



Controls Operation Manual

TCR Series Chiller

Panasonic F-PX Series PLC

Page intentionally blank

Table of Contents

CONTROLS OPERATION	1
<i>Figure 1 – Common Icon Buttons</i>	<i>1</i>
SYSTEM INITIALIZATION	1
<i>Figure 2 – Start-Up Screen</i>	<i>1</i>
<i>Figure 3 – System Overview Screen.....</i>	<i>2</i>
<i>Figure 4 – Screen Select.....</i>	<i>3</i>
SYSTEM SET-UP PARAMETERS	3
<i>Figure 5 – Common Parameters.....</i>	<i>3</i>
<i>Figure 6 – Discharge Pressure Control</i>	<i>4</i>
<i>Figure 7 – Compressor Staging Parameters (1 of 2).....</i>	<i>5</i>
<i>Figure 8 – Compressor Staging Parameters (2 of 2).....</i>	<i>6</i>
<i>Figure 9 – Compressor Staging Sequence</i>	<i>7</i>
<i>Figure 10 – Temperature Mode/Alarm Limits.....</i>	<i>7</i>
COMPRESSOR SET-UP PARAMETERS	8
<i>Figure 11 – Compressor 1 Set-Up</i>	<i>8</i>
<i>Figure 12 – Control Mode Selection</i>	<i>9</i>
<i>Figure 13 – Expansion Valve Control Selection</i>	<i>9</i>
<i>Figure 14 – Auxiliary Expansion Valve Control Selection.....</i>	<i>10</i>
<i>Figure 15 – Compressor Analog Output Control Selection</i>	<i>10</i>
<i>Figure 16 – Compressor Communications Selection</i>	<i>11</i>
<i>Figure 17 – Expansion Valve Mode Selection</i>	<i>11</i>
<i>Figure 18 – Auxiliary Expansion Valve Model Selection</i>	<i>12</i>
<i>Figure 19 – Analog Output Control</i>	<i>13</i>
PUMP CONTROL	14
<i>Figure 20 – Pump Control.....</i>	<i>14</i>
PID COOLING DEMAND.....	15
<i>Figure 21 – Cooling Demand</i>	<i>15</i>
<i>Figure 22 – Cooling Demand PID Help Screen</i>	<i>15</i>
COMPRESSOR DATA MONITORING.....	16
<i>Figure 23 – Compressor Data Screen 1</i>	<i>16</i>
<i>Figure 24 – Compressor Data Screen 2</i>	<i>17</i>
<i>Figure 25 – Compressor Data Screen 3</i>	<i>17</i>
<i>Figure 26 – Compressor Data Screen 4</i>	<i>18</i>
<i>Figure 27 – Compressor Data Screen 5</i>	<i>18</i>
ALARM HANDLER.....	19
<i>Figure 28 – HMI Alarm Handler</i>	<i>19</i>
<i>Figure 29 – Alarm History.....</i>	<i>19</i>
<i>Figure 30 – Alarm History Frequency</i>	<i>20</i>
COMPRESSOR ALARMS	21
COMPRESSOR FAULTS	21
COMPRESSOR BEARING FAULTS.....	21
COMPRESSOR MOTOR FAULTS	22
SYSTEM STATUS MESSAGES.....	22
LOGIN AND KEYBOARD SCREENS	23
<i>Figure 31 – Login Screen</i>	<i>23</i>
<i>Figure 32 – Keyboard Screen 0.....</i>	<i>23</i>
<i>Figure 33 – Keyboard Screen 1.....</i>	<i>24</i>
PASSWORD MANAGEMENT	24
<i>Figure 34 – Administrate Password Screen.....</i>	<i>24</i>
<i>Figure 35 – Password Management Screen.....</i>	<i>25</i>
<i>Figure 36 – Edit Operation Security Password</i>	<i>25</i>
SERVICE INFORMATION.....	26
<i>Figure 37 – Language Selection Screen.....</i>	<i>26</i>

PLC DISCRETE INPUT / OUTPUT STATUS.....27
 Figure 38 – Discrete Input/Output Status27
 Figure 39 – Discrete Input/Output Definition (1 of 2)27
 Figure 40 – Discrete Input/Output Definition (2 of 2)28
SCREEN NAVIGATION29

HMI HARDWARE.....30

SYSTEM MENU30
 TOUCH SWITCH ADJUSTMENT SCREEN32
 BATTERY INSTALLATION & REPLACEMENT.....33

Controls Operation

Before proceeding with this manual, consult your TC Series Central Chiller Installation, Operation and Maintenance Manual for details about readying the chiller for operation. Troubleshooting details are there as well.

Graphical representations presented here may vary based upon the model, but the content of operation will remain consistent.

Before operating your new *Thermal Care* chiller, take a few moments to familiarize yourself with this operator manual. The Human Machine Interface (HMI) screens use common icon buttons throughout for navigational purposes. For a brief description of the use and operation of these buttons, see Figure 1. Explanations of other buttons used solely on specific screens are with the screen operation found later in this manual.

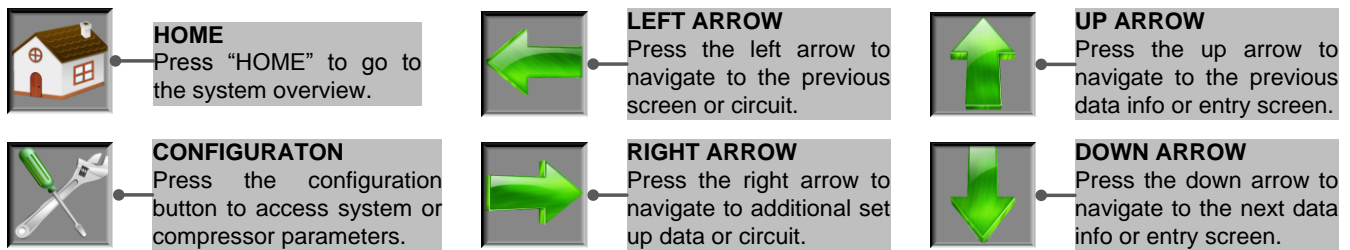


Figure 1 – Common Icon Buttons

System Initialization

Upon power-up, the first screen to appear is the start-up screen as shown in Figure 2. The screen displays for five seconds whilst the Programmable Logic Controller (PLC) and HMI establish communications. Below the screen, in the lower right hand corner, is the actual screen number as identified in the HMI. This screen number will aid in using the navigation quick chart located at the end of the manual.

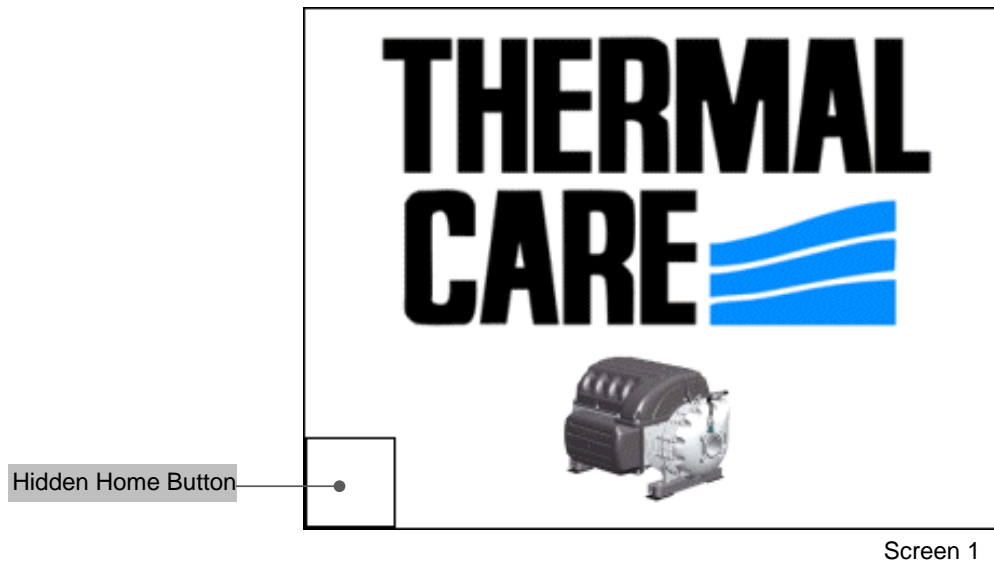


Figure 2 – Start-Up Screen

There is a hidden home button located in the lower left hand corner of this screen. If by some chance this screen is entered by mistake, the button allows the user to return to the default screen. When the five seconds have expired, the HMI automatically switches to the default screen titled *System Overview* displayed in Figure 3.

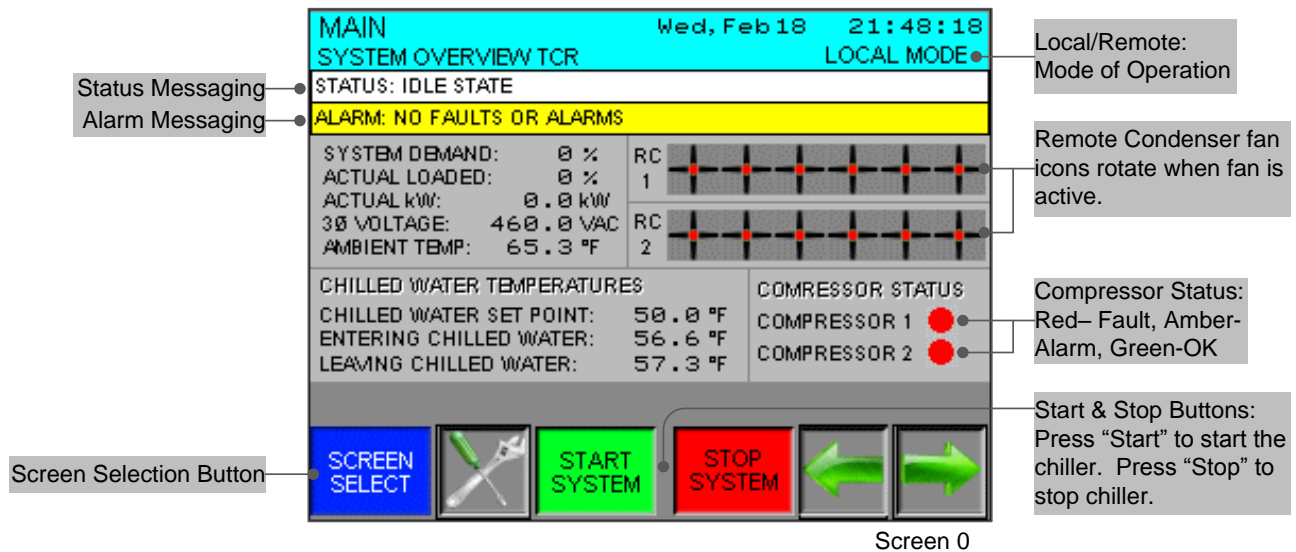


Figure 3 – System Overview Screen

This screen provides an overall synopsis of the chiller system. In addition, it shows the mode of operation in the upper right hand corner, *Local Mode* or *Remote Mode*. When in local mode, the *Start System* and *Stop System* buttons are functional and control the chiller. When the chiller is in remote mode, both buttons are visible but non-functional. The button used to change the status of the operation is located on the *Common Parameter* screen shown later in this manual.

There are two message displays. The first one is the status message, which informs the operator of the chiller operation as well as the status of the compressor(s). The second display provides information regarding any warnings or alarms encountered during the operation of the chiller. Both displays update every three seconds, since more than one message may be active at one time.

To display the operation of the fans located on the remote condensers, fan icons are used. Depending upon the number of fixed fans selected during the system configuration process, determines the number of fans displayed. As the fans turn on, the blades corresponding to the fan motor rotate. Fan stages display from left to right, lowest to highest. Another visual indicator provided on this screen is a compressor status indicator. This indicator changes color from green to yellow or red based on the status of the compressor. Green represents normal operation. The indicator will change to yellow when a non-critical alarm is active. When a critical alarm is active, the indicator changes to red.

In the lower left hand corner of the screen is a button labeled *Screen Select*. When this button is pressed, the display changes to the *Screen Selection* screen as shown in Figure 4. Using the *List Up* or *List Down* buttons on this screen, allows the user to scroll through the entire list of screens. To view the selected screen in the display, press the *Enter* button. To correct an incorrect screen selection, press the left arrow at the lower right of the current screen to return to the previous screen, or the home button to return to the default screen. Almost every screen has the home and left arrow buttons on it.

The right arrow button on the default screen changes the display to the *Circuit 1, Compressor 1* data screen. This is a quick key and allows easy viewing of the compressor data instead of using the screen list selector.

The final button on the default screen is the common parameter set-up button, represented by the icon of a screwdriver crossing a wrench. When the common parameter set-up button is pressed, it changes the screen to the first of four common system configuration parameters. Discussion of these parameters is in the next section.

