TOTAL COLD CONTROL MANUAL

Pro Refrigeration, Inc.

PRO™
CHILLER • SYSTEMS

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Preface

This Manual is intended to be used in conjunction with Pro Refrigeration's TCC control system.

This manual will guide you through the process of installing, wiring, configuring, and using your TCC control board and TCCV display.

Note: Check the following URL for the latest version of this manual and other Pro Refrigeration, Inc. product documentation. *http://www.prochiller.com /support*

TCC Summary

The TCC control system consists of one micro-processor control board per refrigeration circuit, one touch screen interface panel (TCCV), and all associated transducers and components.

The TCC control system can be used with up to four (4) refrigeration circuits. The TCCV display can communicate with up to 4 TCC cards through a RS-485 communications bus.

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1 Installation

1-1 Hardware

The Total Chiller Control (TCC) system consists of a microprocessor control board, a touch screen interface (TCCV), and all associated components. Only use components approved by Pro Refrigeration.

Figure 2

Mount the TCC control board in a NEMA rated enclosure rated for the environment it is to be operated in. Use the mounting tray (Figure 1) and secure it with appropriate hardware at both ends.

Figure 1

Mount the touch screen interface in panel door. Use mounting hardware supplied with the unit to secure.

Figure 3

1-2 Auxiliary Components

There are two types of temperature probes used on the TCC control system. Both are NTC Thermistors.

Use the submersible probe when immersed in fluid such as glycol. Secure probe to internal piping using plastic clamps or cable ties.

Figure 4

Use the brass head (uncoated) type for suction and discharge temperature monitoring. Probe to be mounted to pipe using a clamp to secure it. Probe to be mounted on upper half of pipe as shown in Figure 5.

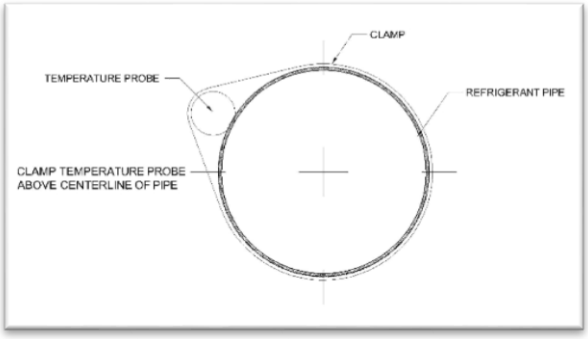


Figure 5

Discharge pressure transducers to be mounted directly onto the compressor in the discharge port. Suction transducers are to be mounted in the top of the suction line between the compressor and suction accumulator.

Figure 6

The TCC is designed to operate two electronic expansion valves per board. Use only Emerson EX type electronic valves.

