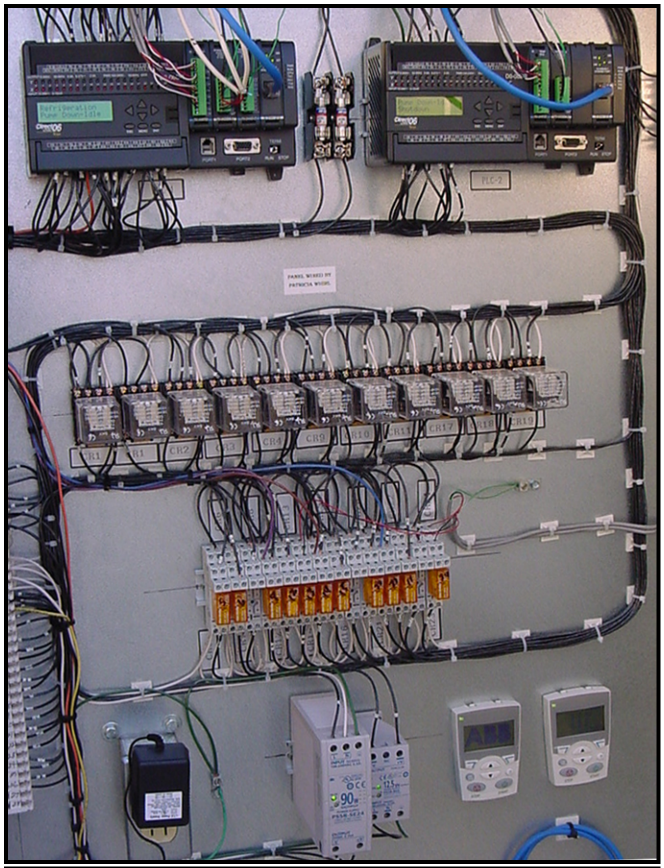
JMC VENTILATION REFRIGERATION, LLC



Refrigeration Controller Operator's Manual (HRC)

PO Box 6183
Kennewick, WA 99336

www.jmcvr.com
1-509-586-9893

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Overview of the HRC Capabilities

The HRC Refrigeration controller, shown below, was developed specifically for controlling semi-hermitic refrigeration circuits. During the development the emphasis was placed on circuit safety, ruggedness, and energy savings strategies. The HRC has capabilities far beyond the typical refrigeration controls including, superheat alarming, VFD condensing fan control, Ethernet connectivity and real-time remote monitoring software. This manual will cover most of the available features included with the HRC refrigeration controller, and has been designed to aid technicians in understanding and troubleshooting the HRC refrigeration controller

