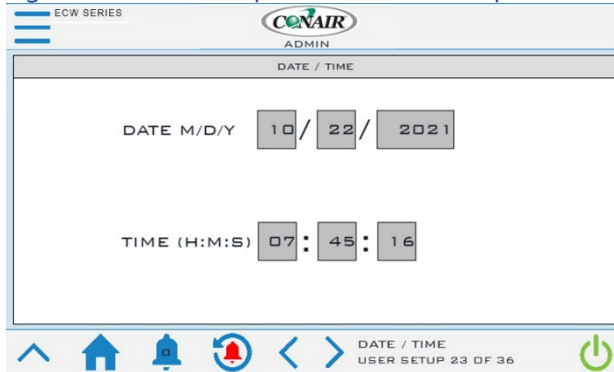


## User Setup – Date/Time

### Date/Time Screen

Date and Time is necessary for accurate data logging as well as fault log time stamps. Touch the fields for adjustment.

Figure 56 - User Setup – Date / Time Setup Screen

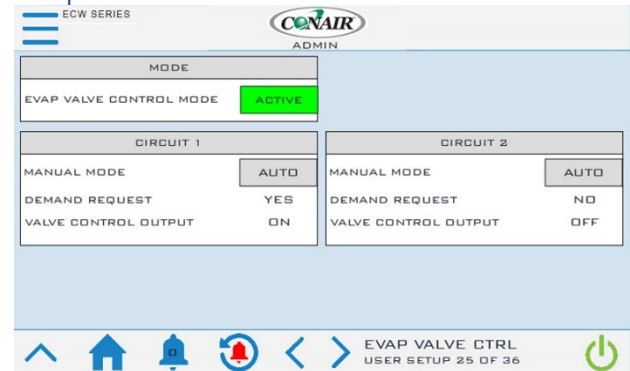


## User Setup – Evaporator Valve

### Evaporator Valve Control Screen

This feature provides the ability to close off evaporator fluid flow when a circuit is not in operation. This allows for tighter temperature control.

Figure 57 - User Setup – Evaporator Valve Control Setup Screen

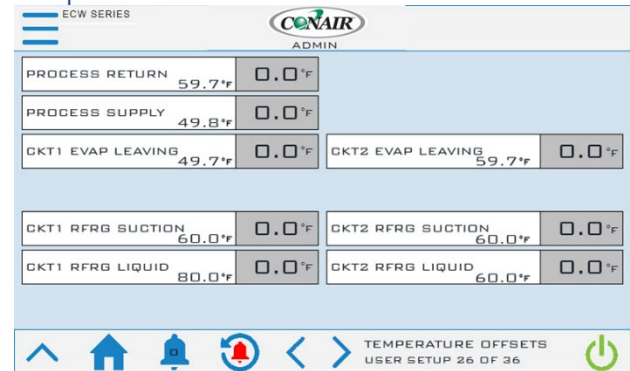


## User Setup – Temperature Offsets

### Temperature Offsets Screen

This screen provides the ability to add an offset to the temperature values if any slight deviations in temperature readings exist.

Figure 58 - User Setup – Evaporator Valve Control Setup Screen



## User Setup – Miscellaneous Process Control

The chiller setpoint can be controlled via process supply or process return. Default control method is configured for process supply. In some applications, it is advantageous to control via process return.

## User Setup – Miscellaneous Local Mode

The Local/Remote Mode toggle indicates if the chiller is set to use a remote contact closure for remote start/stop. When active, the Local Mode toggle will indicate Local mode Digital Start/Stop Enabled and when not active it will indicate Local Mode Digital Start/Stop Disabled.

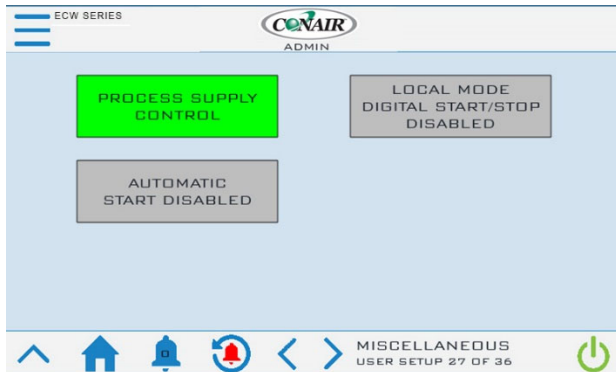
## User Setup – Miscellaneous Automatic Start

The Automatic Start toggle indicates if the chiller is set to automatically start if a power outage has occurred during a run state. When active, the Automatic Start toggle will indicate Automatic Start Enabled and when not active it will indicate Automatic Start Disabled.

## User Setup – Miscellaneous Current Sensors

The Current Sensors toggle indicates if the chiller is set to automatically monitor the compressor current sensors when energized.

Figure 59 - User Setup – Miscellaneous Control Setup Screen



## Compressor Demand

On integral tank systems a pressure transducer is included in order to indicate tank level. A water makeup option existed and can be configure with the following screen.