Figure 7

1-3 Connection

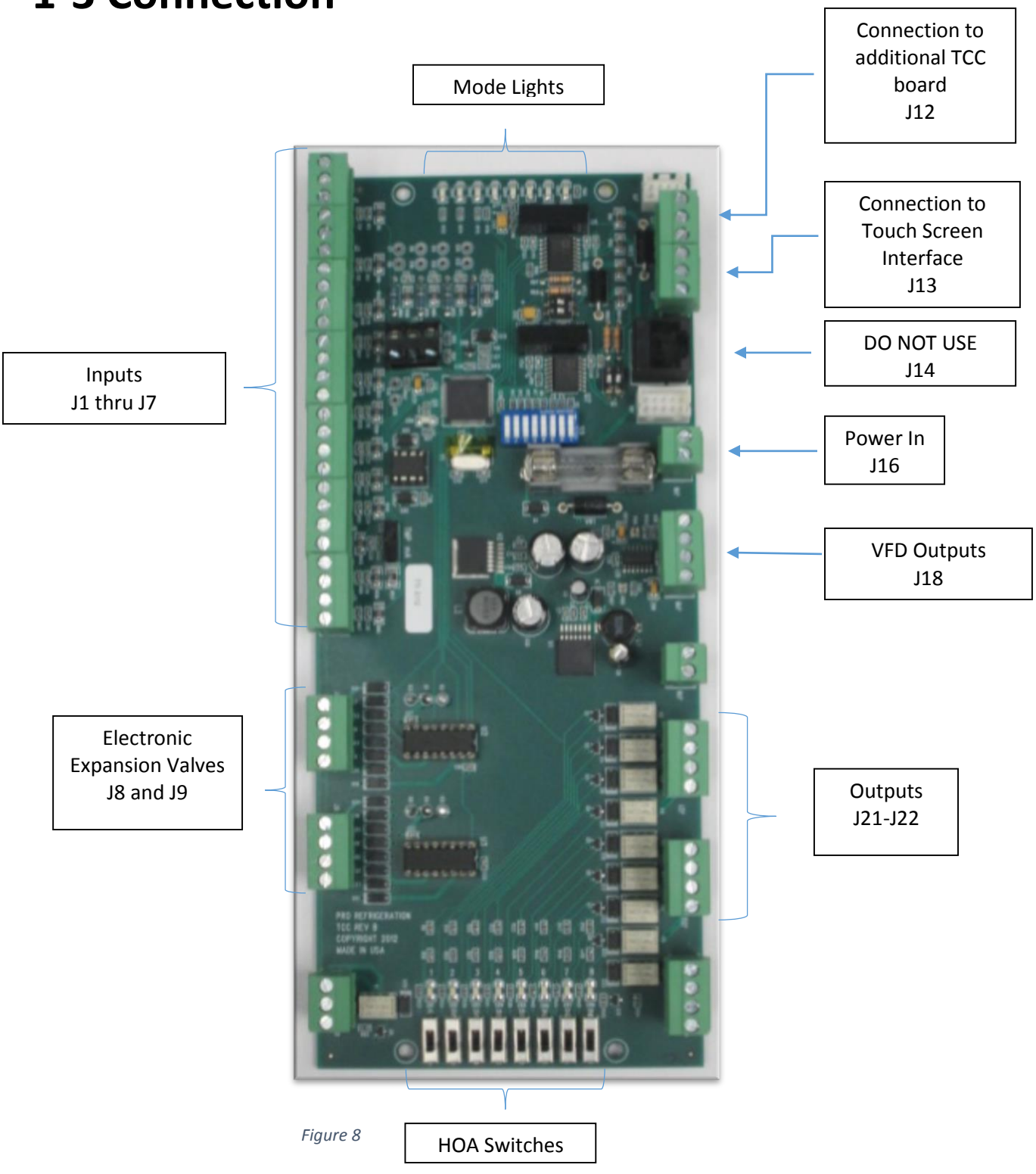


Figure 8

General

Connections to the TCC board are to be made using removable two, three and four point terminal blocks and the mounted terminal block on the card (J24).

DO NOT CONNECT THE 8P8C PORT (J14) TO AN ETHERNET NETWORK. DAMAGE TO THE CONTROL BOARD WILL OCCUR.

J11: Programing port for initial programing of the control board.

J12: RS485 BCS for connection to other TCC control boards (*Figure 9*)

J13: RS485 MODBUS COMM for communication with Touch Screen Interface. (*Figure 9*)

Red wire to Pin 1: RS485 Tx+/Rx+
Black wire to Pin 6: RS485 Tx-/Rx-
Shielded wire to Pin 5: GND

J16: 24V DC power input. F1 fuse block requires a 2A fuse

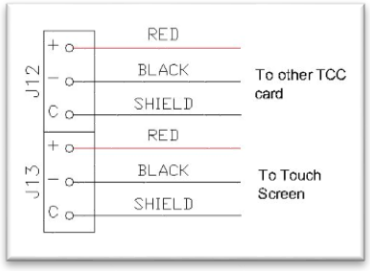


Figure 9

J24: Main run signal. This is typically connected to the switch on the front of the control panel. Connect between 1 and 2 for “Run” mode and between 2 and 3 for “Pump Down” mode.

Inputs

J1: Discharge Pressure Transducer. Requires a 0.5-4.5 V signal from a 0-500 psi transducer.

J2: Suction Pressure Transducer. Requires a 0.5-4.5 V signal from a 0-100 psi transducer.

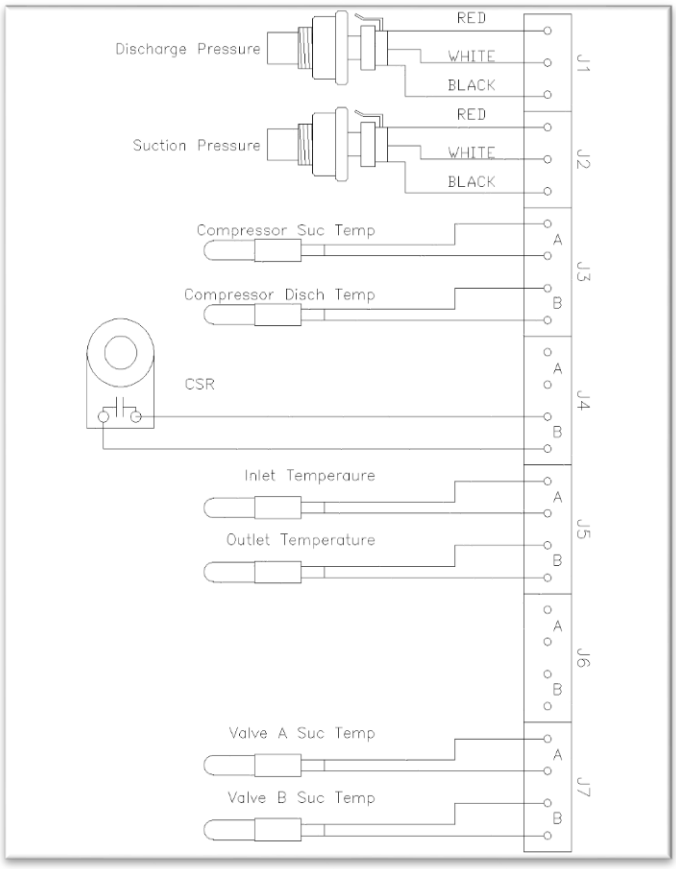


Figure 10

J3A: Compressor suction temperature. Requires brass head temperature probe.

J3B: Compressor discharge temperature. Requires brass head temperature probe.

J4: Current sensing relay located on the circulation pump

J5A: Inlet Temperature. This is used for the temperature of the glycol coming into the

chiller tank. Requires submersible temperature probe.

J5B: Outlet Temperature. This is used for the temperature of the glycol leaving the chiller. Requires submersible temperature probe.

J6: Spare Input

J7A: Valve A suction temp (for use on electronic expansion valve systems). Requires brass head temperature probe.

J7B: Valve B suction temp (for use on electronic expansion valve systems). Requires brass head temperature probe.

J23.3 and J23.4: Remote alarm signal. Jumper to run, open to shut down and alarm.

Outputs

J8: Electronic Expansion valve 1 control. Can be connected directly to Emerson EX electronic expansion valves as shown in *Figure 11*. Do not use any other brand or type of expansion valve with this controller.

J9: Electronic Expansion valve 2 control. Can be connected directly to Emerson EX electronic expansion valves as shown in *Figure 11*. Do not use any other brand or type of expansion valve with this controller.