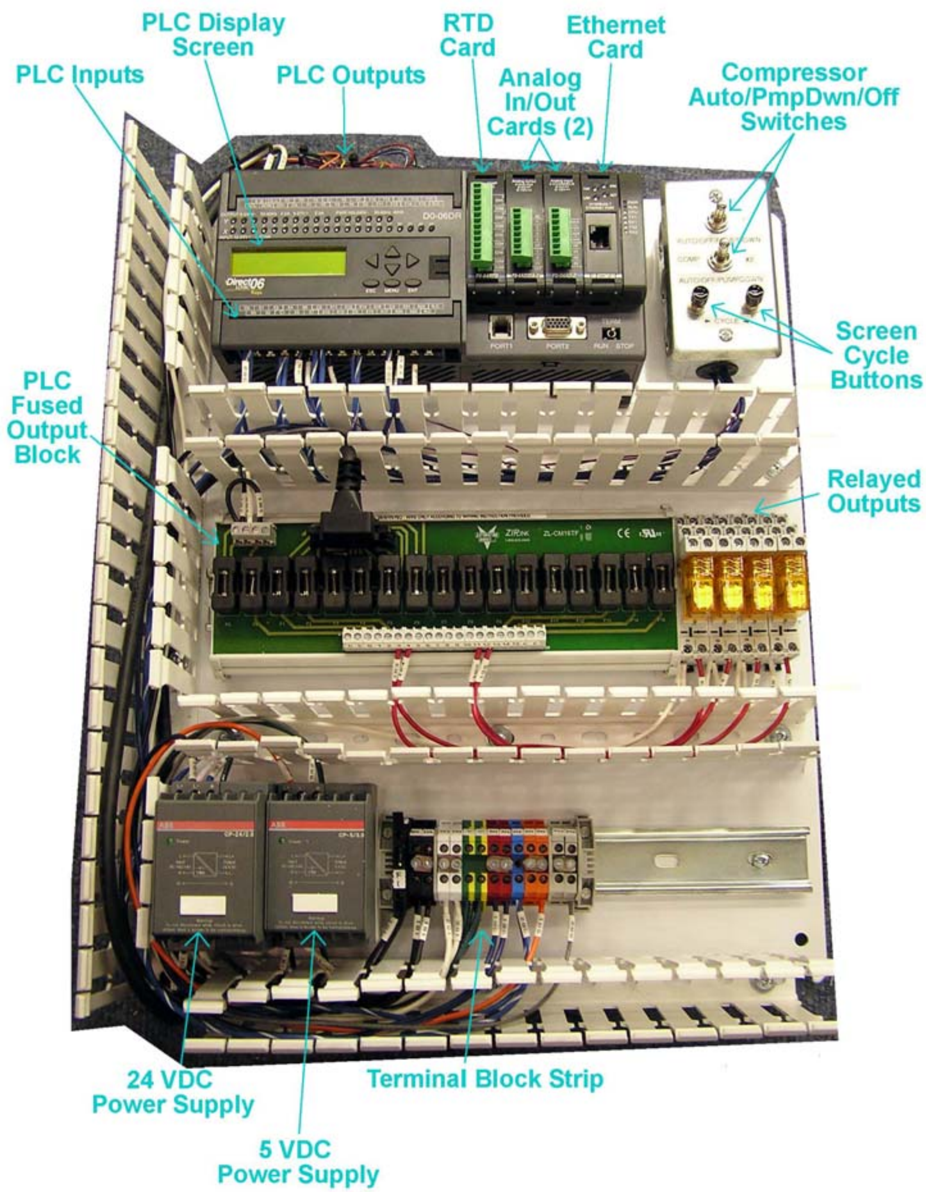


Figure 1: Overview of the HRC

Installation and Hardware

Hardware capabilities

The HRC refrigeration controller has several different inputs and outputs that serve to keep the refrigeration unit operating safely and correctly. The different IO points are summarized on table 1, and then discussed individually. Each HRC is capable of controlling two circuits.

Quick Reference

Refrigeration Control Panel (REF) Quick Reference

All inputs (X) = 24 VDC	
X0	C1 Crankcase Heater
X1	C1 Phase monitor
X2	C1 External
X3	C1 Oil Pressure
X4	C1 High Head
X5	C1 Evap Prove
X6	C1 Auto
X7	C1 Pump Down
X10	C1 Test
X11	C1 Motor Temp
X12	C2 Crankcase Heater
X13	C2 Phase monitor
X14	C2 External
X15	C2 Oil Pressure
X16	C2 High Head
X17	C2 Evap Prove
X20	C2 Auto
X21	C2 Pump Down
X22	C2 Test
X23	C2 Motor Temp

Slot 1: Temperature Card (RTD)	
1 Ch 1	C1 Suction Temperature
1 Ch 2	C1 Discharge Temp
1 Ch 3	C2 Suction Temperature
1 Ch 4	C2 Discharge Temp

Slot 3: Analog In Card (0-5V)	
3 Ch 1	C2 Suction Pressure
3 Ch 2	C2 Discharge Pressure
3 Ch 3	Spare
3 Ch 4	C2 Oil Pressure

All outputs (Y) = 120VAC	
Y0	C1 Condenser Fan #1
Y1	C1 Condenser Fan #2 & #4
Y2	C1 Condenser Fan #3 & #5
Y3	C1 LLS/Pump Down
Y4	C1 Compressor Contactor
Y5	Master Only - System Failure
Y6	C1 Unloader #1
Y7	C1 Reversing Value/Unloader #2
Y10	C2 Condenser Fan #1
Y11	C2 Condenser Fan #2 & #4
Y12	C2 Condenser Fan #3 & #5
Y13	C2 LLS/Pump Down
Y14	C2 Compressor Contactor
Y15	Spare
Y16	C2 Unloader #1
Y17	C2 Reversing Value/Unloader #2

Slot 2: Analog In/Out Card (0-5V)	
2 In 1	C1 Suction Pressure
2 In 2	C1 Discharge Pressure
2 In 3	Refrigeration Staging Signal
2 In 4	C1 Oil Pressure
2 Out 1	C1 Condensing Fan VFD
2 Out 2	C2 Condensing Fan VFD

Slot 4: H0-ECOM Communications

ENGR	JH	
DFTG APPD	JH	3/03/05
CHECKED	JH	3/03/05
DRAWN	JEREMY NELSON	3/03/05
ORIGIN		3/03/05
SCALE		NONE
PROJECT NUMBER:		1002
AUTOCAD PLOT DATE:		3/03/05
AUTOCAD FILE NUMBER:	1002REFQR05.DWG	
PROJECT:	REFRIGERATION CONTROLLER PANEL	

JMC VENTILATION REFRIGERATION, LLC

TITLE: QUICK REFERENCE FOR REF PANEL FIELD WIRING DIAGRAM

CUSTOMER: N/A

SIZE	DWG NO.	SHT	OF	REV
A	1002REFQR05	1	1	A

Figure 2: HRC Quick Reference Guide

HRC Overview:

Figure 2 is diagram of the basic HRC controller. Most of the information on this diagram is self explanatory. The option slots are filled with the cards necessary to make the HRC work and are as follows:

