THERMAL CARE
PiovanGroup

Central Chillers

OPERATION, INSTALLATION AND MAINTENANCE MANUAL

Accuchiller **TCFW375**

LOW GWP REFRIGERANT
FUTURE PROOF SOLUTIONS TODAY

Where water means business.

Table of Contents

Foreword

The central chiller consists of a refrigeration circuit to provide cooling of water or 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 and is general in nature. Equipment-specific drawings and supplemental documents are included 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 hydrofluoroolefin (HFO), trade named R513A, 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 the equipment 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

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: 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 equipment arrives, verify the information on the 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 for 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 equipment, 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 it 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 for 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.

Equipment Storage

When storing the equipment, it is important to protect it from damage. Blow out any water from the chiller; 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

Foundation

Install the chiller 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.

Chiller Location

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 chiller 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 Refrigeration 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

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 designed 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.

The 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 and Temperature Gauges

Install pressure and temperature gauges in the inlet and outlet of both the condenser and evaporator chilled water piping to provide the ability to read the pressure and temperature 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 - 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.

% Imbalance = (Vavg – Vx) x 100 / Vavg

Vavg = (V1 + V2 + V3) / 3
Vx = phase with greatest difference from Vavg

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) x 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: 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

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 load 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 manifolded 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 chiller 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 chiller. Contact our Customer Service department for assistance with any questions before making changes.

There is a 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 equipment Serial Number ready for reference.

System Initialization

Upon power-up, the first screen to appear is the Start-Up Screen as shown in Figure 1. This screen will display while the Programmable Logic Controller (PLC) and Human Machine Interface (HMI) establish communications. The PLC/HMI version shows on the screen.

Figure 1 – Start-Up Splash

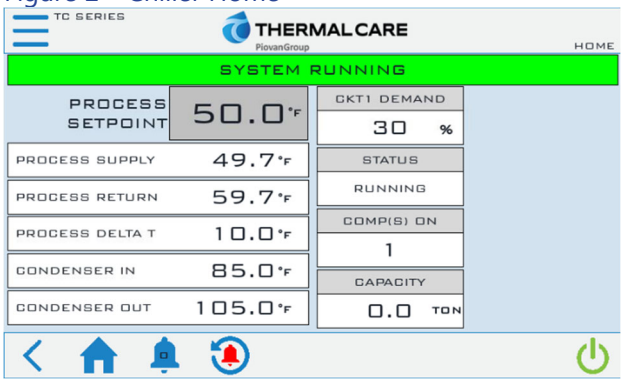
Once control communication is established, the HMI screen automatically switches to the Home Screen.

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 2 – Chiller Home



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 1 – System Overview Functions

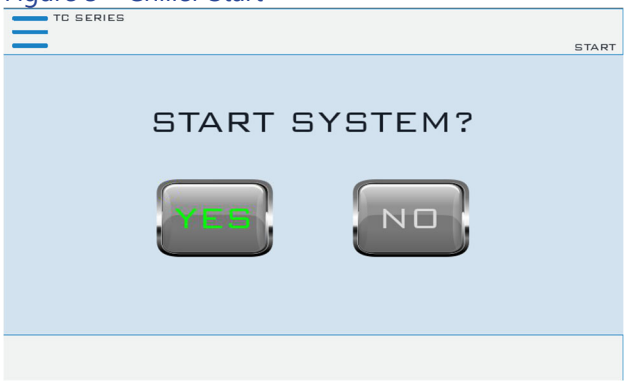
Function	Description	Screen Reference
CKT Demand	Informs the operator of the compressors in operation in each circuit	None
Status Messaging	Provides information about any warnings or alarms which may have occurred.	None
Setpoint	Modify the Setpoint by touching the current Setpoint on the HMI. An authorized security level password is required to enter a new Setpoint.	None
Menu Button	Changes to the Menu 1 screen	Figure 5
		N/A
Alarms	A listing of active and prior alarm history. The number displayed on the bell indicates the number of active alarms.	Figure 7 Figure 8
		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 3 Figure 4
	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.

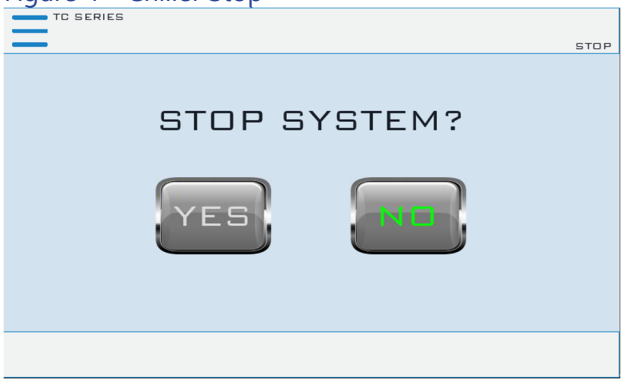
Figure 3 – Chiller Start



Stopping the Chiller

This screen provides the ability to stop chiller operation.

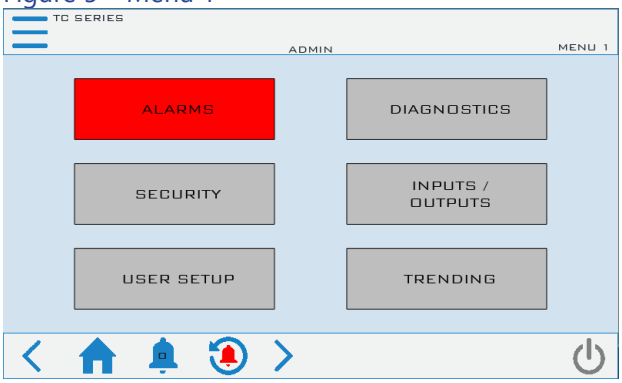
Figure 4 – Chiller Stop



Menu 1 - Overview

Menu 1 - Figure 5 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.

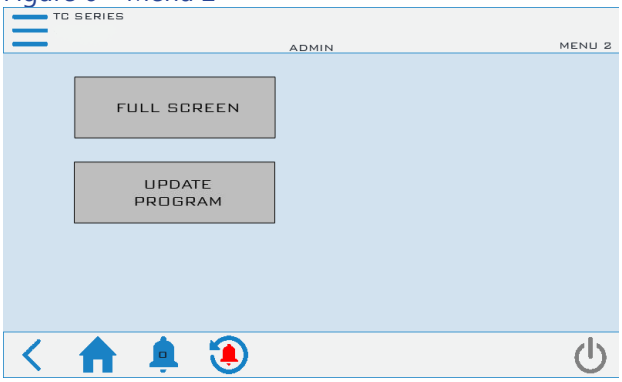
Figure 5 – Menu 1



Menu 2 - Overview

The Menu 2 - Figure 6 contains additional functionality. This includes the ability to show a full screen view as well as updating the HMI program via thumb drive.

Figure 6 – Menu 2

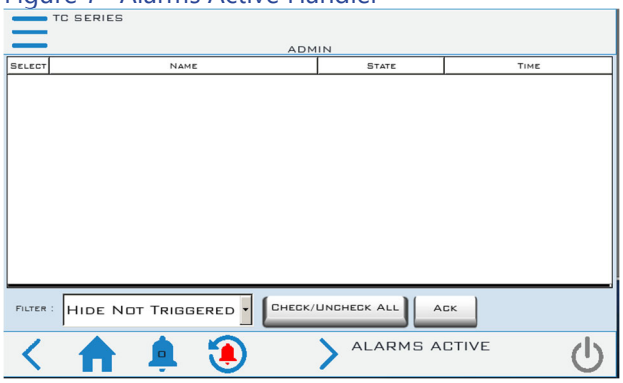


Menu 1 - Alarms

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.