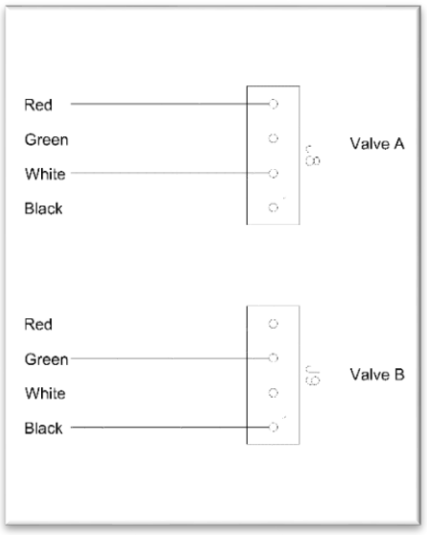


Figure 11

J10: Alarm output

J21.1: Contact closes for condenser fan 1 to turn on.

J21.2: Contact closes for condenser fan 2 to turn on

J21.3 Contact closes for condenser fan 3 to turn on

J21.4 Contact OPENS for circulation pump to turn on.

J22.1 Contact closes for compressor to run

J22.2 Contact closes for liquid solenoid valve to open.

J22.3 Contact closes to energize compressor unloader 1

J22.4 Contact closes to energize compressor unloader 2 (if available)

J23.1 Not Used

J23.2 Common for J21 and J22

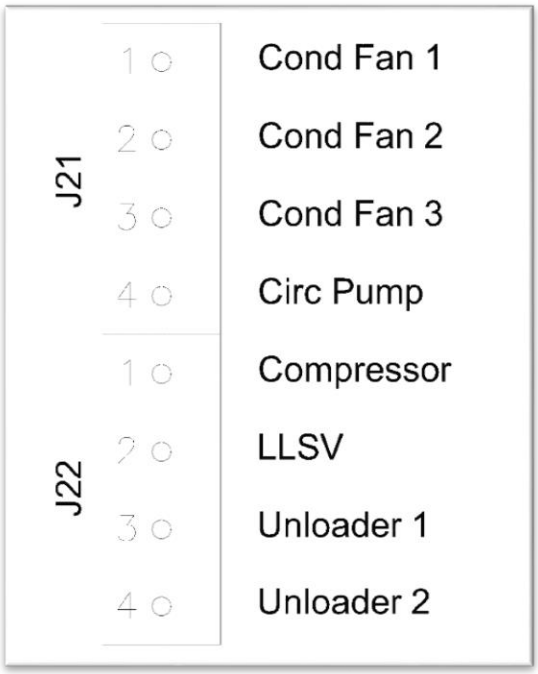


Figure 12

TCCV Connection (Touch Screen Display)

1: 24V Power Terminal: This terminal is connected to a 24V AC or DC power source.

2: COM1/2: The COM1/2 9-PIN serial port is used for RS485 MODBUS communication with the TCC card. The wiring is setup as followed:

Red wire to Pin 1: RS485 Tx+/Rx+
Black wire to Pin 6: RS485 Tx-/Rx-
Shielded wire to Pin 5: GND

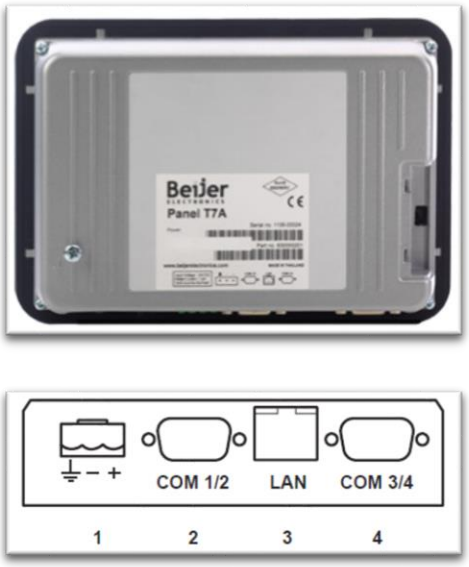


Figure 13

3: LAN: The Ethernet port on the TCCV allows you to connect to your existing computer network, giving you the ability to access the TCCV remotely. Please see the Set Up section for information on setting the TCCV's IP address.

4: COM ¾: Not used.

2 TCC Set Up

2-1 Switch Configuration

When connecting to a network of TCC cards, use the DIP switches (S-9) to assign each card a number in the network (*Figure 15*).

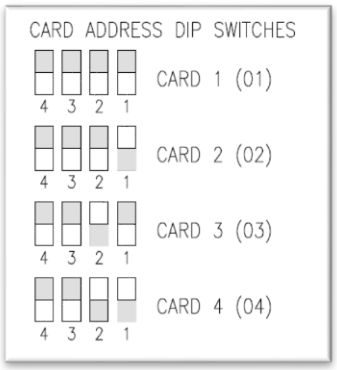


Figure 15

S10: Switch S10 must be set to TMP for all TCC applications

S11 & S12: For 3 and 4 circuit systems, board number 1 must be set to "ON" for both 1 and 2

S1 thru S8: Hand/Off/Auto Switches must be set to "Auto" (*Figure 16*).