Figure 60 - User Setup – Compressor Demand Setup Screen

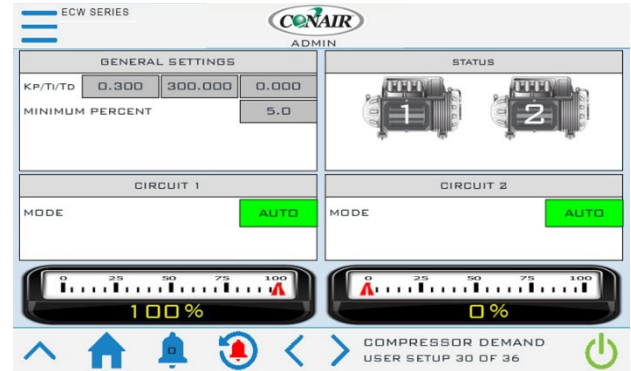


Table 16 – Compressor Demand Parameters

| Menu Item       | Description   | Default Value |
|-----------------|---|---------------|
| Kp              | Proportional PID value  | 0.300         |
| Ti              | Integral PID value  | 300.000       |
| Td              | Derivative PID value  | 0.000         |
| Minimum Percent | Optimal EXV target position   | 5%            |
| Mode            | Compressor demand mode. When in manual mode, a fixed demand percent is transmitted to the compressor. When in AUTO, the demand percent will track in order to achieve setpoint. | AUTO          |

## Menu 1 – Trending

A graphical representation of the core operating parameters of the system are in the trending screens. The trending screen displays the setpoint temperature, evaporator fluid out, process supply and return temperature, and optional hot gas bypass valve resistors (if present) for easy analysis of the system operation. Trending is always enabled and always running.

Figure 61 - System Trending 1 Screen

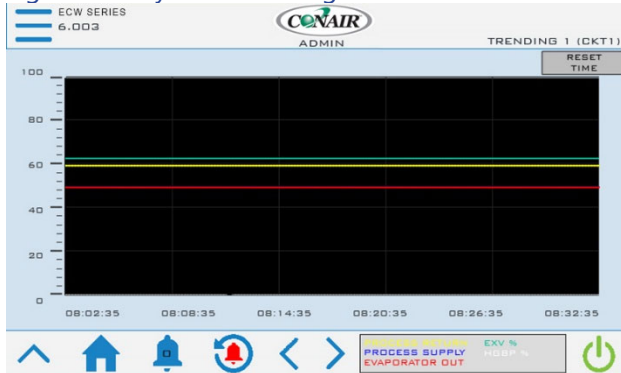


Figure 62 - System Trending 2 Screen



Figure 63 - System Trending 3 Screen

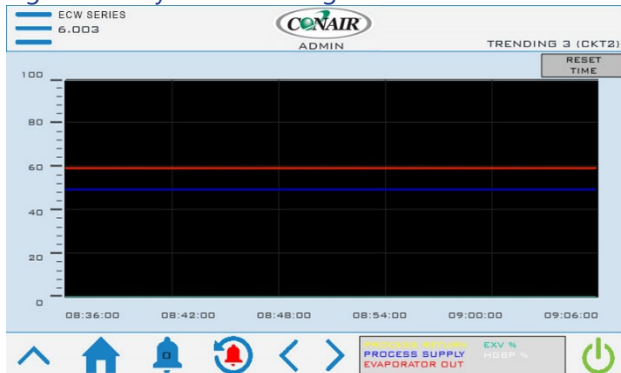
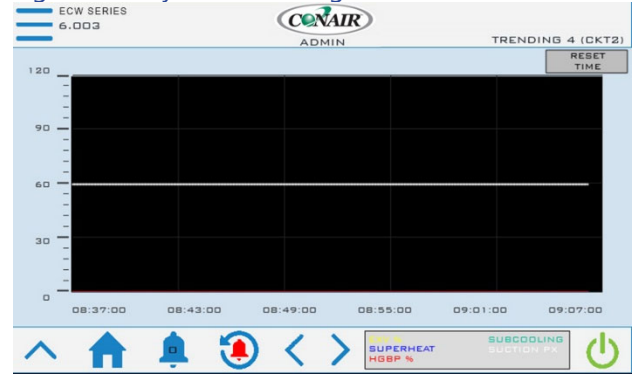


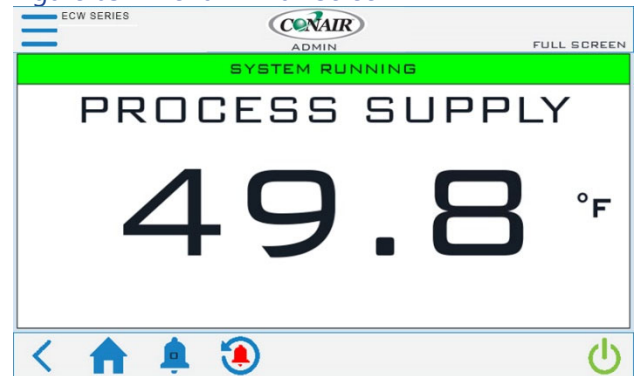
Figure 64 - System Trending 4 Screen



## Menu 2 – Full Screen

This screen provide a simple, large-font display of the process supply temperature for users who are primarily concerned only with this data point of the system operation.