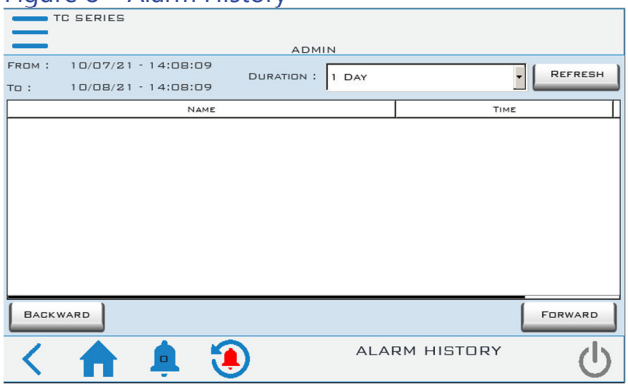
Figure 7 –Alarms Active Handler



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

Alarms History

Figure 8 – 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. 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 9 – Warning Antifreeze

Menu 1 – Diagnostics

Diagnostics Menu

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

Figure 10 – Diagnostics Menu 1

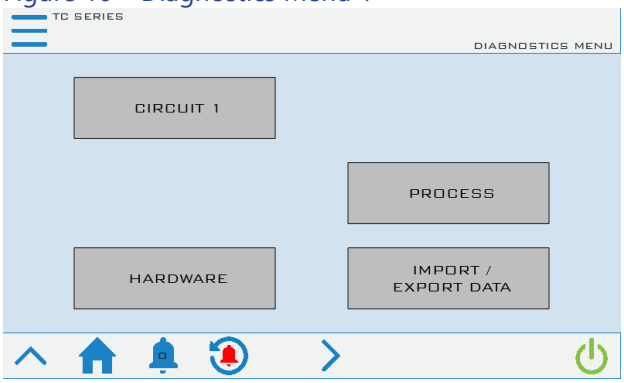


Figure 11 – Diagnostics Menu 2

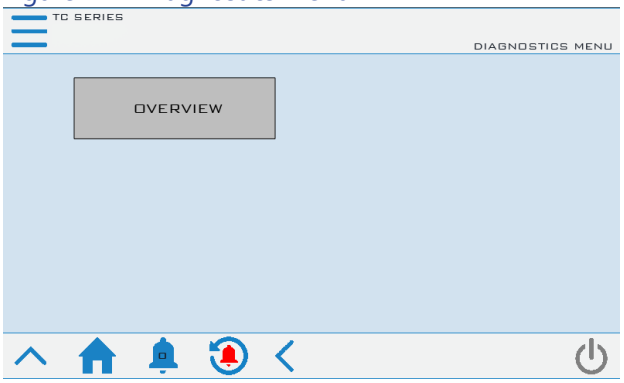


Figure 12 – Diagnostics Circuit Details

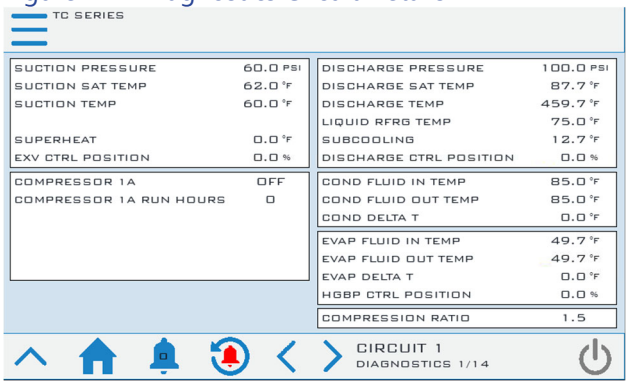


Figure 13 – Diagnostics Circuit Turbocor

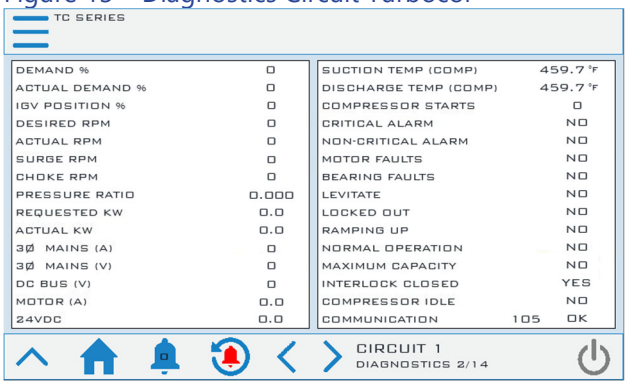


Figure 14 – Diagnostics Circuit Interlock

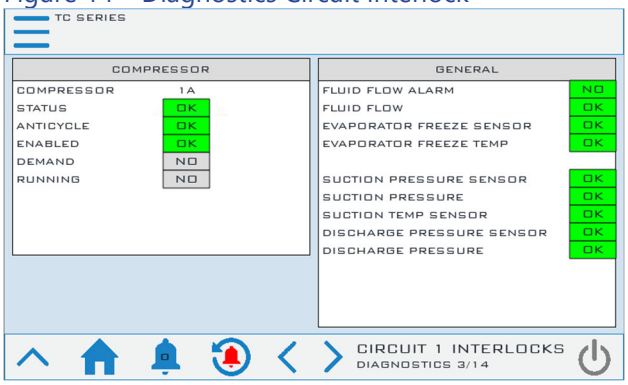


Figure 15 – Diagnostics Process

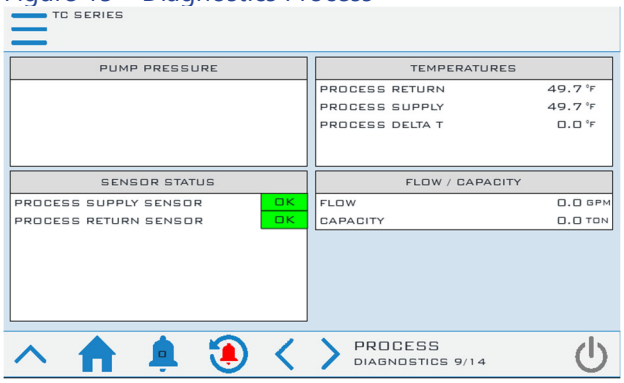


Figure 16 – Diagnostics Hardware

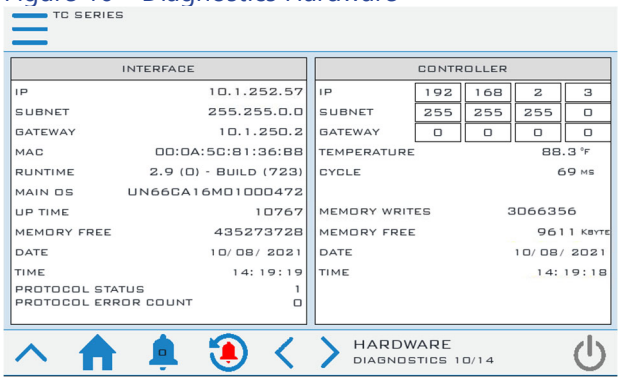


Figure 17 – Diagnostics Import/Export Data

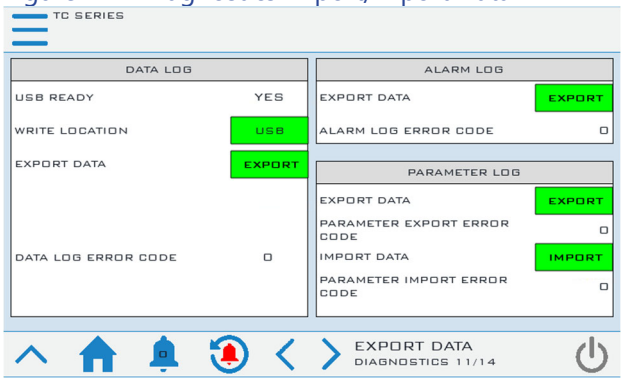
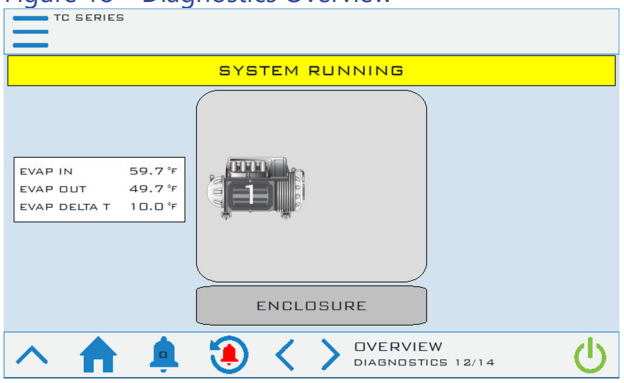


