

HUSSmann®

REFRIGERATION SYSTEMS

Protocol Control System (PCS) Users Manual



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4. Introduction

This document describes the Protocol Control System (PCS). The PCS is an electronic control system designed specifically to control all functions of the Protocol Refrigeration System.

4.1 Organization

This document is organized into a number of sections. The first section is an overview of the hardware. A “quick start” section is included next to enable users to quickly get a minimum amount of information needed to start using the controller. A detailed section follows. The last section describes the PCS supervisory system.

It is recommended that the user familiarize himself with the PCS system by reading all sections of this manual before operation.

5. PCS Hardware

The following are components of the PCS system.

- 1) PCS Controller
- 2) PCS Expansion Board
- 3) PCS Pressure Transducer
- 4) PCS Temperature Probes

This document describes the elements of the PCS components. The schematics included with each Protocol Refrigeration System detail the connections that are made to the components. Refer to the schematics for connection details.

WARNING: The Controller and Expansion board use low voltage (24 VAC) power. However, both units have high voltage loads connected to them. Extreme caution should be used when servicing these units. Failure to observe caution could lead to injury or death.

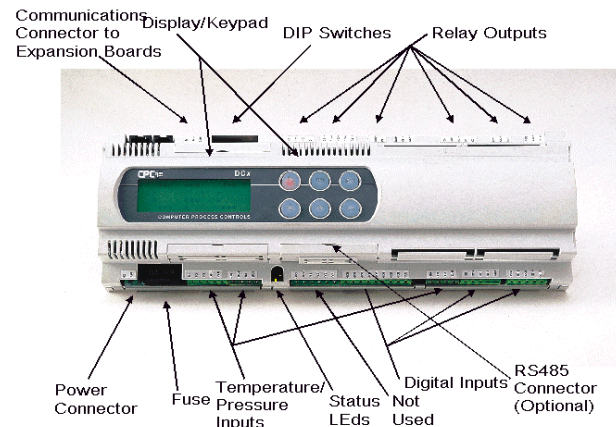
5.1 PCS Controller

The PCS Controller is a microprocessor based system that contains a built in display, keypad and I/O (relays temperature inputs, pressure inputs and digital inputs). It serves as the user interface and runs the algorithms that control the protocol refrigeration system. Additional I/O (relays, digital inputs and temperature inputs) can be added using the PCS Expansion Board. The controller contains all the I/O for all compressors in the Protocol refrigeration system.

The temperature inputs must use the PCS temperature sensors (described below) and the pressure inputs must use the PCS pressure probes (described below).

Figure 1 shows a picture of the PCS Controller and identifies the different parts of the Controller.

Figure 1- PCS Controller



5.1.1 Input Power

The Controller uses 24 VAC (+/-15%, 50/60 Hz) (Class II) power at 50 VA.

5.1.2 Display Contrast Adjust

The contrast of the display can be adjusted by pressing and holding the ENTER and ESC keys together and pressing the UP ARROW key to increase the contrast or the DOWN ARROW key to decrease the contrast. Refer to paragraph 7.1.1 for an explanation of how to identify the keys.

5.1.3 Status LEDs

There are two LED's on the Controller that indicate power status. If the Yellow LED is ON this indicates that the unit is getting power. If it is OFF, there is either no power to the unit or the fuse is blown. The Red LED indicates the status of the Pressure probe power output (Connector J2, terminals GND and +VDC). If the Red LED is ON, there is a fault in the probe supply. Most likely, the pressure probe is bad or there is a short in the cable.

5.1.4 DIP Switches

The DIP Switches on the controller should always be in the down (OFF) position.

5.1.5 Mounting

The Controller is mounted via Din rail mount. The Controller can be removed from the mounting by carefully pulling on the 3 small tabs on the bottom of the controller and rotating the Controller up. All connectors should be removed from the unit before removing the Controller from the mounting.

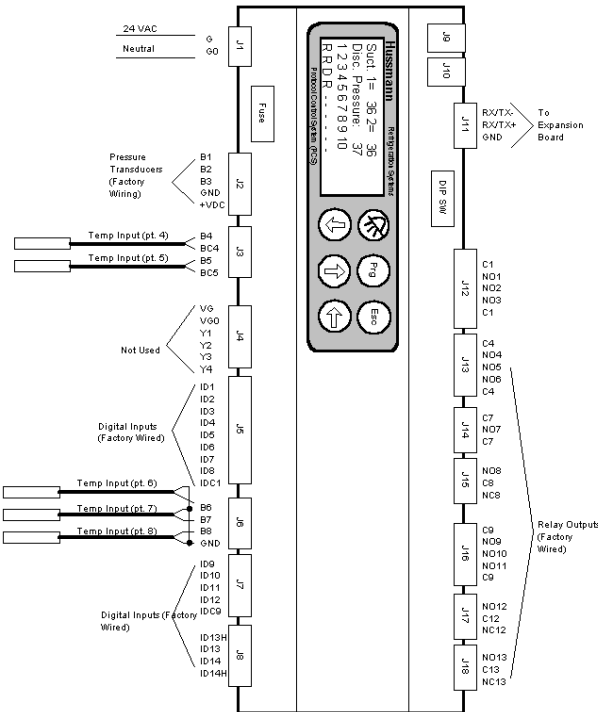
5.1.6 Fuse

The Controller has an internal fuse. If the Controller will not power up and you have verified that the controller is getting input power, you should replace the fuse. Always replace with the same type of fuse.

5.1.7 Controller Wiring

The field wiring for the expansion board is shown in Figure 2. Field wiring for the controller consists of temperature probes on inputs 4 through 8.

Figure 2- Controller Wiring



5.2 PCS Expansion Board

The PCS Expansion board is used to provide additional I/O (relays, digital termination inputs and temperature inputs) to the PCS Controller. Typically, the expansion board will contain the I/O for circuits (refrigeration valve relays, temperature inputs and defrost termination inputs). The Expansion board contains 8 relay outputs (Normally Open/Normally Closed outputs), 8 Temperature inputs and 8 Digital inputs. The temperature inputs must use the PCS temperature sensors (described below). The Expansion board is connected to the PCS Controller by a communications cable (Beldon 8641 or equivalent).

The PCS system supports up to 4 expansion boards. The address of the expansion board is determined by the wiring of inputs AD0 and AD1. Table 1 lists the expansion board address.

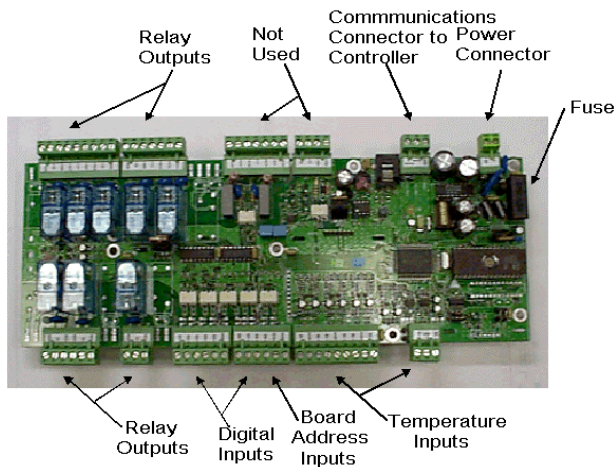
Table 1- Expansion Board Addressing

Expansion Board	AD1	AD0
Board 2 ¹	OPEN	OPEN
Board 3	OPEN	24 VAC ²
Board 4	24 VAC	OPEN
Board 5	24 VAC	24 VAC

Figure 3 shows a picture of the PCS Expansion board and identifies the different parts of the board.

¹ The first expansion board is referred to as board 2. The main controller is referred to as board 1.

² In Table 1, 24 VAC means tied to "G" terminal.

Figure 3 - PCS Expansion Board

5.2.1 Input Power

The Controller uses 24 VAC (+10%/-15%, 50/60 Hz) (Class II) power at 15 VA. Note that if using the same transformer to power the controller and expansion board, care must be taken to connect the G terminals on both boards to the same side of the transformer and the G0 terminals on both boards to the same side of the transformer.

5.2.2 Mounting

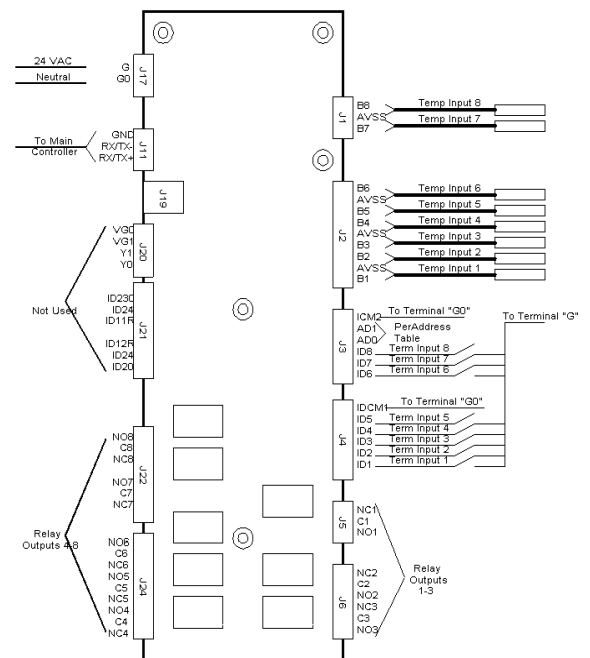
The Expansion board is mounted via standoffs.

5.2.3 Fuse

The Expansion board has an internal fuse. If the Expansion board will not power up and you have verified that the controller is getting input power, you should replace the fuse. Always replace with the same type of fuse.

5.2.4 Expansion Board Wiring

The field wiring for the expansion board consists of the temperature probes and defrost termination sensors. Refrigeration valve relays are factory wired to terminal blocks. Figure 4 shows the connection points for the field wiring.

Figure 4- Expansion Board Wiring

5.3 Pressure Transducer

The PCS system uses a 4/20 milliamp pressure transducer. Inputs are provided for reading suction pressure (optionally a second suction group pressure) and discharge pressure. The same type of pressure transducer is used for reading suction and discharge pressure. The transducer is a 2 wire connection and is polarity sensitive (refer to the Protocol schematics for details). The system reads 0 to 362 PSI.

The wiring for the pressure transducer should not be routed near cables carrying high voltage.

Figure 5 shows a picture of the pressure transducer.

Figure 5- PCS Pressure Probe

allowing complete control of the units from the PC. For this system each of the Controller must have a communications card installed. The controllers must be connected in a daisy chain fashion using **Belden 8641, 24AWG, 2 conductor twisted shielded pair**. This wiring should be carefully routed away from power lines or other high electrical noise environments

Field valve wiring should use 16/18 AWG cable appropriate for the valve current requirements. This wiring should not be run in close proximity to the temperature, termination or communication wiring.

5.4 Temperature Sensor

The PCS system uses an NTC type temperature sensor to read the temperature. The temperature sensor is not polarity sensitive. Note that the wiring for the temperature sensor should be routed in such a way that it is not in close proximity to any power line cables. This will prevent invalid readings from occurring.

The temperature sensor should be placed in the discharge air stream to give a true indication of case temperature.

Figure 6 shows a picture of the temperature sensor.

Figure 6- PCS Temperature Probe

5.5 Field wiring

All wire connections to the PCS system should be in accordance with all applicable local and national codes.

Temperature sensors and defrost termination sensors should be wired to the controller and expansion board using **Belden 8761, 22AWG, 2 conductor twisted shielded pair or equivalent**. This wiring should be carefully routed away from power lines or other high electrical noise environments.

The PCS system offers the option of using a supervisory system where all units in the store are connected to a PC

6. PCS Features

The PCS system has a number of features as defined in the following paragraphs.

6.1 Overview

The PCS system has the following features:

6.1.1 Circuit Control

The PCS system can control up to 10 circuits. Control consists of controlling the defrost schedule, controlling the circuit temperature (by using a solenoid valve), and alarming.

The controller can schedule up to 6 defrosts per day. The defrost can be either off cycle, electric or hot gas. Defrost can be terminated by either time, circuit temperature or digital (Klixon) input.

6.1.2 Suction Pressure Control

The PCS system can control up to 6 compressors. Up to two suction groups are supported.

Control of the pressure is by PI type algorithm for precise pressure control. The reading from the pressure transducer is compared to the setpoint and the appropriate action (turning compressors on and off) is taken to maintain the suction pressure near the setpoint. Note that minimum on and off times and startup delays for the compressors can be programmed.

6.1.3 Lighting Control

Two circuits are provided for lighting control. The lighting circuits can be turned on and off by a 7 day schedule with one on and one off time per day.

6.1.4 Discharge Pressure Control

The PCS system can be used to control condensor fans. The fans are cycled in response to the discharge pressure setpoint and the current discharge pressure reading. The

controller uses a PI algorithm to maintain smooth discharge pressure.

If the Protocol system uses a fluid cooler instead of an air cooled condenser, a separate controller will be used to control the Pump Station (refer to the section on Pump Station Control).

The PCS controller will provide alarming on the discharge pressure input, but will not provide direct control in this case.

6.1.5 Alarms

The PCS system keeps an alarm log with 16 entries. The alarm log displays the date and time that the alarm occurred, the type of alarm and whether the alarm is ACTIVE or has been ACKNOWLEDGED. When an alarm occurs, the alarm relay will activate, the ALARM key will turn RED and the Alarm menu will automatically be displayed. The alarm relay will remain activated and the ALARM key will remain RED until the alarm is ACKNOWLEDGED.

Alarms are provided for the following conditions:

6.1.5.1 High/Low Circuit Temperature

An alarm is signaled if the circuit temperature is too high or too low (as determined by the alarm setpoints).

6.1.5.2 Defrost Termination

An alarm is signaled if a defrost is set up to terminate by temperature or digital termination, but terminates by the maximum time instead. This can indicate that there may be some type of problem with the case (ice build up) or the termination sensor.

6.1.5.3 High/Low Suction Pressure

If the suction pressure is above or below the limits (as defined by the alarm setpoints) this alarm will be signaled.

6.1.5.4 High Discharge Pressure

If the discharge pressure is above the limit (as defined by the alarm setpoint) this alarm will be signaled. Note that the discharge pressure alarm will automatically clear (but will remain in the

alarm log) if the discharge pressure falls below the alarm limits.

6.1.5.5 Sensor Failures

If a temperature or pressure probe failure occurs, this alarm will be signaled. The alarm will provide details as to what sensor has failed.

6.1.5.6 Compressor Proof Failures

This alarm will be signaled if a compressor proof fails. Note that proofing is optional in the Protocol refrigeration system. Refer to the Protocol schematics for details.

6.1.5.7 Compressor General Alarms

This alarm will be signaled if a general alarm occurs for a compressor. A general alarm occurs when the digital input associated with the compressor is active. There is one digital input for each compressor. The digital input will be activated when the oil level sensor trips, there is a high pressure cutout or the discharge temperature is too high. See the Protocol schematic for details.

6.1.5.8 Phase Loss

This alarm will be signaled if the controller detects a phase loss.

6.1.5.9 Controller Reset

If the controller resets due to an interruption of power, this alarm will be signaled when power is restored.

6.1.6 Maintenance/Diagnostics

The controller provides the following capabilities for maintenance:

6.1.6.1 Force Defrost

A circuit can be forced to perform a defrost or to cancel a defrost in progress. Note that if a defrost is forced, the defrost will terminate normally as defined by the circuit setpoints.

6.1.6.2 Force Compressors

A compressor can be forced on or off. Note that the user must be logged in to force the compressor on or off and the compressor state

will return to normal when the controller logoff timeout occurs.

6.1.6.3 Compressor Run Time

The run time (in hours) for each compressor is stored. The run time can be cleared if a compressor is replaced.

7. Quick Start

This section of the manual provides a quick overview of the operation of selected features of the controller. It is intended to provide an overview of the most used features. Refer to the Controller operation section for more details.

7.1.1 Display and Keypad

The controller’s user interface consist of a 4x20 LCD display with a 6 button keypad. The display/keypad are used to see status information on the controller and also to change setpoints. Figure 7 shows the display and keypad of the controller.

Figure 7- Controller Display

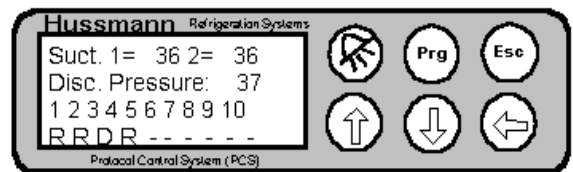


Table 2- Controller Key Functions

Key	Name	Function
	ALARM	Enters the alarm menu or returns to original menu from alarm menu
	PROGRAM	Enters maintenance menu (depends on current screen)
	ESCAPE	Return to Main status screen (from any screen) or move to other status screens (from Main status screen)
	UP ARROW	1) On Main status screen- Moves between status fields 2) On other screens- Used to enter a value
	DOWN ARROW	1) On Main status screen- Moves between status fields

	ENTER	2) On other screens- Used to enter a value 1) On Main status screen- Enters the configuration menus for a given field 2) On other screens- Used to move between fields and to accept a value.
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7.1.1.1 Cursor

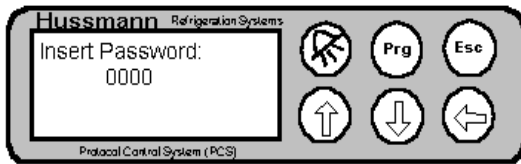
Each screen can have one or more fields. The active field will have a cursor on the first character of the field. The cursor will alternate between a block and the normal character for the field.