Figure 65 - Menu 2 – Full Screen



# Modbus

Table 17 – Modbus Table

| Type            | Index | Size | Variable Name                         | Data Type |
|-----------------|-------|------|---------------------------------------|-----------|
| Coil            | 0     | 1    | HMI_START                             | Bool      |
| Coil            | 1     | 1    | HMI_STOP                              | Bool      |
| Coil            | 2     | 1    | SYSTEM_RUNNING                        | Bool      |
| Coil            | 3     | 1    | SYSTEM_STOPPING                       | Bool      |
| Coil            | 4     | 1    | PULSE_2SEC                            | Bool      |
| Coil            | 5     | 1    | UNITS_TEMPERATURE                     | Bool      |
| Coil            | 6     | 1    | UNITS_PRESSURE                        | Bool      |
| Coil            | 7     | 1    | CKT1_COMPRESSORS_RUNNING              | Bool      |
| Coil            | 8     | 1    | CKT2_COMPRESSORS_RUNNING              | Bool      |
| Coil            | 9     | 1    | CKT1_EVAP_FLOW_SWITCH_OK              | Bool      |
| Coil            | 10    | 1    | CKT2_EVAP_FLOW_SWITCH_OK              | Bool      |
| Coil            | 11    | 1    | AL_ALARMS_PRESENT                     | Bool      |
| Coil            | 12    | 1    | AL_GENERAL_ALARMS                     | Bool      |
| Coil            | 13    | 1    | AL_PRB_CKT1_EVAP_OUT_FLUID.Active     | Bool      |
| Coil            | 14    | 1    | AL_PRB_CKT2_EVAP_OUT_FLUID.Active     | Bool      |
| Coil            | 15    | 1    | AL_PRB_CKT1_SUCTION_TEMP.Active       | Bool      |
| Coil            | 16    | 1    | AL_PRB_CKT2_SUCTION_TEMP.Active       | Bool      |
| Coil            | 17    | 1    | AL_PRB_CKT1_SUCTION_PX.Active         | Bool      |
| Coil            | 18    | 1    | AL_PRB_CKT2_SUCTION_PX.Active         | Bool      |
| Coil            | 19    | 1    | AL_PRB_CKT1_DISCHARGE_TEMP.Active     | Bool      |
| Coil            | 20    | 1    | AL_PRB_CKT2_DISCHARGE_TEMP.Active     | Bool      |
| Coil            | 21    | 1    | AL_PRB_CKT1_DISCHARGE_PX.Active       | Bool      |
| Coil            | 22    | 1    | AL_PRB_CKT2_DISCHARGE_PX.Active       | Bool      |
| Coil            | 23    | 1    | AL_PRB_CKT1_LIQUID_TEMP.Active        | Bool      |
| Coil            | 24    | 1    | AL_PRB_CKT2_LIQUID_TEMP.Active        | Bool      |
| Coil            | 25    | 1    | AL_PRB_PROCESS_RETURN_FLUID.Active    | Bool      |
| Coil            | 26    | 1    | AL_PRB_PROCESS_SUPPLY_FLUID.Active    | Bool      |
| Coil            | 27    | 1    | AL_CKT1_RFRG_ALARM                    | Bool      |
| Coil            | 28    | 1    | AL_CKT2_RFRG_ALARM                    | Bool      |
| Coil            | 29    | 1    | AL_CKT1_CRITICAL_ALARM                | Bool      |
| Coil            | 30    | 1    | AL_CKT2_CRITICAL_ALARM                | Bool      |
| Coil            | 31    | 1    | AL_CKT1_FREEZESTAT.Active             | Bool      |
| Coil            | 32    | 1    | AL_CKT2_FREEZESTAT.Active             | Bool      |
| Coil            | 33    | 1    | AL_CKT1_EVAP_FLOW.Active              | Bool      |
| Coil            | 34    | 1    | AL_CKT2_EVAP_FLOW.Active              | Bool      |
| Coil            | 35    | 1    | AL_CKT1_LPS.Active                    | Bool      |
| Coil            | 36    | 1    | AL_CKT2_LPS.Active                    | Bool      |
| Coil            | 37    | 1    | AL_CKT1_LLPS.Active                   | Bool      |
| Coil            | 38    | 1    | AL_CKT2_LLPS.Active                   | Bool      |
| Coil            | 39    | 1    | AL_COMP1A_STATUS_FAULT.Active         | Bool      |
| Coil            | 40    | 1    | AL_COMP2A_STATUS_FAULT.Active         | Bool      |
| Coil            | 41    | 1    | AL_COMP1B_STATUS_FAULT.Active         | Bool      |
| Coil            | 42    | 1    | AL_COMP2B_STATUS_FAULT.Active         | Bool      |
| Coil            | 43    | 1    | AL_COMP1C_STATUS_FAULT.Active         | Bool      |
| Coil            | 44    | 1    | AL_COMP2C_STATUS_FAULT.Active         | Bool      |
| Coil            | 45    | 1    | AL_HIGH_HIGH_RETURN_FLUID_TEMP.Active | Bool      |
| Coil            | 46    | 1    | AL_HIGH_HIGH_SUPPLY_FLUID_TEMP.Active | Bool      |
| Coil            | 47    | 1    | AL_LOW_LOW_SUPPLY_FLUID_TEMP.Active   | Bool      |
| HoldingRegister | 1     | 2    | CHILLER_SETPOINT                      | Real      |
| InputRegister   | 1     | 2    | PLC_VERSION                           | Real      |
| InputRegister   | 3     | 1    | SYSTEM_DEMAND_PERCENT                 | Int       |
| InputRegister   | 4     | 1    | HMI_ALARM_DISPLAY                     | Int       |
| InputRegister   | 5     | 1    | CHILLER_STATUS                        | UInt      |
| InputRegister   | 6     | 2    | CKT1_RFRG_SUCTION_TEMP_HMI            | Real      |
| InputRegister   | 8     | 2    | CKT2_RFRG_SUCTION_TEMP_HMI            | Real      |