Figure 18 – Diagnostics Overview



Menu 1 – Security

Security Menu

To add protection to sensitive areas of the control program and provide a level of supervisory control to some operating parameters, the control system includes 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 19 – Security Menu

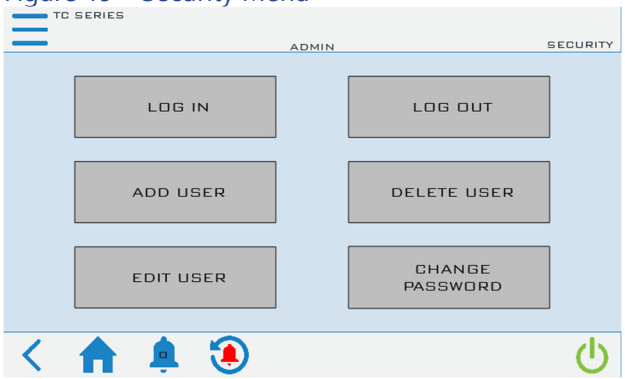


Figure 20 - Security – Log In

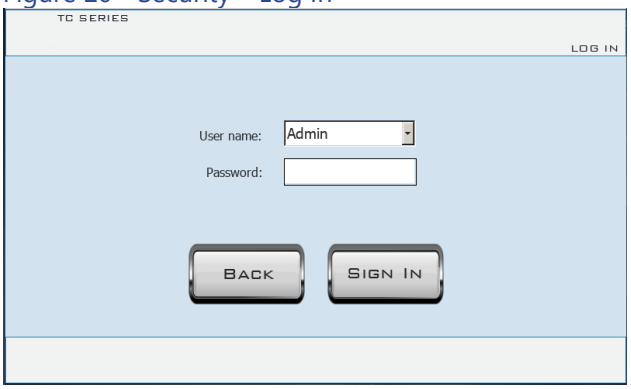


Figure 21 - Security – Add User

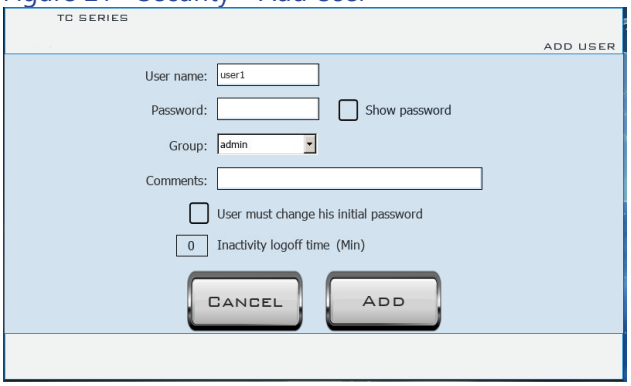


Figure 22 - Security – Edit User

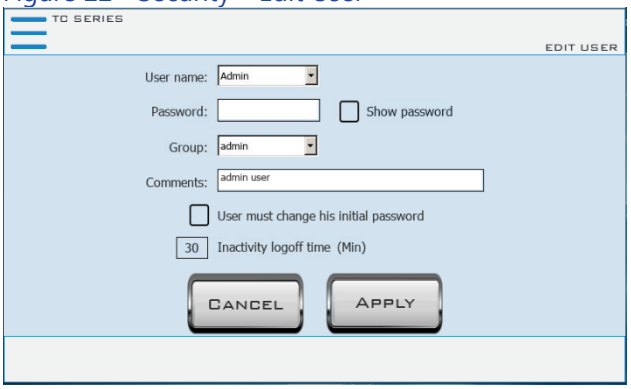


Figure 23 - Security – Delete User

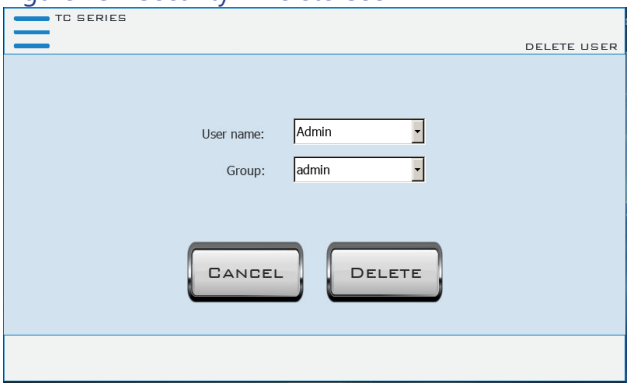


Figure 24 - Security – Change Password

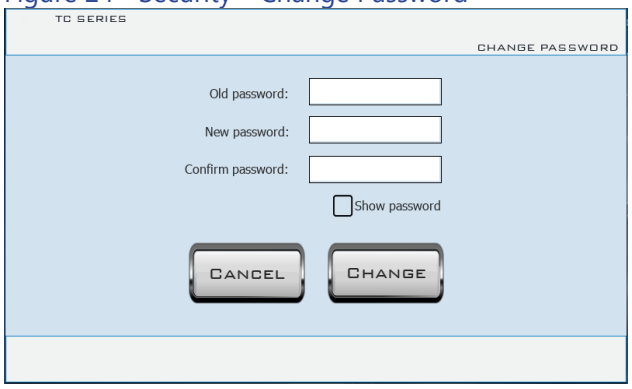


Table 2 - Security – Users and Passwords

User Name	Password	Screen Reference
User	9999	None
Supervisor	7720	None
Admin	Contact Thermal Care	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 25 - Inputs/Outputs - Menu