7.1.2 Login

Certain actions (changing setpoints, forcing defrosts, etc.) require the user to log on to the controller. This requires the user to enter a password. When you must log in to perform the action, a logon screen will pop up and you will be prompted to enter the password. When this happens, enter the numeric password (using the UP or DOWN ARROW keys) then press the ENTER key. If the password is correct the login screen will disappear and you will be able to perform the action. If the password is not correct, you will not be allowed to perform the action and the logon screen will appear again after you press the ENTER key. Once you have logged in, you will not have to enter the password again unless the controller times out and logs out. The time out will occur if you do not press any of the keys for 5 minutes. At that point, the controller will log you out and return to the main status screen.

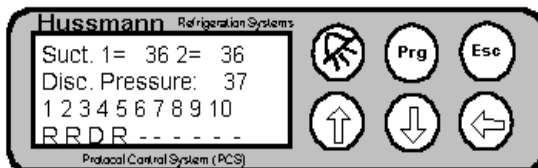
The factory default password is “0000” and it can be changed by an authorized user.

Figure 8 shows the password screen.

Figure 8- Password Screen

7.1.3 Main Status Screen

Figure 9 shows the main status screen. This screen is displayed when the controller is first powered on. This screen will also be displayed if there are no keys pressed for a period of 5 minutes.

Figure 9- Main Status Screen

The first row on this screen shows the current pressure reading for suction group 1 and (if configured for two suction groups) suction group 2. The second row shows the current reading for the discharge pressure. The bottom two rows show the circuit status. The numbers 1 to 10 on the third row represent circuit numbers 1 to 10. On the last row there will be either a "-", "R", "D" or "S" under each circuit number. If a "-" is present, this means that the circuit has not been configured. If a "R" is present, this means that the circuit is currently in refrigeration mode. If a "D" is present, this means that the circuit is in defrost. If an "S" is present, it means that the circuit has temperature control enabled and the circuit temperature is currently satisfied.

To return to the main status screen from a configuration or maintenance screen, press the ESCAPE key once. To return to the main status screen from another status screen, press the ESCAPE key until the Main status screen is displayed. Depending on which status screen you are currently in, you might have to press the ESCAPE key several times.

7.1.4 Configuration Screens

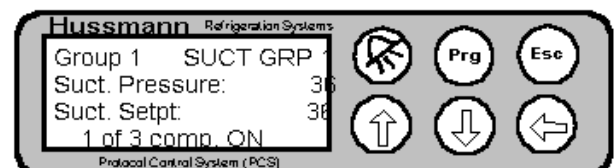
There are several configuration screens. In general, these screens provide more detailed status information and also contain setpoints. Typically, there are several configuration screens for a given function (circuit configuration, for example). When a configuration screen is first entered, the cursor rests in the upper left hand corner of the screen. If you press the UP or DOWN ARROW keys with the cursor in the resting position, the next or previous configuration screen will be displayed.

7.1.4.1 Active Fields

Each configuration screen typically consists of a number of fields. A field can be a setpoint or any other area where a value can be changed. Pressing the ENTER key with the cursor in the resting position will advance the active field to the first field on the screen. At this point, the value of the field can be changed (using the ARROW keys) or pressing the ENTER key again will advance to the next field. If the value of the field is changed, the ENTER key must be pressed to accept the value and move to the next field. Continue pressing the ENTER key until the cursor returns to the upper left corner of the screen.

7.1.5 Viewing/Changing Suction Pressure Setpoint

To view or change the suction pressure setpoint, you must enter the suction configuration screen. To do this from the Main status screen, use the ARROW keys to move the active field to either Suction Group 1 or Suction Group 2. Now press the ENTER key. The Suction Group configuration menu will now be displayed.

Figure 10- Suction Group Configuration Screen

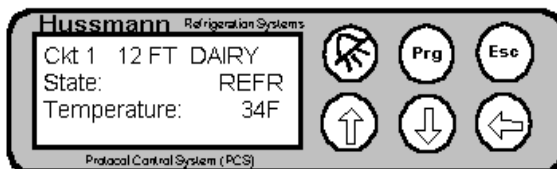
The first row has the group number that you are viewing. The name of the suction group is also displayed on the top row. The next row has the suction pressure reading (in PSI). The next row has the suction setpoint (in PSI). The last row is an indication of how many compressors (that are assigned to this suction group) are currently on. In this example, there are 3 compressors assigned to the group and 1 is on.

If there are two suction groups, you can look at the second suction group by pressing the ENTER key to put the cursor on the group number, then pressing the UP ARROW key to change the value of the field to 2, then press the ENTER key. The other active field on the suction configuration screen is the suction setpoint. Press the ENTER key to advance from the suction group field to the setpoint field. The value can now be changed by pressing the UP/DOWN ARROW keys. After the new value has been entered, press the ENTER key to accept. Press the ENTER key once more to return the cursor to the resting position. The setpoint has now been changed.

7.1.6 Viewing Circuit Temperatures

In order to view circuit temperatures, you must enter the circuit configuration screen. To do this from the Main status screen, press the DOWN ARROW key until the cursor is on the circuit number you would like to view. Then press the ENTER key. The Circuit configuration screen will now be displayed.

Figure 11- Circuit Configuration Screen



The first row displays the circuit number (similar to the suction group number in the suction group configuration screen) and the name of the circuit. The next row displays the current state of the circuit. "REFR" indicates refrigeration. "DEFR" indicates defrost. "SATISFIED" indicates that the circuit has temperature control enabled and the circuit temperature is currently satisfied. The third row shows the current temperature for the circuit.

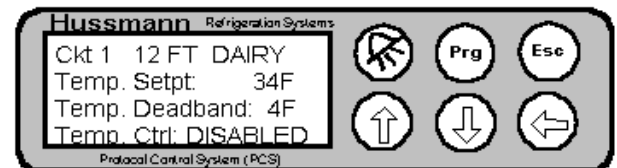
Note that there can be up to three temperature probes defined for a circuit and the number displayed on this screen is the combination of the three.

By pressing the ENTER key on this screen, you will move the cursor to the first field which is the circuit number. You can change the circuit number you are currently viewing by using the UP or DOWN ARROW keys to change the circuit number. The temperature for the selected circuit will automatically be displayed (without the need to press the ENTER) key. There may be a slight delay (up to 2 seconds) for the display to update with the temperature for the new circuit.

7.1.7 Viewing/Changing Circuit Temperature Setpoint

To view or change the circuit temperature setpoint you must enter the circuit configuration screen. With the cursor in the resting position (upper left hand corner), press the DOWN ARROW key two times and a screen will be displayed with the temperature setpoint.

Figure 12- Temp Setpoint Configuration Screen



To change the circuit temperature, press the ENTER key twice to make the Temp Setpt the active field. Use the UP or DOWN ARROW keys to change the value. Press the ENTER key to accept the new value. Note that the active field will automatically go to the Temp Ctrl field. Press the ENTER key again to return the cursor to the upper left corner (resting position).

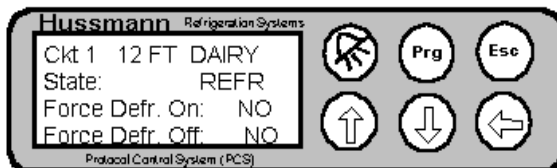
7.1.8 Determining if a Circuit is in Defrost

To determine if a circuit is in defrost you can look at the circuit's status in the Main status screen ("D") or in the circuit configuration screen ("DEFR").

7.1.9 Forcing a Defrost

To force a circuit into defrost, you must be in any of the circuit configuration screens. From a Circuit configuration screen, press the PROGRAM key. The Circuit maintenance screen will be displayed.

Figure 13- Circuit Maintenance Screen

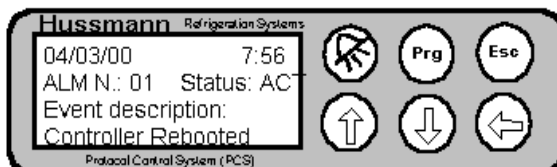


The Circuit maintenance screen displays the circuit number and name on the top row. The current circuit state is displayed on the second row. The third row contains a field called "Force Defr. On:". By moving the cursor to this field (using the ENTER key) and pressing the UP ARROW key the "NO" will be changed to a "YES". Press the ENTER key to accept the change and a forced defrost will be started. Note that the defrost will terminate in the normal way (according to the circuit setpoints). Likewise, you can cancel a defrost by moving the cursor to the field that says "Force Defr. Off:" and changing the "NO" to "YES" with the ARROW key and pressing ENTER.

7.1.10 Alarms

If an alarm occurs, the controller will automatically display the alarm log screen and the ALARM key will turn RED. The alarm screen can also be enter from any other screen by pressing the ALARM key.

Figure 14- Alarm Log Screen



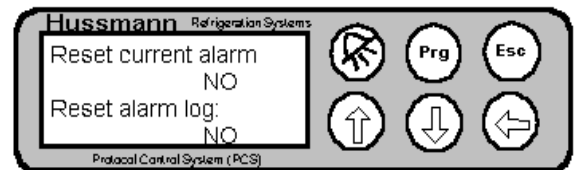
The Alarm screen displays the date and time when the alarm occurred on the top row. The next row shows the alarm number (1 to 16) and the Status (either active (ACT) or acknowledged (AKN)). The last row gives a description of the alarm.

To view other alarms use the UP or DOWN ARROW keys to display other alarms that are in the alarm log.

7.1.10.1 Acknowledging Alarms

To acknowledge an alarm you must be in the Alarm maintenance screen. To enter the Alarm maintenance screen, first enter the alarm screen, then press the PROGRAM key. The Alarm maintenance screen will be displayed.

Figure 15- Alarm Maintenance Screen



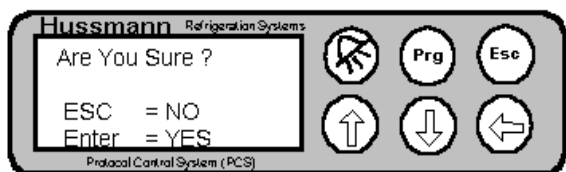
The alarm maintenance screen has two fields. Press the ENTER key to move to the first field that says "Reset current alarm". Press the UP ARROW key and the "NO" will change to "YES". Press the ENTER key to accept the entry and the alarm current active alarm will be acknowledged. The controller will automatically return to the alarm screen.

Note that there may be more than one active alarm. If you have cleared the alarm and the ALARM key is still RED, use the ARROW keys to determine if there are other alarms in the alarm log that are active. If so, use the ARROW keys to display the active alarm then acknowledge the alarm as described in the preceding paragraph.

7.1.10.2 Clearing the Alarm Log

To clear the alarm log, enter the alarm maintenance screen as described in paragraph 7.1.10.1. Press ENTER twice to move the cursor to the "Reset alarm log:" field. Use the ARROW keys to change the "NO" to "YES". Immediately a confirmation screen will pop up asking you to confirm that you would like to clear the alarms. Pressing the ESCAPE key will cancel the operation and return you to the alarm screen. Pressing the ENTER key will result in the alarm log being cleared.

Note: Use caution when clearing the alarm log. Once cleared, alarm entries cannot be retrieved.

Figure 16- Alarm Confirmation Screen

8. Controller Operation

The basic operation of the controller is described in the following paragraphs. An overview of the menu structure is given, the more detailed information for each screen is presented. Where applicable, additional information about the control algorithms, etc. are provided.

8.1 Circuit Control

The PSC controller provides circuit control for up to 10 circuits. Each circuit can have up to 3 temperature probes for temperature monitoring. A relay can be assigned for temperature control. Each circuit also has a defrost schedule that controls defrost.

8.1.1 Defrost

There are three types of defrost supported by the controller, HOT GAS, ELECTRIC and OFF CYCLE. Refer to the Protocol schematics for details of the wiring for each type of defrost.

8.2 Pressure Control

The PCS controller provides control of suction pressure by cycling compressors on and off to meet the load requirements. Up to 6 compressors are supported for a suction group. The controller will support 1 or 2 suction groups.

8.2.1 Switchback

Switchback is a mechanical backup mode of the PCS. This occurs when a hard failure occurs in the controller and it is unable to run. When this occurs, the switchback relay (controller point 7) will open (normally, this relay is held close). This will cause the SBA relay to open and some of the compressors will be powered through the Normally Closed contacts of the SBA relay and the Low Pressure Control. Refer to the Protocol schematics for more detail.

8.2.2 Pressure Control Algorithm

There are two basic pressure control algorithms used in the Controller. If all compressors have the same horsepower, an equal horsepower

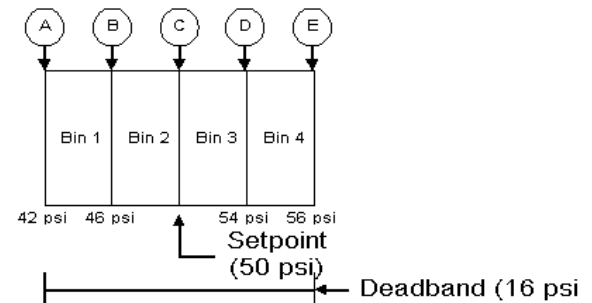
algorithm is used that equalizes run times between compressors. If there are different horsepower, a different algorithm is used. The algorithms are described in the following paragraphs.

8.2.2.1 Equal Horsepower compressors

If the compressors all have the same horsepower, the controller uses the deadband and setpoint to determine what compressors should be on. "Bins" are created which determine when a compressor is turned on and off. One Bin is created for each compressor. The size of the Bin is determined by the deadband divided by the number of compressors. An example is shown in Figure 17. In this example, the setpoint is 50 psi, the deadband is 16 psi and there are four compressors. As the pressure increases (going toward the right side), more compressors are turned on. As the pressure decreases (going toward the left side) compressors are turned off.

Figure 17-Equal Horsepower Example

4 Equal Horsepower Compressor Example



- A- Compressor 1 OFF
- B- Compressor 1 ON, 2 OFF
- C- Compressor 1 ON, 2 ON, 3 OFF
- D- Compressor 1 ON, 2 ON, 3 ON, 4 OFF
- E- Compressor 1 ON, 2 ON, 3 ON, 4 ON

Note that there are other setpoints which affect the minimum on and off times for the compressors (See Figure 30 and Figure 31).

The above example shows the effect of the Setpoint and Deadband in controlling the suction pressure. This is basically "Proportional" control. The controller incorporates an additional parameter that is used for PI (Proportional + Integral) control (See Figure 25). This parameter is called "Integration time" (See Figure 54). For PI control, the controller will add (or subtract) a

small amount to the actual pressure reading before determining how many compressors to turn on. The Integration time is the length of time (in seconds) it takes for the controller to add an error equal to the setpoint minus the actual pressure reading.

Using the example shown in Figure 17, assume that the actual pressure reading is 52 psi and the integration time is 10 seconds. The error is (52 psi – 50 psi) 2 psi. In 10 seconds, 2 psi will be added to the actual pressure and the controller will calculate the compressors to turn on based on a pressure of (52 psi + 2 psi) 54 psi. This is at the bottom of Bin 3 so compressor 1,2 and 3 would be turned on at this point.

8.2.2.2 Unequal Horsepower compressors

If a controller has unequal compressors, the algorithm is slightly different than the above example. First the controller calculates the number of steps it has available. For example, if there are two compressors, the first being a 2 HP and the second being a 3 HP, there are 3 steps available (2 HP, 3 HP and 5 HP). The controller then calculates a % capacity required which is based on the error between the actual reading and the setpoint. This error is divided by the deadband and converted to a percentage (0 to 100%). The percentage is applied to the steps and the closest match is used. No runtime equalization is performed for unequal horsepower compressors.

Note that if PI control is used, an integration error amount is added to the actual reading as described above.

8.3 Condenser Control

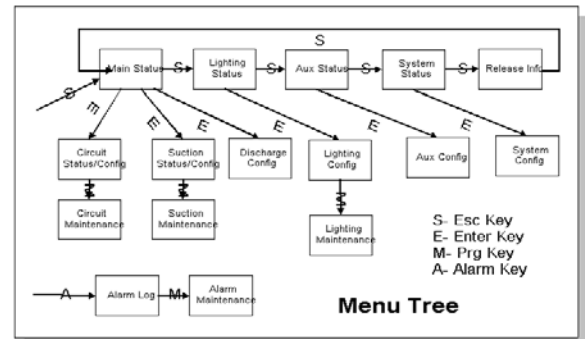
The controller has the capability to control an air cooled condenser (see Figure 32 and Figure 33). The condenser control is very similar to the equal horsepower pressure control with the number of compressors being the number of fans. Note that the control of the fans is Proportional control only.

8.4 Menu Structure

The screens on the controller consist of 4 basic types of screens. They are Status screens, Configuration screens, Maintenance screens and the Alarm screen. Figure 18 shows a menu tree that shows these different types of

screens. Each screen type is discussed in the following paragraphs.

Figure 18 - PCS Menu Tree



8.4.1 Status Screens

Status screens are display only screens. They provide information about a particular function of the controller (for example, Suction pressure). They also serve as the entry into the configuration screens. There are 5 status screens. They are shown on the top row of Figure 18. They are the Main Status, Lighting Status, Aux Processing Status, System Status and Release Info and Status. Each of the screens will be described in detail later in this document.

8.4.2 Configuration Screens

Configuration screens are screens that show more detailed status and also have setpoints. There are six basic types of configuration screens: Circuit, Suction Group, Discharge, Lighting, Aux Processing and System. These screens are shown on row 2 in Figure 18. The configuration screens also serve as an entry to the maintenance screens.