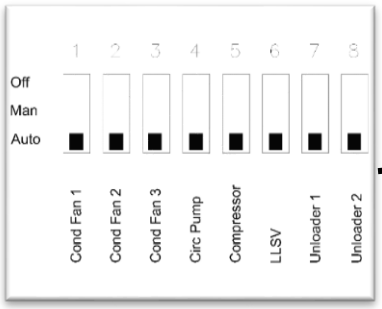


Figure 16

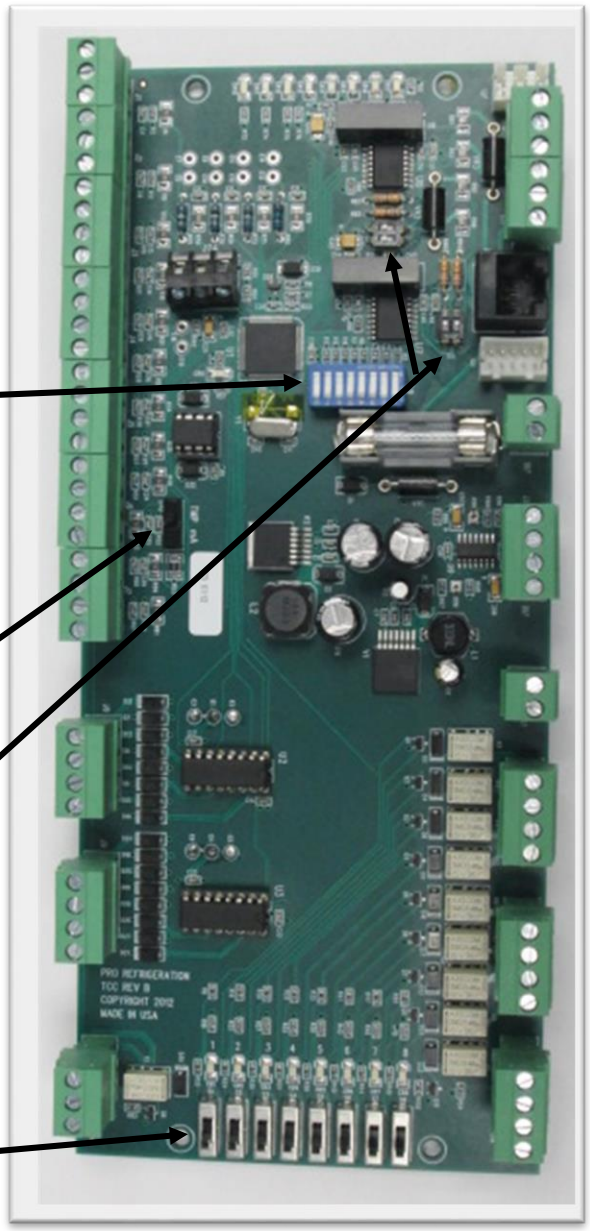


Figure 14

2-2 TCCV Network Configuration

This guide is designed to be used in conjunction with a TCCV Touch Screen Display that was factory installed on a Pro Refrigeration, Inc. Chiller System. As such, this guide assumes that all programming and non-network related wiring is complete

The login information to gain access to your systems operating parameters from the login screen is provided below.

User	Password	Security Level
Read	read	View Only
User	user	View & Control
Admin	admin	View, Control, & Configure

Figure 17

Connect Local Network

Connect an Ethernet cable from an available Ethernet port on the 5 port Ethernet switch located in the control panel to an open port on your network switch or router.

DO NOT CONNECT THE 8P8C PORT (J14) TO AN ETHERNET NETWORK. DAMAGE TO THE CONTROL BOARD WILL OCCUR.

Set IP Address

To allow the TCCV display to communicate with your network, you will need to give it an available IP address on your network. To set the IP address, follow the steps and pictures below.

First, tap on the Login button, then choose the username “User” and enter the password “user” using the on screen keyboard.

Once you are logged in, touch the “SETTINGS” button to go to the settings screen.

Figure 18

From there, tap the button that says “Change IP” to open the “IP Settings” dialog.

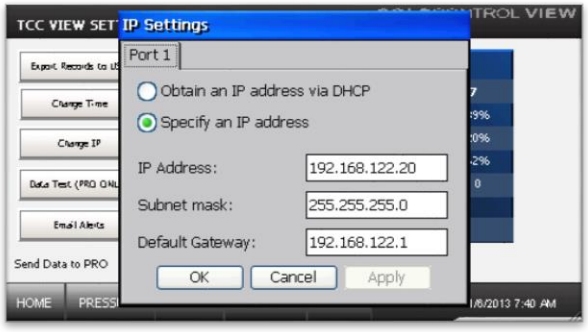


Figure 19

On this dialog, you want to tap on “Specify an IP address”, then tap on each field below and set them to your desired IP address and network settings using the onscreen keyboard. Please note you can leave this as “Obtain an IP address

via DHCP". However, this will prevent you from being able to access your screen as shown in step 4. You may need to move the keyboard (tap & drag) to enter values in the lower fields. Once you have entered the information, tap the button "Apply" to save the changes and tap the button "OK" to close the window.

Send Data to Pro

To set the TCCV to send data to Pro Refrigeration. On the bottom left of the settings screen, there are two buttons labeled "ON" and "OFF" next to "Send Data to PRO". Tap the button that says "ON" to turn this feature on.

Figure 20

Set Up Email Alerts

Finally, set up your email alert addresses on the TCCV. First, tap the button labeled "Email Alerts" to open a small dialog.

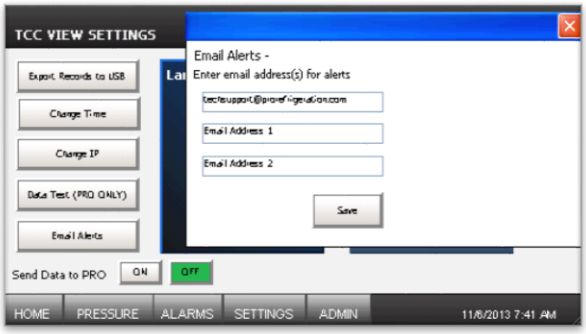


Figure 21

In this window, you will see three boxes filled with "techsupport@prorefrigeration.com", "Email address 1", and "Email address 2". Enter the desired email addresses in the boxes with "Email address 1" and "Email address 2" using the onscreen keyboard. You may need to move the keyboard (tap & drag) to enter values in the lower fields. Once you've entered your desired email addresses, tap the button "Save" to save the information. Finally, tap "X" to close the window.