Table 17 – Modbus Parameters (continued)

| Type          | Index | Size | Variable Name                          | Data Type |
|---------------|-------|------|--|-----------|
| InputRegister | 10    | 2    | CKT1_SUCTION_PRESSURE_HMI              | Real      |
| InputRegister | 12    | 2    | CKT2_SUCTION_PRESSURE_HMI              | Real      |
| InputRegister | 14    | 2    | CKT1_SUCTION_SATURATED_TEMP_HMI        | Real      |
| InputRegister | 16    | 2    | CKT2_SUCTION_SATURATED_TEMP_HMI        | Real      |
| InputRegister | 18    | 2    | CKT1_SUPERHEAT_HMI                     | Real      |
| InputRegister | 20    | 2    | CKT2_SUPERHEAT_HMI                     | Real      |
| InputRegister | 22    | 2    | CKT1_RFRG_DISCHARGE_TEMP_HMI           | Real      |
| InputRegister | 24    | 2    | CKT2_RFRG_DISCHARGE_TEMP_HMI           | Real      |
| InputRegister | 26    | 2    | CKT1_DISCHARGE_PRESSURE_HMI            | Real      |
| InputRegister | 28    | 2    | CKT2_DISCHARGE_PRESSURE_HMI            | Real      |
| InputRegister | 30    | 2    | CKT1_DISCHARGE_SATURATED_TEMP_HMI      | Real      |
| InputRegister | 32    | 2    | CKT2_DISCHARGE_SATURATED_TEMP_HMI      | Real      |
| InputRegister | 34    | 2    | CKT1_SUBCOOLING_HMI                    | Real      |
| InputRegister | 36    | 2    | CKT2_SUBCOOLING_HMI                    | Real      |
| InputRegister | 38    | 2    | CKT1_LIQUID_TEMP_HMI                   | Real      |
| InputRegister | 40    | 2    | CKT2_LIQUID_TEMP_HMI                   | Real      |
| InputRegister | 42    | 2    | CKT1_EVAP_OUT_FLUID_HMI                | Real      |
| InputRegister | 44    | 2    | CKT2_EVAP_OUT_FLUID_HMI                | Real      |
| InputRegister | 46    | 2    | CKT1_EVAP_DELTA_T_HMI                  | Real      |
| InputRegister | 48    | 2    | CKT2_EVAP_DELTA_T_HMI                  | Real      |
| InputRegister | 50    | 2    | CKT1_DISCHARGE_PERCENT                 | Real      |
| InputRegister | 52    | 2    | CKT2_DISCHARGE_PERCENT                 | Real      |
| InputRegister | 54    | 2    | CONDENSER_FLUID_IN_TEMPERATURE_HMI     | Real      |
| InputRegister | 56    | 2    | CKT1_CONDENSER_FLUID_OUT_TEMP_HMI      | Real      |
| InputRegister | 58    | 2    | CKT2_CONDENSER_FLUID_OUT_TEMP_HMI      | Real      |
| InputRegister | 60    | 2    | CKT1_EVAP_IN_FLUID_HMI                 | Real      |
| InputRegister | 62    | 1    | CKT2_EVAP_IN_FLUID_HMI                 | Real      |
| InputRegister | 64    | 2    | CKT1_HGBP_PERCENT                      | Real      |
| InputRegister | 66    | 2    | CKT2_HGBP_PERCENT                      | Real      |
| InputRegister | 68    | 2    | CKT1_EXV_PERCENT                       | Real      |
| InputRegister | 70    | 2    | CKT2_EXV_PERCENT                       | Real      |
| InputRegister | 72    | 2    | MANIFOLD_LEAVING_FLUID_TEMPERATURE_HMI | Real      |
| InputRegister | 74    | 2    | PROCESS_SUPPLY_FLUID                   | Real      |
| InputRegister | 76    | 2    | PROCESS_RETURN_FLUID                   | Real      |
| InputRegister | 78    | 2    | PROCESS_LOCAL_DELTA_T_HMI              | Real      |
| InputRegister | 80    | 2    | PROCESS_VARIABLE_HMI                   | Real      |