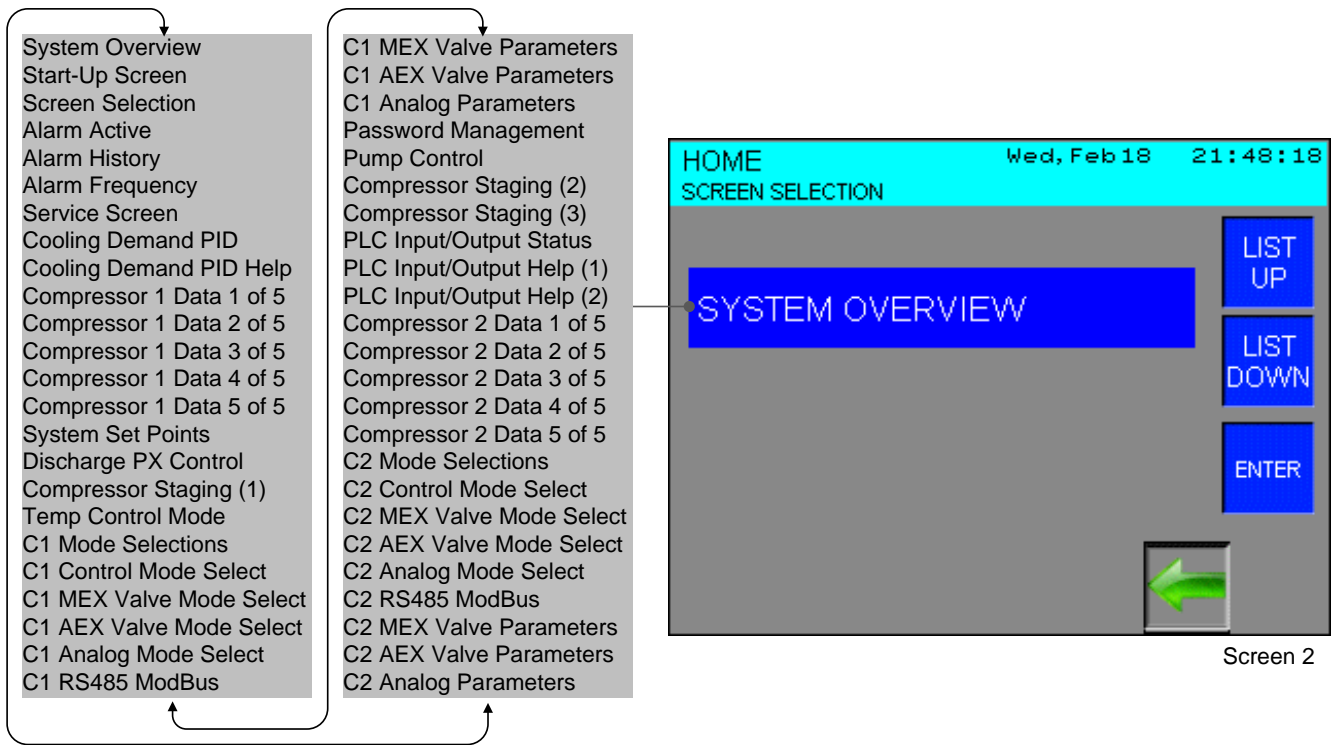


Figure 4 – Screen Select

System Set-up Parameters

Before running the chiller for the first time, the system must be set-up for the configuration of the chiller. The chiller is set-up at the factory with default values; however, certain parameters may require adjustment for a specific application. The first screen of four is *Common Parameters* as shown in Figure 5.

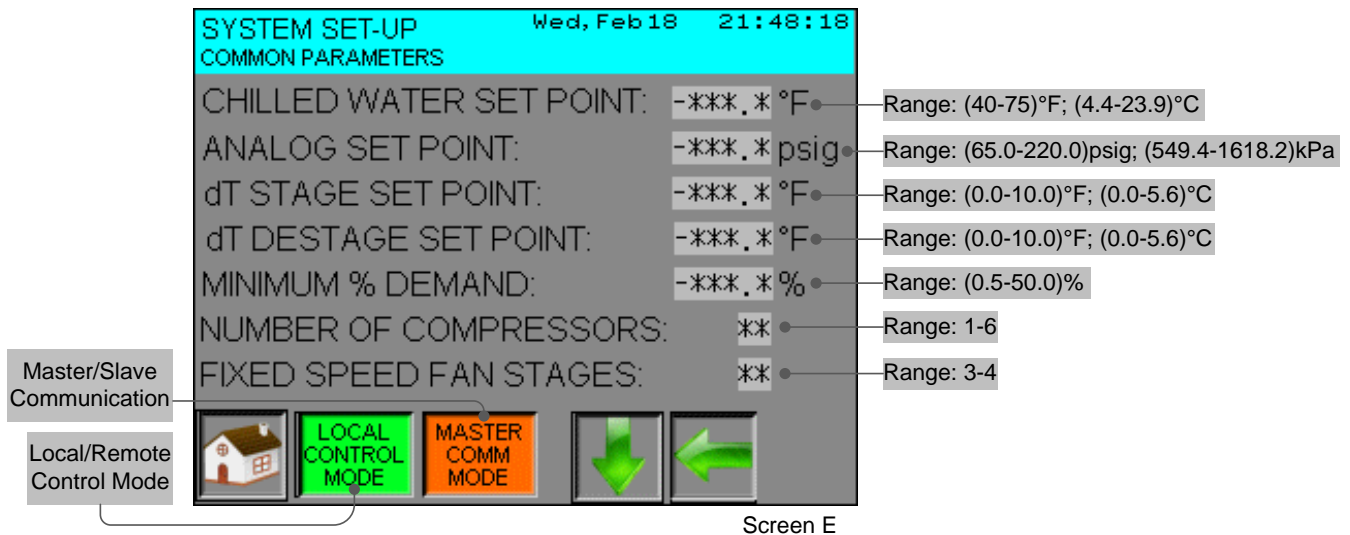


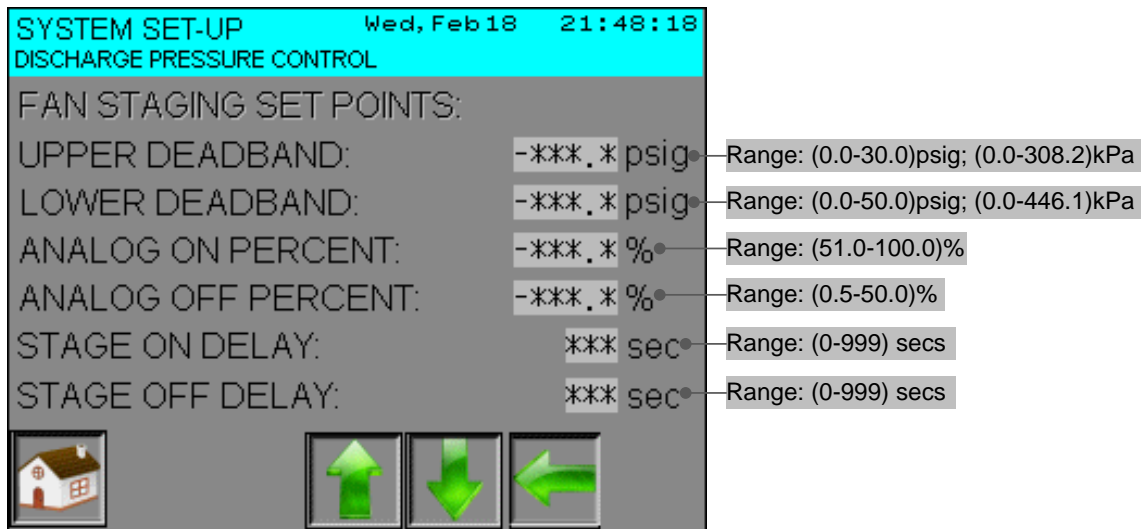
Figure 5 – Common Parameters

This set-up screen has seven parameters. Following is a brief description of these parameters and their default value if applicable. For the ranges of each parameter and its associated unit, please refer to Figure 5. Values entered outside the limits are not accepted, or default to the lowest or highest acceptable value.

- **Chilled Water Set Point:** This parameter is set as required per application. The set point must be above the chiller alarm and fault temperatures; default = 50°F
- **Analog Set Point:** This is the manual set point to control the discharge pressure; default 105psig
- **dT Stage Set Point:** This set point works in conjunction with the *Chilled Water Set Point* to limit short cycling. The first compressor will not stage until the *Chilled Water Set Point + dT Stage Set point* is satisfied; default = 3°F
- **dT De-stage Set Point:** This parameter will de-stage a compressor when the *Chilled Water Set Point – dT De-stage Set Point* is met; default = 5°F
- **Minimum % Demand:** This is the minimum demand value sent to the compressor(s); default = 10%
- **Number of Compressors:** This determines the number of compressors to stage. This number must be equal to the number of compressors in the system. This also controls some items displayed in the screens; default = number of compressors
- **Fixed Speed Fan Stages:** Enter the number of fixed speed fans based on the configuration of the remote condenser. Each remote condenser contains one variable speed fan with the remaining fans being fixed speed; default = 4.

In addition to the parameters, the *Local/Remote Control Mode* and *Master/Slave Communication Mode* buttons are located in this window. Pressing the *Local/Remote Control Mode* button changes the start/stop function from the default screen to a remote controller. Pressing the *Master/Slave Communication Mode* button changes the unit to being the master controller to a slave controller. This mode button is in slave mode when multiple chillers stage from one controller.

To enter the next common parameter screen, use the arrow down button. A new window will appear titled *Discharge Pressure Control* as shown in Figure 6.



Screen F

Figure 6 – Discharge Pressure Control

There are six parameters used to control the discharge pressure by staging the condenser fans. Refer to Figure 6 for the acceptable entry ranges. Following is a brief description of each parameter and its default value.

- **Upper Deadband:** This value is added to the *Analog Set Point* to calculate the upper dead band value; default = 20 psig
- **Lower Deadband:** This value is subtracted from the *Analog Set Point* to calculate the lower dead band value; default = 30 psig
- **Analog On Percent:** This parameter is compared to the actual analog output percent. When this value is equal or greater than the set value, the controller compares the upper dead band value to the current discharge pressure to determine if another fixed speed fan should be staged; default = 90%.
- **Analog Off Percent:** This parameter is compared to the actual analog output percent. When this value is equal or less than the set value, the controller compares the lower dead band value to the current discharge pressure to determine if a fixed speed fan should be de-staged; default = 20%
- **Stage On Delay:** This parameter provides a time delay for staging the next fixed speed fan; default = 5 seconds
- **Stage Off Delay:** This parameter provides a time delay for de-staging a fixed speed fan; default = 30 seconds

In addition, this page has both up and down arrow navigational buttons. To return to the first system parameter screen, use the up arrow key; to move to the next system parameter screen use, use the down arrow key. The next system parameter screen, Screen 10, is titled *Compressor Staging Parameters* and is shown in Figure 7.

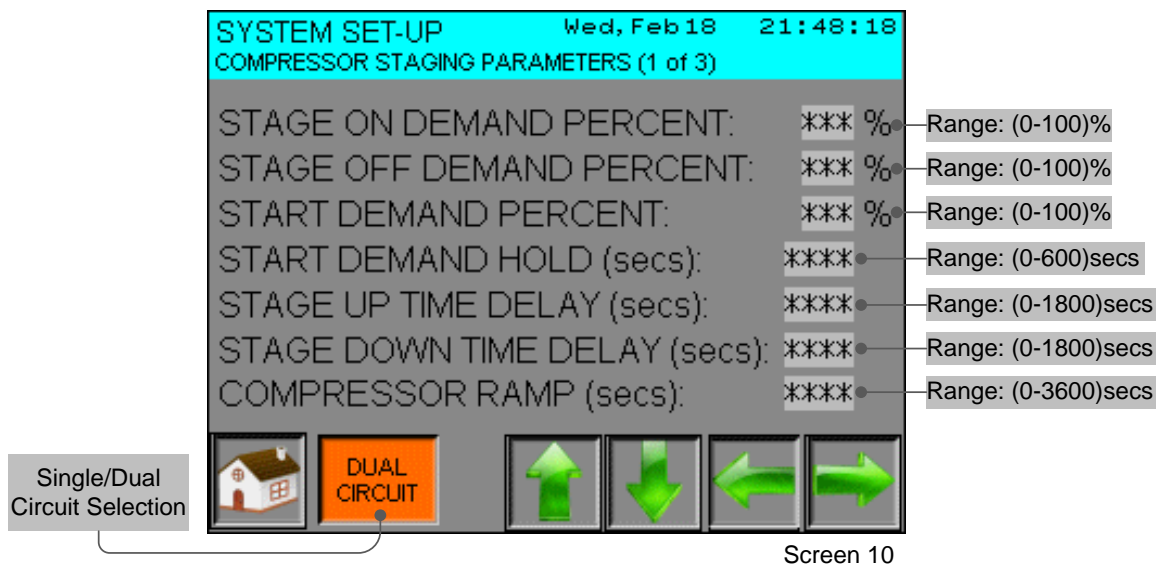


Figure 7 – Compressor Staging Parameters (1 of 2)

The *Compressor Staging Parameters* page has seven data entries. These are below with their default value.

- **Stage On Demand Percent:** This parameter in conjunction with the **Stage Up Time Delay** determines at what percent the next compressor will stage; default = 80%
- **Stage Off Demand Percent:** This parameter in conjunction with the **Stage Down Time Delay** determines when a compressor will de-stage; default = 10%
- **Start Demand Percent:** This value is the demand that is sent to the compressor upon staging; default = 30%
- **Start Demand Hold:** This value is the hold time at which the demand to the compressor stays at the **Start Demand Percent**; default = 90 seconds
- **Stage Up Time Delay:** This value determines the time delay before staging the next compressor; default = 300 seconds

- **Stage Down Time Delay:** This value determines the time delay before de-staging a compressor; default = 60 seconds
- **Compressor Ramp:** This parameter limits the system demand sent to the compressor(s) after the initial **Start Demand Percent** timer has expired. Maximum rate of change per second; default = 90 seconds.