Slot 1: RTD Card

Slot 2: Analog In/Out

Slot 3: Analog In

Slot 4: Ethernet Module

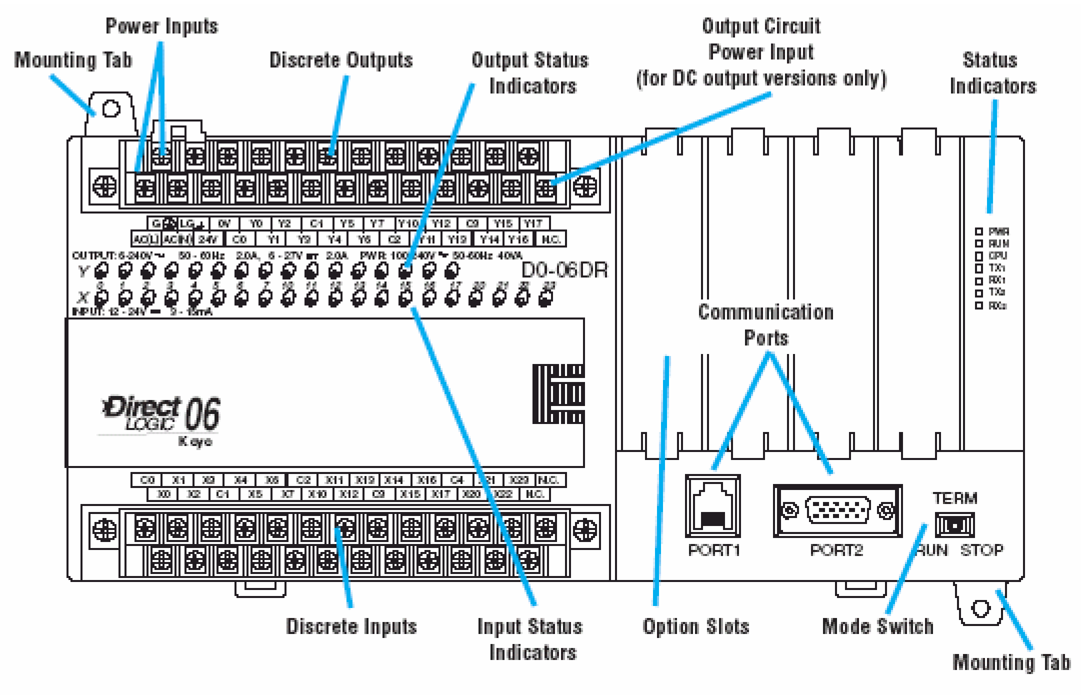


Figure 3: HRC Overview

The status indicators on the right of the controller give an indication of the current mode of the HRC. If the run light is not on the program will not execute. When troubleshooting an HRC system checking this light should always be the first step. In order to bring the controller back into the run mode use the mode switch. First switch to run then term. The controller must be in the term position to execute the program correctly.

The input and output status lights give an indication of the current operation status of the HRC. If the light of an alarm input is lit the alarm circuit is good. Likewise if an output light is on the equipment associated with that output should be running.

The input and output terminal strips are removable with a Phillips screw driver. This allows for removal of the controller without disturbing the field wiring.

Relay Outputs:

The HRC controller comes equipped with 16 AC relay outputs. Each circuit is assigned seven of these outputs; one is the failure output to alert an external controller of an alarm situation, and currently there is one spare. The quick reference show what each output does in general; specific information on how each output acts is discussed separately in this manual.

AC Power Supply Specifications	***Voltage Range***	100-240VAC (40VA)	
DC Input Specifications	***Number of Input Pts.***	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	***Number of Output Points***	16	
	Number of Commons	4 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC,30VDC	
	Maximum Current	2A/point 6A/common	
	Maximum Leakage Current	0.1mA @ 246VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

Digital Inputs:

The HRC includes 20 Digital Inputs, rated to sense 24 **DC**. Most of these are used to relay alarm information to the controller. Most typical external alarm circuits can be wired directly to the controller which allows the HRC to make the appropriate decision on how to react to an alarm. Some inputs are for switches and buttons. All alarm circuits are wired to be continuously on, including the evaporator fan proving circuit. The Evaporator proving circuit can be jumped if other controllers are monitoring the evaporator fans.

Temperatures

Each controller has the capability of measuring four temperatures. These are nearly always the suction and discharge temperatures for the two circuits supported circuits. The TABLE shows the specifications of the RTD inputs. The module automatically re-calibrates every five seconds to remove any offset and gain errors. The RTD module requires no user calibration. However, if your process requires calibration, it is possible to correct the RTD using the remote software. You can subtract or add a constant to the actual reading for that particular RTD. Your company may have guidelines for wiring and cable installation. If so, you should check those before you begin the installation. Here are some general things to consider when wiring RTD's:

Use the shortest wiring route whenever possible.

Use shielded wiring and ground the shield at the transmitter source. Do not ground the shield at both the module and the source.

Unused channels require shorting wires (jumpers) installed from terminals CH+ to CH– to COM.

Do not run the signal wiring next to large motors, high current switches, or transformers. This may cause noise problems.

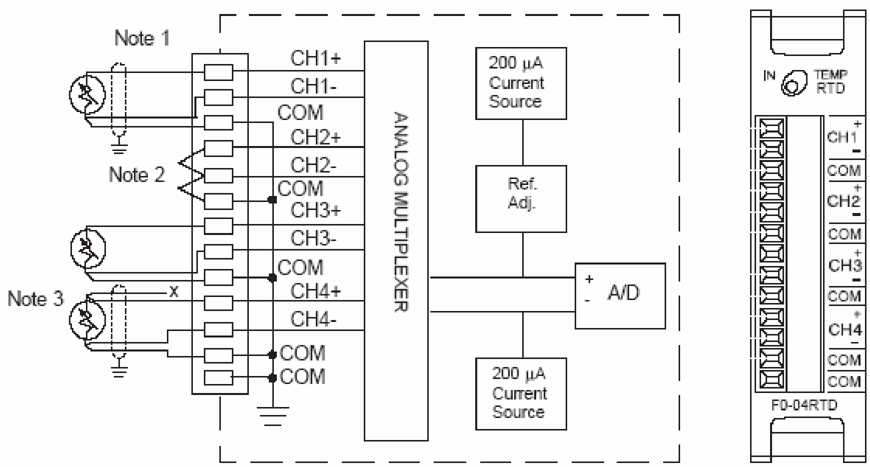
Route the wiring through an approved cable housing to minimize the risk of accidental damage.