Note that Figure 18 only shows one block for each type of configuration screen. Each block may represent many screens. For example, there are six configuration screen for Suction Group setup.

8.4.3 Maintenance Screens

Maintenance screens are shown on the third row of Figure 18. Maintenance screens allow you to

perform a maintenance action (force a circuit into defrost, force off a compressor, etc). Note that there are maintenance screens for Circuits, Suction Groups and Lighting functions.

8.4.4 Alarm Screen

The Alarm screen displays the alarm log. It can be entered from any screen by pressing the ALARM key.

8.4.5 Screen Navigation

8.4.5.1 Status Screens

Pressing the ESCAPE key from any configuration or maintenance screen will always return you to the Main Status screen. If you are on the Main Status screen, pressing the ESCAPE key will move you to the Lighting Status screen. Each press of the ESCAPE key will move to the next status screen as shown on the top row of Figure 18.

8.4.5.2 Configuration Screens

All configuration screens are entered from a status screen. System, Lighting and Auxillary configurations screens are entered by pressing the enter key when in the corresponding status menu. Circuit, Suction Group and Discharge configurations screens are all entered from the Main Status screen. To enter the Suction Group configuration screen from the Main Status screen, move the cursor to either Suction Group 1 or Suction Group 2 pressure field, then press the ENTER key. To enter the Discharge configuration screen, move the cursor to the Discharge pressure field , then press the ENTER key. To enter the Circuit configuration screen, move the cursor to the appropriate circuit number (see Figure 9), then press the ENTER key.

Once in the configuration screen, you can move to the next configuration screen by pressing the DOWN ARROW key (with the cursor in the upper left hand corner). You can move back to the previous configuration screen by pressing the UP ARROW key. Note that at any time you can press the ESCAPE key to return to the Main Status screen.

8.4.5.3 Maintenance Screens

All maintenance screens are entered from a corresponding configuration screen. For example, if you want to enter the Circuit Maintenance (to force a defrost), you must first enter the Circuit configuration screen. Once in the Circuit configuration screen, press the PROGRAM key and the Circuit maintenance screen will be displayed. Maintenance screens are available for Circuit, Suction Group, Lighting and Alarms.

8.5 Screens

8.5.1 Status Screens

The status screens are shown on the top row of Figure 18. They are described in detail in the following paragraphs.

8.5.1.1 Main Status

Figure 19- Main Status Screen

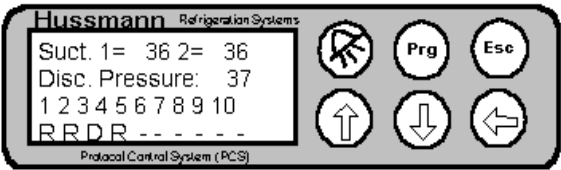


Table 3- Main Status Fields

Field	Explanation
Suct. 1	Suction Group 1 Pressure Reading
Suct. 2	Suction Group 2 Pressure Reading
Disc. Pressure	Discharge Pressure Reading
Circuit Status	Circuit 1 through 10 Status. “-“- Not configured “R”- Refrigeration “D”- Defrost “S”- Temperature is satisfied

8.5.1.2 Lighting Status

Figure 20- Lighting Status Screen

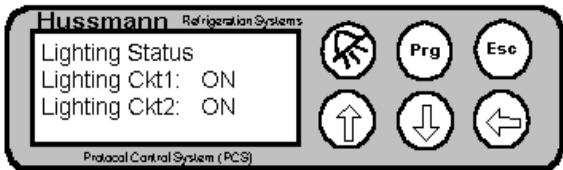


Figure 21- Lighting Status Fields

Field	Explanation
Lighting Ckt1	Status of lighting circuit 1
Lighting Ckt1	Status of lighting circuit 1

8.5.1.3 Aux Processing

Figure 22- Aux Processing Status Screen

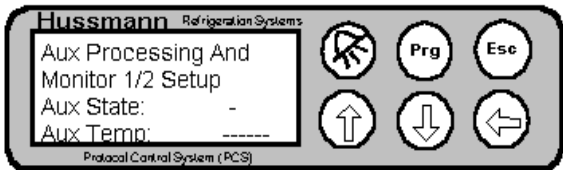


Table 4- Aux Processing Status Fields

Field	Explanation
Aux State	State of the auxiliary relay
Aux Temp	Temperature reading of the auxiliary input

8.5.1.4 System Status

Figure 23- System Status Screen

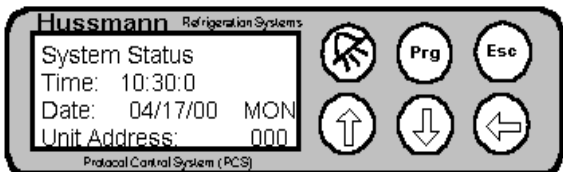
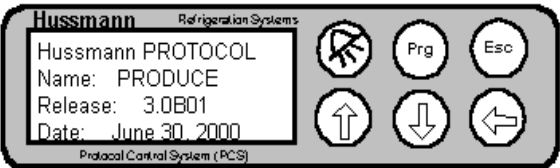


Table 5- System Status Fields

Field	Explanation
Time	The current time (as kept by the controller)

Date	The current date
Unit Address	The address of the unit on the supervisory communications network.

8.5.1.5 Release Info



Field	Explanation
Name	The name of the controller as set by the user
Release	The version number of the software release
Date	The release date of the software.

8.5.2 Configuration Screens

The configuration screens are shown on the second row of Figure 18. Note that each configuration screen block shown in Figure 18 may have several configuration screens associated with it. The following paragraphs detail the configuration screens. Note that all configuration screens for a particular function are shown. To access the different configuration screens, enter the first configuration screen for the desired function, then, with the cursor in the resting position (upper left corner), press the DOWN ARROW key until the desired screen is displayed.

8.5.2.1 System Configuration

The System Configuration screens are used to provide “System” level setup information. These fields should be set up first when programming a controller.

Figure 24- System Configuration Screen 1

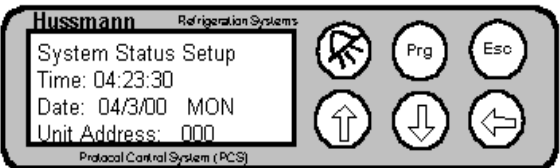
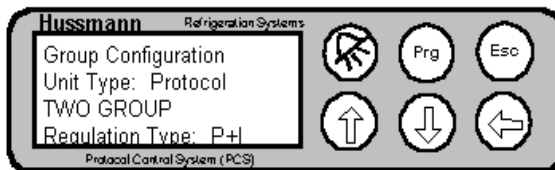
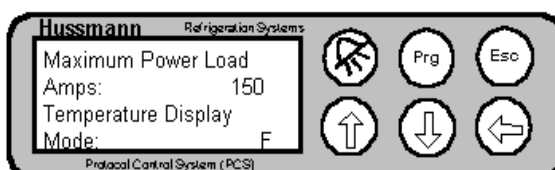


Table 6- System Configuration Screen 1

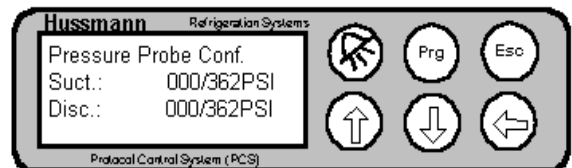
Field	Explanation
Time	Used to set the time of the controller
Date	Used to set the date of the controller
Day	Used to set the Day of the week
Unit Address	Used to set the address of the unit on the supervisory communications network.

Figure 25- System Configuration Screen 2**Table 7- System Configuration Screen 2**

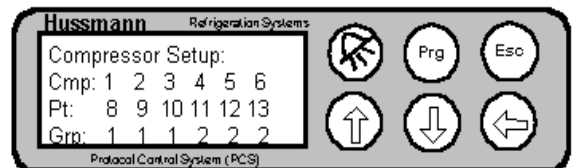
Field	Explanation
Unit Type	Used to select between an LP2000 and Protocol application. Note that this will define the maximum number of circuits and compressors that are supported.
TWO GROUP	Field that indicates two suction groups (TWO GROUP) or one suction group (ONE GROUP), or one suction group + a single compressor satellite (ONE GROUP + COMP. SAT.).
Regulation Type	Type of pressure control algorithm to use either "P"- Proportional only or "P+I"- Proportional + Integral. It is recommended to use P+I for smooth pressure control.

Figure 26- System Configuration Screen 3**Table 8- System Configuration Screen 3**

Field	Explanation
Maximum Power Load Amps	The amount of Current draw the Protocol unit is rated for (used for compressor shedding during electric defrost)
Temperature Display Mode	The display mode for temperature (°F or °C)

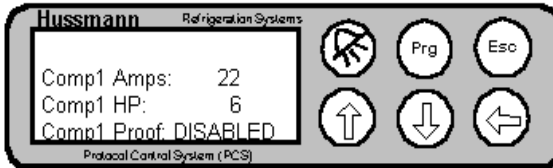
Figure 27- System Configuration Screen 4**Table 9- System Configuration Screen 4**

Field	Explanation
Suct	Displays the minimum/maximum range for the suction pressure probe (both suction groups). This should always be 000/362 PSI.
Disc	Displays the minimum/maximum range for the discharge pressure probe (both suction groups). This should always be 000/362 PSI.

Figure 28- System Configuration Screen 5**Table 10- System Configuration Screen 5**

Field	Explanation
Comp 1 2 3 ...	Read only field that displays the compressor number.
Pt	Displays the relay point number assigned to the compressor. Note that all compressor relays are located on the controller.
Grp	Displays the Group

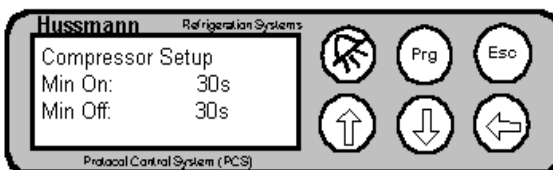
	number that the compressor is associated with.
--	--

Figure 29- System Configuration Screen 6

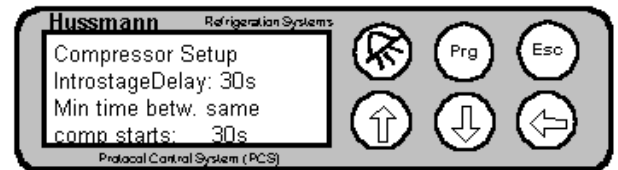
There will be one screen for each compressor (1 – 6) that is identical to the above screen.

Table 11- System Configuration Screen 6

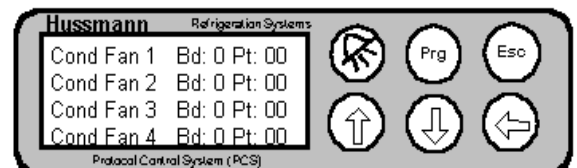
Field	Explanation
Comp1 Amps	The total amp draw of compressor 1 (used for compressor shedding during electric defrost)
Comp1 HP	The Horsepower of compressor 1 (used during capacity calculations for the pressure control algorithm)
Comp1 Proof	Used to ENABLE or DISABLE proofing for a compressor. Note that the compressor proof input points are fixed for each compressor (refer to the Protocol schematics for details)

Figure 30- System Configuration Screen 7**Table 12- System Configuration Screen 7**

Field	Explanation
Min On	Displays the minimum on time for the compressor
Min Off	Displays the minimum off time for the compressor

Figure 31- System Configuration Screen 8**Table 13- System Configuration Screen 8**

Field	Explanation
Compressor Setup IntrostageDelay	Displays the minimum time that will elapse before bringing on a different compressor. This is useful to prevent all compressors from coming on all at one time (such as after a power fail)
Min time betw. Same comp. starts	Displays the minimum amount of time that must elapse (beginning with the time the compressor is turned on) before a compressor can be turned on after being turned off. (Only with version 3.0B01)

Figure 32- System Configuration Screen 9**Table 14- System Configuration Screen 9**

Field	Explanation
Cond Fan 1Bd Pt	Displays the Board number and Point (relay) number for the condenser fans. Applicable only for applications using condenser control.

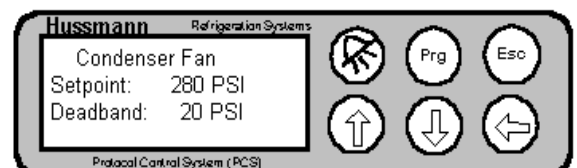
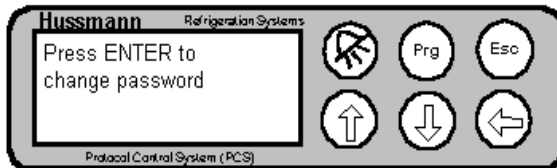
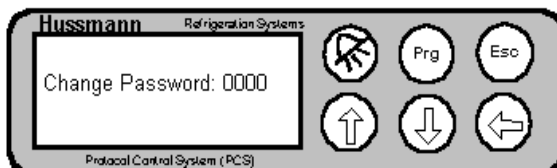
Figure 33- System Configuration Screen 10

Table 15- System Configuration Screen 10

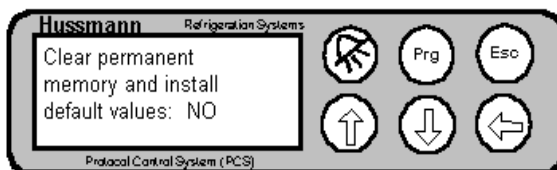
Field	Explanation
Setpoint	Displays the condenser pressure setpoint (applicable only for condenser control)
Deadband	Displays the deadband to use for condenser control

Figure 34- System Configuration Screen 11

This screen has no fields. It is a prompt to change the password. If you'd like to change the password, press the ENTER key. Note that the default password for the controller is "0000".

Figure 35 - System Configuration Screen 12

This screen is displayed if you press the ENTER key on the previous screen. Changing the value displayed will result in the password being changed.

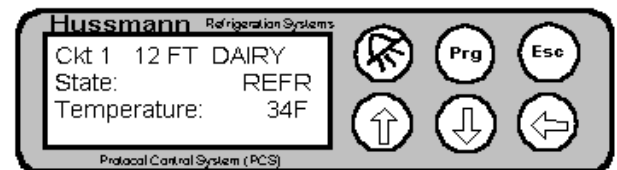
Figure 36- System Configuration Screen 13

This screen is used to completely clear all setpoints which are in the unit. Changing the NO field to YES and pressing ENTER will result in an "Are You Sure?" screen being displayed.

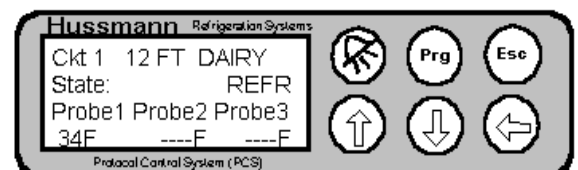
Note that clearing all setpoints will results in ALL configuration information (compressors, circuits, suction group, etc.) being lost. Use this with caution.

8.5.2.2 Circuit Configuration

The following are the circuit configuration screens. Note that the top row of each screen contains the circuit number and the name of the circuit. The circuit number in the top row is an active field in all screens. To view the configuration information for a different circuit, change the circuit number to the desired circuit and the information for the new circuit will be displayed.

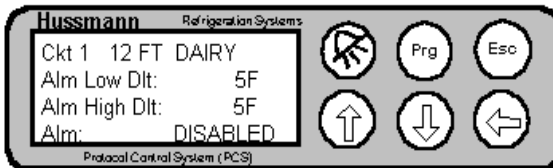
Figure 37- Circuit Configuration Screen 1**Table 16- Circuit Configuration Screen 1**

Field	Explanation
State	Read Only field that displays the state of the refrigeration circuit (REFR- Refrigeration, STAND BY- Temperature is satisfied, DEFR- Circuit)
Temperature	Displays the calculated temperature for the circuit. Note that this may be a combination of multiple temperature probes assigned to the circuit.