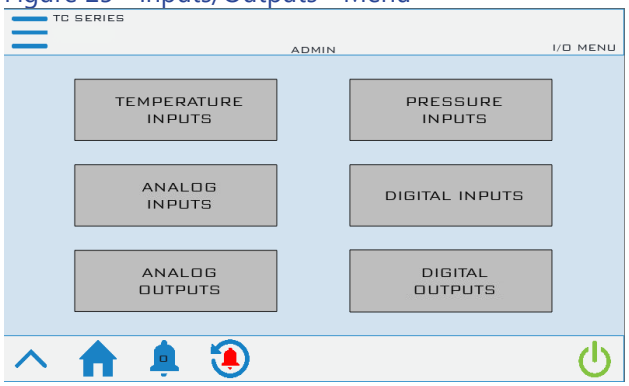


Figure 26 - Inputs/Outputs – Temperature Inputs

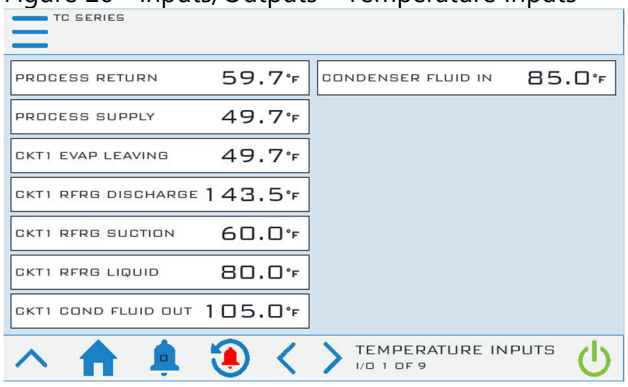


Figure 27 - Inputs/Outputs – Pressure Inputs

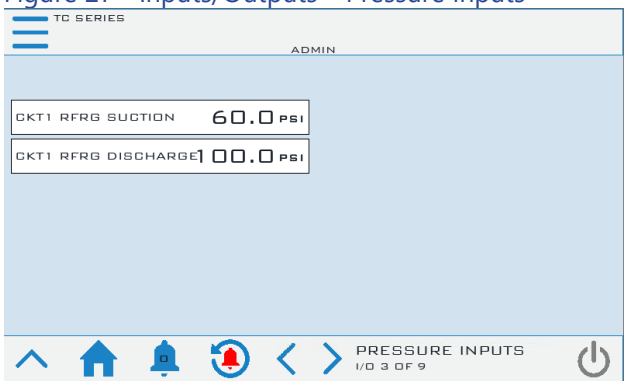


Figure 28 - Inputs/Outputs – Analog Inputs

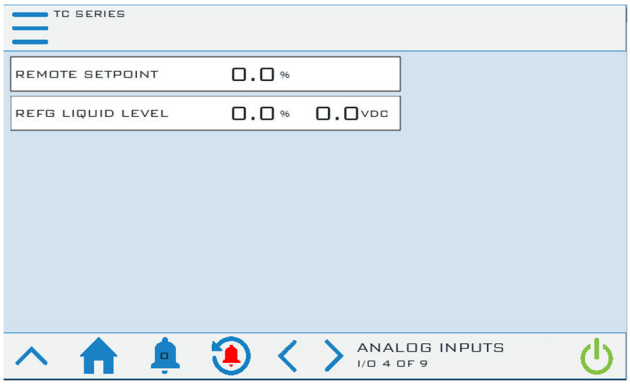


Figure 29 - Inputs/Outputs – Digital Inputs

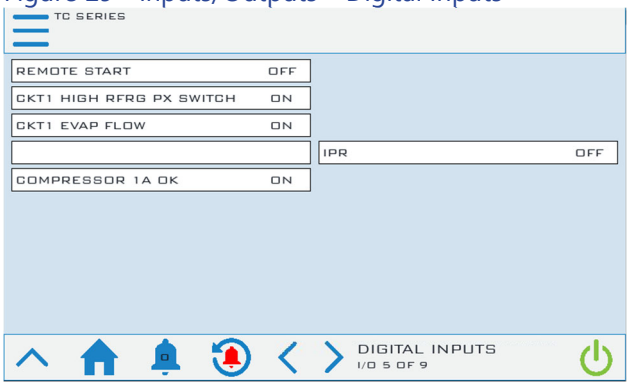


Figure 30 - Inputs/Outputs – Analog Outputs

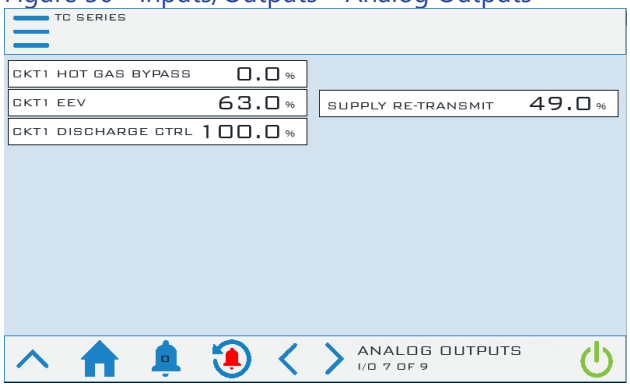
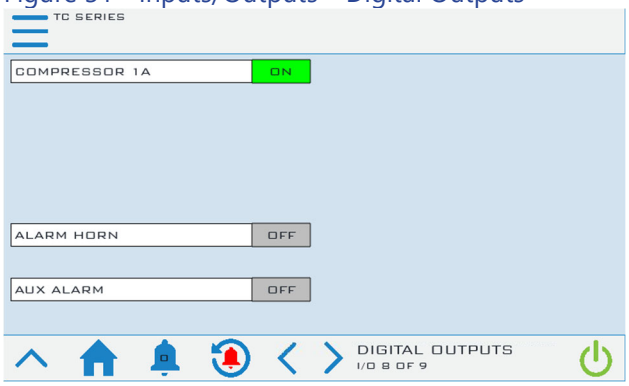


Figure 31 - Inputs/Outputs – Digital Outputs



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 32 - User Setup - Menu 1

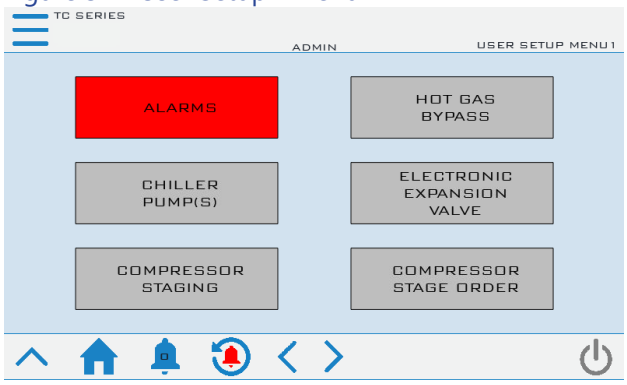


Figure 33 - User Setup - Menu 2

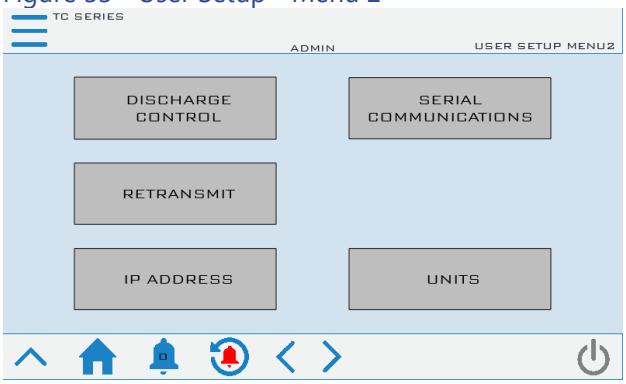


Figure 34 - User Setup - Menu 3

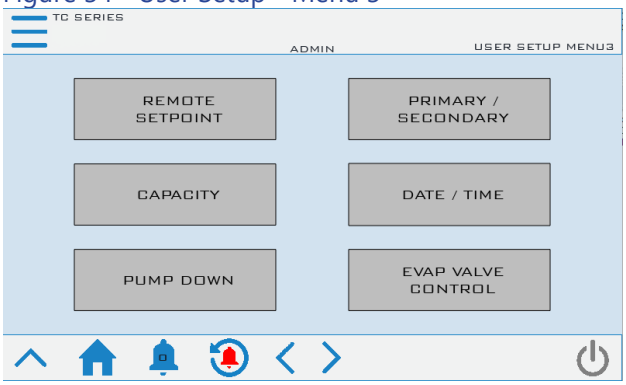


Figure 35 - User Setup - Menu 4

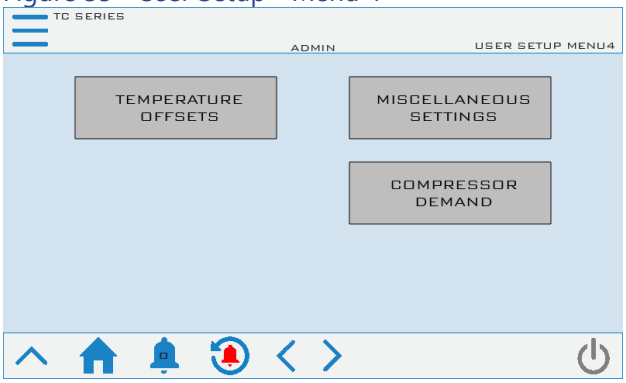
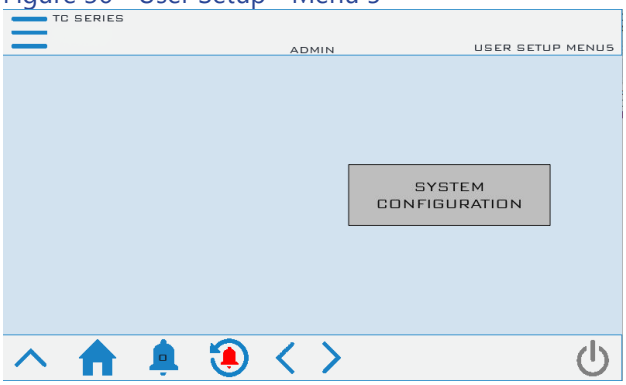