Redirect Ports to TCCV

The TCCV has an embedded webserver to display system status. To allow remote connections to access to your TCCV from outside your network, redirect the following UDP & TCP ports from your router to the address you just configured on your TCCV display.

TCP: 4001

UDP: 4001

Accessing Your TCCV

You should now be able to access your TCCV from any computer using your external IP address and port 4001 in a web browser as shown below.

http://YOUR_EXTERNAL_IP:4001

A login page will display asking for a username and password. Login with username “User” and password “user”.

3 TCCV OVERVIEW

This section contains a summary of each screen within the TCCV display. Details will be given on each setting to give a better understanding of how it can be effectively used in your specific deployment.

3-1 Home Screen

The home screen has basic information related to the chiller. From left to right: lead compressor (indicated by the L# in the top left corner), glycol reservoir temperature (temp probe plugged into J5B), system set point, and cooling demand.

Figure 22

Login -
To login, tap the "Login" button. When the dialog appears, select the user you wish to login as under the User dropdown and enter the corresponding password. The default users and passwords are as follows:

User	Password	Access
Read	read	Read only access to all screens excluding Admin
User	user	Excludes access to Admin screen
Admin	admin	All screens

Changing Set Point -
To change the system set point, tap the green SP circle. A numerical pad will display; enter the desired set point temperature and hit the return key. This will change the set point for all circuits on the system.

Cooling Demand -
The cooling demand gauge indicates the system's total cooling demand. The scale will depend on the number of compressors on a system (ex: 1 compressor = 0 – 100, 2 compressors = 0 – 200, 3 compressors = 0 – 300 and 4 compressors = 0 – 400). The number the gauge is pointing to indicates the number of compressors currently running. On a four-compressor system if the gauge is pointing to 300, then three of the four compressors are currently running.

Figure 23

3-2 Pressure Screen

To access the pressure screen, tap the "PRESSURE" button on the bottom navigation bar. The pressure screen gives compressor specific pressure and superheat information. From left to right and top to bottom: selected compressor, mode, suction pressure, evaporator superheat and discharge pressure.

Figure 24

Compressor Selection-
To change the selected compressor, tap the dropdown in the top left corner and select the compressor you would like to view.

Modes-
The mode box will display the TCC mode of the selected compressor. The following is a list of modes that can be displayed and there meaning. These mode's titles are the user-friendly version. The exact mode of the selected compressor can be found on the Detail screen.

Mode	Description
No Demand	The system is at or below its set point
Chill Mode	The system is in cooling mode
Please Wait	The system is in a safe guard mode to prevent the compressor from shutting down and restarting excessively
Alarm	A system alarm has occurred and can be viewed on the Alarms screen

Detail Button-
The "Detail" button will take you to the Details screen. The Details screen has more compressor specific read-only data.

Detail Screen

To access the Detail screen, tap the "Detail" button in the center of the Pressure screen. The Details screen gives the user access to read-only operational values. The values indicated on this screen are specific to the compressor selected in the dropdown on the top left of the screen.

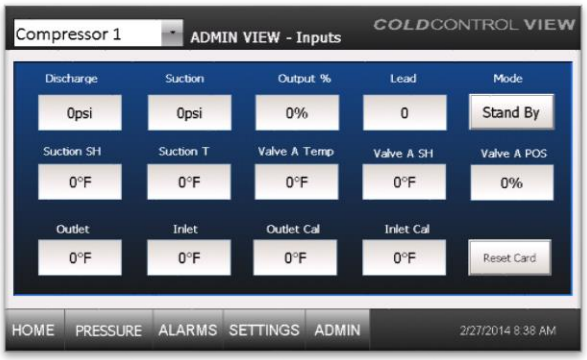


Figure 25

Reset Card-
When the "Reset Card" button is pressed the selected compressors TCC card will be reset. This can be useful when the card is in a non-auto resetting alarm. Once reset the card will check state again, if no alarms are active normal operation will be resumed.

3-3 Alarms Screen

To access the pressure screen, tap the "ALARMS" button on the bottom navigation bar. The Alarms screen gives the user access to the alarm manager, which contains a historical list of all alarms.

Figure 26

Siren Alarm Indicator-
When an alarm occurs you will notice a siren in the top left corner of the screen. A red siren indicates that the alarm is currently active and corrective actions should be taken to clear the alarm. A green siren indicates that an alarm has previously occurred but is not currently active. The green siren will go away when the alarm is acknowledged in the alarm manager.

Acknowledging Alarms-
Alarms that are not currently active can be acknowledged within the alarm manager by tapping the alarm and then pressing the "Ack Selected" button.

Alarms-
See Trouble Shooting Guide for a detailed list of Alarms.

3-4 Settings Screen

To access the Settings screen, tap the "SETTINGS" button on the bottom navigation bar. The Settings screen gives the user the ability to see system resource usage and adjust system settings.

Figure 27

Export Records to USB-
When the "Export Records to USB" button is pressed operational logs will be downloaded to the installed USB drive. Please note that if the USB drive installed at the factory is still present this may not be necessary. By default the system will download daily records to a USB drive and has the capacity to hold up to 5 years of data.

Change Time-
When the "Change Time" button is pressed a Set Date/Time dialog will appear. Adjust to the current time and date. When finished making adjustments press the "OK" button.