In addition, this page has both up and down arrow navigational buttons. To return to the first system parameter screen, use the up arrow key; to move to the next system parameter screen, use the down arrow key. There are two additional buttons on this system parameter screen. The first button allows the selection of a single or dual circuit configuration. The second button is the right arrow key. When pressed, Screen 1D, titled *Compressor Staging Parameters (2 of 2)* appears, as shown in Figure 8.

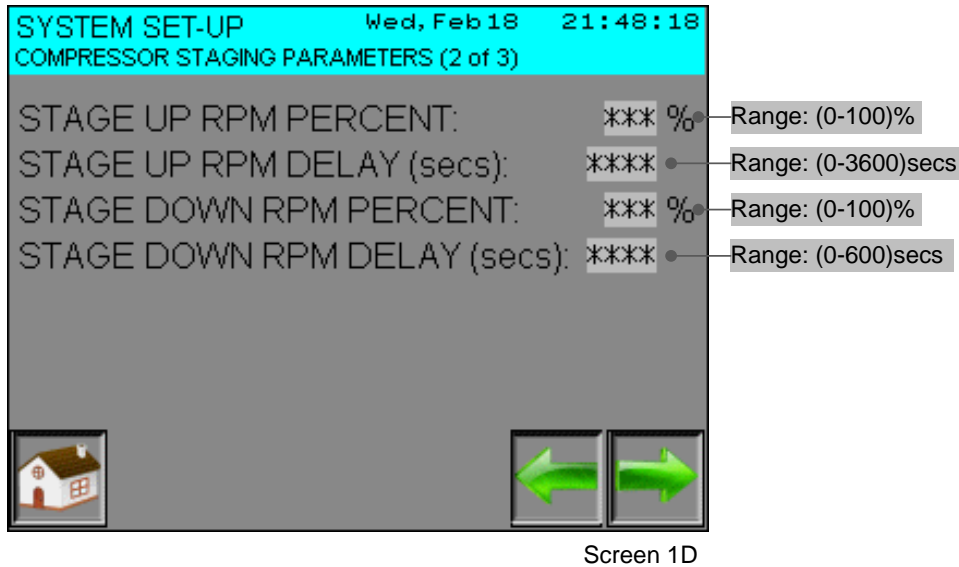


Figure 8 – Compressor Staging Parameters (2 of 2)

The *Compressor Staging Parameters (2 of 2)* page has four data entries. These are below with their default value.

- **Stage Up RPM Percent:** This parameter in conjunction with the **Stage Up RPM Delay** determines at what percent the next compressor will stage; default = 60%.
- **Stage Up RPM Delay:** This value determines the time delay before staging the next compressor; default = 1800 seconds.
- **Stage Down RPM Percent:** This parameter in conjunction with the **Stage Down RPM Delay** determines at what percent the next compressor will de-stage; default = 5%.
- **Stage Down RPM Delay:** This value determines the time delay before de-staging a compressor; default = 1800 seconds.

This page also has two navigational buttons. The left arrow key returns the HMI to the previous screen and the right arrow key switches the screen to 1D, titled *Compressor Staging Sequence*. This screen is shown in Figure 9.

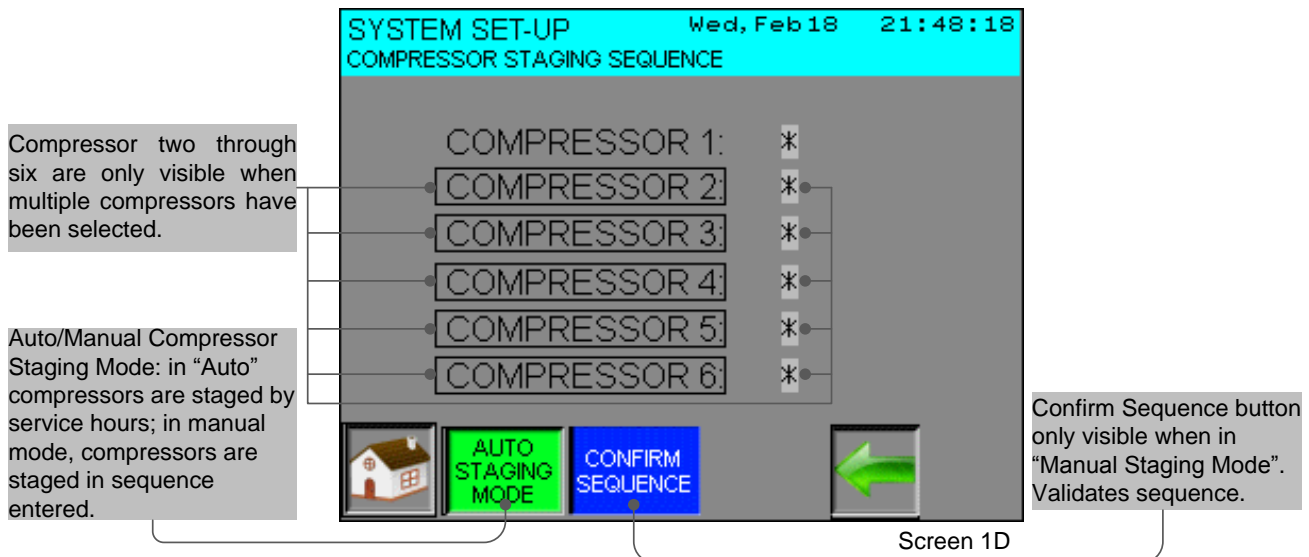


Figure 9 – Compressor Staging Sequence

There are two ways multiple compressor systems stage. The first one is automatically. This is where every twenty-four hours a snap shot of the accumulated compressor hours determine the sorting order of the compressors. The sorting order is determined based on least amount of run time to the most amount of run time. The de-staging of compressors is determined based on first on last off. The second method of staging multiple compressors is by manually selecting the order sequence. When selecting the *Manual Staging Mode*, using the button in Figure 8, the *Confirm Sequence* button becomes visible. After entering the order of compressors, press the *Confirm Sequence* button to confirm the selection. If the entry is valid, the sequence is accepted. If the entry is invalid, upon pressing the *Confirm Sequence* button, the order of the compressors will default to a preset sequence. To return to the previous screen press the left arrow button.

There is one more system parameter screen. Use the green down arrow key to navigate to Screen 10, titled *Temperature Mode/Alarm Limits*, as shown in Figure 10.

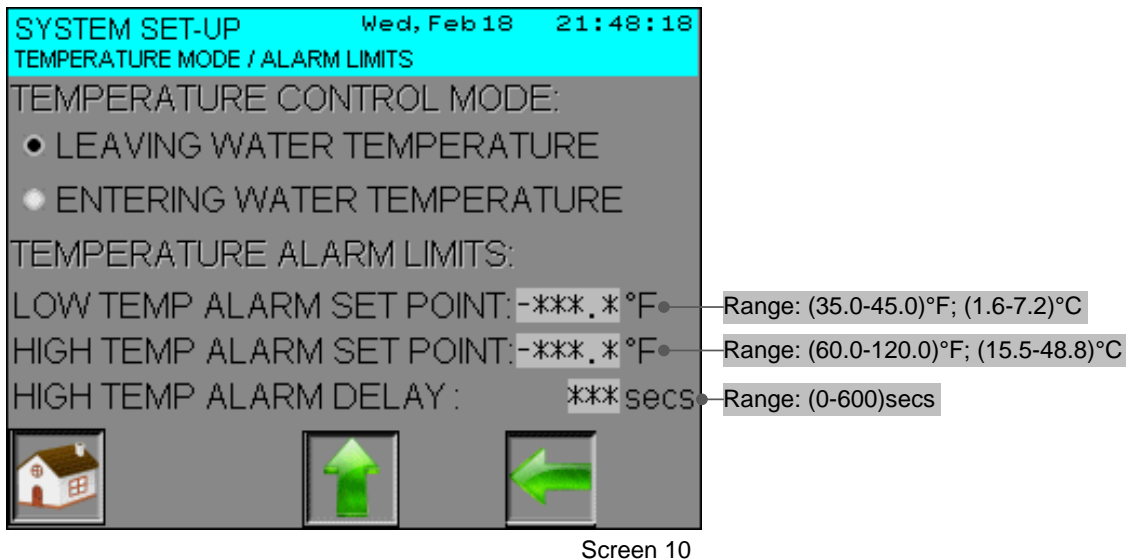


Figure 10 – Temperature Mode/Alarm Limits

There are two selections for the temperature control mode, *Leaving Water Temperature* or *Entering Water Temperature*. To make a change from the current selection, simply press the mode of operation. The dot next to the selected mode of operation will be dark in color.

There are three data entry items under *Temperature Alarm Limits*. A brief description of each one follows with its default value.

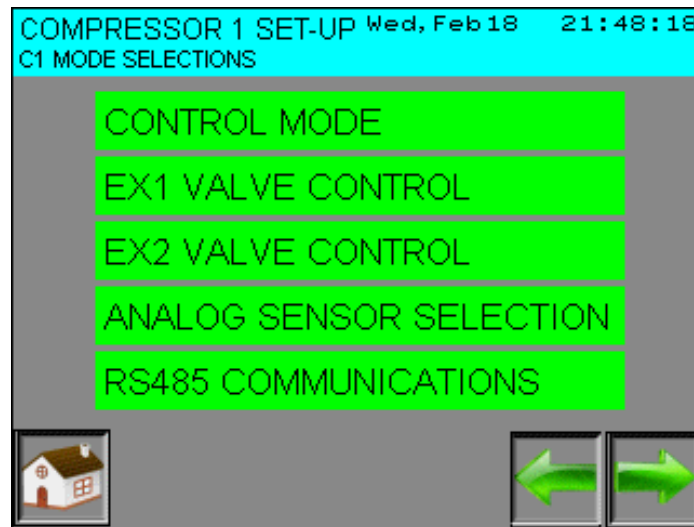
- **Low Temp Alarm Set Point:** This is the chillers anti freeze protection limit. This will turn off the chiller immediately should the leaving water temperature reach this set point; default = 35°F
- **High Temp Alarm Set Point:** When the chiller is started and the system is unable to pull down the temperature below the high temp alarm set point within the time allotted, the chiller will go into a system stop; default = 85°F
- **High Temp Alarm Delay:** Works in conjunction with the high temp alarm set point; default = 300 seconds

To exit this screen and return to the default screen, press the home button.

Compressor Set-up Parameters

The compressors receive commissioning values at the factory. It is important to verify these settings before starting the system. There are two ways to access the set-up screens for the compressor(s) that are both performed from the system default page (see Figure 3, Screen 0). Use either the *Screen Select* button to access the screen selector (see Figure 4, Screen 2), or press the right arrow button to navigate to the default data screen for compressor one titled *Compressor1/CKT 1* (see Figure 22, Screen 9).

If using the screen selector, use the *List Up* or *List Down* button to change the cursor to read “Compressor 1 Data 1 of 5”. Then press the *Enter* button. The screen will change to the *C1 Mode Selections page* (see Figure 11, Screen 12). The other way to navigate to Screen 12 would be to press the set-up button on Screen 9 (see Figure 23).



Screen 12

Figure 11 – Compressor 1 Set-Up

There are five mode selections. To make changes to any of these modes, simply press the green bar associated with the mode to change. Following are the screens that will be present when selecting each item.

The first mode is the *Control Mode Selection*. Referring to Figure 12, there are five possible selections. The default selection is “ModBus Control Mode”.

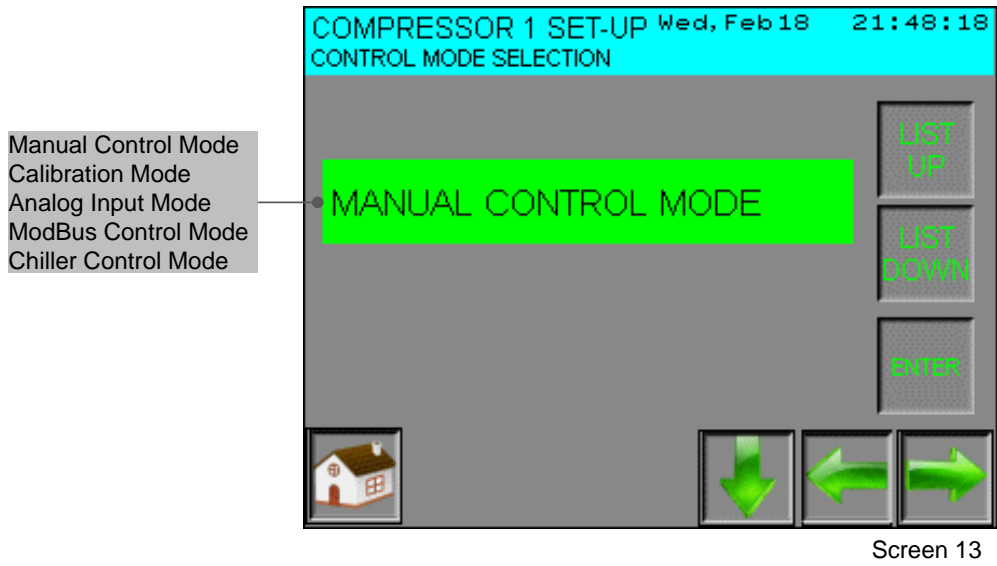


Figure 12 – Control Mode Selection

The second mode is for the compressor’s main expansion valve. There are seven modes of operation. The default mode is “SH Control LIQT, FLG PX”.