Figure 36 - User Setup - Menu 5



User Setup – Alarm Setup

Figure 37 - User Setup - Alarm Setup

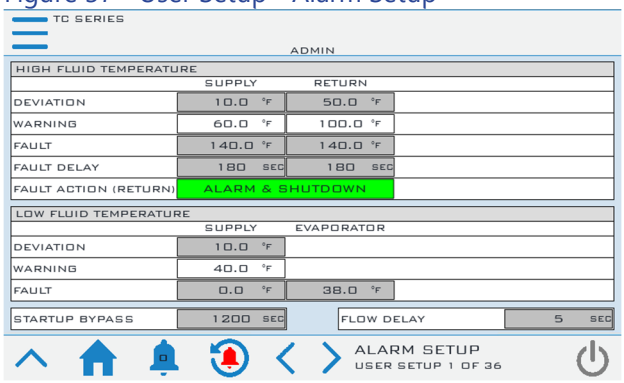


Table 3 – Alarm Setup Parameters

Menu Item	Description	Default Value
High Fluid Temperature		
Deviation	This deviation determines the warning trigger above chiller setpoint	Supply 10.0°F 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 takes action	180 sec.
Fault Action	Takes action when high return fluid alarm occurs	Alarm & Shutdown
Low Fluid Temperature		
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 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 38 - User Setup – Hot Gas Bypass Setup

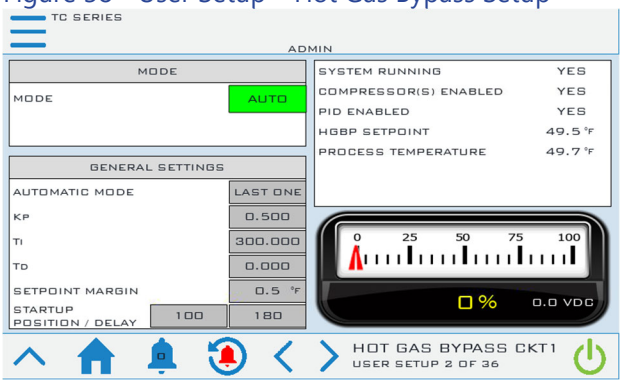


Table 4 – Hot Gas Bypass Valve Setup Parameters

Menu Item	Description	Default Value
Mode Selection	AUTO = Follow Automatic Mode 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). LAST ONE = The valve will only respond relative to the demand PID when operating with the last compressor running. 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	100%
Startup delay	The starting hot gas bypass delay time	180 sec.

User Setup – EEV Control

The electronic expansion valve meters the amount of refrigerant in the precise quantity in order to maintain liquid level.

Figure 39 - User Setup – EEV Control Setup

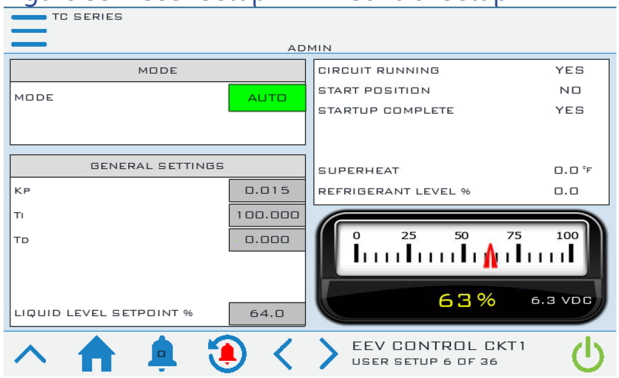


Table 5 – EEV Control Setup Parameters

Menu Item	Description	Default Value
Mode Selection	In Auto Mode, the control system adjusts the valve to maintain liquid level. In manual mode, the system drives the valve to a fixed position and holds it there for service diagnostic purposes.	AUTO
Kp	Proportional PID value	0.015
Ti	Integral PID value	100.000
Td	Derivative PID value	0.000
Liquid Level Setpoint %	Target Liquid Level Setpoint percent	64.0

User Setup – Compressor Staging

Figure 40 - User Setup – Compressor Staging Setup

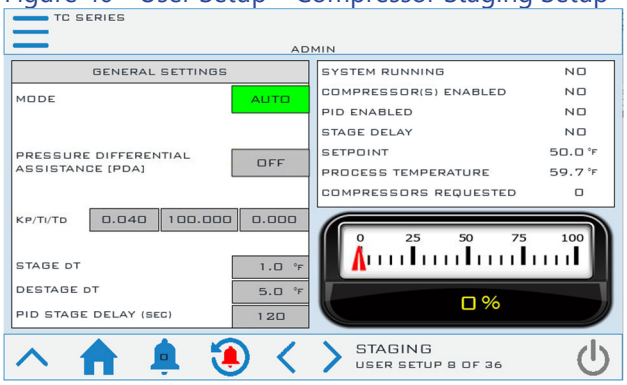


Table 6 – Compressor Staging Setup Parameters

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.	1.0°F
Destage ΔT	If the process value drops below the set point by this differential, all compressors turn off.	5.0°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

Figure 41 - Compressor Stage Order Screen 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 number of hours first to help equalize the run hours of all the compressors

Figure 41 - User Setup – Stage Order Setup

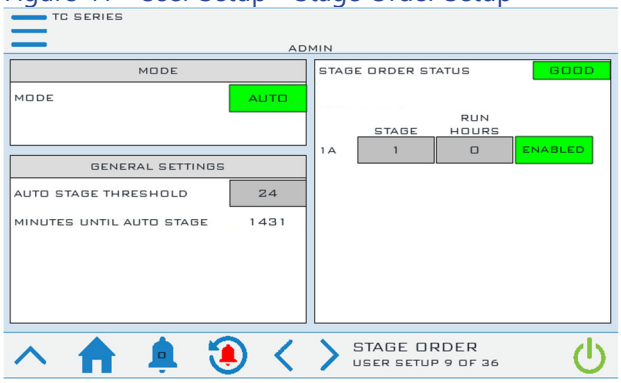


Table 7 – Stage Order Setup Parameters

Menu Item	Description	Default Value
Stage Mode	Automatic: calculates the stage order by the AUTO STAGE THRESHOLD parameter 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. 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.