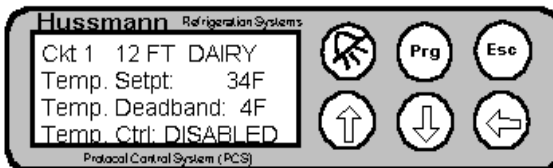
Figure 38- Circuit Configuration Screen 2**Table 17- Circuit Configuration Screen 2**

Field	Explanation
State	Read Only field that displays the state of the refrigeration circuit (REFR- Refrigeration, STAND BY- Temperature is satisfied, DEFR- Circuit)
Probe 1,2,3	Displays the actual reading

	of the temperature probe. Note that “---” will be displayed if a input assignment (board/point) has not been made for the probe.
--	--

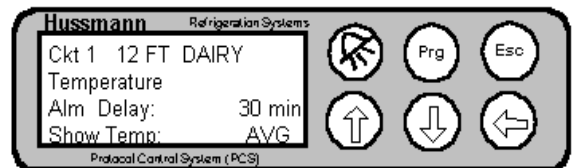
Figure 39- Circuit Configuration Screen 3**Table 18- Circuit Configuration Screen 4**

Field	Explanation
Alm Low Dlt	The delta (difference) below the setpoint that is considered an alarm. For example, if the temperature setpoint is 30 and the delta is 5, the low alarm will be at 25 degrees.
Alm High Dlt	The delta (difference) above the setpoint that is considered an alarm. For example, if the temperature setpoint is 30 and the delta is 5, the high alarm will be at 35 degrees.
Alm	Displays the setting (ENABLED or DISABLED) for the alarm

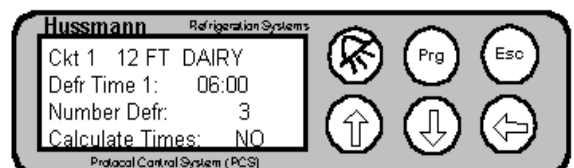
Figure 40- Circuit Configuration Screen 5**Table 19- Circuit Configuration Screen 5**

Field	Explanation
Temp Setpt	Displays the temperature setpoint for this circuit.
Temp Deadband	Displays the deadband to be applied to the setpoint if the circuit is controlling temperature

Temp Ctrl	Displays the temperature control mode of the circuit (ENABLED- temperature control enabled, DISABLED- temperature control disabled). Note that if the circuit is a hot gas defrost, there is not an option for temperature control of the circuit.
-----------	--

Figure 41- Circuit Configuration Screen 6**Table 20- Circuit Configuration Screen 6**

Field	Explanation
Temperature Alm Delay	Displays the amount of delay time after the temperature goes above or below the alarm limits before the temperature alarm is logged
Show Temp	Displays the mode for calculation of the circuit temperature. This is only applicable if there are multiple probes defined for the circuit. Note that this field can be AVG (display the average), MIN (display the minimum), or MAX (displays the maximum)

Figure 42- Circuit Configuration Screen 7**Table 21- Circuit Configuration Screen 7**

Field	Explanation
Defr Time 1	Displays the time of the first defrost
Number Defr	Displays the total number of defrosts per day
Calculate	If the user fills in the Defr

Times	Time 1 field and the Number Defr field and sets this field to YES, the controller will automatically calculate all defrost times (evenly spaced through out the day)
-------	--

Figure 43- Circuit Configuration Screen 8

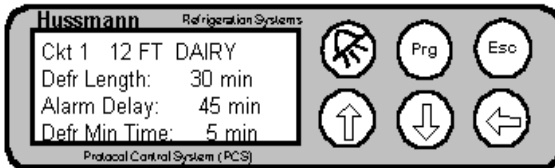


Table 22- Circuit Configuration Screen 8

Field	Explanation
Defr Length	Displays the amount of time for a defrost. If there is no termination or there the controller does not get the termination signal, this is the maximum length of time that the defrost will last.
Alarm Delay	Displays the time delay for an alarm if the controller is in defrost.
Defr Min Time	Displays the minimum time that the controller will run a defrost for. A defrost will run for this minimum amount of time, even if a termination signal occurs before this period of time.

Figure 44- Circuit Configuration Screen 9

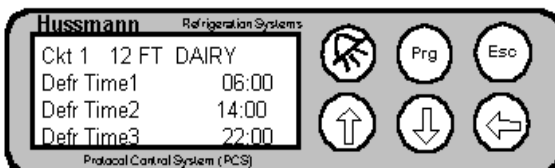


Table 23- Circuit Configuration Screen 9

Field	Explanation
Defr Time 1,2,3	Displays the time of the defrost (24 hour format)

Figure 45- Circuit Configuration Screen 10

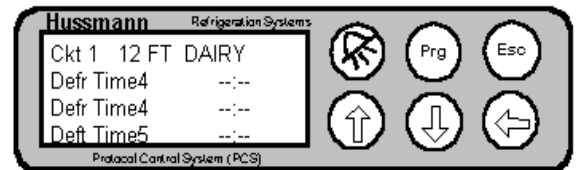


Table 24- Circuit Configuration Screen 10

Field	Explanation
Defr Time 4,5,6	Displays the time of the defrost (24 hour format)

Figure 46- Circuit Configuration Screen 11

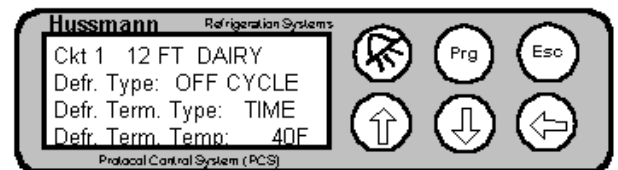


Table 25- Circuit Configuration Screen 11

Field	Explanation
Defr Type	Displays the type of defrost (ELECTRIC, OFF CYCLE or HOT GAS)
Defr Term Type	Displays the type of termination to use (TIME, NONE, TEMPERATURE or DIGITAL (Klixon))
Defr Term Temp	Displays the termination temperature for the circuit

Figure 47- Circuit Configuration Screen 12

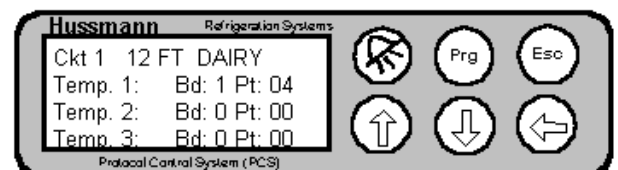
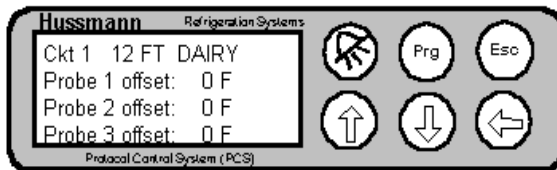
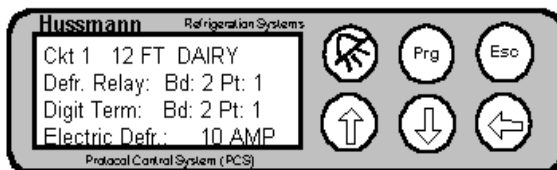


Table 26- Circuit Configuration Screen 12

Field	Explanation
Temp 1,2,3	Displays input Board and Point for the temperature probes for this circuit. Note that the assignment of the board/point defines whether a circuit is active.

Figure 48- Circuit Configuration Screen 13**Table 27- Circuit Configuration Screen 13**

Field	Explanation
Probe 1,2,3 offset	Displays the offset (degrees) that will be applied to the probe reading.

Figure 49- Circuit Configuration Screen 14**Table 28- Circuit Configuration Screen 14**

Field	Explanation
Defr Relay	Displays the output point assignment for the refrigeration relay for this circuit. Note that if this is an electric defrost, the controller automatically takes the next relay point on the board for this circuit as well.
Digit. Term	Displays the input point assignment (Board/Point) for the digital termination for the circuit.
Electric Defr	Displays the Amp draw of the circuit's electric defrost heaters. Used for compressor shedding during electric defrost.

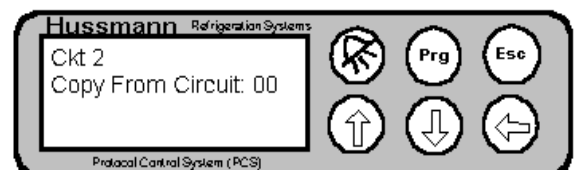
Figure 50- Circuit Configuration Screen 15**Table 29- Circuit Configuration Screen 15**

Field	Explanation
Case Type	Displays the case type defined for the circuit. This allows a circuit to be named to better identify it. Scroll through all the names by selecting the field and pressing the UP ARROW or DOWN ARROW keys.
Case Size	Displays the case size defined for the circuit. Select the size by selecting the fields and pressing the UP or DOWN ARROW keys.

The above screen is the last screen for circuit configuration.

8.5.2.3 Copying Circuit Configuration

A circuit configuration can be copied from an existing circuit to save time during the setup process. To copy a circuit configuration, first setup one circuit. Next go to the first configuration screen of the circuit that you wish to copy into. Press the UP ARROW key and the Circuit Copy Screen (see Figure 51) will be displayed. Go to the Copy from Circuit field and enter the number of the circuit that you have already set up. The controller will then copy all setpoints from the original circuit into the new circuit. Note that after copying it will be necessary to make the required changes to the circuit (defrost schedule, board/points, etc.).

Figure 51- Copy Circuit Configuration Screen

8.5.2.4 Suction Group Configuration

The following are the suction group configuration screens. Note that the top row of each screen contains the group number and the name of the group. The group number in the top row is an active field in all screens. To view the configuration information for a different group, change the group number to the desired group

and the information for the new group will be displayed.

Figure 52- Suction Configuration Screen 1

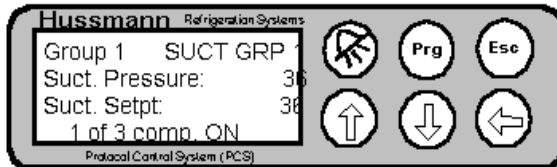
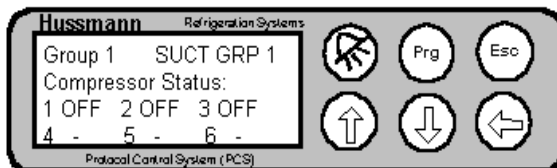


Table 30- Suction Configuration Screen 1

Field	Explanation
Suct. Pressure	Read Only field that shows the current suction pressure reading.
Suct. Setpt	Displays the suction pressure setpoint
X of Y comp ON	Read Only field that shows how many compressors for this suction group are on

Figure 53- Suction Configuration Screen 2



This screen shows the status of all compressors.

Figure 54- Suction Configuration Screen 3

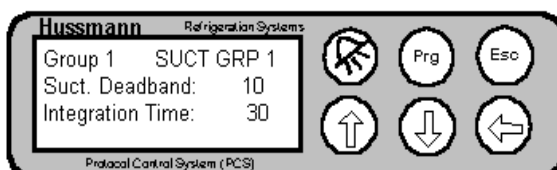


Table 31- Suction Configuration Screen 4

Field	Explanation
Suct. Deadband	Displays the Deadband for the P+I algorithm. Note this deadband is used for both P and P+I. The larger this field, the wider the pressure swings that will be allowed before switching on/off compressors.
Integration Time	Displays the Integration Time for the P+I algorithm

	(in seconds). The larger this number, the slower the controller will be to respond to and try to correct pressure changes.
--	--

Figure 55- Suction Configuration Screen 5

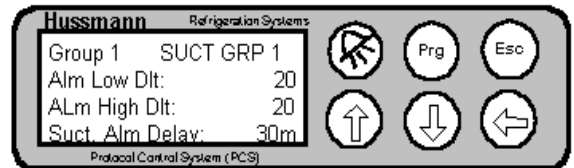


Table 32- Suction Configuration Screen 5

Field	Explanation
Alm Low Dlt	Displays the Low pressure alarm delta (difference) in PSI. Note that value will be subtracted from the setpoint and that will be the value that will trigger a low suction pressure alarm (after the delay time)
Alm High Dlt	Displays the High pressure alarm delta (difference) in PSI. Note that value will be added to the setpoint and that will be the value that will trigger a high suction pressure alarm (after the delay time)
Suct. Alm Delay	Displays the delay time before signaling a high/low pressure alarm

Figure 56- Suction Configuration Screen 6

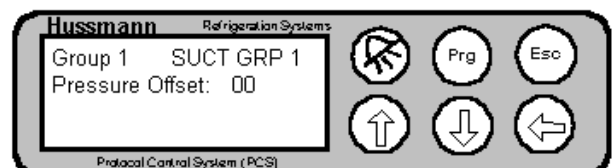
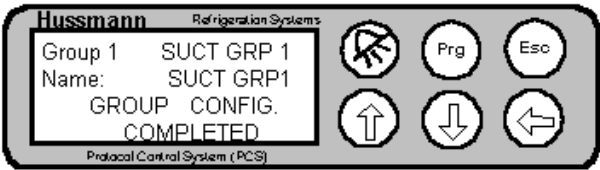


Table 33- Suction Configuration Screen 6

Field	Explanation
Pressure Offset	Displays the offset (PSI) that will be applied to the pressure probe reading.

Figure 57- Suction Configuration Screen 7

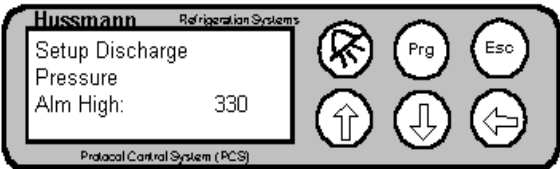


This is the last configuration screen for the suction group. The suction group can be named by selecting the name field and using the UP or DOWN ARROW keys to select a letter, then pressing the ENTER key to move to the next letter.

8.5.2.5 Discharge Pressure Configuration

This screen shows the configuration screen for the discharge pressure setup. Note that the only field on this screen is the setting of the Alarm setpoint (in PSI).

Figure 58- Discharge Configuration Screen



8.5.2.6 Lighting Configuration

The following screens show the configuration screens for lighting control.

Figure 59- Lighting Configuration Screen 1

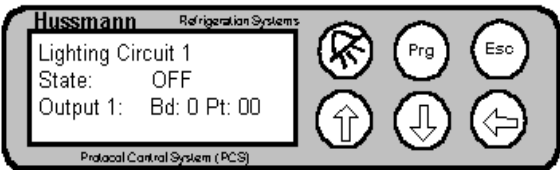


Table 34- Lighting Configuration Screen 1

Field	Explanation
State	Read Only field that displays whether the circuit is ON or OFF
Output 1:	Displays the output point (board/point) assignment for the output relay.

Figure 60- Lighting Configuration Screen 2

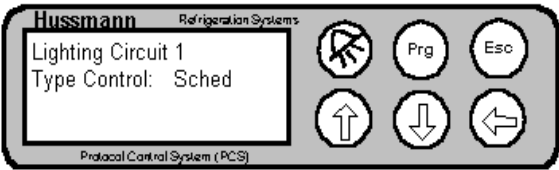
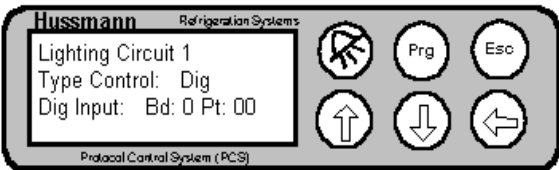


Table 35- Lighting Configuration Screen 2

Field	Explanation
Type Control:	Displays the control mode for the lighting circuit. Can be either SCHED- controlled from a schedule or DIG- controller from a digital input point (ON when the input is high)

Figure 61- Lighting Configuration Screen 2A



Note that Figure 61 shows the screen in Figure 60 if the Type Control field is set to DIGITAL.

Field	Explanation
Type Control	Displays the control mode for the lighting circuit. Can be either SCHED- controlled from a schedule or DIG- controller from a digital input point (ON when the input is high)
Dig Input:	Displays the input point (board/point) assignment for the input.

Figure 62- Lighting Configuration Screen 3

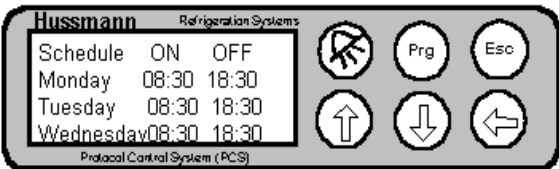


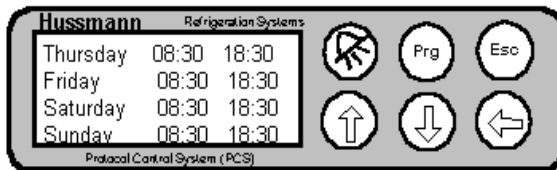
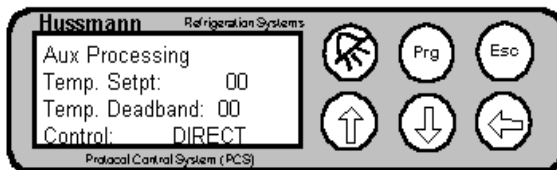
Figure 63- Lighting Configuration Screen 4

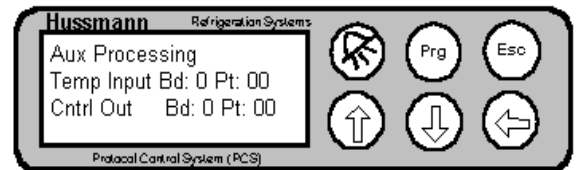
Figure 62 and Figure 63 show the screens used to configure the schedule for the lighting circuit. An ON and OFF time can be entered (24 hour format) for each day of the week.

8.5.2.7 Auxiliary Configuration

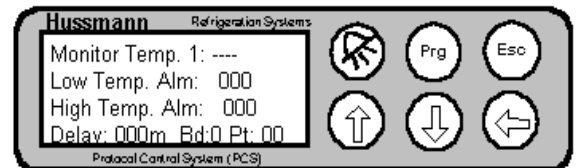
There are two auxiliary functions that can be configured on the PCS. The first is the ability to take a temperature input and turn a relay output ON or OFF if the temperature is above/below a setpoint. The second is the ability to monitor two temperatures. Note that there is no control function associated with the temperature inputs, but alarms can be set for the temperature inputs

Figure 64- Aux Configuration Screen 1**Table 36- Aux Configuration Screen 1**

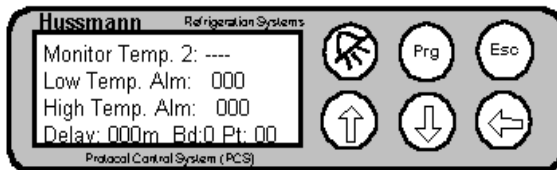
Field	Explanation
Temp Setpt	Displays the temperature setpoint for the auxillary temp control function
Temp Deadband	Displays the deadband for the temp control function
Control	Displays the type of control, either DIRECT (relay closes on temperature above setpoint + ½ deadband) or REVERSE (relay opens on temperature above setpoint + ½ deadband)

Figure 65- Aux Configuration Screen 2**Table 37- Aux Configuration Screen 2**

Field	Explanation
Temp Input Bd/Pt	Displays the input point assignment (board/point) for the temperature input
Cntrl Out	Displays the output point (board/point) assignment for the output relay.