Check local and national codes to choose the correct method for your application.

Input Specifications	
Number of Channels	4
Input Ranges	Pt100: -200.0 °C to 850.0 °C (-328 °F to 1562 °F) PT1000: -200.0 °C to 595.0 °C (-328 °F to 1103 °F) jPt100: -38.0 °C to 450.0 °C (-36 °F to 842 °F) 10Ω Cu: -200.0 °C to 260.0 °C (-328 °F to 500 °F) 25Ω Cu: -200.0 °C to 260.0 °C (-328 °F to 500 °F) 120Ω Ni: -80.0 °C to 260.0 °C (-112 °F to 500 °F)
Resolution	16 bit (1 in 65535)
Display Resolution	±0.1 °C, ±0.1 °F (±3276.7)
Absolute Maximum Ratings	Fault Protected Inputs to ±50VDC
Converter Type	Charge Balancing, 24 bit
Sampling Rate	140ms per channel
Linearity Error (End to End)	±0.05 °C maximum, ±0.01 °C typical
PLC Update Rate	4 channels/scan
Temperature Drift	15 ppm / °C maximum
Maximum Inaccuracy	±1 °C
RTD Excitation Current	200µA
Common Mode Range	0-5VDC
Notch Filter (Common Mode Rejection)	>50 db notches at 50/60Hz
Digital Input Points Required	None; uses special V-memory locations based on slot
Power Budget Requirements	70 mA @ 5VDC (supplied by base)
Operating Temperature	0 to 60° C (32 to 140° F)
Storage Temperature	-20 to 70° C (-4 to 158° F)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304
Replacement Terminal Block	D0-ACC-4
Wire Size Range & Connector Screw Torque	28 - 16 AWG; 0.4Nm; DN-SS1 Screwdriver Recommended

Figure 4: RTD Input Specifications

The RTD card and analog card have removable terminal blocks. To remove the terminal block, disconnect power to the PLC and the field devices. Pull the terminal block firmly until the connector separates from the module. You can remove the RTD module from the PLC by folding out the retaining tabs at the top and bottom of the module. As the retaining tabs pivot upward and outward, the module's connector is lifted out of the PLC socket. Once the connector is free, you can lift the module out of its slot. Use the following diagram to connect the field wiring.



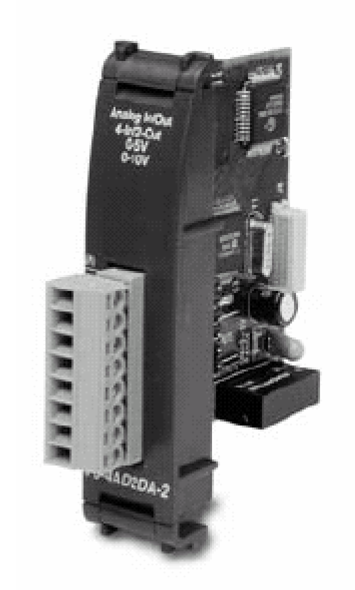
Notes:

1. The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.
2. Unused channels require shorting wires (jumpers) installed from terminals CH+ to CH– to COM to prevent possible noise from influencing active channels. This should be done even if the unused channel is not enabled in the V-memory configuration.
3. If a RTD sensor has four wires, the plus sense wire should be left unconnected as shown.

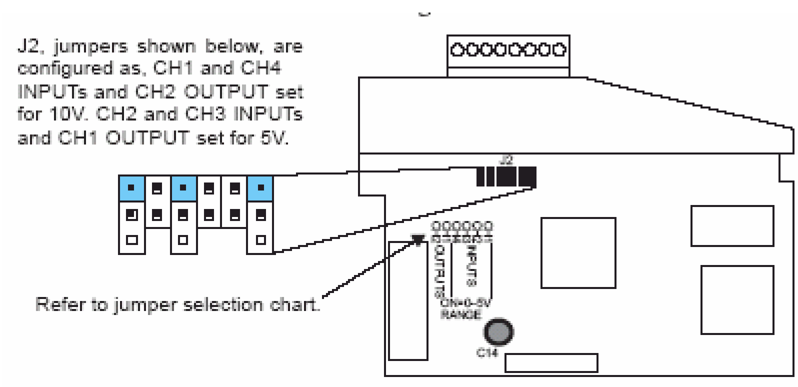
Figure 5: Typical RTD Wiring

Use shielded RTD's whenever possible to minimize noise on the input signal. Ground the shield wire at one end only, preferably at the RTD source. Lead Configuration for RTD Sensors the suggested three-lead configuration shown below provides one lead to the CH+ terminal, one lead to the CH– terminal, and one lead to the common terminal. Compensation circuitry nulls out the lead length for accurate temperature measurements. Precision analog measurement with no long term temperature drift is assured by a chopper stabilized programmable gain amplifier, ratio metric referencing, and automatic offset and gain calibration.

