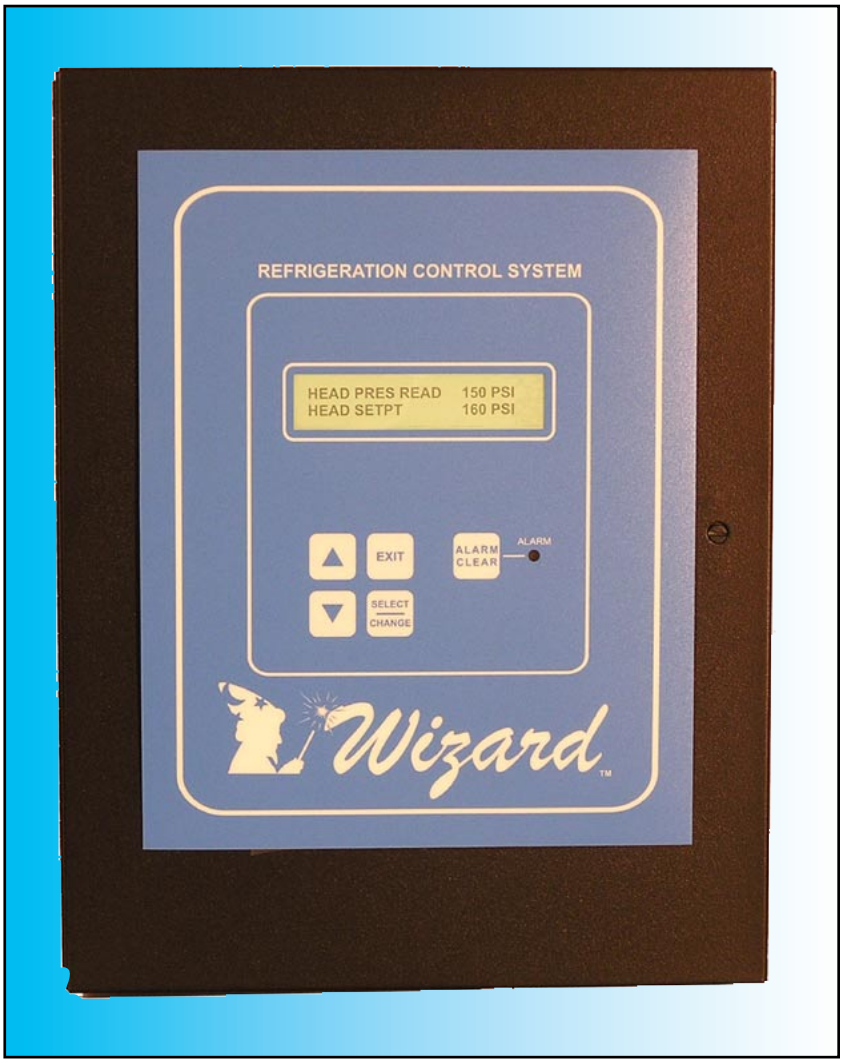
Wizard

Refrigeration Control System



7 Stage Fixed Speed Condenser Fan Control (WCFC)

CONTROL UP TO SEVEN CONDENSER STAGES (FANS, PUMPS, OR DAMPERS) OR SIX FANS WITH A SPLIT CONDENSER

The *Wizard* Condenser Fan Control (**WCFC**) is an ETL listed control and is the most advanced condenser system controller in the industry today. The control will efficiently cycle up to seven fan banks or six fan banks with split condenser, controlling the discharge pressure effectively.

The **WCFC** was engineered to meet the two main variations in systems today; fixed head and floating head. The Fixed head control will sequence fans based on discharge pressure, while floating head control will sequence fans based on discharge pressure and liquid temperature.

The control has a 10 character alphanumeric vacuum fluorescent display, four input keys, integrated input terminals and output relays on a single P.C. Board. The compact design makes this Control very reliable. It is designed to operate from -30°F to 150°F ambient temperature. Menu driven software eases operating parameter changes and setting adjustments.

The **WCFC** was engineered to control a wide variety of condenser types, Air Cooled, Cooling Towers, Evaporative Condensers.

The **WCFC** utilizes three control methods: **Fixed Head** Pressure Control; **Floating Head** or Liquid Temperature Control; and Differential or **Deadband Control**.

Fixed Head Control will sequence fans of an Air Cooled Condenser based on a fixed discharge pressuresetpoint.

Floating Head Control will sequence fans based on discharge pressure, liquid temperature, and ambient temperature.

Differential or Deadband Control will cycle each stage based upon user definable Cut-In and Cut-Out parameters.

The fans are cycled first according to the head pressure. Once the head pressure is satisfied, the fans are cycled by the liquid line temperature. In order to obtain optimal sub-cooling of the liquid refrigerant, the flooding valve in the rack should be set 5 lbs below the minimum (flooding) head pressure setpoint.