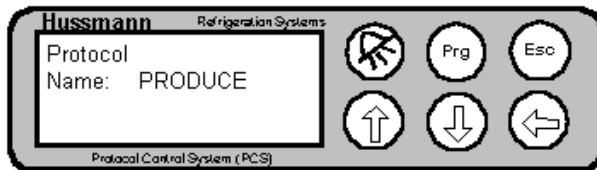
Figure 66- Aux Configuration Screen 3**Table 38- Aux Configuration Screen 3**

Field	Explanation
Low Temp Alm	Displays the low temp alarm value. If the Monitor temp input is below this value for the appropriate delay time, an alarm will be signaled.
High Temp Alm	Displays the high temp alarm value. If the Monitor temp input is above this value for the appropriate delay time, an alarm will be signaled.
Delay	Displays the delay time to wait before signaling an alarm (minutes)
Bd/Pt	Displays the input point (board/point) assignment for the temperature input.

Figure 67- Aux Configuration Screen 4

This screen is identical to Figure 63, but is for the second monitor input.

8.5.2.8 Release Configuration Screen

Figure 68- Release Configuration Screen

The Release configuration screen allows the unit to be named. Select the name field then use the UP or DOWN ARROW keys to choose the letters, pressing the ENTER key after each letter is chosen.

8.5.3 Alarms

Refer to paragraph 7.1.10 for details on the alarm screen.

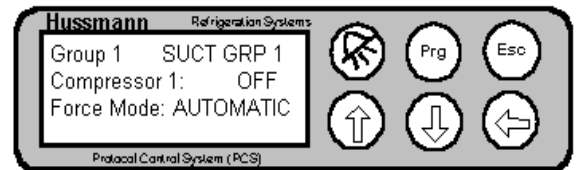
8.5.4 Maintenance

8.5.4.1 Circuit

Refer to paragraph 7.1.9 for details of the Circuit maintenance operation.

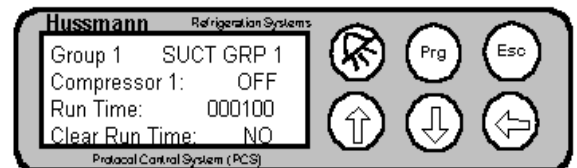
8.5.4.2 Suction Group

The Suction Group maintenance screens allow you to force a compressor on or off and to see the run times of a compressor. Note that the following screens are repeated for each compressor.

Figure 69- Suction Group Maintenance Screen 1**Table 39- Suction Group Maintenance Screen 1**

Field	Explanation
Compressor 1	Read only field that shows the current state of the compressor
Force Mode	Displays the control mode of the compressor. AUTOMATIC- the pressure control algorithm is controlling the state, ON- the state of the compressor will be forced on, OFF- the state of the compressor will be forced off.

Warning: the Force Mode will always revert back to AUTOMATIC when the controller logs out so do not rely on the controller holding the compressor off for an extended period of time.

Figure 70- Suction Group Maintenance Screen 2**Table 40- Suction Group Maintenance Screen 2**

Field	Explanation
Compressor 1	Read only field that shows the current state of the compressor
Run Time	Displays the run time in hours for the compressor
Clear Run Time	Setting this field to YES will clear the run time counter

8.5.4.3 Alarm

Refer to paragraphs 7.1.10.1 and 7.1.10.2 for details of the Alarm maintenance operation.

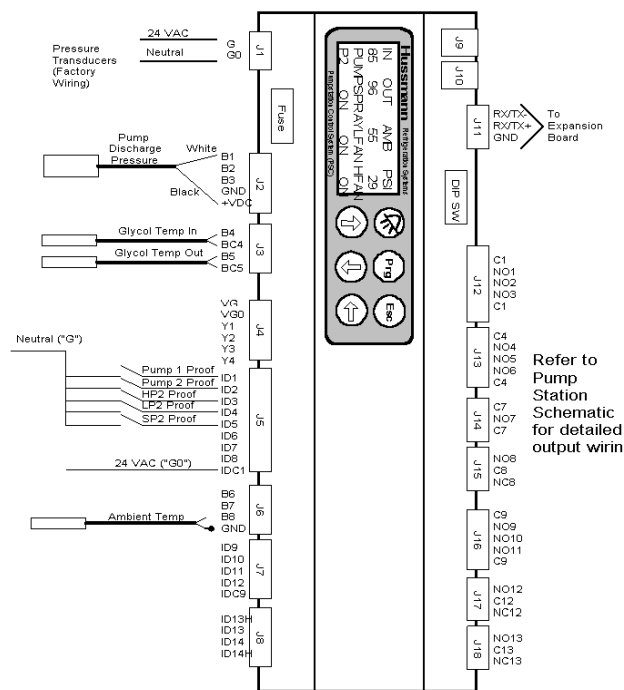
9. Pump Station

9.1 Overview

The Protocol Refrigeration system offers an optional water chiller. If a water chiller is used, it will be equipped with the Hussmann Pump Station Controller. The Pump Station controller provides control of the water pump and the fluid cooler (providing low and high speed fan control and water spray control).

9.2 Hardware

The Hussmann Pump Control System (PCS) uses the same hardware platform as the Protocol Controller. The software load is different. The label is different to make it easy to identify the Pump Station controller from the Protocol Controller.



9.3 Operation

9.3.1 Pump Motor

There are two motors on a pump station. The pump motor algorithm will cycle the between the two motors based on a user entered time interval (the default is 84 hours). The Pump (Relay 8) output will be used to switch the pumps. When the output is deenergized,

pump #1 will be switched on. When the output is energized, pump #2 will be switched on.

The pump motors are monitored by the corresponding proof inputs. If a pump motor is on, the corresponding proof input should be active (contact closed). If the proof input does not close within 5 seconds of switching the pump motor on, the controller will switch to the other pump and signal a proof alarm. The controller will stop the timer until the user resets the proof failure by entering the maintenance screen and resetting the proof alarm. At this point the timer will start over at 0 and normal operation will continue.

The controller will monitor the water pressure to insure proper pressure at all times. If the water pressure is outside of the low and high pressure setpoints for a programmable amount of time, an alarm will be indicated and the controller will be switched to the other pump. The interval timer will not operate until the condition is reset by the user.

9.3.2 Fluid Cooler

The fluid cooler algorithm attempts to maintain the temperature of the glycol leaving the fluid cooler. This is done by cycling on the spray water and low/high speed fans. The control is a simple cut in/cut out algorithm. The controller monitors the temperature of the glycol leaving the fluid cooler and turns on the appropriate outputs based on the cut in and cut out values for each. Note that there will be a cut in and cut out parameter for each output. When the glycol temperature is above the cut in temperature for the each output, that output will be turned energized. When the temperature goes below the cut out temperature, the output will be deenergized. Note that the outputs are independent and are controlled only by the corresponding cut in/cut out parameters.

If a proof failure occurs for an output, an alarm will be signaled. Other than signaling an alarm, the controller will operate normally.

A mode will be provided that allows for winter operation or low ambient conditions to lockout the Spray water pump. A cut in and cut out setpoint will be provided that locks out the water pump based on the ambient temperature. If the ambient temperature is below the cut in, the water pump output will be locked out and will not be energized. If the temperature comes above the cut out, the water pump output will be energized based on the spray water cut in/cut out setpoints. There will also be a glycol override temperature setpoint. When the glycol temperature is above this setpoint the spray water

pump output will operate normally based on the glycol temperature and the spray water cut in/cut out setpoints.

9.4 Screens

9.4.1 Status Screens

There are four status screens as shown in the following paragraphs. Pressing the ESC key will move between the status screens.

Figure 71- PSC Main Status Screen

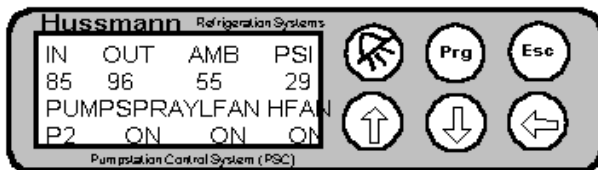


Table 41- Main Status Fields

Field	Explanation
IN	Glycol In Temperature
OUT	Glycol Out Temperature
AMB	Ambient Temperature
PSI	Pressure reading
PUMP	Status of the PUMP (P1 or P2)
SPRAY	Status of the Spray Pump
LFAN	Status of the Low Speed Fan Output
HFAN	Status of the High Speed Fan Output

Figure 72- PSC Pump Status Screen

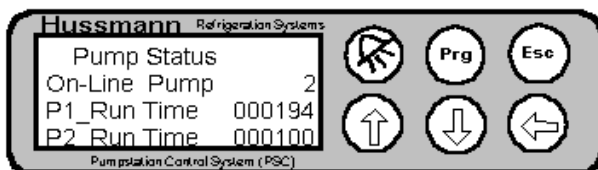


Table 42- Pump Status Fields

Field	Explanation
On Line Pump	Which pump is on
P1 Run Time	Total run time of pump 1
P2 Run Time	Total run time of pump 2

Figure 73- PSC Pump Date/Time Screen

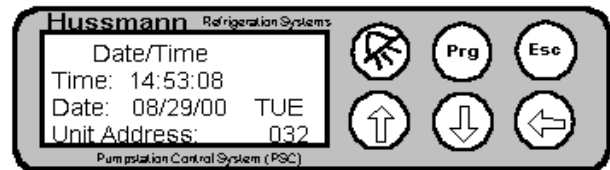


Table 43- Date/Time Status Fields

Field	Explanation
Time	Current Time
Date	Current Date and Day
Unit Address	The address of the unit on the supervisory communications network

Figure 74- PSC Release Screen

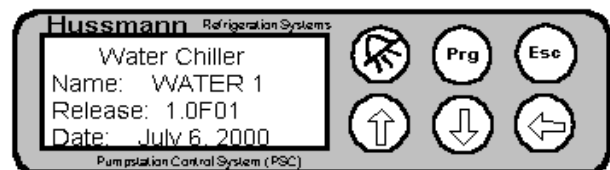


Table 44- Release Fields

Field	Explanation
Name	Name of this controller as set by the user
Release	Version number of the software release
Date	Release date of the software

9.4.2 Configuration Screens

There are ten configuration screens for the PSC controller. The configuration screens are entered by starting at the Main Status screen and pressing the ESC key until the Password Screen (shown in Figure 75) is displayed. Enter the password, then press the ENTER key and the first configuration screen (shown in Figure 76) will be displayed. Scroll to the next configuration screen by pressing the DOWN ARROW with the cursor in the upper left corner of the screen.

Figure 75- PSC Password Screen

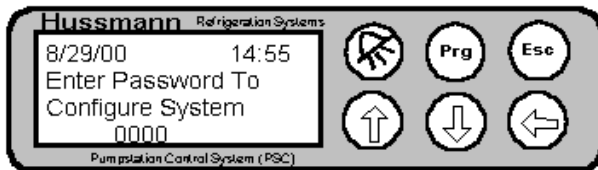


Figure 76- PSC Configuration Screen 1

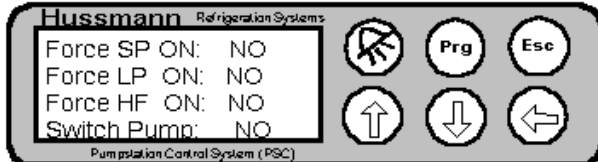


Table 45- PSC Configuration Screen 1 Fields

Field	Explanation
Force SP ON	Set to YES to Force the Spray Pump On. Note that the force will revert to the original value in 3 minutes.
Force LF ON	Set to YES to Force the Low Speed Fan On. Note that the force will revert to the original value in 3 minutes.
Force HF ON	Set to YES to Force the High Speed Fan On. Note that the force will revert to the original value in 3 minutes. Note that if the High Speed is forced to ON, the Low Speed Fan will be turned OFF.
Switch Pump	Set to YES to change the pump. If the pump is switched, it will remain on until the pump timer expires. Note that the pump timer is reset when the pumps are changed.

Figure 77- PSC Configuration Screen 2

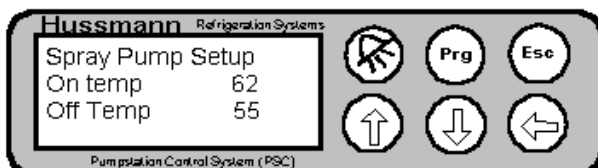


Table 46- PSC Configuration Screen 2 fields

Field	Explanation
On Temp	Temperature to turn the Spray pump ON ³
Off Temp	Temperature to turn the Spray pump OFF

Figure 78- PSC Configuration Screen 3

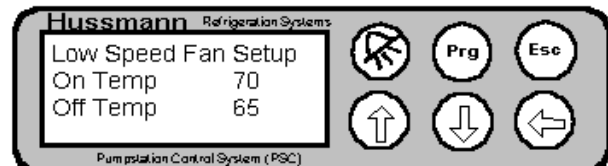


Table 47- PSC Configuration Screen 3 fields

Field	Explanation
On Temp	Temperature to turn the Low Speed Fan On ⁴
Off Temp	Temperature to turn the Low Speed Fan OFF

Figure 79- PSC Configuration Screen 4

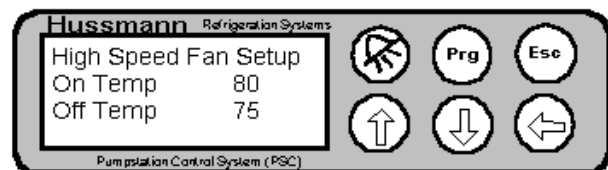
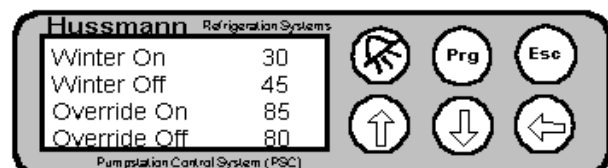


Table 48- PSC Configuration Screen 4 Fields

Field	Explanation
On Temp	Temperature to turn the High Speed Fan On
Off Temp	Temperature to turn the High Speed Fan OFF

Figure 80- PSC Configuration Screen 5

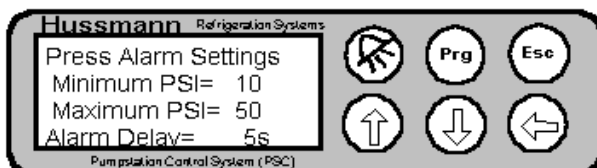


³ Note that operation of the Spray Pump will be affected by the Winter Summer Mode as defined in Table 49.

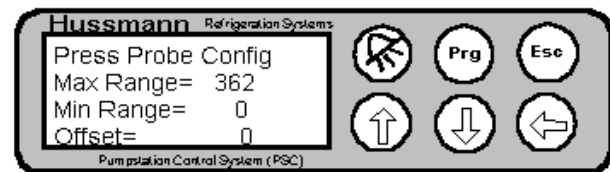
⁴ Note that the Low Speed Fan will be turned off if the High Speed Fan comes on.

Table 49- PSC Configuration Screen 5 Fields

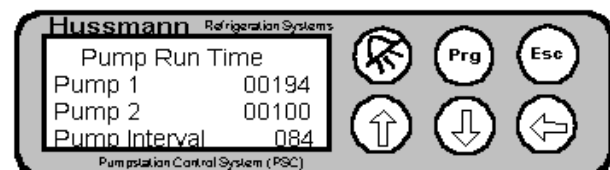
Field	Explanation
Winter On	If the ambient temperature is below this setpoint, the spray pump will not be turned on
Winter Off	If the ambient temperature is above this setpoint, the spray pump can be turned on
Override On	If the outlet temperature is above this setpoint, the spray pump will be enabled regardless of the ambient temperature. Note that if the outlet temperature goes above this setpoint, a High Temp Alarm will be activated.
Override Off	If the outlet temperature is below this setpoint, the spray pump will be disabled if the ambient temperature is below the Winter On setpoint

Figure 81- PSC Configuration Screen 6**Table 50- PSC Configuration Screen 6 Fields**

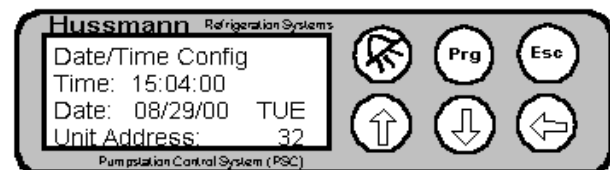
Field	Explanation
Minimum PSI	Low Pressure setpoint for the water pressure. If the pressure is below this value for the delay time, an alarm will be activated.
Maximum PSI	High Pressure setpoint for the water pressure. If the pressure is above this value for the delay time, an alarm will be activated.
Alarm Delay	Delay time before activating pressure alarm

Figure 82- PSC Configuration Screen 7**Table 51- PSC Configuration Screen 7 Fields**

Field	Explanation
Max Range	Maximum range of the pressure probe. Should always be 362 PSI.
Min Range	Minimum range of the pressure probe. Should always be 0 PSI.
Offset	Offset of the pressure probe

Figure 83- PSC Configuration Screen 8**Table 52- PSC Configuration Screen 8 Fields**

Field	Explanation
Pump 1	Initial value for run time value for Pump 1 (hours)
Pump 2	Initial value for run time value for Pump 2 (hours)
Pump Interval	Time interval to switch between pumps (hours)

Figure 84- PSC Configuration Screen 9**Table 53- PSC Configuration Screen 9 Fields**

Field	Explanation
Time	Used to set the time of the controller
Date	Used to set the date of the controller
Day	Used to set the day of the controller

Unit Address	Used to set the address of the unit on the supervisory communications network
--------------	---

Figure 85- PSC Configuration Screen 10

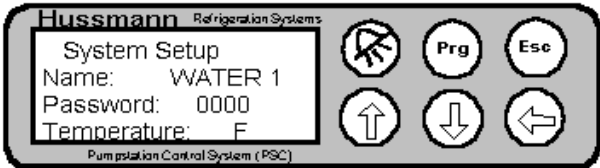


Table 54- PSC Configuration Screen 10 Fields

Field	Explanation
Name	Used to set the name of the controller
Password	Used to set the password of the controller
Temperature	Used to set the temperature display mode of the controller

Figure 86- PSC Configuration Screen 11

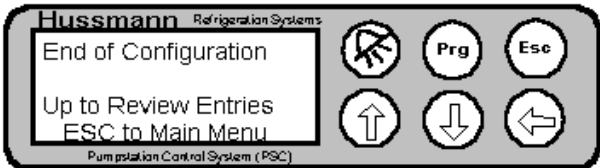


Figure 86 shows the last configuration screen. When this screen has been reached, the configuration for the controller has been completed.