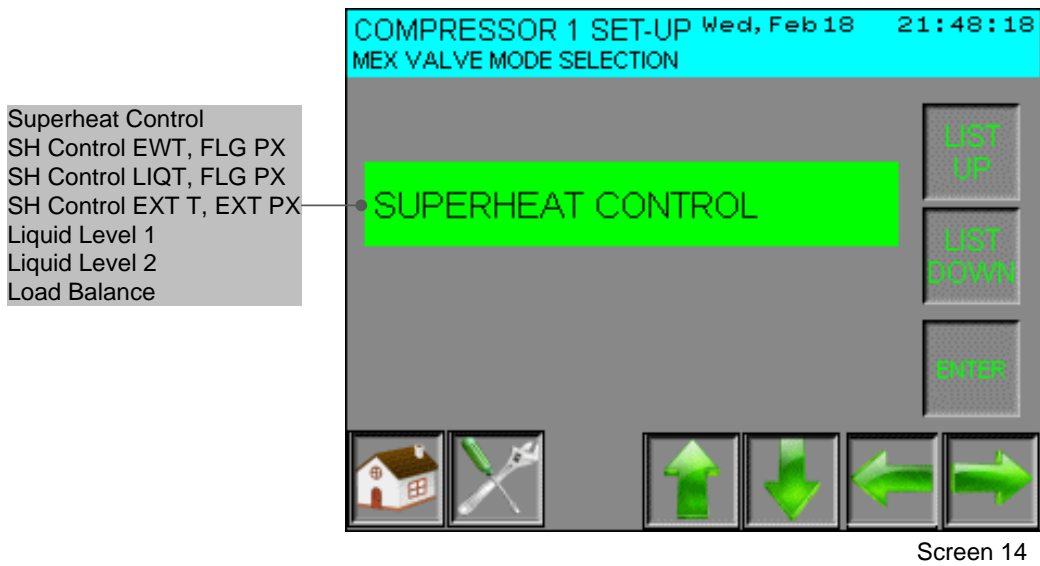
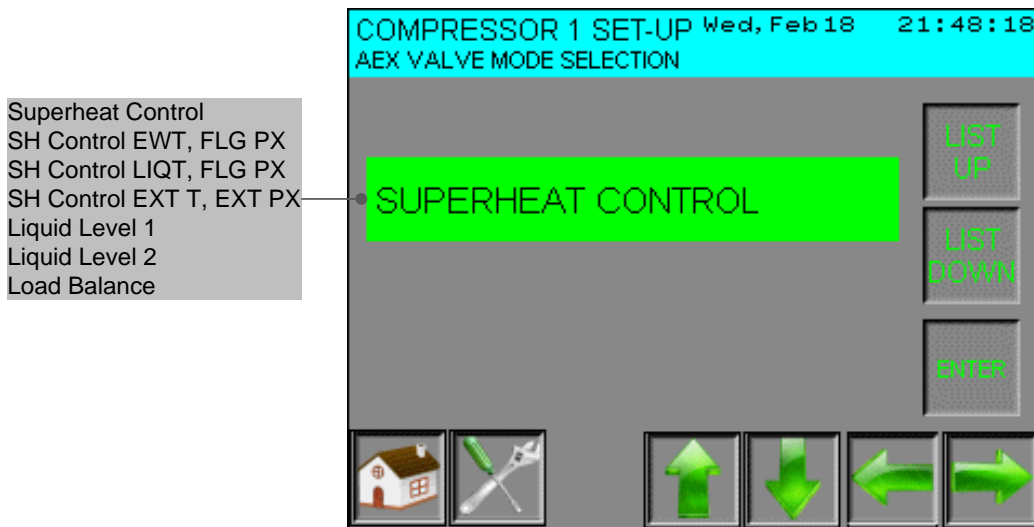


Figure 13 – Expansion Valve Control Selection

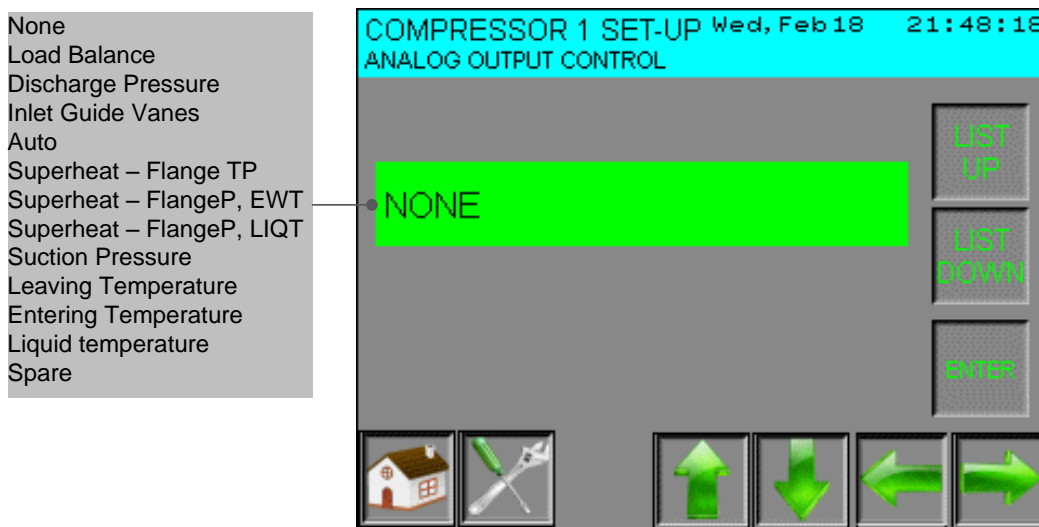
The third mode is for the compressor’s auxiliary expansion valve. There are seven modes of operation. The default mode is “Load Balance”.



Screen 15

Figure 14 – Auxiliary Expansion Valve Control Selection

The fourth mode is for the compressor’s analog output control. There are thirteen modes of operation. The default mode is “Discharge Pressure”.



Screen 16

Figure 15 – Compressor Analog Output Control Selection

The final mode selection is for communications with the compressor. The controller communicates with the compressor via RS-485 ModBus communications. If the communications are off, the compressor will not start. RS-485 ModBus communications is the default mode of operation. When this occurs, there is a green round icon to the left of the “ModBus Communications”. To change the mode, simply press the “ModBus Communications” area and the mode will alternate. On this screen, there is also a *Circuit Enabled/Disabled* button. When pressed, the status of the circuit alternates. When the circuit is disabled, the compressor will not start, but the communications to the compressor are still active. **Note: Prior to disconnecting power to the compressor(s) using the service disconnect(s) for service reasons, disable the ModBus communications. This will prevent a ModBus alarm from occurring.**

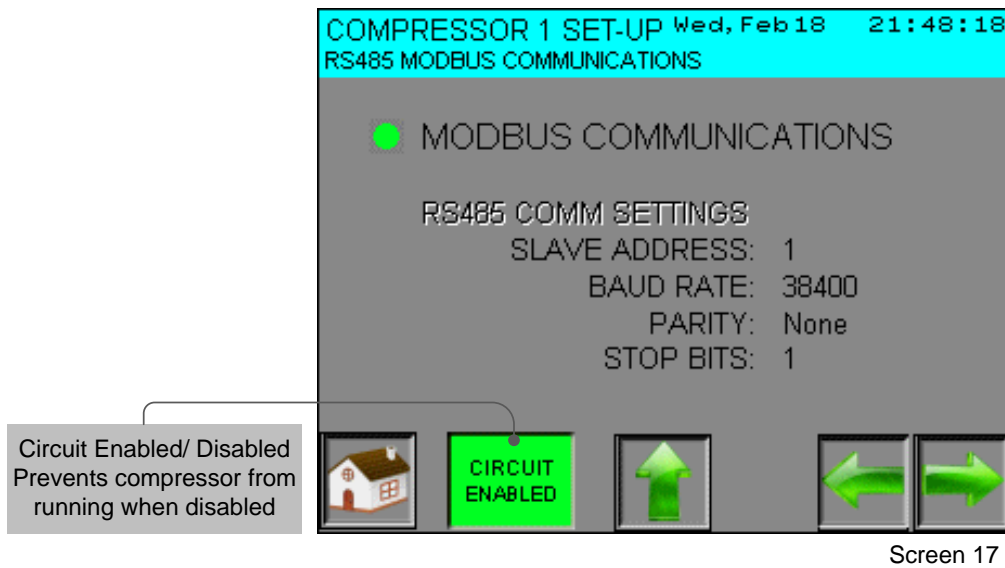


Figure 16 – Compressor Communications Selection

If multiple compressors are used, the same five screens exist for each compressor. To access another compressor's mode selection screens, use the right and left arrow keys on each of the screens shown above. This is also an easy way to compare set-ups between compressors. It is also possible to access these screens using the list selector.

Referring back to screens shown in Figure 13 through Figure 15, there is set-up button on each screen. Starting with the *MEX Valve Mode Selection* (Figure 13), press the set-up button. A new screen appears as shown in Figure 17.

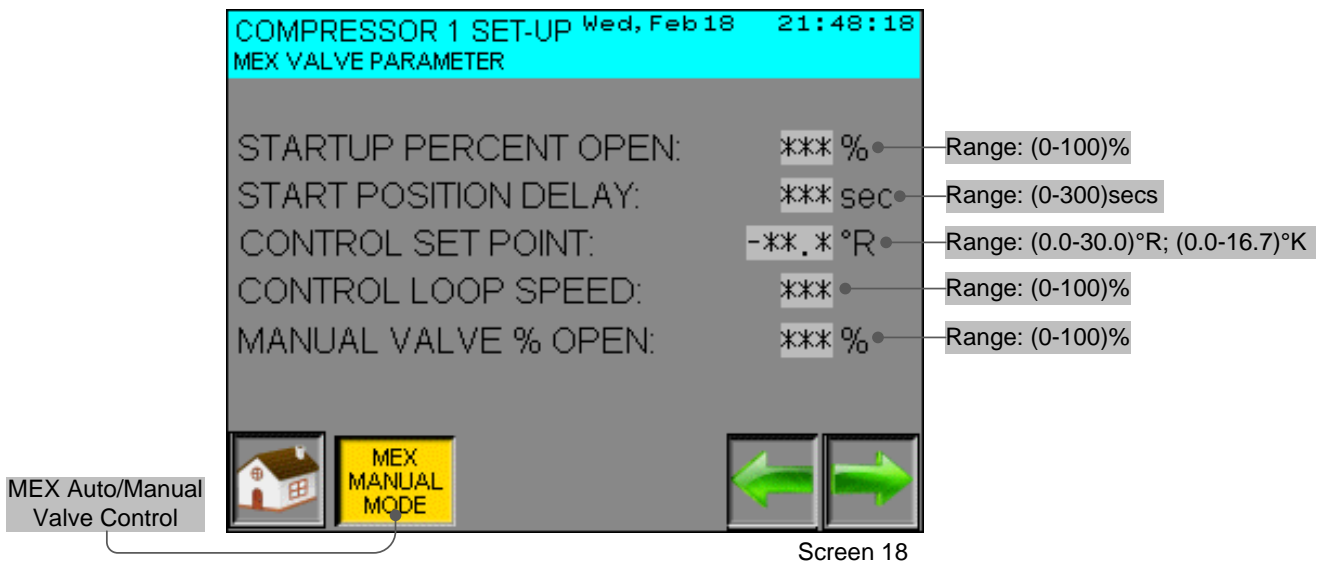


Figure 17 – Expansion Valve Mode Selection

The *MEX Valve Parameter* page has five data entries. These are below with their default value.

- **Start-up Percent Open:** This sets the valve to a pre-start position for a given period; default = 10%.
- **Start Position Delay:** This is the delay time from compressor start-up to hold the valve at the start-up percent open position; default = 60 seconds
- **Control Set Point:** The suction superheat or liquid level; default = 9.0°R (Not applicable to load balance control mode.)
- **Control Loop Speed:** This value represents the reaction time of the control loop to a process error; default = 60%

- **Manual Valve % Open:** When the chiller is in an idle state, the MEX valve operation can be placed in manual mode by pressing the *MEX Auto/Manual* button. This will allow the valve to open to the percent value entered in the data field. This is useful when verifying operation of the expansion valve.

Referring back to *AEX Valve Mode Selection* (Figure 13), press the set-up button. A new screen appears as shown in Figure 18.