Figure 42 - User Setup – Discharge Control Setup

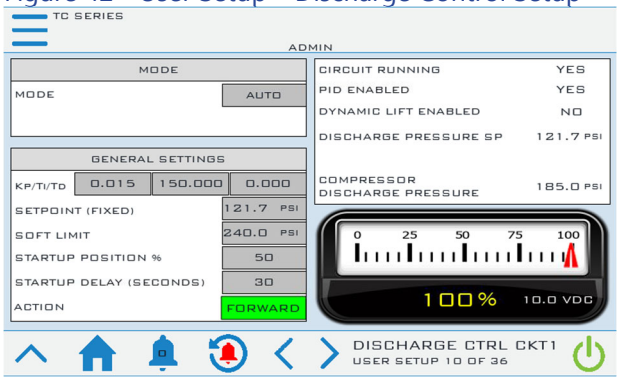


Table 8 – Discharge Control Setup Parameters

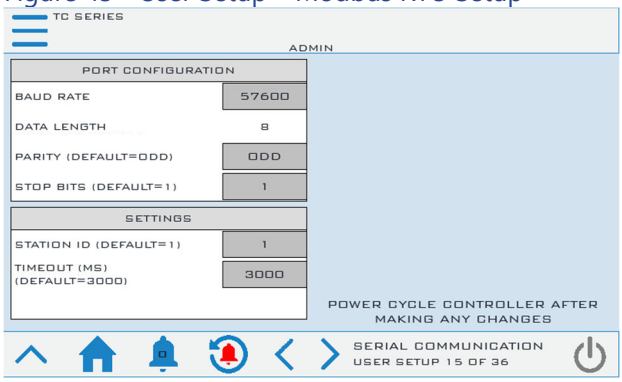
Menu Item	Description	Default Value
Mode	In Auto Mode, the fans adjust to maintain optimum performance. In manual mode, it holds to the Manual Mode Position input valve.	AUTO
Kp	Proportional PID value	0.015
Ti	Integral PID value	150.000
Td	Derivative PID value	0.000
Setpoint	Discharge Setpoint Value	121.7 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 Forward/Reverse	Forward

User Setup – Serial Communications Setup

Modbus RTU Setup Screen

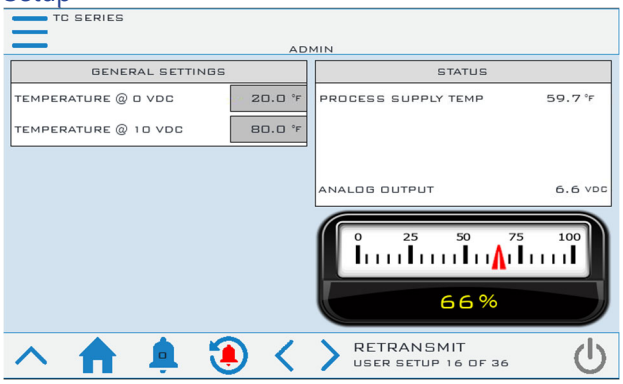
Figure 43 - Modbus RTU Setup Screen provides the ability to modify communication parameters. Default Modbus RTU Settings: Baud-57600, Data Length-8, Parity-Odd, Stop Bits-1.

Figure 43 - User Setup – Modbus RTU Setup



User Setup – Temperature Retransmit

Figure 44 - User Setup – Temperature Retransmit Setup



User Setup – IP Address

Figure 45 - User Setup – IP Address Setup (revised)

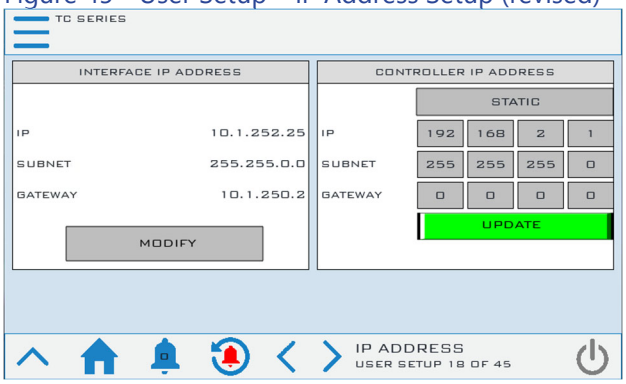


Figure 46 – User Setup – IP Address Setup Screen – 2

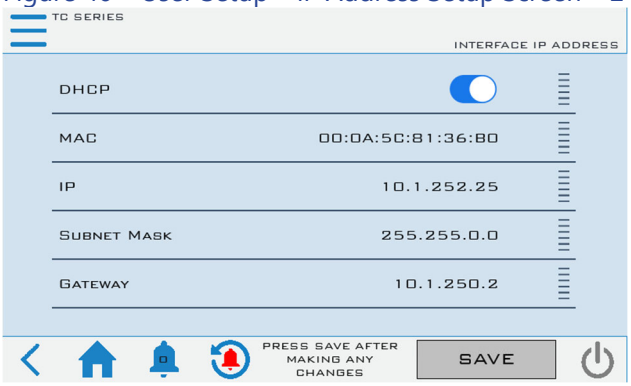
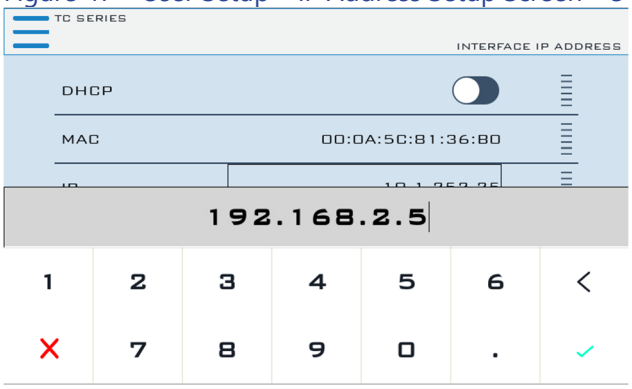
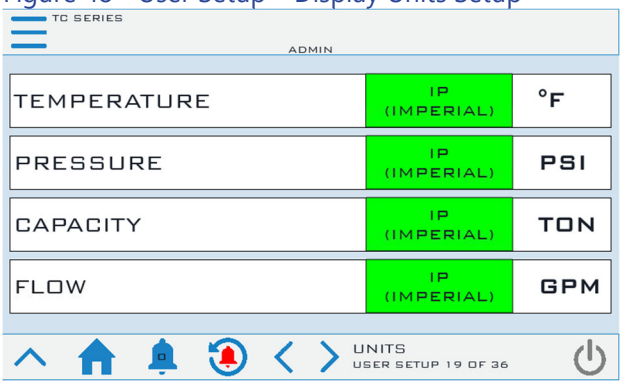


Figure 47 – User Setup – IP Address Setup Screen – 3



User Setup – Units

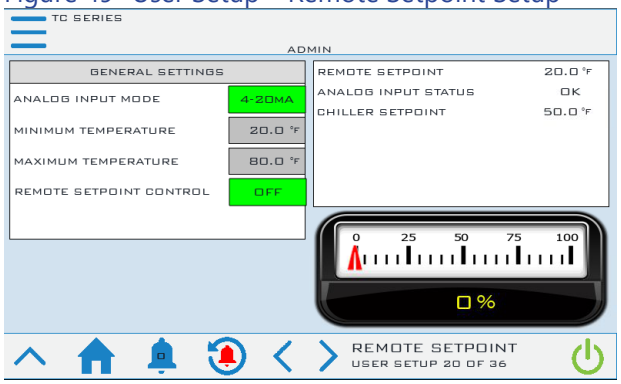
Figure 48 - User Setup – Display Units Setup



User Setup – Remote Setpoint

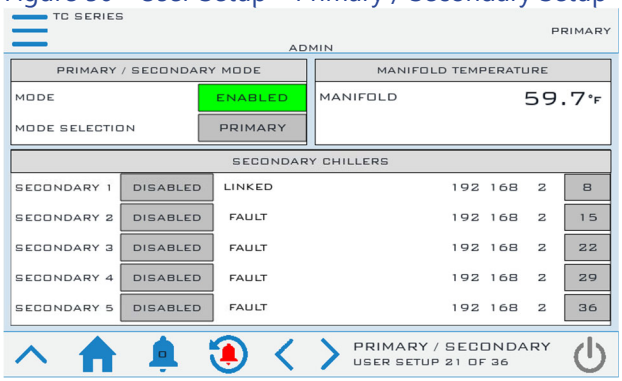
When the remote setpoint option is active, an incoming 4-20mA or 0-10VDC signal controls the setpoint of the primary chiller. The signal will span from the MINIMUM TEMPERATURE to the MAXIMUM TEMPERATURE as defined in Figure 47.