## Start-Up

Every unit is factory set to deliver chilled water in accordance with the standard operating specifications for that particular chiller. Due to variables involved with different applications and different installations, minor adjustments may be required during the initial start-up to ensure proper operation. Use a qualified refrigeration technician to perform the start-up procedure in sequence. The following serves as a checklist for the initial start-up and for subsequent start-ups if the chiller is out of service for a prolonged time.



**WARNING:** This equipment contains hazardous voltages that can cause severe injury or death.



**WARNING:** This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.



**WARNING:** This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.



**WARNING:** The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.



**CAUTION:** Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.



**CAUTION:** Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wire the unit ground in compliance with local and national codes.

## Step 1 – Connect Main Power

Connect main power properly ensuring it matches the voltage shown on the nameplate of the unit. Check the electrical phase sequence prior to start-up. Operation of the compressor with incorrect electrical phase sequencing will cause damage to the compressors. Check the phasing prior to applying power. The proper sequence is "ABC." If the phasing is incorrect, open the main power disconnect and switch two line leads on the main power terminal blocks (or the unit mounted disconnect). All electrical components are in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals. After making proper power connection and grounding, turn the main power on.

## Step 2 – Fill Coolant Circuit

Check to make sure all process chilled-water piping connections are secure. Open the chiller cabinet and fill the coolant reservoir with the proper water or water/glycol solution following the guidelines shown below. When using a glycol solution only use glycol with a corrosion inhibitor.

## System Fill Water Chemistry Requirements

The properties of water make it ideal for heat transfer applications. It is safe, non-flammable, non-poisonous, easy to handle, widely available, and inexpensive in most industrialized areas.

When using water as a heat transfer fluid it is important to keep it within certain chemistry limits to avoid unwanted side effects. Water is a "universal solvent" because it can dissolve many solid substances and absorb gases. As a result, water can cause the corrosion of metals used in a cooling system. Often water is in an open system (exposed to air) and when the water evaporates, the dissolved minerals remain in the process fluid. When the concentration exceeds the solubility of some minerals, scale forms. The life giving properties of water can also encourage biological growth that can foul heat transfer surfaces.

To avoid the unwanted side effects associated with water cooling, proper chemical treatment and preventive maintenance is required for continuous plant productivity.

#### Unwanted Side Effects of Improper Water Quality

- Corrosion
- Scale
- Fouling
- Biological Contamination

#### Cooling Water Chemistry Properties

- Electrical Conductivity
- pH
- Alkalinity
- Total Hardness
- Dissolved gases

Chillers at their simplest have two main heat exchangers: one that absorbs the heat from the process (evaporator) and one that removes the heat from the chiller (condenser). All our chillers use stainless steel brazed plate evaporators. Our air-cooled chillers use air to remove heat from the chiller; however, our water-cooled chillers use either a tube-in-tube or shell-in-tube condenser which has copper refrigerant tubes and a steel shell. These, as are all heat exchangers, are susceptible to fouling of heat transfer surfaces due to scale or debris. Fouling of these surfaces reduces the heat-transfer surface area while increasing the fluid velocities and pressure drop through the heat exchanger. All of these effects reduce the heat transfer and affect the efficiency of the chiller.

The complex nature of water chemistry requires a specialist to evaluate and implement appropriate sensing, measurement and treatment needed for satisfactory performance and life. The recommendations of the specialist may include filtration, monitoring, treatment and control devices. With the ever-changing regulations on water usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved. Table 1 shows the list of water characteristics and quality limitations.

Table 18 – Fill Water Chemistry Requirements

| Water Characteristic   | Quality Limitation |
|--|--------------------|
| Alkalinity (HCO <sub>3</sub> <sup>-</sup> )                      | 70-300 ppm         |
| Aluminum (Al)  | Less than 0.2 ppm  |
| Ammonium (NH <sub>3</sub> )                                      | Less than 2 ppm    |
| Chlorides (Cl <sup>-</sup> )                                     | Less than 300 ppm  |
| Electrical Conductivity  | 10-500µS/cm        |
| Free (aggressive) Carbon Dioxide (CO <sub>2</sub> ) <sup>†</sup> | Less than 5 ppm    |
| Free Chlorine(Cl <sub>2</sub> )                                  | Less than 1 PPM    |
| HCO <sub>3</sub> <sup>-</sup> /SO <sub>4</sub> <sup>2-</sup>     | Greater than 1.0   |
| Hydrogen Sulfide (H <sub>2</sub> S)                              | Less than 0.05 ppm |
| Iron (Fe)  | Less than 0.2 ppm  |
| Manganese (Mn)   | Less than 0.1 ppm  |
| Nitrate (NO <sub>3</sub> )                                       | Less than 100 ppm  |
| pH   | 7.5-9.0            |
| Sulfate (SO <sub>4</sub> <sup>2-</sup> )                         | Less than 70 ppm   |
| Total Hardness (dH)k   | 4.0-8.5            |