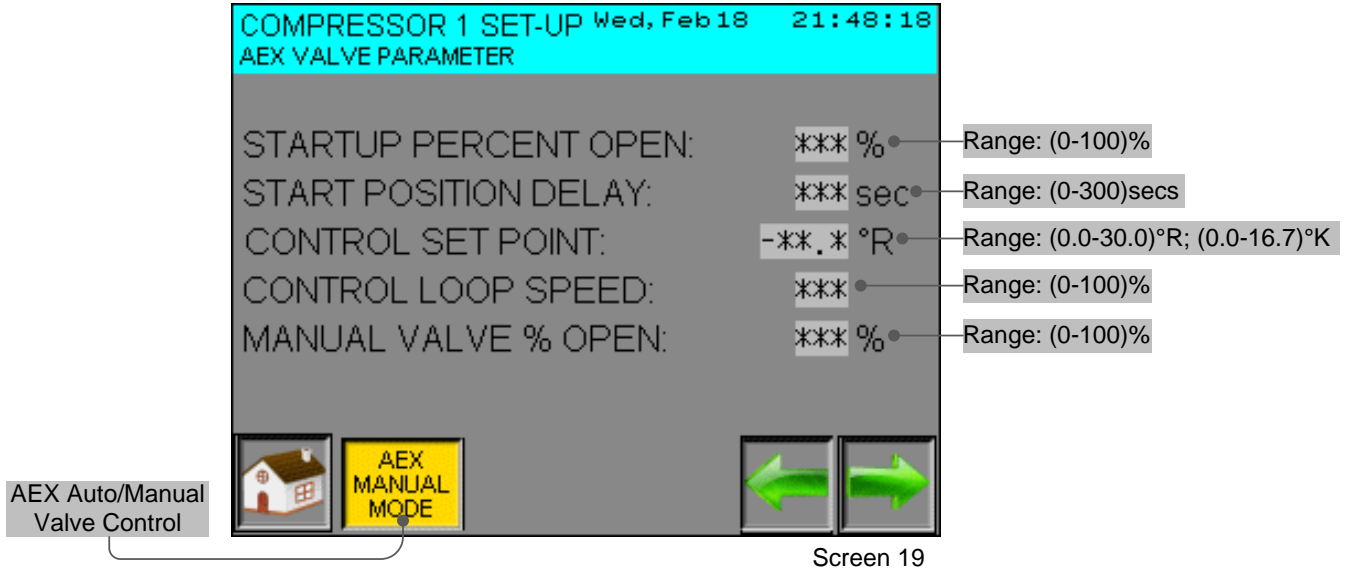


Figure 18 – Auxiliary Expansion Valve Model Selection

The *AEX Valve Parameter* page has five data entries. These are below with their default value.

- **Start-up Percent Open:** This sets the valve to a pre-start position for a given period; default = 50%.
- **Start Position Delay:** This is the delay time from compressor start-up to hold the valve at the start-up percent open position; default = 180 seconds
- **Control Set Point:** The suction superheat or liquid level; default = 0.0 (Not applicable to load balance control mode.)
- **Control Loop Speed:** This value represents the reaction time of the control loop to a process error; default = 92%
- **Manual Valve % Open:** When the chiller is in an idle state, the AEX valve operation can be placed in manual mode by pressing the *AEX Auto/Manual* button. This will allow the valve to open to the percent value entered in the data field. This is useful when verifying operation of the load balance valve.

Referring back to *Analog Output Control* (Figure 15), press the set-up button. A new screen appears as shown in Figure 19.

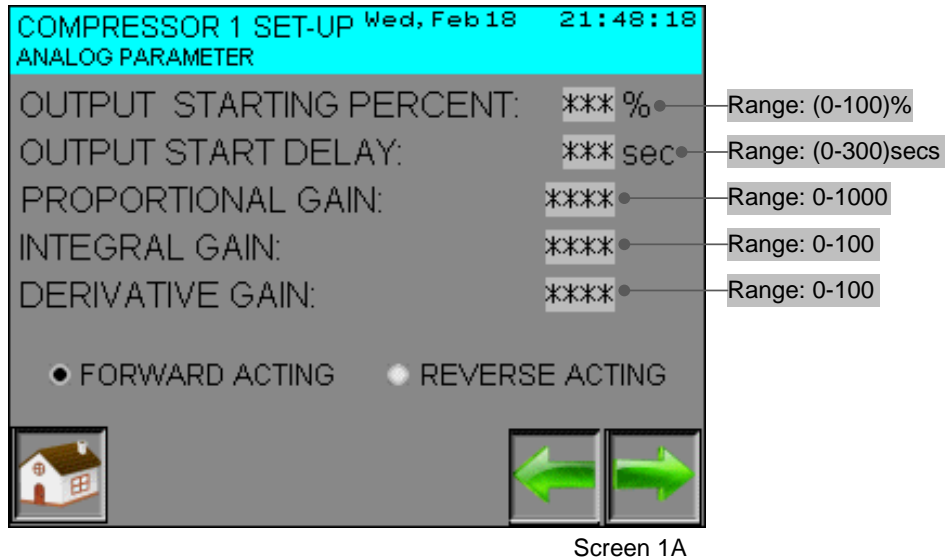


Figure 19 – Analog Output Control

The *Analog Parameter* screen has five data entries and PID control action selections. These are below with their default value.

- **Output Starting Percent:** This value equals the percentage of maximum voltage sent to the terminals of the *Compressor Interface Module* on compressor start-up. The analog output will hold at this position until the start delay timer has expired; default = 50%. (The operating range can be set to 0-5V or 0-10V via jumpers on the *Compressor Interface* module.)
- **Output Start Delay:** This is the time in seconds that the output starting percent is held upon compressor start-up; default = 90 seconds
- **Proportional Gain:** Adjust for stable PID control; default = 10
- **Integral Gain:** Adjust for stable PID control; default = 3
- **Derivative Gain:** Adjust for stable PID control; default = 1
- **Manual % Output:** This parameter is only visible when the discharge pressure control is in manual control. To place the discharge pressure control into manual mode, press the *DISCHARGE PX AUTO MODE* button, located next to the home icon, and the button face will change to read *DISCHARGE PX MANUAL MODE*. At this time, the manual percent output becomes visible. Press the highlighted area next to the % sign and enter a value between 0-100. The analog output will change to this value. (Note: There is a short time delay before the analog output begins to change. This feature is for testing purposes. Engaging during normal operation hinders the RS485 communication performance)
- **Forward Acting / Reverse Acting:** Determines control action of PID

Located at the bottom of the screen is the discharge pressure auto/manual mode button. This button switches between a preset entered discharge pressure set point and a calculated one. The calculated discharge pressure set point is determined based upon the saturated pressure value as a function of temperature.

If multiple compressors are used, the same three screens exist for each compressor. To access another compressor's mode selection screens, use the right arrow key on each of the screens above (Figure 17-19). This is also an easy way to compare set-ups between compressors. It is also possible to access these screens using the list selector.

Pump Control

The chiller controller is capable of handling two pumps, P1 the condenser circulation pump, and P2 the evaporative circulation pump. The only way to view the *Pump Control Parameters* screen is to use the screen list selector. Upon entering the screen list selector window, use the *List Up* button to change the cursor to read "Pump Control". Press the *Enter* button and a new screen will display as shown in Figure 20.

There are five data entries and an auto/manual button for each pump. Following is a brief description of each and their default value.

- **Number of Pumps:** Determines how many pumps are enabled during a system start; default = 0
- **P1 Delay Off Preset:** This is the time delay for P1 to turn off during a controlled system shutdown; default = 30 seconds
- **P2 Delay On Preset:** This is the time delay for P2 to turn on after P1 starts; default = 30 seconds.
- **P2 Delay Off Preset:** This is the time delay for P2 to turn off after the compressors shut down during a controlled system stop; default = 30 seconds
- **Chiller Delay On Preset:** This is the time delay to start the compressor after P2 is started; default = 15 seconds

Manual pump operation occurs by pressing the associated Auto/Manual button. Press the *P1 Auto Mode* button once, and the P1 pump will start. The button will change color and display *P1 Manual Mode*. Press the *P1 Manual Mode* button to return the P1 pump to auto mode. Manual operation of the P2 pump is also possible. Follow the same procedure as used for the P1 pump. Use the two navigational buttons to exit this screen.

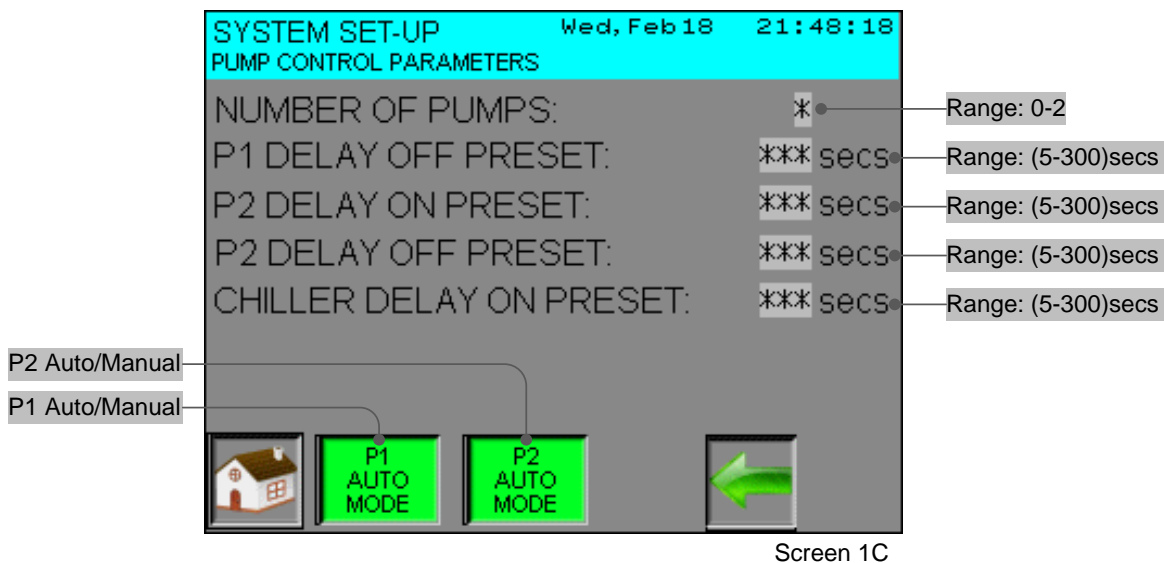


Figure 20 – Pump Control

PID Cooling Demand

A PID control loop generates the chiller demand. Use the screen selector list to view the PID control screen. Use the *List Down* button until the cursor displays "Cooling Demand PID". Press the *Enter* button. The screen will change to the *Cooling Demand* screen, as shown in Figure 21.

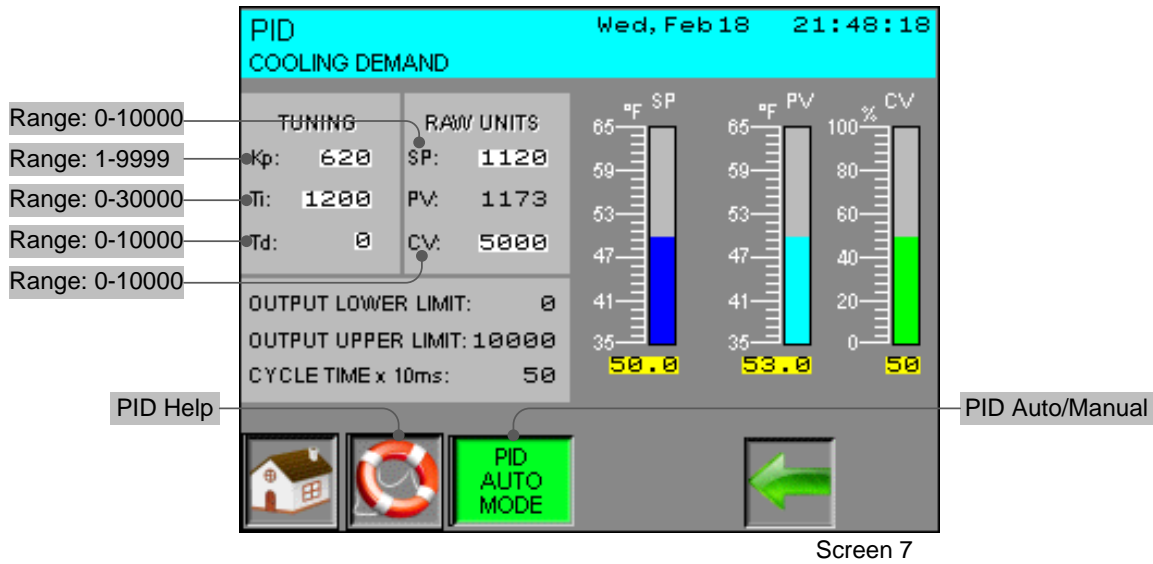
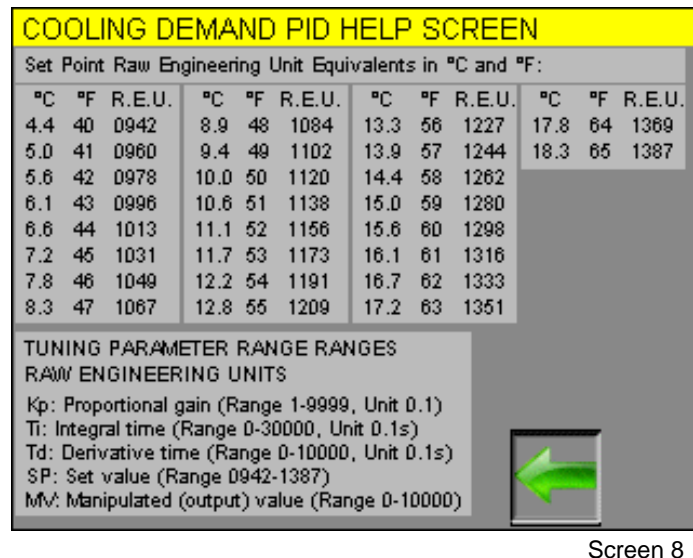


Figure 21 – Cooling Demand

This screen provides information regarding the tuning parameters, the set point, process variable and the control variable. The display can be broken into four areas. The first area is the tuning section. There are three data entry fields identified by a highlighted background as seen in Figure 22. By pressing on the highlighted area, a numeric keypad pops-up which allows for entering a new number within the range shown. For help, press the button that looks like a lifesaver. This will change the screen to the *Cooling Demand PID Help Screen* as shown in Figure 22.