9.5 Alarms

The alarm management in the pump station is very similar to the alarms in the Protocol controller. Press the ALARM key to enter the alarm screen (shown in Figure 87). Press the PRG key to enter the maintenance menu. There is a prompt to reset alarms in the maintenance menu. Entering YES to this prompt will reset the current alarm and clear the alarm menu.

The following Alarms are provided in the Pump Station controller:

9.5.1 Controller Reboot

Power was applied to the controller.

9.5.2 Spray Pump Fail

The proof for the Spray Pump failed.

9.5.3 Low Speed Fan

The proof for the Low Speed Fan failed.

9.5.4 High Speed Fan

The proof for the High Speed Fan failed.

9.5.5 Pump 1

The proof for the Pump1 failed.

9.5.6 Pump 2

The proof for the Pump 2 failed.

9.5.7 High Discharge Pressure

The pressure was above the alarm setpoint for greater than the alarm delay time.

9.5.8 Low Discharge Pressure

The pressure was below the alarm setpoint for greater than the alarm delay time.

9.5.9 Pressure Sensor Fail

The pressure was above the alarm setpoint for greater than the alarm delay time.

9.5.10 Inlet Temp probe Fail

The inlet temperature probe failed.

9.5.11 Outlet Temp probe Fail

The outlet temperature probe failed.

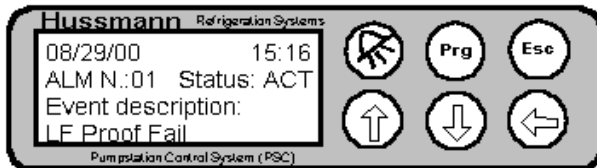
9.5.12 Ambient Temp Fail

The ambient temperature probe failed.

9.5.13 Alarm Winter Override

The outlet temperature was higher than the Winter Override setpoint.

Figure 87- PSC Alarm Screen



10. Supervisory System

10.1 Overview

The PCS Supervisory system provides a means to monitor and supervise Protocol Controllers from a central point within a store. The system runs a PC and communicates with the controller via an RS485 network. The system requires an RS485 converter and a software protection key to be installed on the PC.

10.2 Supervisory Connection Wiring

The RS485 network wiring must be wired correctly in order for the Supervisory system to function. Refer to the drawing in [Appendix A](#) for details.

10.3 Requirements

The following are the general requirements for the computer which will run the supervisory system.

1. CPC P4 800 Mhz (or equivalent)
2. 512 MB Ram
3. 20 GB Hard Drive
4. 1024 x 768 Video
5. 2 serial ports (COM1/COM2) (for fax dialout/Remote Access and RS232/RS485 Adapter)
6. CD-ROM Drive (Speed not critical)
7. US Robotics 56K Data/Fax Modem (Important: Hardware modem, not software modem)
8. PS2 Mouse and Keyboard
9. 15" SVGA Monitor
10. Windows 2000 SP4 or Windows XP SP1
11. Modem for Fax Dial out and remote access
12. Internet Explorer v6.0 or newer

Additional Information

- 1) PC must be dedicated to running the supervisory system
- 2) UPS must be provided to insure no data loss (USB type preferred for auto shutdown)

Other Accessories

1. Outside phone line or network access at PC (for fax dial outs and remote access)
2. RS-485 cable type = Belden 8641 2 conductor shielded
3. Supervisory Kit (shipped with Protocol's to job site) which consists of
 - a) Supervisor Software

- b) RS485 Converter
- c) Transformer
- d) DB25 to DB9 RS232 cable
- e) Connector for RS485 converter
- f) Terminating Resistors

10.4 Software Installation

Note that the PCS Supervisory System runs on the Windows platform. It is assumed that the user is familiar with Windows and general windows commands. Consult the Windows User Manual if you have questions.

The Supervisory software is called PlantVisor.

Use the following steps to install the PCS software.

- 1) Insure that you are logged on as a local user with Administrator privileges.
- 2) Insert the CD into the CD Rom drive. If the program does not start, run the install program by clicking the start button, selecting run and typing X:\setup, where X represents the drive letter for the CD Rom.

The installation screens you will see are described in the following paragraphs.

Figure 88- Installation Screen



On this screen select English as the language, Select Local then press the Setup button. A dialog box will pop up asking you to install Microsoft FAX software (necessary to fax alarms). Select Yes to install the fax software (note that you may need to have the original Windows CD available for this step).

The installation program will then copy the necessary files to the PC's harddrive. A dialog box will then pop up informing you that you will need to answer yes to the next dialog box. Select OK and a new dialog box will pop up informing you that a digital signature is not found

and asking you if you want to continue the installation. Select Yes and the installation will continue. After the installation, a dialog box will be displayed asking you to reboot the computer. Select Yes and the PC will be rebooted.

10.5 Hardware Installation

There are two pieces of hardware that must be installed on the PC for the PCS Supervisory system to operate. The first is an adapter that converts the RS485 signals from the PCS supervisory network into RS232 signals that can be connected to the PC. The second is a software Key that the must be installed. The following paragraphs describe how to install each of these devices.

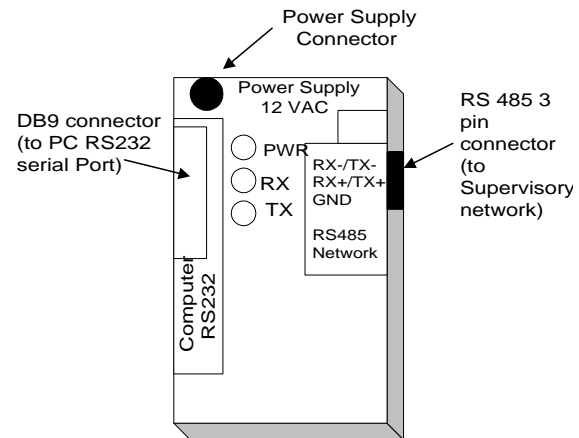
10.5.1 RS485 Adapter

The RS485 Adapter converts the RS485 signals from the PCS Supervisory network to RS232 signals. The RS485 adapter comes with a transformer and a RS232 cable. To install the adapter do the following:

- 1) Connect one end of the RS232 cable to the DB9 connector (left side of the adapter) on the Adapter and connector the other end of the cable to the DB9 connector for COMM1 on the PC.
- 2) Connect the RS485 PCS Supervisory network cable to the 3 pin RS485 connector. Depending on the network wiring, a terminating resistor may also need to be applied at this connector. See Appendix A for details.
- 3) Connect the power supply (12 VAC) to the adapter. Note that there is power LED that should light up when power is applied.

The adapter has LED's that light to represent serial network traffic being sent and received (RX and TX LED's). Under normal operation these LED's should flash at an intermittent rate. TX represents the PC attempting to communicate to the controller's and RX represents the controller's answering. Note that if the RX LED does not flash, this indicates a problem on the Supervisory network (wiring, controller addressing).

Figure 89- RS485 Adapter



10.5.2 PlantVisor Software Key

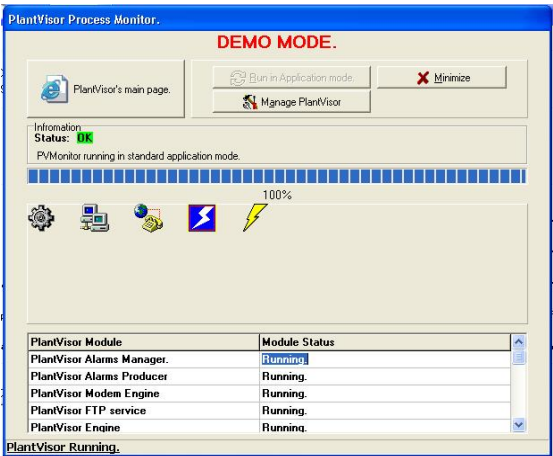
The PCS Supervisory system requires that a software Key (referred to as a SmartKey in the documentation) be installed on the USB port for the software to operate. See Figure 90 for a picture of the Key. If the Key is not installed, the PlantVisor Engine will run in Demo mode as indicated by the letters DEMO MODE at the top of the PlantVisor Engine screen (See Figure 91).

Figure 90- PlantVisor Software Key



Note that if the SmartKey is not present or recognized by PlantVisor the program will run in Demo Mode and will terminate in approximately 3 hours- all logging, alarming and other functions associated with PlantVisor will stop when PlantVisor terminates.

Figure 91- PlantVisor Engine Demo Mode



10.6 Remote Access

If Remote communications is desired from an off site PC only one modem is required. Plantvisor will use the same modem for inbound and outbound calls. There is no need for PCAnywhere with PlantVisor. A typical configuration for the PC is as follows:

- a) COM1- for an external modem for fax/remote access (can be eliminated if PC has an internal modem)
- b) COM2- RS232/RS485 converter
- c) USB- For the PVKey

10.7 Operation

10.7.1 Running the PCS Supervisor

To run the supervisory software, click the start button and select PlantVisor. The software will then launch the PlantVisor engine as shown in the PlantVisor software will run in Demo mode (as described in paragraph 10.5.2 and will terminate (stopping all logging, alarming and other supervisory functions) after a short period of time.

Figure 92. After the Engine starts and all modules are running, a Internet Explorer browser page will automatically be opened displaying the PlantVisor logon screen (Figure 93). Note that if a KEY is not present, the PlantVisor software will run in Demo mode (as described in paragraph 10.5.2 and will terminate (stopping all logging, alarming and other

supervisory functions) after a short period of time.

Figure 92- Plantvisor Engine Screen

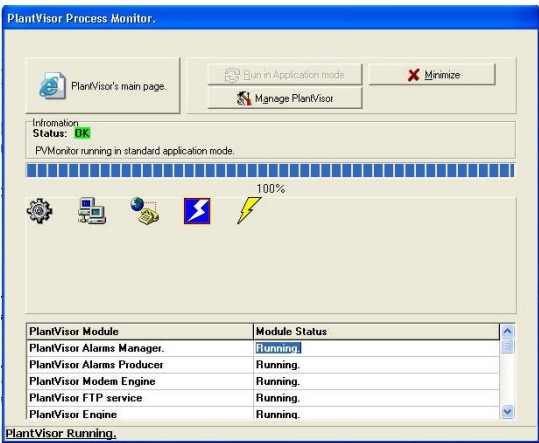


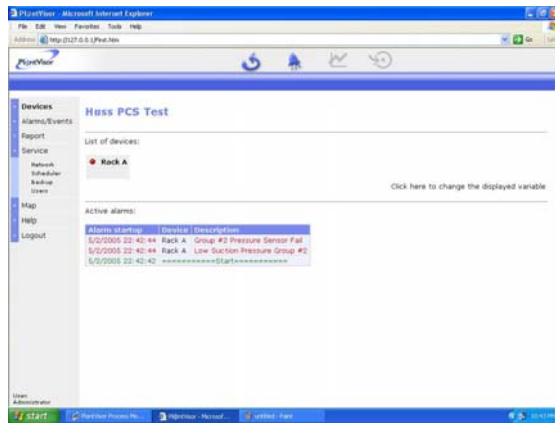
Figure 93- Logon Screen



Enter your login (default is Administrator or Guest with no password) and click OK.

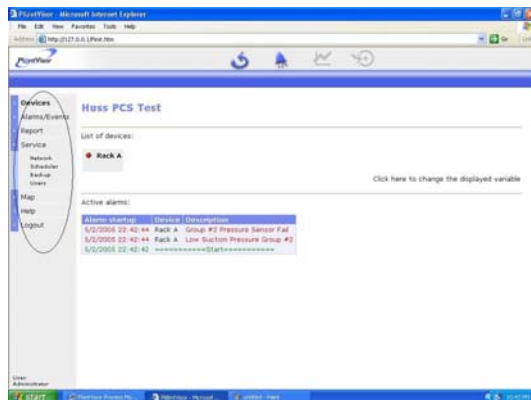
Note: it is recommended that after logging in for the first time the passwords should be changed to prevent unauthorized access.

The main screen will be displayed as shown in Figure 94.

Figure 94- Main Screen

10.7.2 Navigation

The PlantVisor system is web based and uses the Internet Explorer to display the web pages. Normal Internet Explorer commands (such as the Back Arrow) can be used to navigate through the web pages. There is also a left menu tab or pane that is used to navigate. Figure 95 shows the location of these menu items.

Figure 95- Navigation Examples

In general you will use the left hand menu pane to navigate through various levels of the system. Note that depending on the menu item a submenu could be displayed.

Devices- Select the Devices Menu Item to display the devices connected to the PlantVisor. In the example above the devices are shown in the right hand pane as RACKA and RACKB

Alarm/Events- Use the Alarms item to display info about alarms. Note that a submenu is used to see All Alarms, Only Active Alarms or Events that have occurred.

Report- The Report menu item is used to create various reports that detail operation of the system.

Service- The Service menu item is used to configure the system.

Logout- The Logout menu item is used to logout of the PlantVisor system.

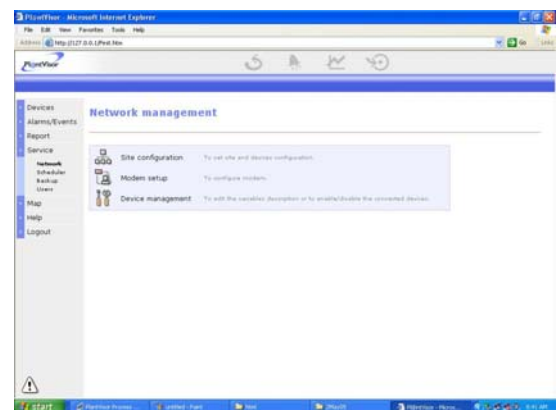
Help- The Help menu item brings up a Help information for the system.

10.7.3 Configuration

When the supervisor is first started, you will need to configure certain parameters to insure correct operation. The follow paragraphs describe these steps. Note that there are several screens with configuration information that must be completed. In general, after the appropriate information has been entered on a screen, the Save & Exit button must be pressed to save the configuration information entered. If Save & Exit is not pressed, the configuration information will be lost.

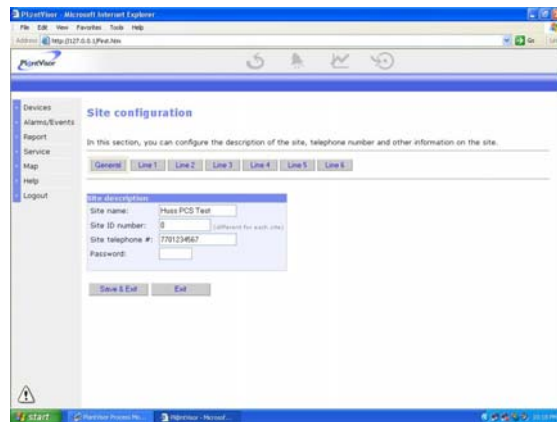
10.7.3.1 Network

Select the Service menu item from the left side of the Main Screen. The menu will expand and show 4 additional choices (Network, Scheduler, Backup, Users). Select the Network item from the submenu. The screen will change to the network setup menu.

Figure 96- Network Management Screen

Select the Site configuration item from the Network Management Screen and the Site Configuration Screen will be displayed.

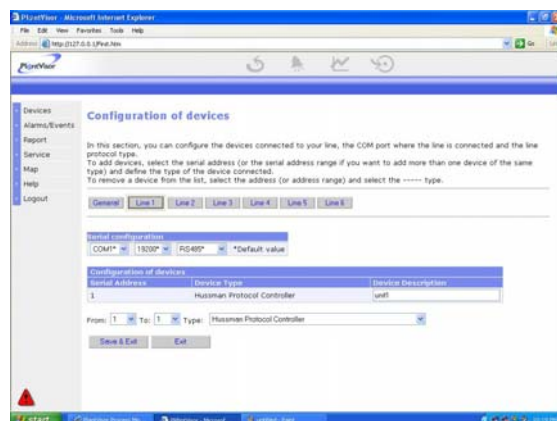
Figure 97- Site Configuration Screen



Note that the Site Configuration Screen is organized with Buttons along the top for General, Line 1, Line 2, etc. Press the General button to display the Site name and other general information. In the Site Configuration Screen, enter a name for the site and a Site ID number. Note that the Site ID number must be a unique number such as a modem telephone number, etc. The Site Telephone # and Password are optional.

Press the button labeled Line 1 to display the serial line configuration screen. In this screen you will enter information about what units are connected to the RS485 converter.