Analog Inputs



The HRC has the capability of measuring 8 analog inputs. These include suction, discharge and oil pressures for each compressor, a staging signal and one spare. The included table gives the general specification of the analog inputs. The position of the J2 jumpers determines the input and output signal levels. You can choose between 0–5VDC and 0–10VDC. The module ships with the jumpers installed connecting the pins. In this position, the input and output signal level is 0–5VDC. To select 0–10VDC signals, use the jumper selection chart located on the module. One or more channels can be selected for 0–10 VDC input and output signal level by removing the jumper from the connecting pin of the appropriate channel. This will allow you to have one channel selected for a 0–5 VDC signal and another channel selected for 0–10 VDC signal.



Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to 5 VDC or 0 to 10 VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0 mS to 95% of full step change
Crosstalk	-80 dB, 1/2 count maximum*
Active Low-pass Filtering	-3 dB at 300Hz (-12 dB per octave)
Input Impedance	Greater than 20KΩ
Absolute Maximum Ratings	± 15V
Linearity Error (End to End)	± 2 counts maximum*
Input Stability	± 1 count *
Gain Error	± 6 counts maximum *
Offset Error	± 2 counts maximum*
Maximum Inaccuracy	±0.3% @ 25°C (77°F) ±0.6% 0 to 60°C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical

Figure 6: Analog Specifications

The pressures read by the HRC are scaled to the range of the transducer used. Suction pressure and Oil pressure are 0-300 PSI transducers (0-5V ratio metric) and the Discharge pressure is 0-500 PSI.

Analog Output

The HRC refrigeration controller also includes up to 4 Analog outputs. Figure 5 gives the general specifications for the analog outputs. Typically two analog outputs are used to control condensing fan VFD's.

Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to 5 VDC or 0 to 10 VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Conversion Settling Time	50µS for full scale change
Crosstalk	-80 db, 1/2 count maximum*
Peak Output Voltage	± 15 VDC (power supply limited)
Offset Error	0.1% of range
Gain Error	0.4% of range
Linearity Error (end to end)	±1 count (0.075% of full scale) maximum*
Output Stability	± 2 counts*
Load Impedance	2KΩ maximum
Load Capacitance	0.01 µF maximum
Accuracy vs. Temperature	±50 ppm/°C typical
* One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).	

Figure 7: Analog output specifications

Communications

Each HRC comes equipped with three different communication ports. There are two serial ports that are generally used for programming and diagnostic work and there is an Ethernet card. Most of the discussion here will be about Ethernet communications.

Depending on the number of compressors in the system and the type of main panel the HRC may need to have a network installed. Information is shared between master and slave controllers and if a JMC Storage Control panel is the circuit, staging, defrost and proving information will be shared with the master controller. Much of the specifics of this network will be discussed later in this manual, in the software section. Figure 6 shows the general specifications of the Ethernet card.

The maximum distance per 10BaseT cable segment is 100 meters or 328 feet. Repeaters extend the distance. Each cable segment attached to a repeater can be 100 meters. Two repeaters connected together extend the total range to 300 meters. Figure 7 shows a typical Ethernet configuration.

When wiring industrial Ethernet networks shielded cable should always be used.

Module Type	Intelligent Data Communications Module
Quantity of Modules Per Base	Defined by CPU and base configuration
Diagnostics	LEDs/Network Monitoring Software (NetEdit)
Communications	10BaseT Ethernet
Data Transfer	10 Million bits per second
Extension Port	RJ45
OK Indicator	Green LED
Link Good Indicator (LINK)	Green LED
Activity Indicator (ACT)	Red LED
Error Indicator (ERR)	Red LED
Power Consumption	250 mA (Supplied by DL05/DL06 base)
Operating Temperature	32° to 140° F (0° to 60° C)
Storage Temperature	–4° to 158° F (–20° to 70° C)
Relative Humidity	30% – 95% RH (non-condensing)
Environmental Air	No corrosive gases permitted
Networking Protocols Supported	TCP/IP, IPX