<sup>†</sup> Dissolved carbon dioxide calculation is from the pH and total alkalinity values shown below or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x 2<sup>[(6.3-pH)/0.3]</sup> where TA = Total Alkalinity, PPM as CaCO<sub>3</sub>

Table 19 - Recommended Glycol Solutions

| Chilled Water Temperature | Percent Glycol By Volume |
|---------------------------|--------------------------|
| 50°F (10°C)               | Not required             |
| 45°F (7.2°C)              | 5 %                      |
| 40°F (4.4°C)              | 10 %                     |
| 35°F (1.7°C)              | 15 %                     |
| 30°F (-1.1°C)             | 20 %                     |
| 25°F (-3.9°C)             | 25 %                     |
| 20°F (-6.7°C)             | 30 %                     |



**CAUTION:** When your application requires the use of glycol, use industrial grade glycol specifically designed for heat transfer systems and equipment. Never use glycol designed for automotive applications. Automotive glycols typically have additives engineered to benefit the materials and conditions found in an automotive engine; however, these additives can gel and foul heat exchange surfaces and result in loss of performance or even failure of the chiller. In addition, these additives can react with the materials of the pump shaft seals resulting in leaks or premature pump failures.



**WARNING:** Ethylene Glycol is flammable at higher temperatures in a vapor state. Carefully handle this material and keep away from open flames or other possible ignition sources.

### Step 3 - Check Condenser

There are two possible types of condensers present in the chiller: water-cooled and remote air-cooled. It is important to verify the chiller will have adequate condenser cooling for proper chiller operation.

#### Water-Cooled Condenser Check

Check the condenser water lines to make sure all connections are secure. Make sure sufficient condenser water flow and pressure are available, the condenser water supply is on, and all shut-off valves are open. The electronic water regulating valves ship in the closed position and opens after enabling the circuit.

#### Remote Air-Cooled Condenser Check

Check the refrigerant lines to make sure all connections are secure and the refrigeration is as described in the installation section of this manual. Check the remote condenser main power and control wiring to ensure all connections are secure.

### Step 4 – Check Refrigerant Valves

During shipment or installation it is possible valves were closed. Verify that all refrigerant valves are open.

### Step 5 – Check Low Temperature Alarm

Make sure the Low Temperature Alarm Set Point is proper for the operating conditions of the chiller. The Low Temperature Alarm setting is in a password-protected menu of the chiller controller. Refer to the control section of this manual for instructions on how to access this menu. Set the Low Temperature Alarm 10°F below the minimum chilled water temperature setting that the chiller will be operating. Also, ensure the process coolant has sufficient freeze protection (glycol) to handle at least 5°F below the Low Temperature Alarm setting. All chillers ship with the Low Temperature Alarm set at 35°F. This protects against a possible freeze-up if no glycol is present. Once the proper glycol solution is present, adjust the Low Temperature Alarm to the appropriate setting.



**CAUTION:** The manufacturer's warranty does not cover the evaporator from freezing. It is vital that the Freezestat is set properly.

### Step 6 – Turn On Control Power

Turn on the control power by turning the control power switch to "On." The panel should be on. Due to extreme ambient temperatures during shipment and installation, you may encounter a High Refrigerant Pressure alarm when you turn on the control power. If this is the case, reset the alarm and do not proceed until no further alarm conditions are present.

### Step 7 – Establish Coolant Flow

Establish flow through the chiller.

*Note: The compressor will not start as long as the flow switch is open. The compressors only operate if there is a positive flow through the evaporator.*

Set water flow using a discharge throttling valve or flow control valve (by others). The valve should be the same size as the To Process connection of the chiller. Standard chillers operate with approximately 2.4 gpm/ton of nominal capacity. A significant increase in flow beyond this in a standard chiller may result in excessive pressure loss and negatively impact chiller efficiency and in extreme cases may cause premature wear or damage of internal components.

### Step 8 – Initial Unit Operation

Enter the desired leaving fluid temperature on the chiller HMI. Unless otherwise specified, the chiller is factory set to deliver coolant at 50°F. Adjust to the desired operating temperature. The chiller should now be controlling to the selected temperature. Please note that if there is insufficient load the compressor may cycle on and off causing swings in temperature.



**WARNING:** Under no circumstance, deactivate the High Refrigerant Pressure or the Low Compressor Pressure switches. Failure to heed this warning can cause serious compressor damage, severe personal injury, or death.