Figure 98- Serial Line Configuration Screen



You must have a separate address for each PCS controller that is connected to the RS485 Adapter. Refer to the PCS controller manual

for information on how to set the serial address of the controller. For the Serial Configuration, use the defaults for the Comm Port (unless the RS485 Adapter is connected to a different Comm Port), Baud Rate and Type (COM1, 19200, RS485). Below the "Serial Configuration" section, is a section labeled "Configuration Of Devices." In this section you must enter an address and type for each PCS Controller connected to the RS485 Adapter.

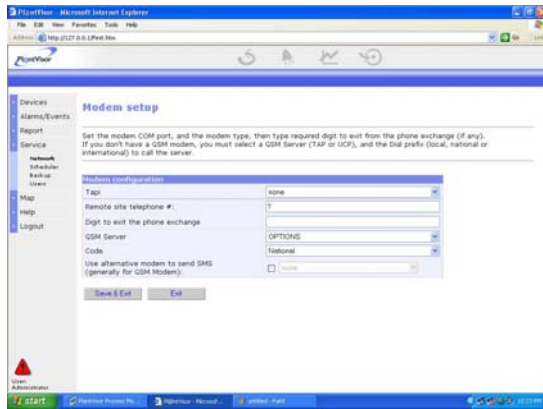
In order to add and configure the units, You must first select the address, then set the device type in the drop down box, then rename the units to a descriptive name. There are two ways to set the address for each unit, individually or as a group. To set the address individually, set the "From" and "To" boxes to the serial address of the unit, a new unit with the given address will be added to the list of devices. To set the address for a range of units, select the first address in the "From" box and the last address in the "To" box. After the address has been set, set the device type to either Hussmann Protocol Controller or Hussmann Pump Station Controller (click on the check mark beside the box and scroll the list of items until the correct one is shown). New units with the appropriate address or range of addresses will be added to the list of devices. Once the units are added, name the units with a descriptive name. Note that the default name is unitX where X represents the address. The name can be changed by selecting the name in the Device Description column and entering the new name.

When finished with the serial and site configuration, press the Save & Exit button.

Note that the address selected for each unit must match the address set in the appropriate PCS controller in order for the PlantVisor system to communicate with the PCS controllers. Refer to paragraph 10.9.3 for details on how to tell if controller is communicating with the PlantVisor.

Return to the Site Configuration Screen Figure 97 and click the Modem Setup button to enter the modem setup screen.

Figure 99- Modem Setup Screen



In the modem setup screen enter the modem from the drop down list under the TAPI field. You will then see a message explaining that the machine will be rebooted when Save is selected. Click the OK button in the message box. The Remote Site Telephone # is used if this PC will be dialing into a PlantVisor remote (off site-Not at the store) PC. The “Digit to exit phone exchange” allows a character to be dialed in certain circumstances where it is necessary to dial some digit before getting an outside line. The GSM Server and Code fields are not used. If no remote PC will be utilized, leave the telephone number blank. When the modem setup is completed, press the Save & Exit button. The PC will now reboot to configure the modem. When the setup has been completed, it may take several minutes for the Plantvisor engine to shut down and reboot. *Do not force the reboot, let the PC complete the process.*

After the PC has rebooted, start the Plantvisor application again and click the Scheduler link under the Service Dropdown menu. You should now be able to click the checkbox on the Fax To selection. Type in the fax number exactly how it needs to be dialed (i.e. with the appropriate digit to access an outside line followed by a comma, then the fax number (For example, if the fax number is 123-456-7890 and you must dial an 8 for an outside line, the Fax number would be entered as 8, 1234567890). If you insert an incorrect number, you must correct the number then shut down and restart PlantVisor for the change to take effect. Note that PlantVisor does not follow the Windows dialing property rules in the Windows modem setup area.

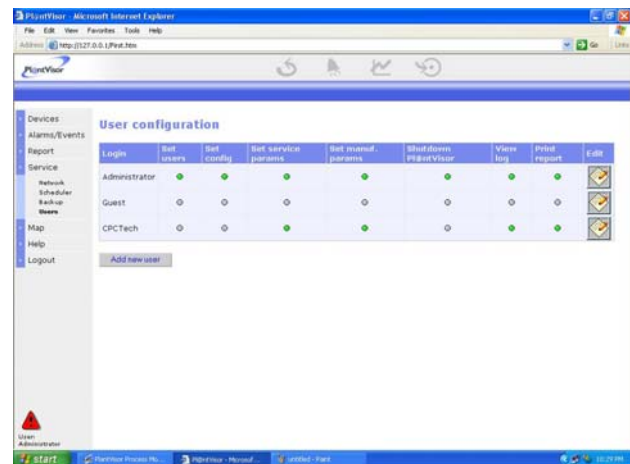
Important: Always verify that the Fax works properly and that a Fax is correctly received by

the Fax machine after setting up the fax portion of Plantvisor.

10.7.3.2 User Setup

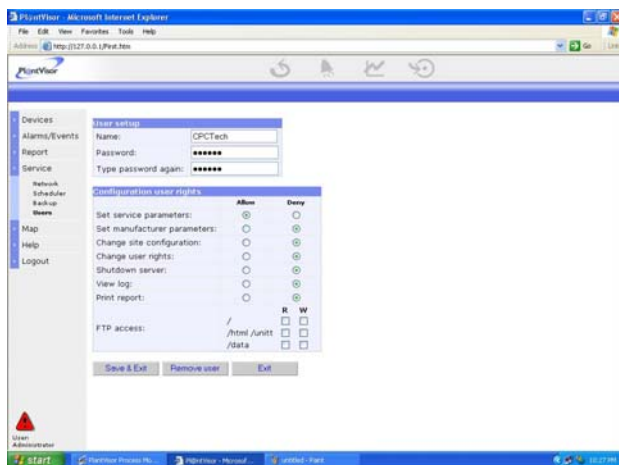
The next step in the configuration is to set up the users. Click the Users button on the left hand menu tab to enter the User setup screen.

Figure 100- User Configuration Screen



There are 2 users configured by default, Administrator and Guest. Additional users can be added by clicking the Add New User button. Click the Edit Icon for each user to customize the rights and password of each user. Note that the User Configuration screen has both Service & Manufacturing parameters. For the PCS PlantVisor system, these are the same and should both be checked if a user is allowed to change parameters of the PCS controllers.

To add a new user, click the “Add New User” button. The screen shown in Figure 101 will be displayed. Enter the Username and password for the new user, then configure the user rights by checking the appropriate button to Allow or Deny each of the privileges listed. Note that FTP access should be left unchecked for the user. When finished with the configuration, press the Save & Exit button to return to the User Configuration screen.

Figure 101- Add New User Screen

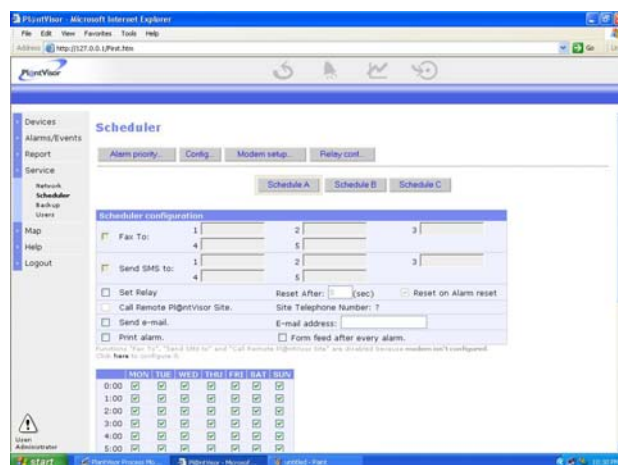
schedule. To configure the Scheduler to dial an alarm, check to box labeled “Fax To”, then fill in the telephone number (including any digits needed to get an outside line) of the fax machine that will be dialed if an alarm occurs. The “Send SMS” box should not be checked.

Near the bottom of the page is a schedule showing the days of the week and the hours in the day. A check mark in the box signifies that the schedule is active at that particular time. This feature can be used to have different alarm handling during the evening or on weekends. A 2nd Alarm schedule would be setup with the new configuration information and the active times selected for the 2nd schedule. Note that the appropriate Fax information must be set for each alarm schedule.

Note that you must press the Save button after each schedule is configured.

10.7.3.3 Scheduler & Alarm Priorities

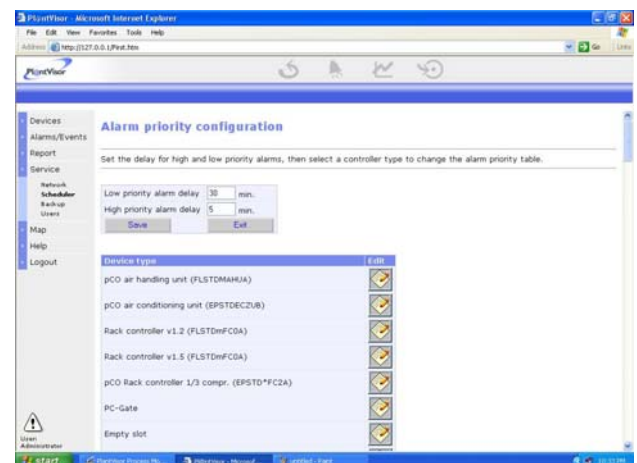
The scheduler allows the user to configure the way various events are handled by the supervisory system. Click the Scheduler button on the left hand menu tab to enter the Scheduler configuration screen shown in Figure 102.

Figure 102- Scheduler Configuration Screen

In the scheduler configuration screen, there are 3 alarm handling schedules that can be setup as well as alarm priority and configuration.

There are 3 alarm schedules. Each schedule an action is defined (i.e. Fax the alarm, dial out to a remote PlantVisor, Send email, Print etc.). Note that Send SMS message is not supported. Set the appropriate information for the alarm

After the schedules have been setup, the alarm priorities can be set up. Click the “Alarm Priority” button in the Scheduler Configuration screen to access the Alarm Priority screen (shown is Figure 103). There are 2 priorities, LOW and HIGH and each can have it’s own alarm delay time. Set the appropriate delay times by entering the minutes to delay before alarming and taking the action as defined in the Scheduler Configuration screen.

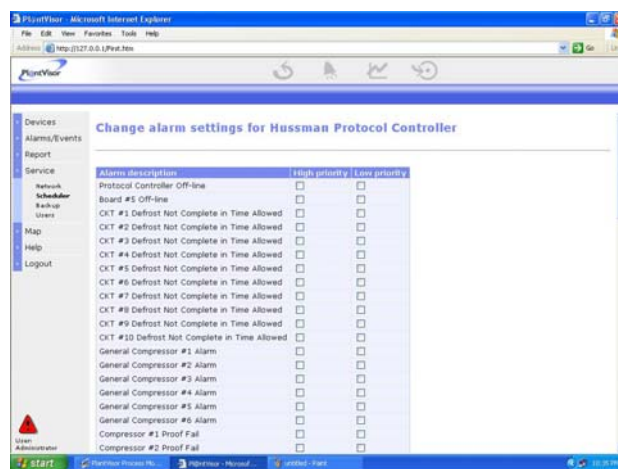
Figure 103- Alarm Priorities Screen

After the delays have been set, you will need to configure the individual alarms from the PCS controller as High or Low priority. To do this access the Hussmann Protocol Controller device type which will be shown below the delay

times. Scroll down the list until the appropriate device is selected. Only the Hussman Protocol Controller and Hussman Cooling Tower are supported. To configure the priorities of these devices, select the appropriate device, then press the Edit Icon for the device.

All alarms in the device will be displayed, along with a checkbox for LOW or HIGH priority (See Figure 104). For each alarm select the desired priority by checking the appropriate box, then press the Save & Exit button at the bottom of the screen.

Figure 104- Device Alarm Settings



Important: Always verify that the Fax works properly and that a Fax is correctly received by the Fax machine after setting up the Alarm & Scheduler portion of Plantvisor.

Note that a report can be generated by Clicking on the "Report" button. Numerous information can be included in the report including:

- 1) Last time the supervisory started
- 2) Any faxes
- 3) Any units off line

A time period can be specified for a report allow you to drill down into a specific date/time range.

The configuration of the PlantVisor software is now complete.

10.8 Running the System

10.8.1 Troubleshooting

See the troubleshooting guide in **Appendix B-Troubleshooting** if there is a problem with the supervisory software.

10.9 PCS Supervisory System Screens

The following section describes the screens of the PCS supervisory system. The information on these screens are generally the same as previously described under the appropriate section of the PCS manual. For detailed information about a status value or setpoint, refer to the appropriate section of the PCS manual.

10.9.1 General Information

There are two basic types of information on the Supervisory screens. Status information that is for display only (for example, a circuit temperature) and setpoints that can be changed (for example, the circuit temperature setpoint). Numeric setpoints are changed by selecting the setpoint field by clicking on the field and changing the value using the numeric keys on the keyboard or the up/down arrows on the numeric dialog box.

Note that in any screen where changes can be made, a Submit Changes button is present. Any changes made in the screen (i.e. setpoints) will not be sent to the Protocol Controller until the Submit Changes button is clicked. Failure to click the Submit Changes button will result in the loss of any changes made in the screen.

10.9.2 PlantVisor Engine Screens

When the PlantVisor system software is started, the PlantVisor engine will startup first, followed by the Supervisory System. The PlantVisor Engine screen, shown in Figure 105 shows the status of the PlantVisor system as it starts up. Once the startup is complete, A browser window will be automatically launched with the Supervisory System Main Screen displayed. In order to close the Plantvisor System, click the Manage PlantVisor button in the Engine Screen. A Detailed Status screen will be displayed as

shown in Figure 106. Clicking the Close PlantVisor button in this screen will display prompt a request for a password. You must enter the correct username and password (that has been configured with appropriate rights to close PlantVisor- see paragraph 10.7.3.2) to close PlantVisor (Shown In Figure 107).

Figure 105- PlantVisor Engine Screen

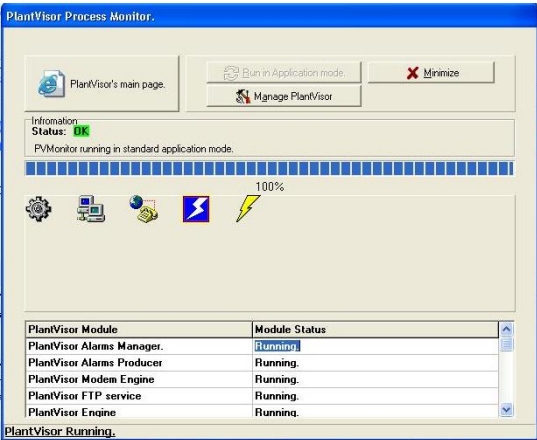


Figure 106- PlantVisor Engine Detail Screen

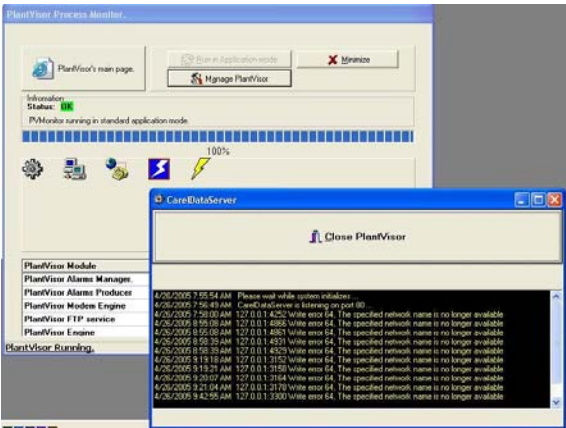
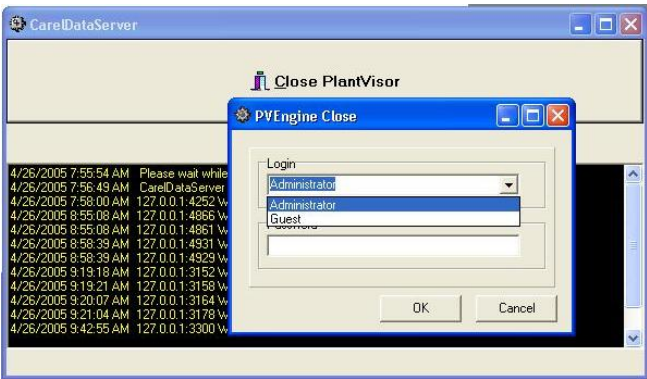


Figure 107- PlantVisor Engine Close Screen

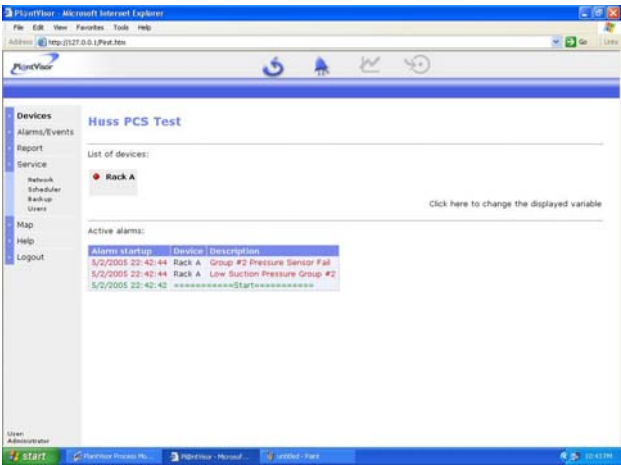


10.9.3 Supervisory Main Screen

When the PlantVisor browser is started the main screen will be displayed (See Figure 108). The main screen displays the PCS units that are connected to the PC via the RS485 converter (shown as RackA for this example) and will display active alarms (that have not been acknowledged) for the units. If the PCS Controller is communicating with the PlantVisor appropriately there will be either a green dot or red dot next to the Name. The green dot indicates normal communications and the PCS Controller is not in alarm. The red dot indicates normal communications and the unit is in alarm. A grey dot indicates no communication with the PCS Controller. In order to navigate to a particular unit, click on the unit name. The main screen for that unit will then be displayed.