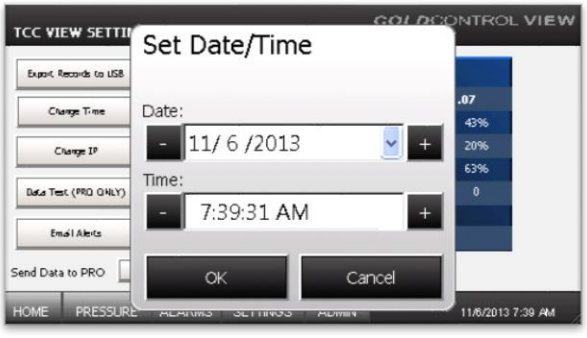


Figure 28

Change IP-
See Set Up guide

Data Test (PRO ONLY)-

The "Data Test (PRO ONLY)" button should only be used by PRO engineers for troubleshooting purposes. This button will display no data on the screen but will make a test entry into the server database for PRO staff to confirm that communication is occurring between the screen and database server.

Email Alerts-

See Set Up guide

Send Data to PRO-
If the screen is connected to a network that has internet access this should be set to ON. This option will allow status updates to be sent to PRO's database servers. This is also what allows emails to be sent from PRO's servers to your previously specified email alert addresses. Please note that if your screen is not active on a network with an internet connection this should be set to OFF. Errors can occur after failing numerous times to connect to PRO's servers when no internet connection is present.

3-5 Admin Screen

To access the Admin screen, tap the "ADMIN" button on the bottom navigation bar. The Admin screen gives admin users access to modify system parameters. The values indicated on this screen are specific to the compressor selected in the dropdown on the top left of the screen.

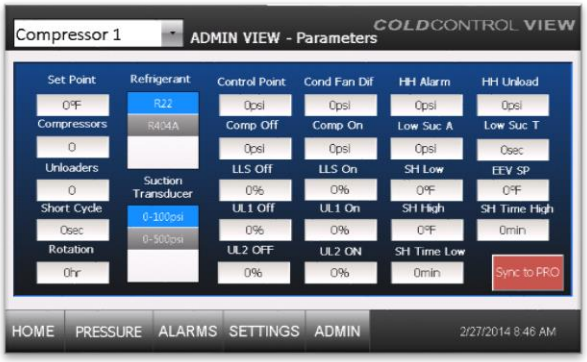


Figure 29

Sync to PRO-
When pressed the "Sync to PRO" button will sync the screens unique address, chiller serial number and site name with PRO's servers. This is used to identify the screen in future communications with PRO's servers. PLEASE NOTE THIS IS SET AT THE FATORY AND SHOULD NOT BE SYNCED IN THE FIELD UNLESS DIRECTED BY PRO PERSONNEL.

Figure 30

4 TCC OPERATION

4-1 Cooling Demand

The Cooling Demand gauge indicates the system's total cooling demand. The scale will depend on the number of compressors on a system (ex: 1 compressor = 0 – 100, 2 compressors = 0 – 200, 3 compressors = 0 – 300 and 4 compressors = 0 – 400).

Figure 31

The four operational modes are as follows.

Mode	Description
No Demand	The system is at or below its set point
Chill Mode	The system is in cooling mode
Please Wait	The system is in a safe guard mode to prevent the compressor from shutting down and restarting excessively
Alarm	A system alarm has occurred and can be viewed on the Alarms screen

The system must be in "Chill Mode" for the compressor to turn on.

4-2 Compressor

The compressor is controlled through the Comp Off and Comp On suction pressure set point located in the Admin screen. When the suction pressure rises above Comp On setting, the compressor will turn on. When the suction pressure falls below the Comp Off, the compressor will shut down.

4-3 Unloader

The unloaders are controlled by the "Cooling Demand". The unloader will energize (which unloads the compressor) when the Cooling Demand falls below the UL Off set point. As the Cooling Demand increases, the unloader will de-energize at the UL1 On set point.

4-4 Condenser

For air cooled systems with fan cycling controls, the TCC uses a step control to maintain the set point "Control Point" located in the Admin screen.

The "Cond Fan Dif" value controls the steps for additional fans as follows.

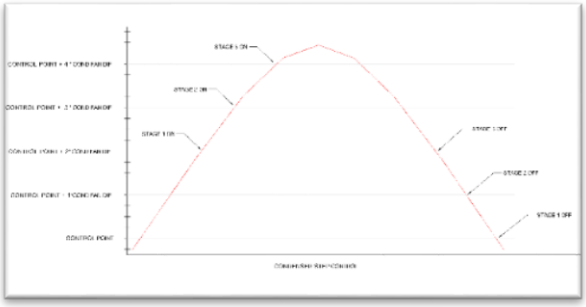


Figure 32

Note that fan 3 is not used on all systems.

For systems equipped with a VFD, the TCC supplies a 0-10VDC signal to maintain the "Control Point" value.

4-5 Liquid Solenoid Valves

The liquid line solenoid valves are controlled via Cooling Demand and the LLS Off and LLS On values. When the Cooling Demand goes above the LLS On value, the solenoid valve will open. When the Cooling Demand goes below the LLS Off value, the valve will close.