Figure 49 -User Setup – Remote Setpoint Setup



User Setup – Primary / Secondary

Figure 50 - User Setup – Primary / Secondary Setup

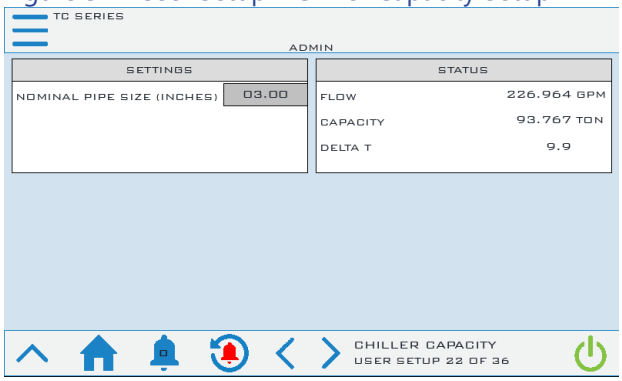


User Setup – Chiller Capacity

Chiller Capacity Screen

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

Figure 51 - User Setup – Chiller Capacity Setup

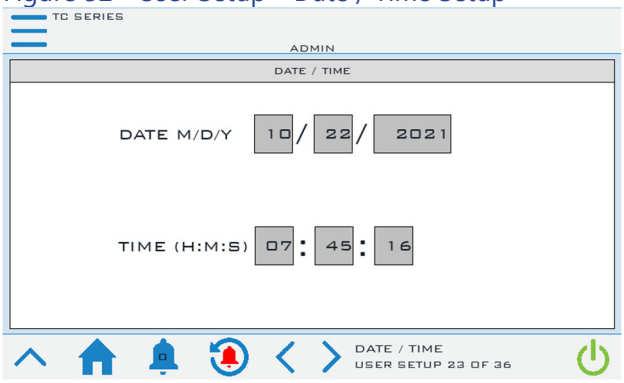


User Setup – Date/Time

Date/Time Screen

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

Figure 52 - User Setup – Date / Time Setup

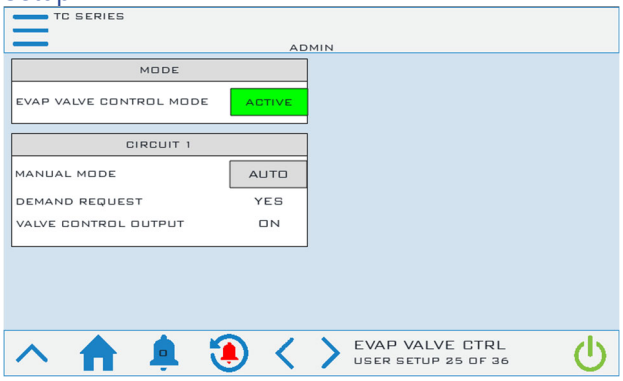


User Setup – Evaporator Valve

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 53 - User Setup – Evaporator Valve Control Setup

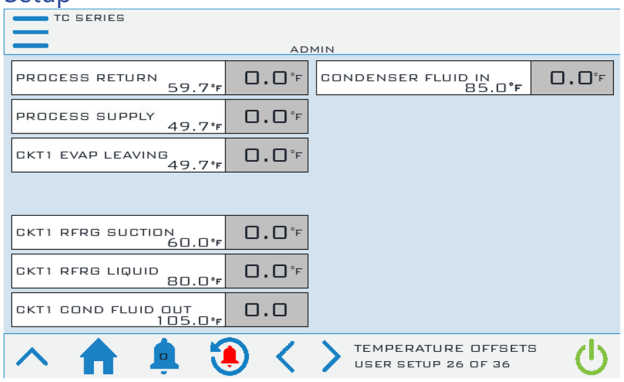


User Setup – Temperature Offsets

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 54 - User Setup – Temperature Offset Control Setup



User Setup – Misc 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 – Misc 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.

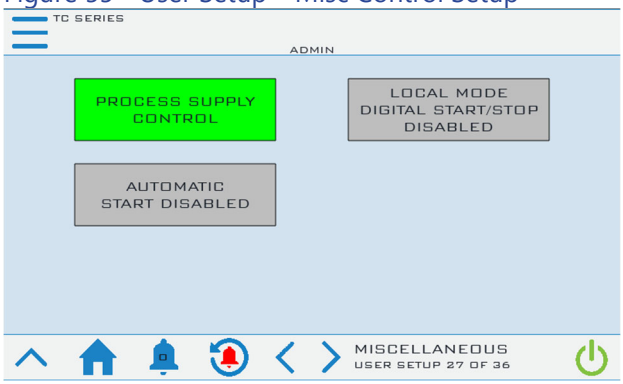
User Setup – MiscAutomatic Start

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 – Misc Current Sensors

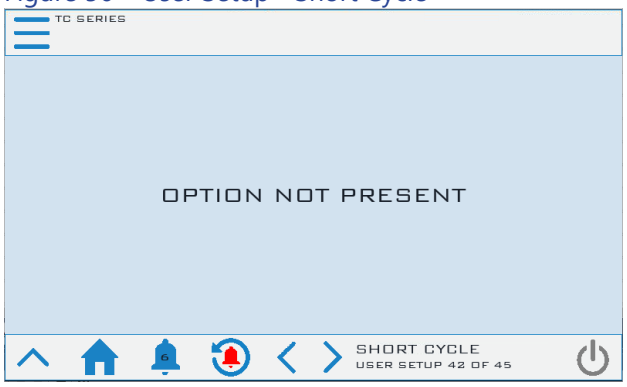
The Current Sensors toggle indicates if the chiller is set to automatically monitor the compressor current sensors when energized.

Figure 55 - User Setup – Misc Control Setup



User Setup – Short Cycle

Figure 56 – User Setup - Short Cycle



Compressor Demand

Figure 57 - User Setup – Compressor Demand Setup

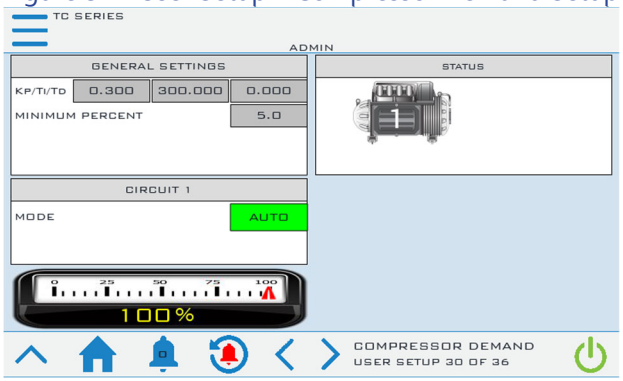


Table 9 – Compressor Demand Parameters

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 resisters (if present) for easy analysis of the system operation. Trending is always enabled and always running.

Figure 58 - System Trending 1

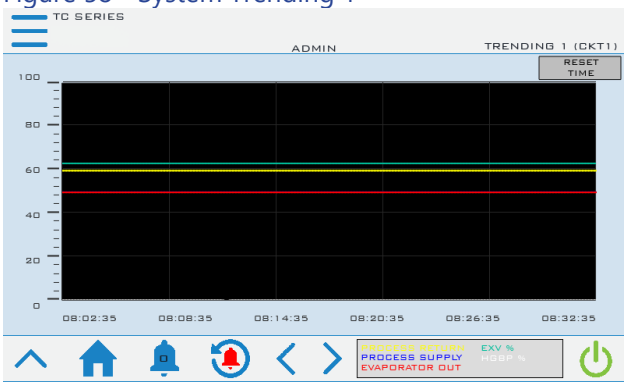
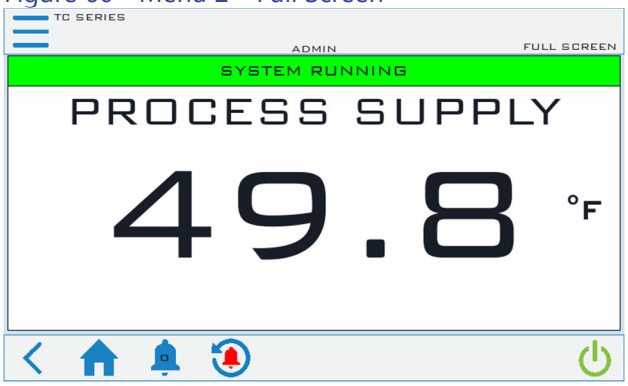