Operate the system for approximately 30 minutes. Check the liquid line sight glass. The refrigerant flow past the sight glass should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line. An indication of a shortage of refrigerant is if operating pressures are low and sub-cooling is low. Normal sub-cooling ranges from 10°F to 20°F. If the sub-

cooling is not within this range, check the superheat and adjust if required. The superheat should be approximately 10°F. If the operating pressures, sight glass, superheat, and subcooling readings indicate a refrigerant shortage, charge refrigerant as required. With the unit running, add refrigerant using industry best practices until operating conditions become normal.



*CAUTION: A clear sight glass alone does not mean that the system is properly charged. Also, check system superheat, subcooling, and unit operating pressures. If both suction and discharge pressures are low but subcooling is normal, a problem other than refrigerant shortage exists. Do not add refrigerant, as this may result in overcharging the circuit.*

After achieving proper flow and temperature, press the Stop button. The unit is now ready for service.

## Preventive Maintenance

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Once your chiller is in service, follow the maintenance procedures as closely as possible. Specific site conditions may require repeating certain tasks more frequently. The importance of a properly established preventive maintenance program cannot be overemphasized. Taking the time to follow these simple procedures will result in substantially reduced downtime, reduced repair costs, and an extended useful lifetime for the chiller. Any monetary costs of implementing these procedures will usually more than pay for itself.

### Once a Week

1. Check to make sure that the To Process temperature is reasonably close to the Set Point temperature. If the temperature stays more than 5°F away from the set point, there may be a problem with the chiller. If this is the case, refer to the Troubleshooting Chart or contact our Customer Service Department.
2. Check the suction and discharge refrigerant pressure at the compressor.

3. Check each refrigerant sight glass for air bubbles or moisture indication. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line. If the sight glass indicates that there is a refrigeration problem, have the unit serviced as soon as possible.
4. Units are equipped with a Y-strainer between the return connection and the evaporator inlet. Open the blow-down valve attached to the strainer to flush the screen free of debris.

### Once a Month

Repeat items 1 through 4 and continue with the following.

5. Shut off the power disconnect. Check the condition of electrical connections at all controls. Check for loose or frayed wires.
6. Check the main power supply to ensure it is acceptable, connected properly, and the unit has a proper ground (see Installation section of this manual for details).
7. Check the amp draws to each leg of the compressor(s) to confirm that it is drawing the proper current.
8. Check the system superheat and sub-cooling. The normal superheat is approximately 10°F and should not be more than 15°F. The normal sub-cooling range is from 10°F to 20°F.
9. Units are equipped with a Y-strainer between the return connection and the evaporator inlet. Remove the strainer basket and clean if necessary. This may be required more often if contaminants can easily get into the process water.
10. Check the flow sensor tip visually for signs of build-up and clean with a soft cloth. If there is some suborn calcium build-up that is not easily removed with a soft cloth use household vinegar as a cleaning agent to remove the deposit.

## Once Every 6 Months

Repeat items 1 through 10 and continue with the following.

11. Check for visible mechanical damage to the compressor.
12. Check for excessive vibration from other rotating equipment.
13. Check for signs of hot spot/discoloration on power cables.
14. Check the DC bus voltage.
15. Check all communication cables are secure and tight.
16. Check all electrical modules are secure.
17. Check system refrigerant charge and verify the system is still full charged.

## Once a Year

Repeat items 1 through 17 listed and continue with the following.

18. (TCW Models) Check the condition of the condenser water for algae and scale. If contamination is present, rod out the tubes and back flush condensers before reconnecting pipes.
19. (TCR Models) Check the condition of the air coils of the remote condensers for dirt and debris. If the coils are dirty or clogged, use a compressed air source to blow the contaminants out of the air coil.

20. Check operation of all system safety devices and interlocks.
21. Check physical condition of all exposed circuit boards for dust build-up and clean if necessary.
22. Check calibration of temperature/pressure sensors.
23. Check operation of IGV assembly.

## Once Every 5 years

Repeat items 1 through 23 and continue with the following.

24. Replace capacitor set

## Maintenance

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### Cleaning the Operator Interface

Use of abrasive cleaners or solvents may damage the window. Do not scrub or use brushes. To clean the display window:

1. Disconnect power from the terminal at the power source.
2. Using a clean sponge or a soft cloth, clean the display with a mild soap or detergent. If paint or grease splash is present, remove before drying by rubbing lightly with isopropyl alcohol. Afterward, provide a final wash using a mild soap or detergent solution. Rinse with clean water.
3. Dry the display with a chamois or moist cellulose sponge to avoid water spots.