Figure 33

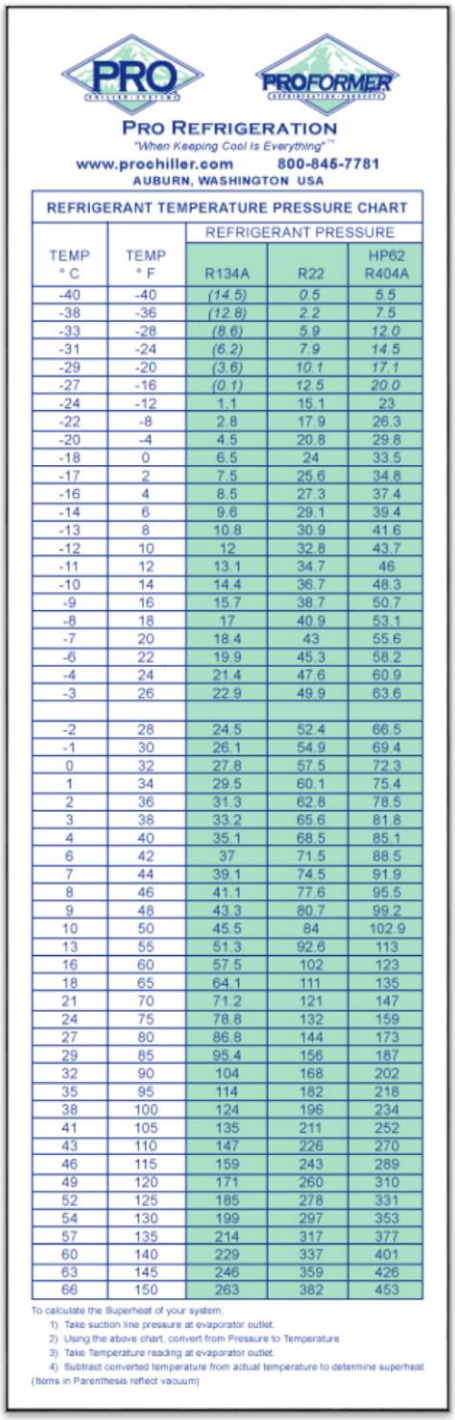
4-6 Pumps

Circulation pumps are turned on and off with the compressor. If the circulation pumps are off for a period of time, they will turn on for a short period (stir cycle).

The process pump is not controlled by the TCC.

4-7 Electronic Expansion Valves (EEV)

Each TCC control board can control two Electronic expansion valves. These valves open and close to control the superheat. Superheat is determined by the suction temperature probe (J7A and J7B) and the saturated suction temperature (determined by the suction pressure transducer). Superheat set point is located in the ADMIN screen.



PRO REFRIGERATION

"When Keeping Cool Is Everything"™

www.prochiller.com 800-845-7781

AUBURN, WASHINGTON USA

REFRIGERANT TEMPERATURE PRESSURE CHART

TEMP °C	TEMP °F	REFRIGERANT PRESSURE R134A	R22	HP62 R404A
-40	-40	(14.5)	0.5	5.5
-38	-36	(12.8)	2.2	7.5
-33	-28	(8.6)	5.9	12.0
-31	-24	(6.2)	7.9	14.5
-29	-20	(3.6)	10.1	17.1
-27	-16	(0.1)	12.5	20.0
-24	-12	1.1	15.1	23
-22	-8	2.8	17.9	26.3
-20	-4	4.5	20.8	29.8
-18	0	6.5	24	33.5
-17	2	7.5	25.6	34.8
-16	4	8.5	27.3	37.4
-14	6	9.6	29.1	39.4
-13	8	10.8	30.9	41.6
-12	10	12	32.8	43.7
-11	12	13.1	34.7	46
-10	14	14.4	36.7	48.3
-9	16	15.7	38.7	50.7
-8	18	17	40.9	53.1
-7	20	18.4	43	55.6
-6	22	19.9	45.3	58.2
-4	24	21.4	47.6	60.9
-3	26	22.9	49.9	63.6
-2	28	24.5	52.4	66.5
-1	30	26.1	54.9	69.4
0	32	27.8	57.5	72.3
1	34	29.5	60.1	75.4
2	36	31.3	62.8	78.5
3	38	33.2	65.6	81.8
4	40	35.1	68.5	85.1
6	42	37	71.5	88.5
7	44	39.1	74.5	91.9
8	46	41.1	77.6	95.5
9	48	43.3	80.7	99.2
10	50	45.5	84	102.9
13	55	51.3	92.6	113
16	60	57.5	102	123
18	65	64.1	111	135
21	70	71.2	121	147
24	75	78.8	132	159
27	80	86.8	144	173
29	85	95.4	156	187
32	90	104	168	202
35	95	114	182	218
38	100	124	196	234
41	105	135	211	252
43	110	147	226	270
46	115	159	243	289
49	120	171	260	310
52	125	185	278	331
54	130	199	297	353
57	135	214	317	377
60	140	229	337	401
63	145	246	359	426
66	150	263	382	453

To calculate the Superheat of your system,
1) Take suction line pressure at evaporator outlet.
2) Using the above chart, convert from Pressure to Temperature.
3) Take Temperature reading at evaporator outlet.
4) Subtract converted temperature from actual temperature to determine superheat.
(Items in Parenthesis reflect vacuum)

Figure 34

5 Troubleshooting Guide

If a problem with the chiller occurs, service should be performed by a qualified service mechanic. The following is to be used as a reference guide for diagnosing possible issues with the control system and associated components.

TCC Operation & Indication

The operation of the TCC card is displayed in the status lights and indications of the status lights located on the TCC Card.