Figure 8: Ethernet Card General Specifications

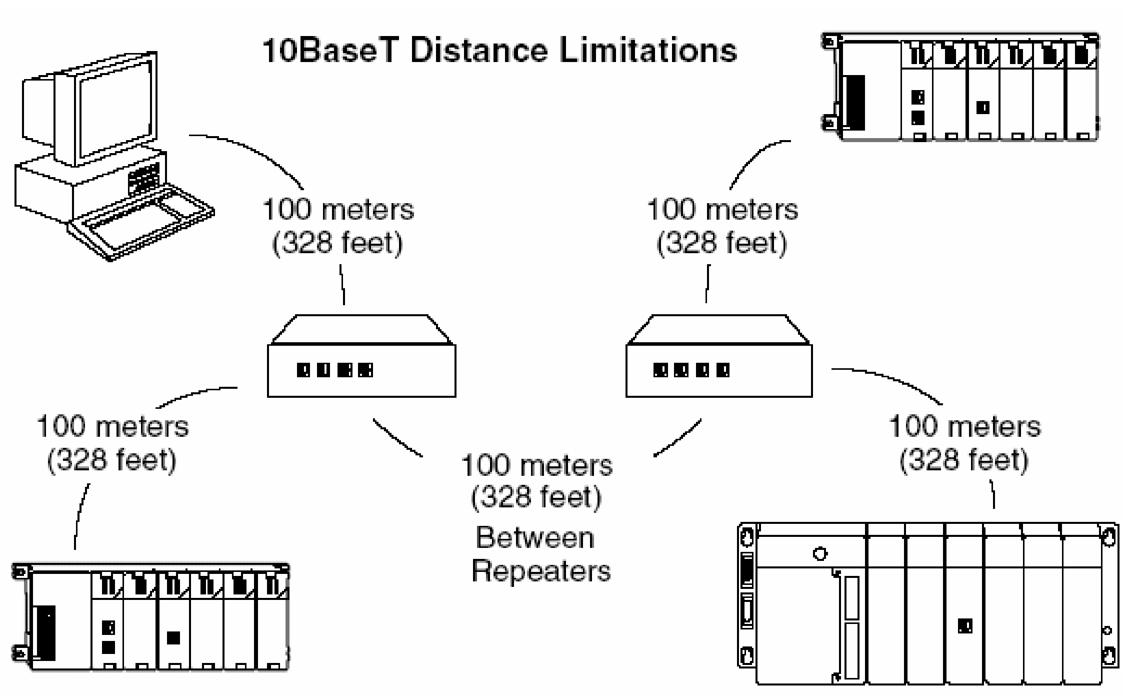


Figure 9: Maximum Ethernet Runs

The Ethernet module has four status indicators. The figure 8 below explains the status for each indicator.

The green OK LED on the H0–ECOM module is on steady after a successful power up. If the LED fails to turn on, the module failed to power up. It may not be properly installed or it may be defective.

The green LINK (link good) LED is on steady when the H0–ECOM module is correctly connected to an active device on the network and is receiving 5VDC operating voltage from the PLC power supply.

The LINK LED verifies that the proper cables are connected, and the H0–ECOM module is functioning correctly. If a mismatch with the 10BaseT or 10BaseFL connections occurs this LED will not be illuminated.

The red ACT (activity) LED flashes to indicate that the module sees data traveling on the network. If any network device is sending or receiving data, the ACT LED will be illuminated. In idle mode (no network traffic) this LED is OFF. During heavy communication loads this LED will be steady on.

If the Ethernet module's red ERROR indicator is flashing or steady on, a fatal error has occurred. The error may be in the H0–ECOM module itself, or a network problem may be causing this symptom. The ERROR indication can be caused by a faulty ground, an electrical spike or other types of electrical disturbances. Cycle the system power to clear the error.

Indicator	Status	Description
OK	ON – GREEN	Module is powered up and functional
	OFF	Module powerup failed
LINK	ON – GREEN	Properly connected to network
	OFF	Not connected to network or incorrect configuration
ACT	ON or FLASHING RED	Active network data
	OFF	Network idle
ERR	ON or FLASHING RED	A fatal error has occurred
	OFF	No error present

Figure 10: Ethernet Card Diagnostic LED's

Ethernet cabling has been standardized. Use figure 9 when crimping on Ethernet ends. The two types of cable shown have different uses. Use a straight cable when connecting a device to a router, hub, or switch. Use a crossover cable when connecting a PC directly to another Ethernet enable device such as another PC or the HRC.

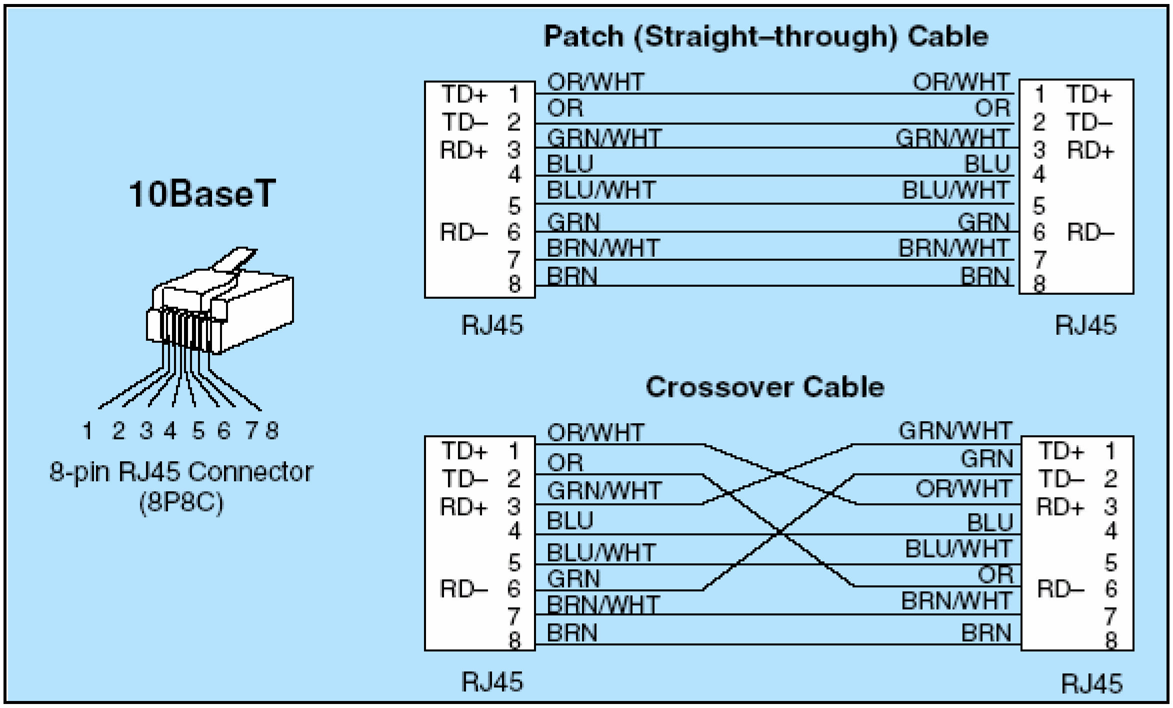


Figure 11: Ethernet Cabling Standards

Power Supplies

The HRC required two separate power supplies in order to operate. A 24VDC supply is required for the safety circuits. Standard mechanical controls generally use a dry contact for their proving circuit which the 24VDC can be routed through. In some instance a mechanical control will output a different voltage. In these cases a relay must be inserted into the safety loop as the main controller will only accept 24VDC.