## Troubleshooting

| Symptom   | Possible Cause   | Action Required   |
|---|--|---|
| Low suction pressure  | Low water flow   | Check fluid flow is within design, clean Y-strainer       |
|   | Chilled water temperature too low                                | Check set point   |
|   | Faulty pressure sensor   | Check sensor  |
|   | Low refrigerant charge   | Check sub-cooling and discharge temperatures              |
|   | Restriction in refrigerant piping                                | Check electronic expansion valve and filter drier         |
|   | Inlet guide vane (IGV) stuck open                                | Check position and operation                              |
|   | Fouled Evaporator  | Back flush and chemically clean                           |
| High discharge pressure   | Condenser water temperature too high (TCW Models only)           | Check cooling tower system set point                      |
|   | Condenser coils dirty or condenser fan failure (TCR Models only) | Check condenser   |
|   | Low condenser water flow (TCW Models only)                       | Check condenser water flow is 3 gpm per ton per circuit   |
|   | Fouled condenser water tubes (TCW Models only)                   | Check and clean condenser tubes                           |
|   | Faulty pressure sensor   | Check pressure sensor                                     |
|   | Non-condensable in system  | Dehydrate system  |
|   | System overcharged   | Adjust refrigerant charge                                 |
|   | Discharge valve closed   | Check valve position                                      |
| Restrictions in piping  | Check piping for excessive pressure drops                        |   |
| High evaporator pressure  | Chilled water temperature too high                               | Check temperature sensor. Check for excessive fluid flow. |
|   | Faulty pressure sensor   | Check pressure transducer                                 |
|   | Inlet guide vane (IGV) failure (closed)                          | Check position and operation                              |
|   | Electronic expansion valve failed open                           | Check position and operation                              |
| Low water temperature cut-out                                   | Insufficient refrigerant charge                                  | Check refrigerant charge                                  |
|   | Faulty sensor  | Check sensor  |
|   | Water temperatures too low                                       | Check set points  |
|   | Low water flow   | Check water flow, check Y-strainer, clean as necessary    |
| Compressor does not power up                                    | No/Low DC Bus voltage – capacitor failure                        | Check DC bus  |
|   | Phase failure  | Check phases of line power supply                         |
|   | No 250 VDC Bus – high voltage DC-DC converter fault              | Check converter   |
|   | No 250 VDC Bus – Bearing PWM amplifier                           | Check PWM module and backplane                            |
|   | No 250 VDC Bus – low voltage DC-DC converter fault               | Check PWM module and backplane                            |
|   | DC Bus midpoint imbalance – faulty capacitor                     | Replace capacitor   |
|   | DC Bus midpoint imbalance - faulty bleed resistor                | Replace bleed resistor                                    |
| DC Bus midpoint imbalance – faulty high voltage DC-DC converter | Replace high voltage DC-DC converter                             |   |
| No motor drive  | IGBT inverter fault  | Check DC Bus  |
|   | IGBT inverter interface cable fault                              | Check cable   |
|   | Bearing/motor controller fault                                   | Replace bearing/motor controller                          |
|   | Faulty stator  | Replace stator  |
|   | Demagnetized shaft   | Replace shaft   |
| Bearing will not calibrate or levitate                          | Shaft position sensor fault                                      | Check/replace sensor                                      |
|   | Faulty bearing wiring  | Check/repair wiring                                       |
|   | Faulty bearing PWM amplifier                                     | Replace bearing PWM amplifier                             |
| No compressor controller connection                             | Faulty bearing/motor controller                                  | Replace bearing/motor controller                          |
|   | Faulty compressor controller                                     | Replace compressor controller                             |
|   | External wiring fault  | Check/repair wiring                                       |
|   | Interface converter fault  | Check/repair interface converter                          |
| Sensor fault – faulty wiring connector                          | Interface converter fault  | Check/repair interface converter                          |
|   | Sensor fault – faulty wiring connector                           | Check/replace wiring connector                            |

## Troubleshooting (continued)

| Symptom                      | Possible Cause                           | Action Required                         |
|------------------------------|--|---|
| Drive temperature too high   | No motor cooling                         | Check motor cooling solenoid valve      |
|                              | Insufficient sub-cooling                 | Check refrigerant charge                |
|                              | Faulty temperature sensor                | Check sensor                            |
| Winding temperature too high | Faulty power bolt                        | Check power bolt continuity             |
| Compressor does not start    | No cooling demand signal                 | Check temperature set points            |
|                              | Faulty chilled water temperature sensors | Check chilled water temperature sensors |
|                              | No main power                            | Check power at terminal block           |
|                              | Low water flow                           | Check water flow                        |

## Drawings

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We have prepared a customer set of drawings for your unit and placed them inside the control panel prior to shipment. Please refer to these drawings when troubleshooting, servicing, and installing the units. If you cannot find these drawings or wish to have additional copies sent, please contact our Customer Service Department and reference the serial number of your unit.


## We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

## How to Contact Customer Service

To contact Customer Service personnel, call:



 **NOTE:** Normal operating hours are 8:00 am - 5:00 pm (EST). After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

## Before You Call...

**If you do have a problem, please complete the following checklist before calling Conair:**

- Make sure you have all model, control type from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

## Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

## Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

## Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.