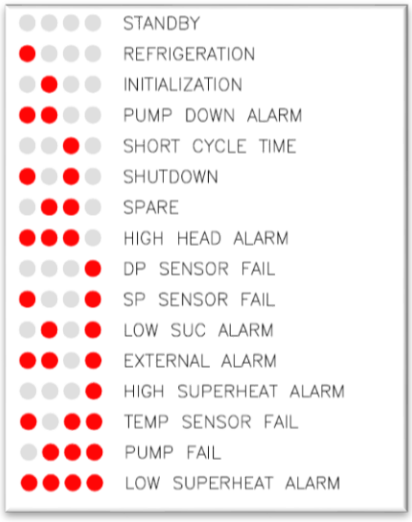


Figure 35

5-2 Replacement Parts

Customer Support Hours:

Monday-Friday

7am-5pm (Pacific Standard Time)

Telephone: (253) 735-9466

Fax: (253) 735-2631

Email: service@prorefrigeration.com

Item	Part #
TCC board	TCCREVB
4” TCCV	T4A
7” TCCV	T7A
Power supply	MDP60-24A-1C
Brass temp probe	A4175-21
Coated temp probe	IPC8SENSOR
0-500 Pressure transducer	P499VCP-105C
0-100 Pressure transducer	P499VCP-101C
Current Switch	R1BXKTF

Alarm	Description	Correction
High Head A	High Head Alarm is activated when the discharge pressure exceeds a pre-set value. This is typically set from 25 – 50 psi, less than the mechanical high-pressure switch.	Check condenser fan operation Check for clogged condenser coil
DP Sensor A	DP Sensor Alarm mode is a failure of the discharge pressure sensor. This is a critical sensor, and will shut down all outputs immediately if a failure is detected.	Inspect connection to TCC board Check for broken wire, or sensor plug Check for broken transducer
SP Sensor A	SP Sensor Fail mode is a failure of the suction pressure sensor. This is a critical sensor, and will shut down all outputs immediately if a failure is detected.	Inspect connection to TCC board Check for broken wire, or sensor plug Check for broken transducer
Low Suc A	Low Suction Alarm mode is activated only in the Refrigeration mode. It has both a psi value for the suction pressure as well as an alarm timer associated with it. If the timer is set to zero, the alarm will be disabled. The low suction alarm point should be set above the low operator shut off point.	Check refrigerant level Check glycol concentration Check for frozen evaporator
External A	External Alarm mode can be activated by low oil pressure, high head pressure, phase loss or compressor protection fail. After 5 minutes, the LED's will come on steady and lock out in an alarm condition. If the external alarm is reset before the 5 minutes is up, then normal operation will be resumed.	Check status of oil pressure switch Check status of discharge safety switch Check status of compressor protection
Superheat A	The Super Heat window has a high and low setting, and a time delay. The TCC calculates the compressor Suction Super Heat continuously, and compares this setting to the alarm parameters. The recommended suction super heat is between 20 to 40 degrees F. The Super Heat window is active anytime the compressor is running. Setting the time delay to zero will disable this alarm.	Check connection of TXV bulb Review operating conditions Check for frozen evaporator
Temp Sens A	The Temperature Sensor Failure Alarm is activated when a controlling temperature sensor is found out of range.	Inspect connection to TCC board Check for broken wire, or sensor plug Check for broken sensor

Glossery of Terms

The following is a glossery of terms with definitions as they apply to Pro Refrigeration chillers and the TCC controller.

Circulation Pump: Used to pump glycol from the glycol resevoir to the evaporator(s).

Compressor: Elevates pressure of refrigerant.

Condenser: Converts high pressure gas to high pressure liquid. For air cooled applications, this heat exchanger transfers heat from the refrigerant to the air.

Contactor: Electrically actuated switch. Similar to a relay.

Cooling Demand: Value calculated through a PID loop to assign demand requirements to the refrigeration circuits. CSR: Current Sensing Relay – Device that closes an internal contact when current is present in wire. Also known as "current donut," this device is used to prove circulation pump operation

Discharge Pressure: Pressure at the outlet of the compressor. Sometimes refered to as "head pressure."

Discharge Temp: Generally refers to the temperature at which refrigerant is changing phase (condensing) for the discharge pressure. (high side of the refrigeration system).

EEV: Electronic Expansion Valve – Motor driven valve that is used to control the super heat by metering the liquid feed to the evaporator. This valve replaces Thermostatic Expansion valves (TXV).

Embedded Web Server: Computer program that uses HTTP protocol.

Ehternet Switch: Multi-port device that can connect multiple computer devices to a network or router.

Evaporator: Converts low pressure liquid to low pressure gas. In chiller applications, this is the heat exchanger that transfers heat from the glycol to the refrigerant.

IP Address: Numerical label assigned to each device participating in a computer network

Glycol: Secondary heat transfer fluid.

LAN: Local Area Network – building network

ModBus: Communication protocol used to link multiple TCC cards together

Thermistor: "Thermal resistor" - type of temperature sensor that changes resistance through a range of temperatures.

Transducer: Converts a mechanical pressure to an electronic signal. This sensor allows the TCC to "read" pressure.

Pump Down: Condition when there is no liquid refrigerant present in the evaporator and the compressor is off due to low suction pressure.

Process Pump: Used to pump glycol from the chilled glycol resevoir to facility

Router: Connects networks together and/or to the internet.

RS485: Network protocol standard used for communication between TCC cards and to the TCCV.

Saturated Suction Temperature: - Suction Temp - Refers to the temperature at which refrigerant is changing phase (evaporating) for the suction pressure (low side of the refrigeration system).

Solenoid valve (LLS): Electrically operated valve that is fully open or fully closed. Typically, these

valves are used on the liquid line just prior to the expansion valve. Power to open.

Suction Pressure: Pressure at the inlet of the compressor.

Super heat: Difference between the suction gas temperature after the evaporator and the saturated suction temperature.

TCP: Transmission Control Protocol – network protocol used to connect to the world wide web.

Unloader: Device that reduces capacity of compressor.

USB: Universal Serial Bus – standard connector and communication protocol. The TCC uses a USB port to connect to a memory stick for program uploads as well as log data downloads.

VFD: Variable Frequency Drive – Also known as an Inverter – Electronically adjusts the AC power to a specified condition for the output. Usually used as a speed control for fan or pump motors.

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