In order for PlantVisor to perform logging, alarming and other supervisory functions the PCS controllers must be communicating with the PlantVisor PC.

Figure 108- Supervisory Main Screen



10.9.4 Unit Main Screen

The Unit Main Supervisory Screen is shown in Figure 109. This screen contains general status of the functions associated with the protocol

unit and a means to display screens which allow the user to change parameters or display graph's, etc. The following paragraphs describe the specific items on the Main Screen.

Figure 109- Unit Main Screen- No Alarms



10.9.4.1 Misc Information

On Line is GREEN if the unit is communicating with the PC (See Figure 111). If the unit has an active alarm, an RED Alarm indication will be displayed below the Online indicator (See Figure 110). Note that clicking on the Alarm button will send an Alarm acknowledgement to the PCS Controller acknowledging the alarm. See paragraph 10.9.11 for more information on alarms.

Figure 110- Main Screen With Alarms



10.9.4.2 Date/Time

The Date and Time of the protocol unit are shown in the upper right hand corner. Click on either to display a dialog box that will allow the Date and Time to be changed.

10.9.4.3 Suction/Discharge

This section of the screen shows the status and setpoints for the suction groups and the discharge pressure. Pressure is shown in the first column. Other columns show the setpoints and alarm information. Clicking on the button labeled "Compressor Setup" will display the Suction/Compressor Setup Screen, where the setpoints can be changed.

10.9.4.4 Circuits

The circuit state (refrigeration or defrost), the current temperature and the setpoint are shown for all circuits. The user can view a graph of the circuit temperature by clicking on the appropriate button located beneath the circuit. Clicking on the appropriate "Setup" button will enter the Circuit Setup Screen where additional information is displayed and setpoints can be changed.

10.9.4.5 Compressor Information

The status of all compressor's for the Protocol unit are shown in the lower left portion of the screen. For each compressor (1 through 6) the state of the compressor is shown (ON or OFF) as well as the suction group that it is assigned to and the relay point (of the main controller) that it is associated with.

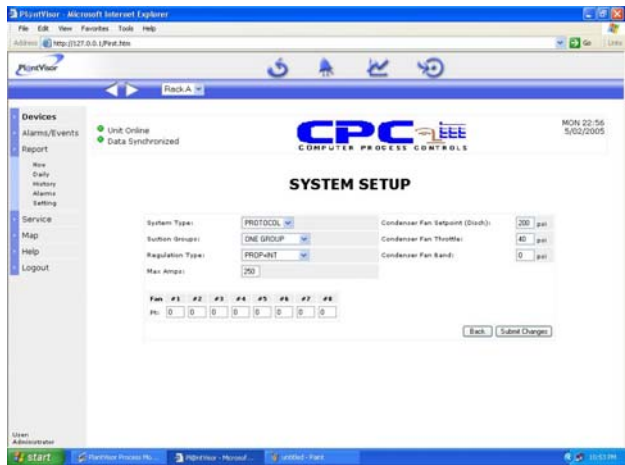
10.9.4.6 Navigation to other screens

There are six buttons located at the bottom of the main screen. These buttons are used to navigate to other screens for status information or to change setpoints. Each of these screens are described in the following paragraphs. Note that in each screen, a "Back" button is provided. Clicking on the "Back" button will return to the Main Screen.

10.9.5 System Setup

Pressing the "System Setup" button located on the Main Screen will display the System Setup screen. The System Setup screen is shown in Figure 111.

Figure 111- System Setup Screen



This screen is used to set basic system information about the Protocol units and Condenser control information.

10.9.6 Suction Group/Compressor Setup

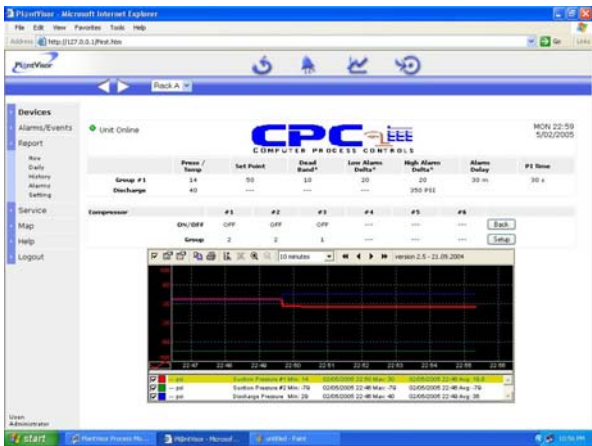
The Suction Group/Compressor Setup screen is used to enter the setpoints associated with the Suction Groups, the Discharge Pressure Alarm and the Compressor information. The Suction Group/Compressor Setup screen is shown in Figure 112. A graph of the pressures can be viewed by pressing the “Graph” button in this screen.

Figure 112- Suction Group/Compressor Setup Screen



A graph of the suction and discharge pressures can be obtained by clicking on the “Graph” button. Figure 113 shows the pressure graph.

Figure 113- Pressure Graph



10.9.7 Aux Control and Temperature Monitor

The Aux Control and Temperature Monitoring Setup screen is used to 1) display the temperature monitoring points, 2) change the setpoints associated with the temperature monitoring points, 3) see the status of the Aux control output and 4) Change the setpoints of the Aux Control output. The screen is shown in Figure 114.

Figure 114- Supervisory Temperature Monitor and Aux Control Screen



10.9.8 Light Ckt

The Lighting Circuit screen is used to see the status and enter the setpoints for a lighting circuit. The screen for Lighting Circuit 1 is shown in Figure 115.

Figure 115- Lighting Circuit Screen

is synchronizing data with the Protocol unit, the “Data Synchronized” light (upper left corner) will be RED indicating that the data is not valid yet. When the “Data Synchronized” light turns GREEN this means that the data displayed is valid. In addition, the circuit temperatures displayed in this screen may not be updated. Clicking the back button, then entering the circuit screen will update the displayed temperatures.

The Circuit Setup Screen is shown in Figure 117.

Figure 117- Circuit Setup Screen

10.9.9 Info

The Info screen displays the Software Version of the Supervisory System (PlantVisor) and the Protocol Controller. The Info Screen is shown in Figure 116.

Figure 116- Information Screen

There are two other screens that can be accessed from the circuit setup screen, Defrost Setup and Graph. To complete the Defrost setup for a circuit, click the button labeled, Defrost Setup. The Defrost Setup Screen, shown in Figure 118, will be displayed. Note that after any changes are made in the Defrost Setup Screen, you must click on the Submit Changes button to save the changes to the controller. If the button is not clicked, the changes will be lost. A defrost can also be manually started (Force Defrost On button) from this screen or a defrost that is in process can be canceled (Force Defrost Off button).

10.9.10 Circuits

The Circuit Setup Screen provides more detailed status information about a circuit and allows all setpoints associated with a circuit to be changed.

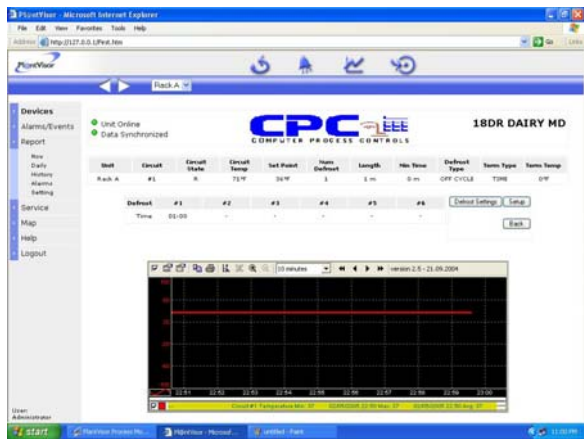
Note that as the user changes from one circuit to another, the data must be synchronized between the Protocol unit and the PC. This action can take several seconds to complete. While the PC

Figure 118- Defrost Setup Screen



There is also a “Graph” button in the Circuit Setup Screen. Clicking the “Graph” button will result in a graph of the circuit temperature being displayed (see Figure 119).

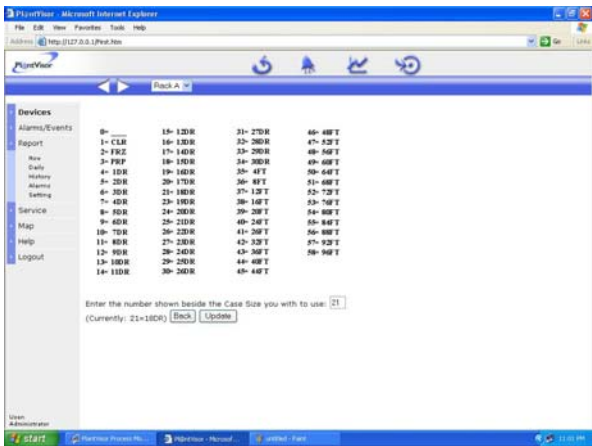
Figure 119- Circuit Temperature Graph



10.9.10.1 Case Size

The “Case Size” button in the Circuit Setup Screen is used to display a list of case sizes to identify a case. Note that the size can be identified by a special type (CLR, FRZ, PRP), a number of doors (DR) or by a length. The Size can be used in conjunction with the Case Type field to identify the type of case this circuit is associated with. Figure 120 shows the Case Size Screen.

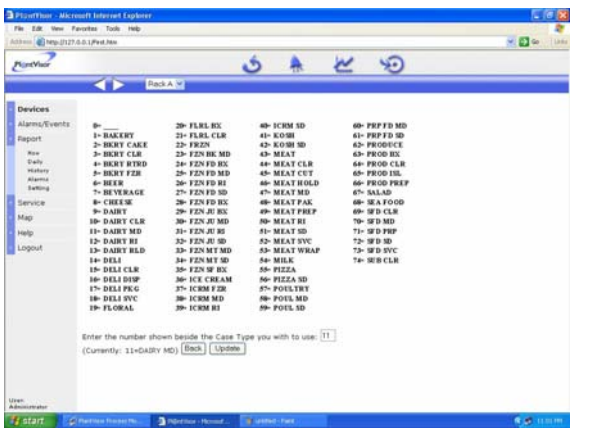
Figure 120- Case Size Screen



10.9.10.2 Case Type

The “Case Type” button in the Circuit Setup Screen is used to set the type of case the circuit is associated with. By using the Case Size field with the Case Type field, the case can be completely described. Figure 121 shows the Case Size Screen.

Figure 121- Case Type Screen

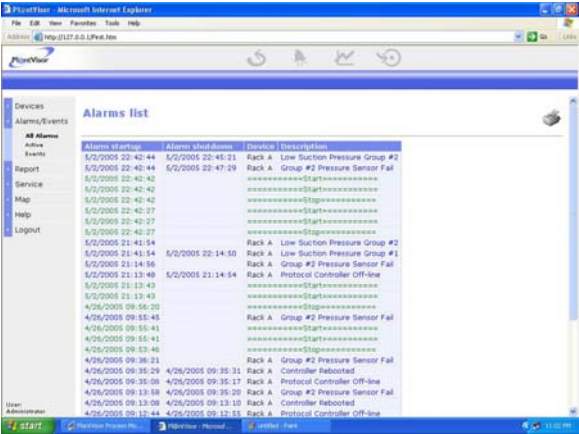


10.9.11 Alarms

If a Protocol unit is in an alarm state, an indication will be displayed in the main screen for the unit (See Figure 110). There will be a RED Alarm indication in the main screen for the unit just under the unit online indicator. *Clicking on this indicator will acknowledge the alarm (an acknowledgment will be sent to the Protocol Controller).* Display the alarm screen (Shown in Figure 122) by selecting the Alarms/Events Item in the left menu pane and choosing either All Alarms (show all

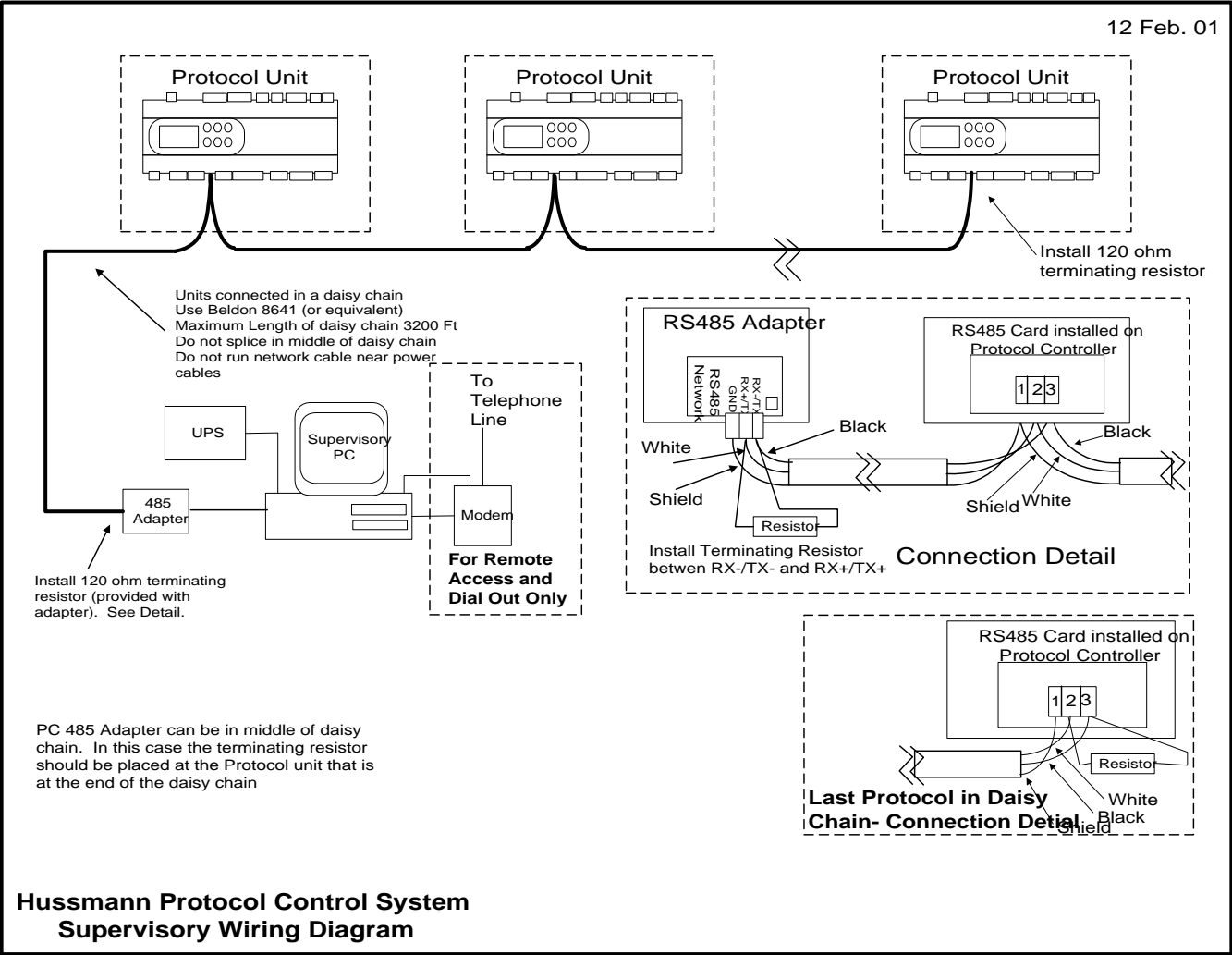
alarms, active or acknowledged), Active Alarms (show only active alarms) or Events (show all events for the unit).

Figure 122- Supervisory Alarms Screen



11. Appendix A- Supervisory Wiring

Figure 123 - Supervisory Wiring



12. Appendix B- Troubleshooting

12.1 PCS Troubleshooting

Below are some typical problems that may be encountered in the installation and use of the PCS.

Problem	Cause	Solution
Boot BIOS screen displayed on power up or Board offline alarm	Problem with expansion board communications	Check the wiring of the communications between the Controller and the expansion boards. Also check the addressing of the expansion boards.
Defrosts are not happening	Expansion board communications	Check Expansion board addressing and communications (try forcing a defrost and see if the appropriate relay on the expansion board closes) also check for board off line alarms.
	Termination problem	Check the termination (either digital or temperature) to insure that the sensor is not shorted causing the controller to terminate a defrost early
Temperature Probe bad	Temperature probe reads -623F (or a very low value)	Probe is open
	Temperature probe reads +687 (or a very high value)	Probe is shorted
Pressure probe bad	Bad offset value	Check to insure that there is no offset entered for the probe
	Reads -90 lbs	Probe is open
	Reads 400 or 401 lbs	Hardware failure

12.2 Supervisory System Troubleshooting

Below are some typical problems that may be encountered in the installation and use of the supervisory system.

Problem	Cause	Solution
Unable To Install PlantVisor	Do not have Administrator Privileges on the PC	Log on as an administrator of the PC before installing
The following message appears "SmartKey Not Found. Running Demo"	The supervisor does not recognize the supervisory key.	Reinstall the Key on the USB port of the PC.
No data to the supervisor	The wrong serial port is being used	Reinstall the PlantVisor Software
	Addressing of the units is not correct	Check the com port assigned for the supervisor
	Wiring problem	Check that all units have a different address
		Check all wiring and insure that proper termination is installed