DETERMINATION OF SET POINTS

Fixed Head Staging Method

For fixed head operation, the controlling parameter is discharge pressure as measured by a Discharge Transducer. An optional ambient temperature sensor is used to optomize the fan cycling speed.

The set point for discharge pressure is user definable in the system menu and is modified when defrost or heat reclaim is turned on. Below shows how the Cut-In and Cut-Out parameters are obtained for each stage.

The **WCFC** will cycle fans on at a point 5% above this set point, and cycle fans off 2.5% below this set point. This will maintain the average discharge pressure at the set point pressure.

Example: Setpoint = 185 psig

Stage #1 Cut-in = 185 + 5% =194 psig
Cut-out = 185 - 2.5% = 180 psig

Stage #2 Cut-in = 185 + 10% = 203 psig
Cut-out = 185 - 5% = 176 psig

This staging method is ideal for Air Cooled Condensers.

Floating Head

For floating head control, all control setpoints are calculated based on the ambient conditions. The liquid line temperature setpoint is equal to ambient temperature plus the condenser offset temperature. See Below for details. The condenser offset temperature is adjustable from 6^{O} - 25^{O} F. The effect of this setting is the amount of subcooling the Condenser control will maintain. A lower offset value will tend to increase the amount of subcooling.

Example: Ambient Temperature = 80^{O}F

Condenser Offset = 10^{O}F (User defined)

Liquid Temperature Control Setpoint = 80^{O}F+ 10^{O}F=90^{O}F

The range of the liquid temperature setpoint is from 40^{O}F to 100^{O}F. If the calculation method has a liquid temperature set point below 40^{O}F, the control will defaut to 40^{O}F, and if the calculation exceeds 100^{O}F, then the control will default to 100^{O}F.

The discharge pressure setpoint is determined from the saturation curve. Different refrigerants have different saturation curves. The range of the discharge pressure setpoint is 148 psig - 250 psig for R-502 for example.

The fans are cycled first according to the head pressure. Once the head pressure is satisfied, the fans are cycled by the liquid line temperature. In order to obtain optimal sub-cooling of the liquid refrigarant, the flooding valve in the rack should be set 5 lbs below the minimum (flooding) head pressure setpoint.
A few safety setpoints are defined by the User

Minimum Head Pressure - This is the Lowest level the controller will float the head pressure.

Minimum Head During Defrost - A closure across the "Defrost Status" input on the IO board will activate this function. The controller will maintain at least this pressure in order to provide enough pressure to push Hot Gas to the evaporator coils for Hot Gas Defrost.

Minimum Head During Heat Reclaim - If the discharge gas is drawn off to provide head to the building or a hot water heater, the controller wll maintain at least this pressure in order to provide enough pressure to push Hot Gas to the heater coils.

Deadband Control

Deadband Control provides the user the flexibility of controlling the exact pressures that each stage will cycle. This control scheme is ideal for large, water cooled or air cooled condensers in commercial and industrial applications.

Each stage is provided with a user definable Cut-In and Cut-Out setpoint. Should more than one stages Cut-In levels are exceeded, the controller will stage them in 10 - 15 second increments.

The **WCFC** provides ambient lockout capabilities for each stage. A control wide Ambient Cutout setpoint is defined by the user. Each stage has the option of lockout at this setpoint or to continue to operate. This feature prevents the need to change staging or wire in thermostats to prevent staging during cold weather.

SPLIT CONDENSER

On a dual header condenser, the Condenser Control will allow half of the circuits to be turned off and on by energizing and de-energizing a valve. The Split Condenser relay operates to full condenser mode when the relay is de-energized. The fan relay selection mode (N.O./N.C.) has no effect on this relay. The determination of when to split is based on the number of fans running at any given time. If the number of fans on is less than half the total number of fans, and the last 30 minutes was in full condenser mode, the Control will activate the half condenser mode. At the same time the Control will energize fan relay circuits so that the same numbers of fans (not banks) are in operation. The half of the split condenser not activated will be pumped out to suction and the fans on that side will be deactivated by use of an external relay in the condenser control panel.

The condenser will be changed back to full condenser after all fans on one side are on, and the operating conditions are above their set points. The control will turn on at least half of the fan bank and turn off the half condenser valve. There is only a slight time delay(less than 18 seconds) when going from half condenser to full condenser.