Figure 59 - System Trending 2

Menu 2 – Full Screen

This screen provides 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 60 - Menu 2 – Full Screen



Modbus

Table 10 – Modbus

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	5	1	UNITS_TEMPERATURE	Bool
Coil	6	1	UNITS_PRESSURE	Bool
Coil	7	1	CKT1_COMPRESSORS_RUNNING	Bool
Coil	9	1	CKT1_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	23	1	AL_PRB_CKT1_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	29	1	AL_CKT1_CRITICAL_ALARM	Bool
Coil	31	1	AL_CKT1_FREEZESTAT.Active	Bool
Coil	33	1	AL_CKT1_EVAP_FLOW.Active	Bool
Coil	35	1	AL_CKT1_LPS.Active	Bool
Coil	37	1	AL_CKT1_LLPS.Active	Bool
Coil	39	1	AL_COMP1A_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	10	2	CKT1_SUCTION_PRESSURE_HMI	Real
InputRegister	14	2	CKT1_SUCTION_SATURATED_TEMP_HMI	Real
InputRegister	18	2	CKT1_SUPERHEAT_HMI	Real
InputRegister	22	2	CKT1_RFRG_DISCHARGE_TEMP_HMI	Real
InputRegister	26	2	CKT1_DISCHARGE_PRESSURE_HMI	Real
InputRegister	30	2	CKT1_DISCHARGE_SATURATED_TEMP_HMI	Real
InputRegister	34	2	CKT1_SUBCOOLING_HMI	Real
InputRegister	38	2	CKT1_LIQUID_TEMP_HMI	Real
InputRegister	42	2	CKT1_EVAP_OUT_FLUID_HMI	Real
InputRegister	46	2	CKT1_EVAP_DELTA_T_HMI	Real
InputRegister	50	2	CKT1_DISCHARGE_PERCENT	Real
InputRegister	54	2	CONDENSER_FLUID_IN_TEMPERATURE_HMI	Real
InputRegister	56	2	CKT1_CONDENSER_FLUID_OUT_TEMP_HMI	Real
InputRegister	60	2	CKT1_EVAP_IN_FLUID_HMI	Real
InputRegister	64	2	CKT1_HGBP_PERCENT	Real
InputRegister	68	2	CKT1_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 chiller 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: 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. This chiller is designed for 40% Industrial Grade Ethylene Glycol with a corrosion inhibitor.

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). Our water-cooled chillers use a shell-and-tube condenser that 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 fluid 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 fluid usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved.

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 - Condenser Water Temperature and Flow

Check the condenser water lines to make sure all connections are secure. Make sure sufficient condenser fluid flow and pressure are available, and all shut-off valves are open. The chiller includes a factory mounted condenser water-regulating valve to regulate condenser water flow to maintain the proper refrigerant pressures. The electronic water regulating valve ships in the closed position and opens after enabling the circuit. The nominal design is for 220 gpm of 40% ethylene glycol or water @ 85°F entering the condenser with a 10 psi pressure drop. The chiller will start and operate with inlet water temperatures between 55°F and 95°F. The actual flow requirements will vary.

Step 4 – Check Refrigerant Valves

During shipment or installation, valves are sometimes 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 Fault setting. All chillers ship with the Low Temperature Fault set at 38°F. This protects against a possible freeze-up if no glycol is present. Once the proper glycol solution is present, adjust the Low Temperature Fault to the appropriate setting.

CAUTION: The manufacturer's warranty does not cover the evaporator from freezing. It is vital that the Evaporator Low Temperature Fault 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 wait 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 compressor only operates if there is a positive flow through the evaporator.

Set 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. The nominal flow rates of the chiller are 467 gpm of 40% ethylene glycol @ 10°F setpoint with a 16 psi pressure drop and 427 gpm of 40% ethylene glycol @ 15°F set point with a 12 psi pressure drop.

Step 8 – Initial Chiller Operation

Enter the desired leaving fluid temperature on the chiller HMI. The chiller has an intended operating range of 10°F to 15°F and a set point range of 10°F to 55°F. Under normal operation, the entering water temperature should not exceed 80°F; however, the chiller can start and operate short-term with entering fluid temperatures up to 90°F to allow the chiller to pull down the temperature of a reservoir or process fluid loop on start-up. 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 15°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 2-4°F. Since the chiller is factory charged, adding or removing refrigerant charge should not be necessary. If the operating pressures, sight glass, superheat, and subcooling readings indicate a refrigerant shortage, charge refrigerant as required. With the chiller 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 chiller 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 chiller is now ready for service.

Preventive Maintenance

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 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 equipment serviced as soon as possible.

Once a Month

Repeat items 1 through 3 and continue with the following.

4. Shut off the power disconnect. Check the condition of electrical connections at all controls. Check for loose or frayed wires.

5. 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).

6. Check the amp draws to each leg of the compressor(s) to confirm that it is drawing the proper current.

7. Check the system superheat and sub-cooling. The normal superheat is approximately 2-4°F. The normal sub-cooling range is from 15°F to 20°F.

8. Check the flow sensor tip visually for signs of build-up and clean with a soft cloth. If there is some 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 8 and continue with the following.

9. Check for visible mechanical damage to the compressor.

10. Check for excessive vibration from other rotating equipment.

11. Check for signs of hot spot/discoloration on power cables.
12. Check the DC bus voltage.

13. Check all communication cables are secure and tight.

14. Check all electrical modules are secure.

15. Check system refrigerant charge and verify the system is still fully charged.

Once a Year

Repeat items 1 through 15 listed and continue with the following.

16. Check the condition of the condenser fluid for algae and scale. If contamination is present, rod out the tubes and back flush condensers before reconnecting pipes.

    Note: Inspection is not necessary for closed-loop glycol systems, unless leaks or head pressure issues occur.

17. Check operation of all system safety devices and interlocks.

18. Check physical condition of all exposed circuit boards for dust build-up and clean if necessary.

19. Check calibration of temperature/pressure sensors.

20. Check operation of the inlet guide vane (IGV) assembly.

Once Every 5 years

Repeat items 1 through 20 and continue with the following.

21. Replace compressor capacitor set.

Maintenance

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 fluid flow	Check fluid flow is within design
	Chilled fluid 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 liquid level 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 fluid temperature too high	Check cooling tower system set point
	Low condenser water flow	Check condenser fluid flow is within design spec
	Fouled condenser fluid tubes	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 fluid 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 liquid level valve failed open	Check position and operation
Low water temperature cut-out	Insufficient refrigerant charge	Check refrigerant charge
	Faulty sensor	Check sensor
	Fluid temperatures too low	Check set points
	Low fluid flow	Check fluid flow
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
	Shaft position sensor fault	Check/replace sensor
Bearing will not calibrate or levitate	Faulty bearing wiring	Check/repair wiring
	Faulty bearing PWM amplifier	Replace bearing PWM amplifier
	Faulty bearing/motor controller	Replace bearing/motor controller
No compressor controller connection	Faulty compressor controller	Replace compressor controller
	External wiring fault	Check/repair wiring
	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

We have prepared a customer set of drawings for your equipment and placed them inside the control panel prior to shipment. Please refer to these drawings when troubleshooting, servicing, and installing the equipment. 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 equipment.

THERMAL CARE
PiovanGroup

5680 W. Jarvis Ave. • Niles, IL 60714
847.966.2260
www.thermalcare.com

New Equipment Sales
847.966.2260
sales@thermalcare.com

Customer Service
847.966.2636
tcservice@thermalcare.com

Parts Department
847.966.8560
tcparts@thermalcare.com