Apply in other voltage than 24VDC to the input side of the HRC could destroy the input channel.

The HRC also used a 5VDC circuit. This must be a regulated power supply capable of supplying exactly 5VDC as this supply is used in the measurement of the 0-5VDC pressure transducers. Each system need to have both of these power supplies each power supply is capable of 4 circuits.

LCD Screen

The HRC refrigeration controller can be equipped with an optional LCD screen and navigation buttons. This screen is capable of two functions. The first is to alert a user to an alarm situation or inform the user of the current mode of operation. When in this mode of operation the top line of the LCD refers to circuit one and the second line refers to circuit two. The second is to display the current operating data of the system.

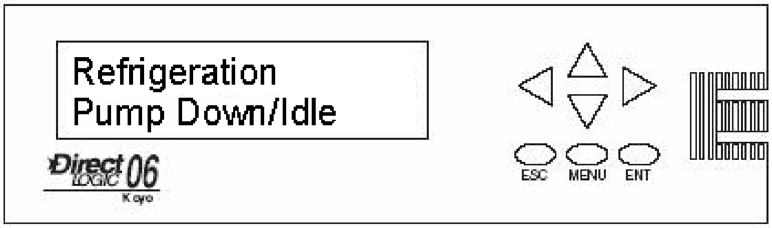


Figure 12: LCD Screen Typical

Navigation is done with two scrolling button that can be wired into inputs X10 and X22 labeled as C1 Test and C2 Test. By activating these inputs the LCD screen will change from displaying mode and alarm information and begin displaying current operating data. By pressing the two buttons the user can scroll forward and backward through the list of parameters. By holding the forward scroll button (X10) for 3 seconds the LCD will switch back to displaying mode and alarm information. If no buttons are pushed for 10 minute the controller will default back to the mode and alarm information. Below the different alarms and operating information displayed by the LCD are shown.

Modes and Alarms List	Operating Data
1. Refrigeration	1. C1 Refrigeration Call
2. Pump Down-Idle	2. C1 Suction Temp
3. Short Cycle	3. C1 Discharge Temp
4. Shutdown	4. C1 Suction Press
5. Crank Case	5. C1 Discharge Press
6. Phase Monitor	6. C1 Oil Press
7. EXT-Power	7. C1 Sat Suc Temp
8. Low Oil Pressure	8. C1 Superheat
9. High Head Pressure	9. C2 Suction Temp
10. Motor Temp	10. C2 Discharge Temp
11. SW High Head	11. C2 Suction Press
12. Low Super heat	12. C2 Discharge Press
13. SW Low Suction	13. C2 Oil Press
14. SW Low Oil	14. C2 Sat Suc Temp
15. Power Loss	15. C2 Superheat
16. Master Comm. Error	
17. Slave Comm. Error	

Figure 13: LCD Display Messages

It is important to know that alarms will be displayed from 16 to 1. For example if a controller has both a Low Super heat and is in Shutdown only the Low Super heat alarm will show on the screen.

HRC Operation and Features

The HRC has many modes of operation and alarming features. This section will cover the basic operating modes, and how they are referenced in the program. A diagram of a typical HRC controller installation is shown in figure asdfasdf. Each HRC installation is different and the controller has been designed to be flexible, due to this your installation may not look the same however the components should be the same.

Operational Modes

These sections briefly describe each of the operation modes available in the HRC refrigeration controller.

Refrigeration Mode

Refrigeration mode will enabled whenever the compressor switch in **Auto** and the staging signal is greater than turn on point for that compressor. If the compressor is short cycle, defrost, alarm mode, or the evaporator fans are not running refrigeration mode cannot be started

Refrigeration mode operates simple by opening the liquid line solenoid (LLS) when the staging signal is greater than the turn on point for the compressor. When suction pressure rises to the Suction on pressure the compressor turns on. The compressor will then stay on until the staging signal reaches the turn off point. The HRC does not turn off the LLS when the suction off pressure is achieved instead opting to allow time for the expansion valve to bring the pressure up or failing on low suction pressure. Un-loaders are also turned on and off in this stage. Because the HRC shares staging information between the compressors it is possible to turn on other compressors before loading the first. This is discussed further in the software portion of this manual.

Short Cycle

Short cycle mode occurs every time the compressor stops running. A timer prevents the compressor from running whenever the HRC is in short cycle mode. This timer is adjustable from the software.