Screen 8

Figure 22 – Cooling Demand PID Help Screen

To exit the help screen and return to the PID screen, use the left arrow key. The tuning parameters are set at the factory but may need some adjusting upon installation. These numbers should not require changes once set.

The area next to the tuning parameters displays the set point, the process variable, and the control variable in Raw Engineering Units (REU). To understand what these numbers mean requires the use of the PID help screen or the bar

graphs/data display to the right of the raw unit's area. On the help screen, a table shows the relationship between the REU's and the temperature they represent. The control variable ranges from 0 to 10000 counts and may be looked at as a percentage of 0-100% of the control variable output.

The default mode for the PID control is auto. To manually manipulate the PID control, press the *PID Auto Mode* button. The button will change colors, flash, and display *PID Manual Mode*. In manual mode, altering of the set point and the control variable is possible. It is highly recommended not to change the set point from the PID screen. Use the system parameter set-up screen to do this (Screen E, Figure 5).

Compressor Data Monitoring

In addition to the system data, there are five screens with compressor specific data. To access these screens, use either the screen list selector or the right arrow key from the system default screen (Screen 0). When using the screen list selector, use the *List Down* arrow key until the cursor displays "Compressor 1 Data 1 of 5". Press the *Enter* key. The first of five screens displayed are in Figure 23.

The first of five screens has the same message handlers as the system default screen. It also has three red/green status indicators. These indicators are on all five screens. Following is a brief description of each.

- **Interlock:** The interlock goes to a PLC output. The PLC output goes true when water flow is established. This in turn closes a set of dry contacts wired to the compressor interface board. Feedback from the compressor determines that the interlock is open or closed. When it is open, the indicator shows red. When closed, the indicator changes to green.
- **Status:** This signal comes from an internal normally open contact of the compressor that closes during normal operation and opens in the event of a compressor critical fault. When this circuit is open, the compressor will not restart until the demand signal has been reset to 0.
- **RS485:** This signal comes from the PLC based upon the RS-485 ModBus communications with the compressor being active. It is typical for this indicator to change from green to red often. When it stays red or green, communications have been lost with the compressor(s). Software in the PLC will disable the ModBus to the circuit(s) having an issue. Therefore, to re-establish the ModBus to the compressor at fault, refer to Figure 16 (Screen 17).

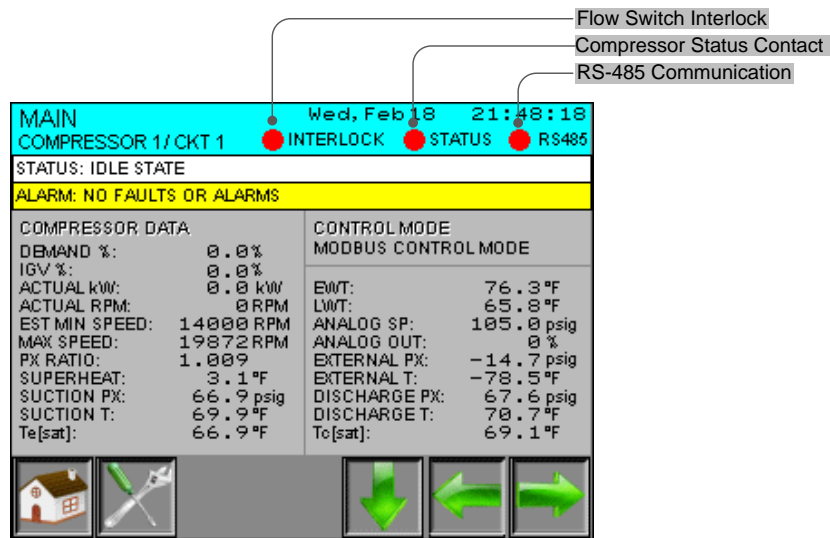
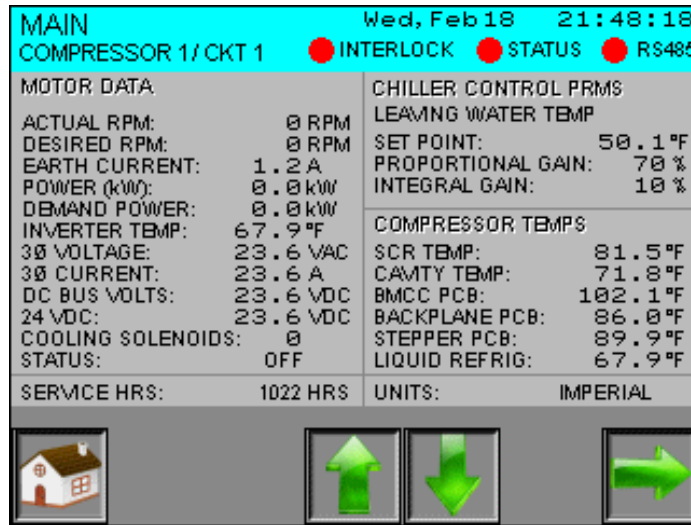


Figure 23 – Compressor Data Screen 1

Following are Figures 24 through 27 showing the remaining compressor data screens. Please refer to the TurboCor *Service Monitor User Manual* for explanation of parameters.



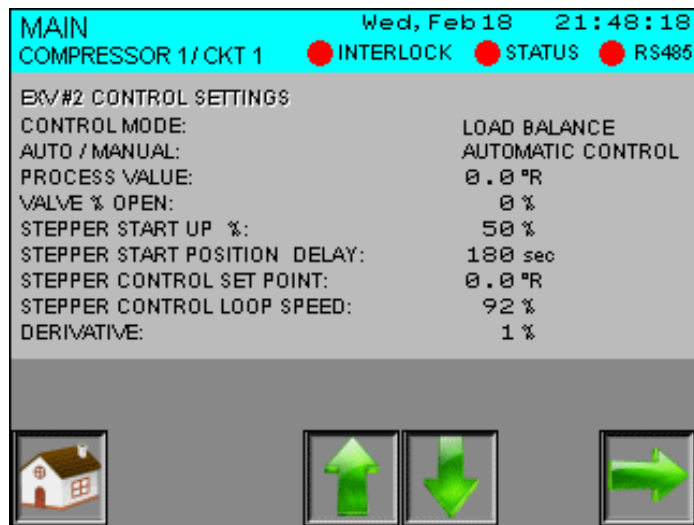
Screen A

Figure 24 – Compressor Data Screen 2



Screen B

Figure 25 – Compressor Data Screen 3



Screen C

Figure 26 – Compressor Data Screen 4

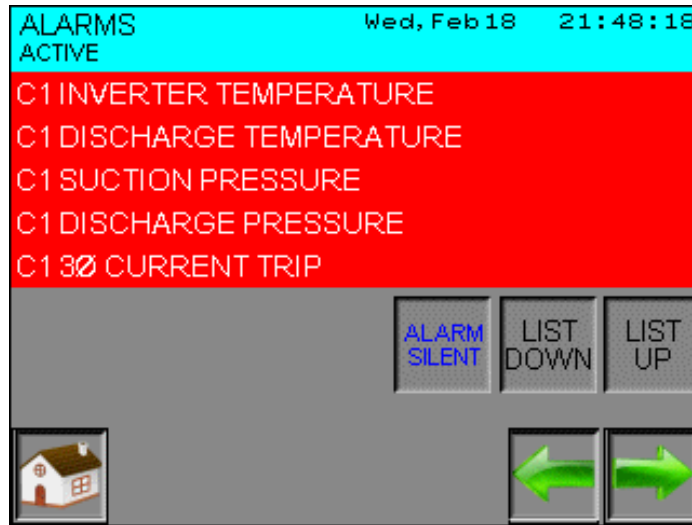


Screen D

Figure 27 – Compressor Data Screen 5

Alarm Handler

When a critical system fault occurs, the controller activates the HMI alarm handler. This forces an alarm screen to appear with the current fault(s). Refer to Figure 28.

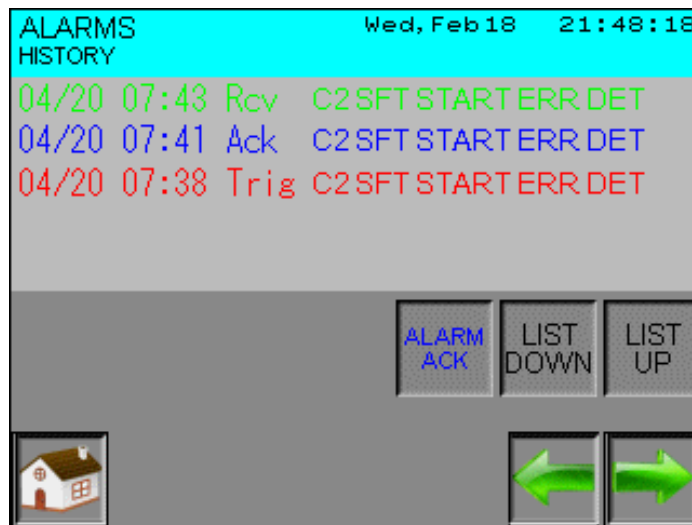


Screen 3

Figure 28 – HMI Alarm Handler

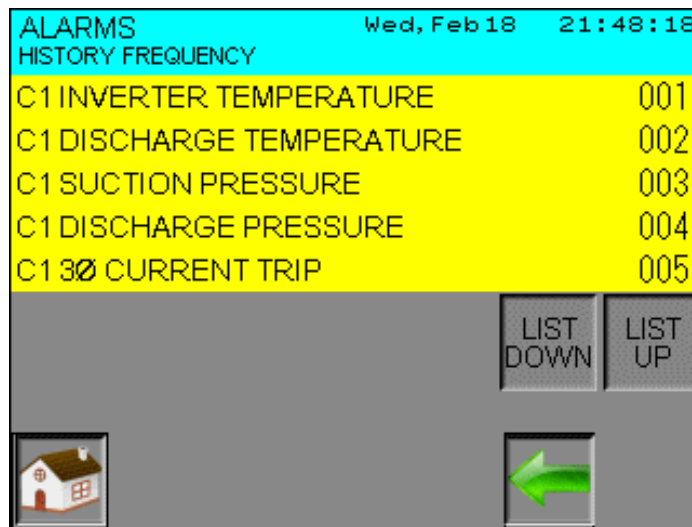
Associated with an active alarm is an alarm horn that sounds on and off every second. To silence this alarm, press the *Alarm Silent* button. If multiple alarms are active at once, use the *List Down* and *List Up* buttons to view all alarms. When no alarm(s) is active, the red portion of the display will be blank. To access this screen when not automatically popped up, use the screen list selector.

There are two more screens associated with the alarm handler. The first one is the *Alarm History* and the second is the *Alarm History Frequency* as shown in Figures 29 and 30 respectfully.



Screen 4

Figure 29 – Alarm History



Screen 5

Figure 30 – Alarm History Frequency

Any time a critical alarm occurs, it is entered into the HMI memory, which holds 128 alarms. When this memory area is full, the oldest alarm is purged from memory. To access the *Alarm History* page from the *Alarms Active* page, press the right arrow button. To view the *Alarm History Frequency* screen from the *Alarm History* page, use the right arrow button. All three screens are accessible by using the screen list selector.

Please refer to Figure 29 during the explanation of the *Alarm History* page. When a critical alarm occurs, the alarm is loaded into the alarm history memory location. Alarms are stamped with the current time and date. There are three stages of the alarm on the history page.

- **Triggered (Trig):** Time when the alarm is triggered. The font color of the triggered alarm is red.
- **Acknowledged (Ack):** Time when an alarm is acknowledged. This occurs after the operator presses the Alarm ACK button. The font color of the acknowledged alarm is blue.
- **Recovered (Rcv):** Time when the alarm clears. The font color of the recovered alarm is green.

To acknowledge an alarm, highlight the alarm to acknowledge by pressing on it. Now press the Alarm ACK button. A new line will appear on the screen as shown in Figure 29. The color of the font is blue, and the abbreviation Trig is replaced with Ack. After acknowledging the alarm, the time date updates. When the alarm recovers, the recovered line automatically goes into the alarm history page and is not dependent upon the alarm being acknowledged. It also has a time and date stamp and displays Rcv for recovered.

The final screen that deals with alarms is the Alarm History Frequency screen. This screen displays alarms in order of frequency. To view all the alarms on this page, use the List Up and List Down buttons. To navigate to the Alarm History page, use the left arrow button. To return to the system default page, press the home button.