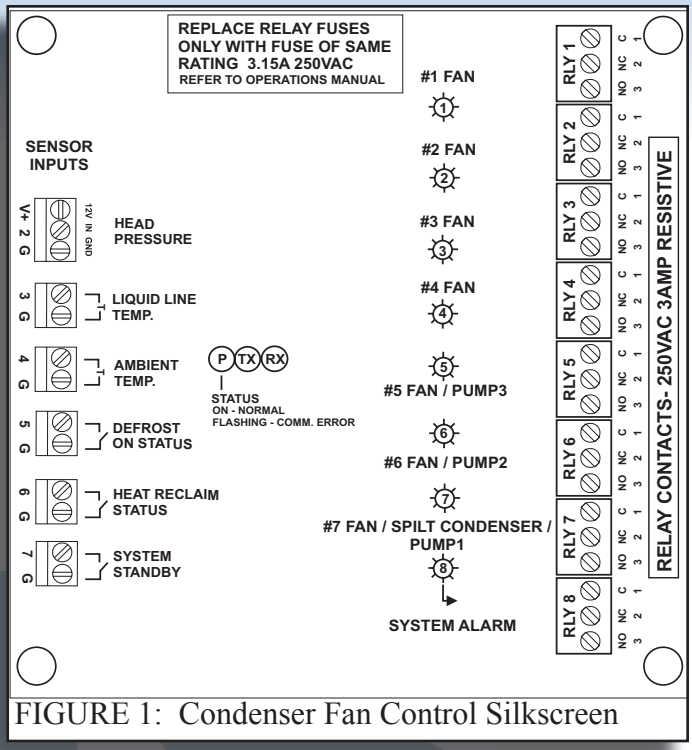


FIGURE 1: Condenser Fan Control Silkscreen

FAN CYCLING SPEED

Fan cycling is affected by the Fan Cycling Speed selection in the Configuration menu

Fast speed	=	1/2 normal speed
Medium speed	=	3/4 normal speed
Normal speed	=	present speed,standard
Low	=	Twice normal

Condenser ambient temperature

Higher ambient temperature will delay the turn off of the a fan opposed to cooler temperatures.

Defrost status input

During defrost and 4 minutes after defrost, the fan cycling time will run twice as fast.

ALARM AND SWITCH BACK

The alarm relay is operated in a fail safe way, so it operates in Normally Closed mode (the relay is energized) when not in alarm and De-energized when in ALARM. If the Control loses power, the alarm relay will drop out and will trigger an ALARM.

The alarm can be reset and normal operation can be resumed under the ALARM menu. If however, the cause of the alarm is not corrected, the control will eventually go back into alarm.

HARDWARE SPECIFICATIONS:

CONTROL SYSTEM

Microprocessor based Program logic stored within non-volatile EPROM memory. Set points and system configuration stored within EEPROM. Logged Data stored within Battery Backed Memory chip, minimum of 10 years storage life. Menu driven controls with all operating sequences and control algorithms included. The control has non-volatile program memory and a capacitor backed clock in the event of power outage. All programmable options are installed via a "Yes" or "No" question.

Keypad

Front panel accessible with 5 tactile key switches. Key assignments -- UP, DOWN, SELECT/ENTER, EXIT, ALARM RESET.

Display

2 x 20 character LCD Back Lighted Display.

Power

Input -- 100-250 VAC, 50/60 HZ, 2.5 Amp.

Housing

Metal Cabinet, NEMA 1, Enclosure Option 1
- NEMA 1, Door Mountable

Option 2
- NEMA 4X Enclosure, Watertight

INPUTS

Head Pressure Transducer, 0-500 PSIG
Liquid Line Temperature Sensor
-- 2-wire thermistor, -40 to 150 °F
Ambient Temperature Sensor
-- 2-wire thermistor, -40 to 150 °F
Heat Reclaim Status
GenCom Communications Link
Defrost Status or A/C off Input

OUTPUTS

Control Relays

8 total Relays - Relays 1 - 7 are for condenser stages . Relay 7 can be used for split condenser. Relay 8 is an alarm relay. Relay Outputs are 1 Form C SPDT rated for 250 VAC and 3 Amp per circuit Each relay circuit is fused with a 3.15 Amp slow blow fuse on the common leg.

LISTINGS ETL, Conforms to UL Std. 3111-1
Certified to CAN/CSA
C22.2 Std. No. 1010.1

NEMA 1 Compliant Enclosure - This enclosure is intended for indoor use only primarily to provide a degree of protection against contact with the enclosed equipment. The enclosure is not designed to provide protection from water or to be placed in a hazardous environment. Mount only in Pollution Level 2 environments, ie. environmentally controlled offices, control rooms, or environmentally controlled machine rooms.

Dimensions Inches (mm)
12.0 x 9.5 x 5.0 (305 x 241 x 127)

NEMA 4X Compliant Enclosure - This enclosure is intended for either indoor or outdoor use, 0 to 50 °C, to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose directed water.

Dimensions Inches (mm)
14.0 x 15.0 x 8.2 (312 x 381 x 208)

NEMA 1 Panel Mount Option - The control and display assemblies must be suitably mounted in an enclosure. The Faceplate may be surface mounted onto a Nema 1 enclosure. The IO Board Assembly must be mounted within an enclosure providing at least Nema 1 protection.

Dimensions Inches (mm)
Faceplate -
10.2 x 8.5 x 2.0 (259 x 216 x 51)
Backplate -
10.6 x 8.5 x 3.0 (269 x 216 x 76)

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