Pump Down – Idle

There are several different ways to end up in pump down mode. Below is a list of common circumstances:

1. The compressor switch is in **pump down**.

2. The compressor switch is in **auto** and but the staging is below the turn on point.

3. The Master has a communications failure with the Storage Controller (JMC Storage controls only).

4. The Slave Controller has a communication failure with the master HRC.

5. Out of a phase monitor recovery

6. Evaporator fan failure

In pump down mode the compressor and the first unloader turn on when suction on pressure is reached and turn off when the suction off pressure is reached.

Shutdown

Shutdown mode can be reached by multiple paths. These include:

1. The switch is in shutdown

2. The soft alarm lock is on.

3. The hard alarm lock is on.

4. The phase monitor is actively tripped.

When the HRC is in a shutdown mode all outputs are disabled.

Reverse Cycle Defrost

Documentation Coming Soon

Air Defrost

Documentation Coming Soon

Alarms

There are many different system monitors included in the HRC refrigeration controller. All of the alarm circuits have some similarities that make it easy to setup and troubleshoot. First, all alarms can be reset by switching the circuit switch to shutdown. When the switch is put back to the auto or pump down position the circuit will attempt to run if the staging signal allows. The HRC will not reset external alarms (i.e. Oil or head pressure controls); these must be reset at the control and in the HRC. External alarms cannot be reset through software but calculated alarms such as superheat are software reset able. All alarms have a time delay circuit. If the time delay is entered as zero the safety circuit is disabled. The minimum delay is 10 ms which is fast enough to prevent damage to a circuit but leaves a convenient way to turn alarms on or off and to allow a delay for installations that have electrical issues. Below is a list and descriptions of current alarms.

Crankcase Heater

The crankcase heater alarm uses a current switch to monitor correct operation of the crank case heater. In the event of a failure the compressor will soft lock. Recommended Delay is 1 second. There are currently other uses of this alarm currently under development.

Phase Monitor

The phase monitor is an external alarm that monitors proper phasing and voltage supplied to the unit. In the event of 'bad' power the phase monitor will prevent the compressor from running. Recommended delay is 10ms. This circuit will reset itself if the proper power conditions are met and the phase monitor is capable of auto reset.

EXT Alarm

This monitors any other alarm that the user wishes to install.

Mechanical Oil Pressure

This monitors the contact on the mechanical oil pressure. This is generally a back-up to the software alarm, which in most cases should alarm first. Copeland requires a mechanical oil switch for warranty purposes and it is standard practice to have one installed. Recommended delay is 1 second.

Mechanical High Head

This monitors the contact on the high head pressure control. This is generally a back-up to the software alarm, which in most cases should alarm first. Copeland requires a mechanical high head for warranty purposes and it is standard practice to have one installed. Recommended delay is 1 second.

Compressor Module (Motor Temperature)

This monitors the compressor module that trips on high amp or high temperature situations in the electric motor. This alarm can have a longer delay. The Copeland module on startup has about a 30 second delay before energizing which is where we recommend the delay for the alarm.

Software High Head

Software high head is the same as the mechanical high head except that it is reset able through the controller. Recommended settings are 325 PSI for 1 second. The general goal for this alarm is to have the circuit fail here before it trips the mechanical allowing an opportunity to reset the circuit remotely before sending a service technician.

Low Superheat

This alarm monitors the compressor superheat for low condition that can cause damage. It can be used in two different ways. The more common approach is to set the delay long, around 10-15 minutes and leave the superheat failure set point higher around 8-10 PSI. The other method is to set the delay short, around 1 second and

High Discharge Temp

High discharge temperature alarm protects the compressor against future oil issues typically caused by running too hot. This alarm is reset able from the software. Typical settings for this alarm range from 215 – 220 F for around 10 minutes.

Low Suction Pressure

Low suction pressure alarm is include to alert the user low suction issues typically caused by icing of the evaporator coils or from lost charge. Typical settings are dependent on the storage condition but the delay is generally high to prevent nuisance trips.

Software Low Oil Pressure

Software low oil is the same as the mechanical oil pressure except that it is reset able through the controller. Recommended settings are 8.5 PSI for 40 seconds. The general goal for this alarm is to have the circuit fail here before it trips the mechanical control allowing an opportunity to reset the circuit remotely before sending a service technician.

Head Pressure Control

The HRC controller comes equipped with head pressure control. The head pressure control set point is differential type set point where the actual value floats with suction pressure. The Discharge pressure the controller will hold is the suction pressure added to the set point. Typically this will be 80-100 PSI for a set point. This allows proper functionality for a thermal expansion valve (TXV). This setting can be driven lower when used in conjunction with electric expansion valves (EXV) due to the better range of the electric valves. The HRC supports 6 different fan configurations for head pressure control and it is important to understand how the staging works in order to properly wire the condensing fans.

	Fan Configuration					
Output	**1**	**2**	**3**	**4**	**5**	**VFD**
Y0	**Fan #1**	**Fan #1**	**Fan #1**	**Fan #1**	**Fan #1**	**VFD Start Circuit**
Y1	**X**	**Fan #2**	**Fan #2**	**Fan #2** **Fan #3**	**Fan #2** **Fan #3**	**X**
Y2	**X**	**X**	**Fan #3**	**Fan #4**	**Fan #4** **Fan #5**	**X**

Figure 14: Head pressure control fan configurations

Software

In order to access the settings that the HRC uses to control a unit it is necessary to use the JMC Remote Monitoring software. These sections attempt to explain the installation process, connection setup, and the features of the software.

Installation

Creating a Connection

Screens and Operation