Compressor Alarms

The following is a list of non-critical alarms processed by the controller:

- Inverter Temperature Alarm
- Discharge Temperature Alarm
- Suction Pressure Alarm
- Discharge Pressure Alarm
- 3 Phase Over Current Alarm
- Shaft Cavity Temperature Alarm
- Leaving Air / Water Temperature Alarm
- Total Compression Ratio Alarm
- Bearing Motor Alarm
- SCR Temperature Alarm
- System Lock Out State
- Lockout Alarm
- Winding Temperature Alarm
- Super Heat Alarm

Compressor Faults

The following is a list of critical alarms processed by the controller:

- Inverter Temperature Fault
- Discharge Temperature Fault
- Suction Pressure Fault
- Discharge Pressure Fault
- 3 Phase Over Current Fault
- Shaft Cavity Temperature Fault
- Leaving Air / Water Temperature Fault
- Total Compression Ratio Fault
- Bearing Motor Fault
- SCR Temp Fault
- System Lock Out State
- Lockout Fault
- Winding Temperature Fault
- Super Heat Fault

Compressor Bearing Faults

The following is a list critical bearing alarms processed by the controller:

- Calibration Failed
- Startup Check Failed
- Excessive Axial Over Orbit
- Axial Static Load
- Excessive Front Radial Orbit
- Front Radial Static Load
- Excessive Back Radial Orbit
- Back Radial Static Load

Compressor Motor Faults

The following is a list of critical motor alarms processed by the controller:

- Motor Single Phase Over-Current Detected
- DC Bus Over-Voltage Detected
- Motor High Current Warning
- Motor High Current Fault
- Inverter Error Signal Active
- Rotor may be Locked
- Bearing Error Active
- Bearing Warning Active
- Output Voltage on the Motor Generates No Current. IGBT inverter command signals disconnected or drive coil error.
- DC Voltage Below Limit
- Motor Back EMF is Low
- EEPROM Checksum Error
- Generator Mode Active
- SCR Phase Loss
- System in Startup Mode

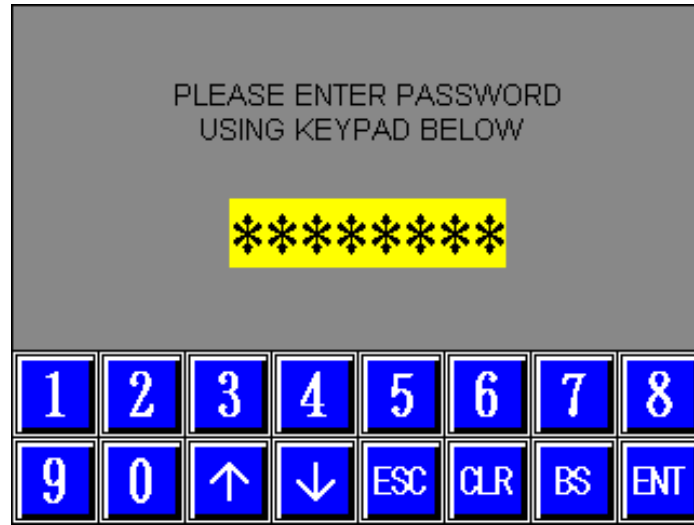
System Status Messages

On the system default screen and base screen of each compressor's data pages, there is a system message display. Following is list of messages displays during the operation of the chiller. C1 precedes messages pertaining to Circuit 1. Additional circuit messages are preceded by their circuit identifier, C2, C3, etc.

- Locked Out State (Cycle Power to Reset)
- System Resetting
- Compressor Ramping Up
- Partially Closed Vane
- Normal Operation State
- Maximum Flow State
- Minimum IGV Reached (System Fully Unloaded)
(Note: Load Balance Valve will Start to Open Now)
- Compressor has Demand Applied but Interlock is Open
- Fault is Active – Waiting for the Demand
- Compressor can't Start Inverter Temperature too High
- Compressor Below Surge Speed Loading Up
- Anti-Cycle Timer Active
- RS-485 Error
- P1 Pump Started
- P1 Pump Stopped
- P2 Pump Started
- P2 Pump Stopped

Login and Keyboard Screens

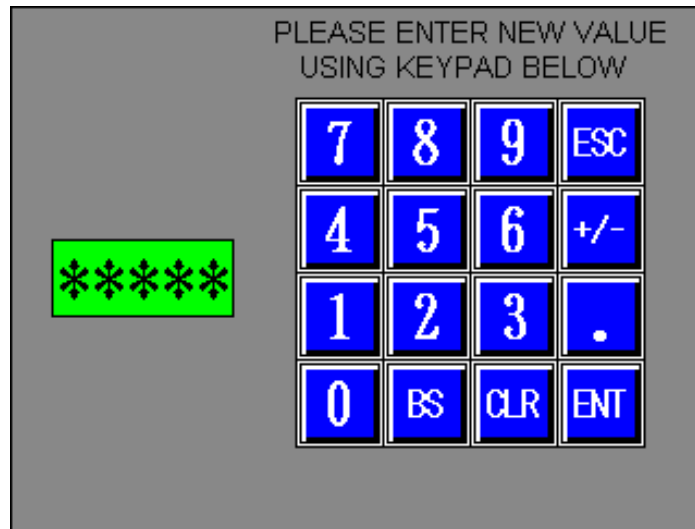
Throughout the chiller set-up process, there are numerous parameters to enter. A password is required to alter any parameter. For example, to change the chiller set point, the user will select Screen E (Figure 5), and press the area displaying the current set point. A login screen will appear as shown in Figure 31. Enter the default four-digit password and press the *ENT* enter button. The login screen will close and Screen E displays again. Press the area displaying the current set point again. This time a numeric keypad will appear as seen in Figure 32. Enter the new value and press the *ENT* enter button. The keyboard screen will close and the new set point value displays on Screen E.



Login Screen 1

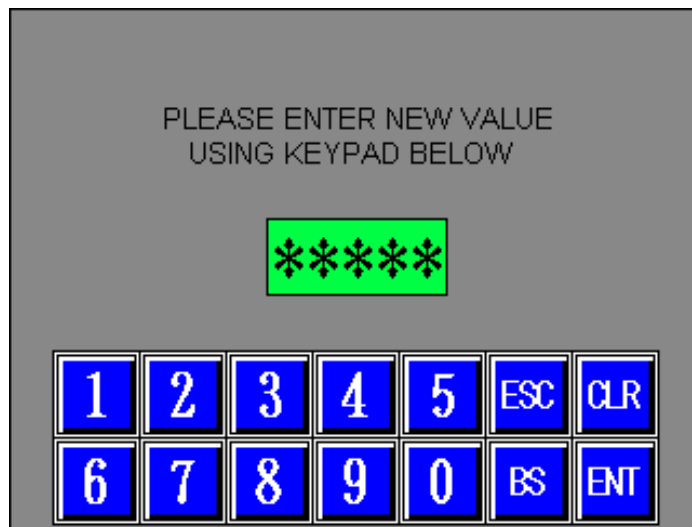
Figure 31 – Login Screen

There are two different keyboard screens. The first one, presented in Figure 32 is for parameters requiring floating point entries. Parameters that use only integer values use a numeric keyboard as shown in Figure 33.



Keyboard Screen 0

Figure 32 – Keyboard Screen 0

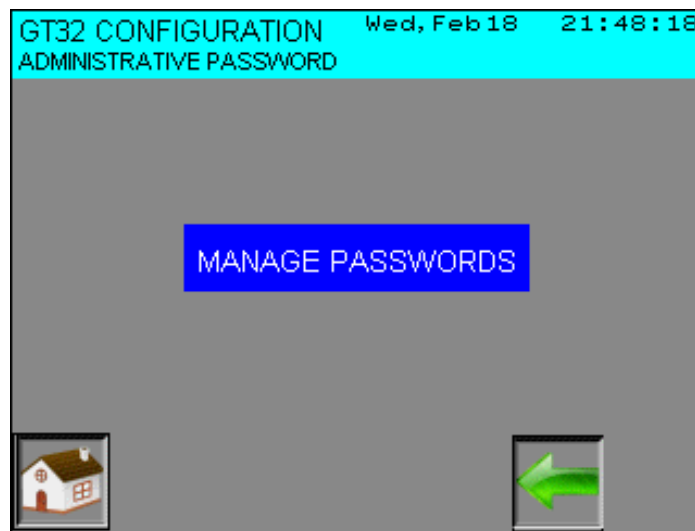


Keyboard Screen 1

Figure 33 – Keyboard Screen 1

Password Management

There are two levels of password protection. To make changes to these passwords, an administrative password screen as shown in Figure 33. Use the screen selector list to reach this screen. With the *Administrative Password* screen open, press the button labeled *MANAGE PASSWORDS*. The login window, Figure 31, will open. A level 15 access code is required to gain access to the *Password Management* screen as shown in Figure 35. Once accessed, any password it is possible to change any password including the level 15 code. The HMI leaves the factory with three levels of security. To make a password change, first select the number and then the level. Referring to Figure 36, each level of security has a number and level associated with it. Most chiller parameters require a supervisor level password. Following Figure 35 is a list of parameters changeable using the operator level password.



Screen 1B

Figure 34 – Administrate Password Screen

Password Management Screen ESC

No. Level

New Password

Re-Type Password

Figure 35 – Password Management Screen

Edit Operation Security Password - TCRManual.IOP x

Title: Eng

No.	Password	Security Level	Comment
0	1234	1	Operator Password Level
1	4321	2	Supervisor Password Level
2	ABC123	15	Adminiistrator Password Level
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Figure 36 – Edit Operation Security Password

Items changeable at the operator security level:

- Chiller Set Point
- Local / Remote Control Mode
- Circuit Enable / Disable
- Auto / Manual Compressor Staging

All other parameters require a supervisor password.

Service Information

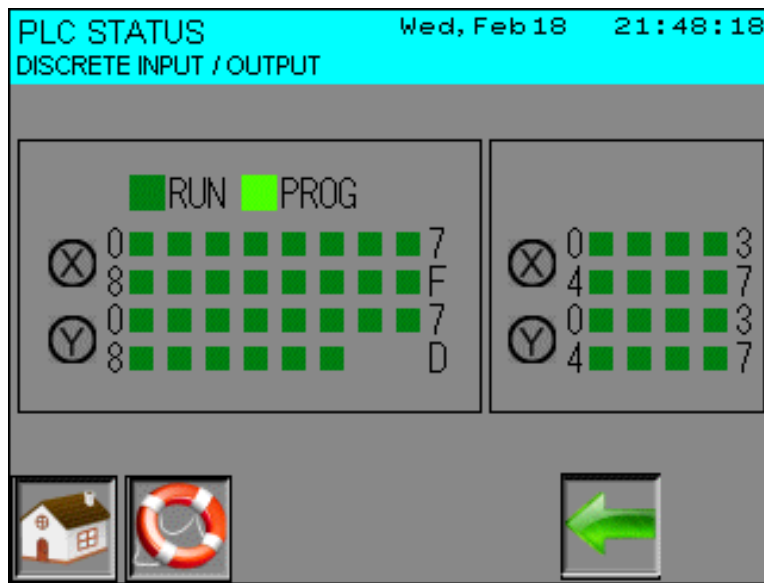
For convenience, machine information regarding the model number, job number and contact telephone numbers are available on a service screen. To access this screen, use the screen list selector. Use the *List Up* or *List Down* button to change the cursor to display 'Service Screen'; then press the *Enter* key. The screen will change to the service screen page, as shown in Figure 37. The contact information for the Thermal Care Service Department and Spare Parts is displayed in four languages: English, Spanish, French, and German. Referring to Figure 37, the four languages are identified by their national flag. By pressing one of the flags, the information changes from the current displayed to the new nationality. Please note only three flags are visible at once. If the current selection is English, only the Spanish, French and German flag are visible. This holds true for the remaining three languages. Just above the flags and to the right, are the model number of the chiller and its corresponding job order number. This will help the service center and spare parts representatives in assisting the customer in their requests.



Figure 37 – Language Selection Screen

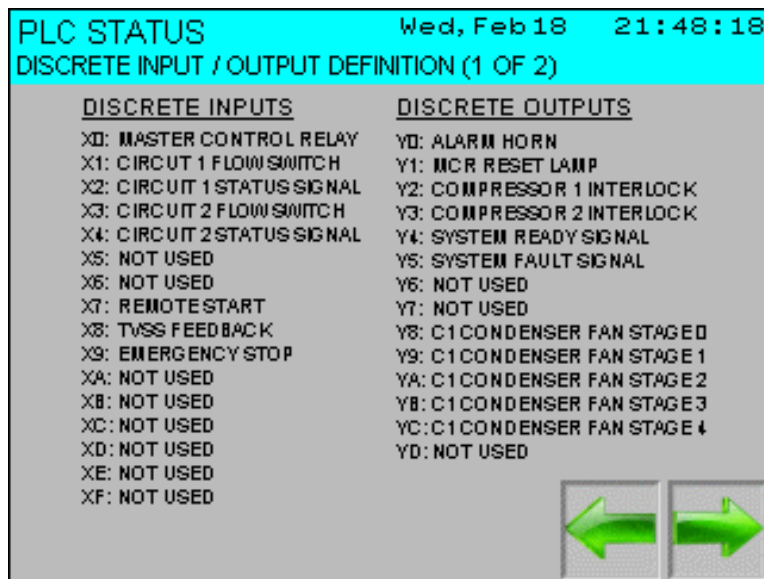
PLC Discrete Input / Output Status

It is possible to view the status of the discrete inputs and outputs of the PLC by using the screen selector. Using the *List Up* or the *List Down* buttons, change the screen list until *PLC INPUT / OUTPUT STATUS* is displayed. Press the *ENTER* button and the screen will change to the “PLC STATUS” screen, as shown in Figure 38.



Screen 1F

Figure 38 – Discrete Input/Output Status

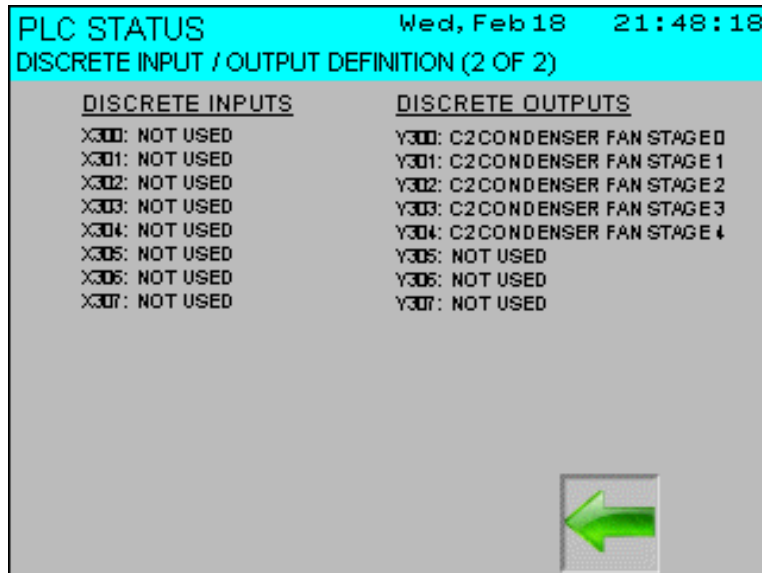


Screen 20

Figure 39 – Discrete Input/Output Definition (1 of 2)

The screen mimics the actual front view of the PLC. There are two sections of inputs and outputs on this screen. The PLC base unit has sixteen LED's located next to the 'X' and are discrete inputs and fourteen LED's located next to the 'Y' that are discrete outputs. The PLC expansion unit has eight LED's located next to the 'X' and are discrete inputs and eight LED's located next to the 'Y' that are discrete outputs. When an LED is lit (note the lighter shade of green next to the 'PROG' display), the corresponding input or output is on. The inputs and outputs are numbered using the hex base numbering

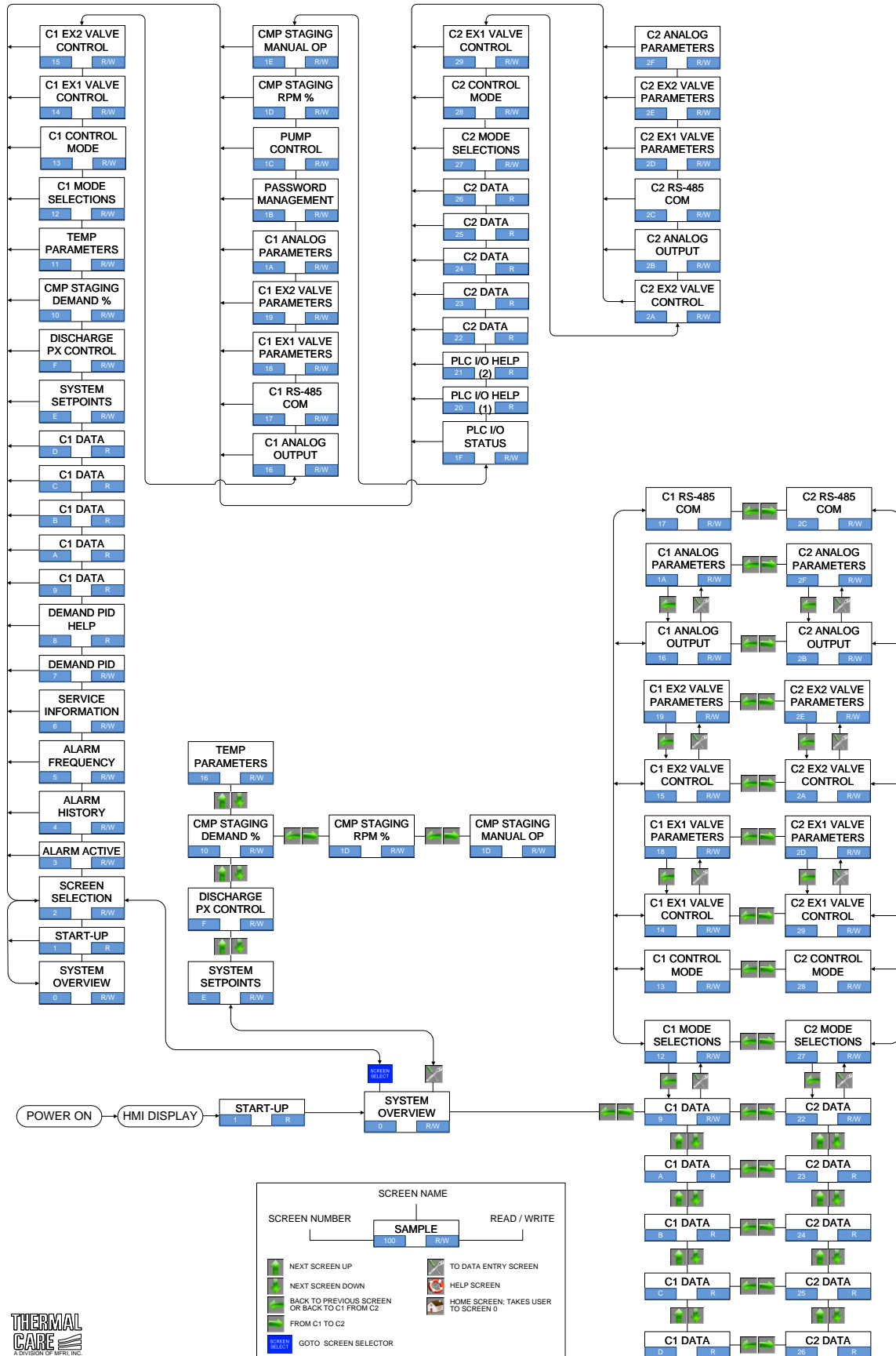
system. To identify a corresponding input or output to its function, two help screens have been added. The first help screen, shown in Figure 39, defines the inputs and outputs for the base unit. The second help screen, shown in Figure 40, defines the inputs and outputs for the expansion unit. To access the first screen, press the lifesaver button and the 'DISCRETE INPUT/OUTPUT DEFINITION (1 of 2)' screen will be displayed as shown in Figure 39. To access the 'DISCRETE INPUT/OUTPUT DEFINITION (2 of 2)' screen press the right arrow key and the screen shown in Figure 40 will appear. To return to the previous screen, use the left arrow key. Both 'DISCRETE INPUT/OUTPUT DEFINITION' screens are also accessible using the screen selector list.



Screen 21

Figure 40 – Discrete Input/Output Definition (2 of 2)

Screen Navigation



HMI Hardware

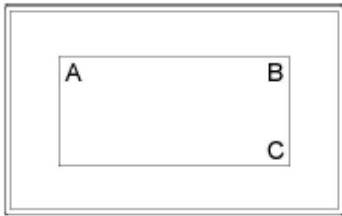
System Menu

The following documentation is from the Panasonic Manual regarding the GT32 HMI system menu. The system menu allows calibration of the touch screen, clock setting, system diagnostics, etc. For additional information regarding the GT32 HMI, please refer to Panasonic GT SERIES TECHNICAL MANUAL ARCT1F398E-5 7.11. This manual is available on-line and is a free download.

The following procedure is used to bring up the system menu

1. Touch the LCD touch panel as the following procedure.

For GT01, GT05, GT11, GT21 and GT32



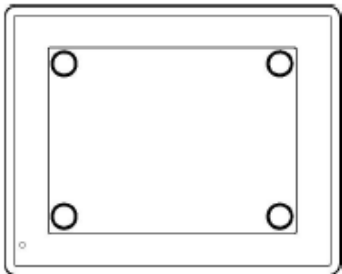
1. Press the upper left corner (area A) for at least two seconds.
2. Next, immediately press the upper right corner (area B) and lower right corner (area C), in that order.

* Press areas A, B and C, in order, individually. It will not work if you press them together.

* For vertical type displays, arrange the GT vertically and, press the top left corner, top right corner and bottom right corner in order.

* The System Menu does not support vertical type displays. It will display the same as on the horizontal type.

For GT30

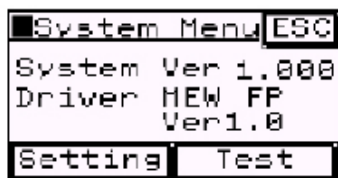


1. Touch four corners at the same time, and continue pressing them for about one second.

2. The initial screen of the system menu is displayed.

The screen of the system menu varies depending on the GT models.

The following is explained using the GT01 screen.



"System Ver" indicates the ROM version of the GT system.

The initial screen of the system menu is displayed on the GT. Touching either the [Setting] or [Test] key shifts to the next screen.

Touching the [ESC] key exits the system menu and returns to the normal operating mode.

Note) There is no screens for selecting the setting mode and test mode in the initial screens of the GT21 and GT30.

3. Select the mode.

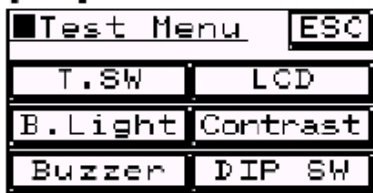
[Setting] Setting mode initial screen



This is where configuration settings for the GT, such as the contrast, clock, and memory, are specified.

Please refer to the table below for the information on the available settings for each model.

[Test] Test mode initial screen



This is where GT configuration elements such as the touch switches, backlight, clock, buzzer, LCD, contrast, and memory are tested.

Available functions for each model

Function name	GT01	GT11	GT21	GT30	GT32M	GT32T	GT05
Communication parameters COM port	A	A	A	A	A	A	A
Communication parameters TOOL port	A	A	A	A	N/A	N/A	N/A
Communication parameters Ethernet port	N/A	N/A	N/A	N/A	N/A	A	N/A
Clock	N/A	A	A	A	A	A	A
Contrast	A	A	A	A	A	N/A	A
Backlight	A	A	A	N/A	N/A	N/A	A
Touch switch adjustment	A	A	A	N/A	A	A	A
Memory initialization S	A	A	A	A	A	A	A
Memory initialization F	A	A	A	A	A	A	A
Copy	A	A	A	N/A	N/A	N/A	N/A
SD memory card	N/A	N/A	N/A	N/A	A	A	A

A: Available N/A: Not Available

Touch Switch Adjustment Screen

Touching [Setting] on the initial screen of the system menu and then the [Touch SW] ([T. SW] for the Gt01) key of the setting mode menu displays the touch switch adjustment screen. The position of the GT touch switch is adjusted here.

Touch switch adjustment screen

Procedure for bringing up the screen

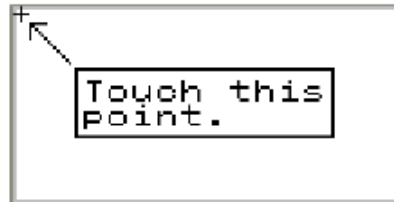
[Initial screen]

↓

[Setting]

↓

[Touch SW]



Touch panel operation:

[ADJUST] Touch the “+” mark with a soft, narrow instrument. Touch the “+” mark three times as displayed on the screen. Please repeat if the touch position has shifted greatly. You will not lose this setting when the power is turned off. The setting will be initialized when the F-ROM memory is initialized.

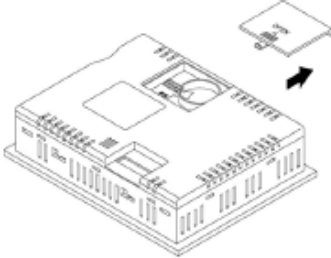
[RETURN] The adjustment should be completed to return to the previous screen.

Battery Installation & Replacement

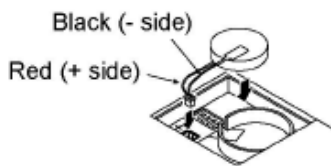
The GT32 uses a battery to maintain the system clock. To replace the battery, follow the instructions listed below.

The figures below is explained using the GT32. Although the design of the GT05 is different, the procedure is the same.

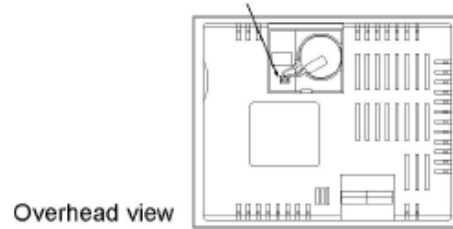
1. Remove the battery cover.



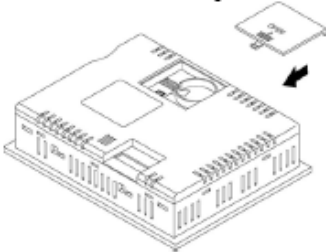
2. Connect the connector to make the red line be the (+) side, and place a battery in the circular frame.



Position where the connector is connected



3. Fit the battery cover.



Thermal Care, Inc.
7720 North Lehigh Ave.
Niles, IL 60714-3491
www.thermalcare.com

New Equipment Sales
Phone (847) 966-2260
Fax (847) 966-9358
Email info@thermalcare.com

Customer Service
Phone (847) 966-2636
Fax (847) 966-2906
Email service@thermalcare.com

Parts
Phone (847) 966-8560
Fax (847) 966-6065
Email tcparts@thermalcare.com