TRANE™

UCP2 – The Operator's Perspective

Technical Training
Student Handbook

ST-MNL-5

UCP2 – The Operator's Perspective

CONTENTS

This manual is a companion to the Trane seminar of the same name. To order additional copies of this manual, contact:

Service Literature Department
The Trane Company
3600 Pammel Creek Road
La Crosse, WI 54601

Please specify literature order number ST-MNL-5.

The following related material is also available through Trane Service Literature:

ST-MNL-4 "UCP2 – A First Look"

The Trane Company, La Crosse, Wisconsin 54601-7599

INTRODUCTION

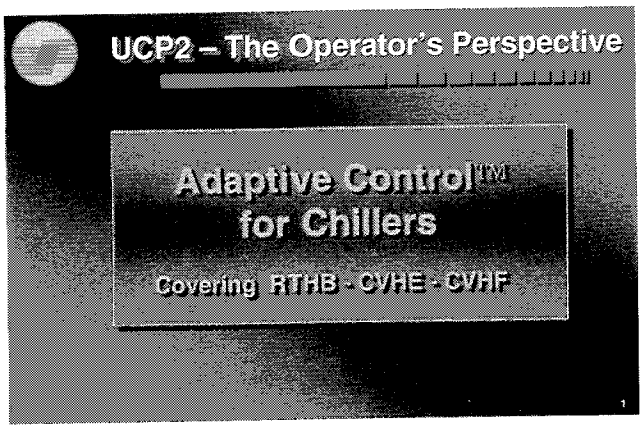

Figure 1

(Figure 1) This course is a continuation of the material contained in the companion training module to this one, ST-LG-4; "UCP2 – A First Look".

ST-LG-4 introduced the UCP2 and covered the clear language display's four report functions. This course picks up at that point, continuing with the UCP settings functions and concluding by discussing basic chiller operation using the control.

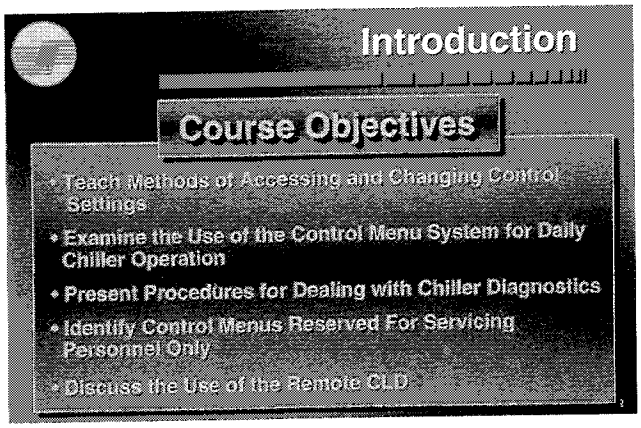

Figure 2

(Figure 2) The Adaptive Control™ System is presently available on these Trane products:

- Model CVHE 230-1250 ton CenTraVac® (3-stage centrifugal chillers)
- Model CVHF 650-1250 ton CenTraVac (2-stage centrifugal chillers)
- Model RTHB 130-450 ton Series R® CenTraVac (helical-rotary chillers)
- Model ABSC Absorber (single-stage absorption chillers)
- Model ABTE Absorber (2-stage absorption chillers)

This manual covers model CVHE and CVHF centrifugal and RTHB helical-rotary chillers equipped with Trane's UCP2 microprocessor control panel.

The manual will show how to use the control's menu system for daily chiller operation and how to deal with machine diagnostics and restore chiller operation. By studying this manual, the reader should learn how to access and use UCP2 control settings and become familiar with which ones chiller operating personnel would typically be expected to understand and set or change.

Finally, the reader will learn what control menus are reserved for service technician use and how to protect the chiller controls from unauthorized access.

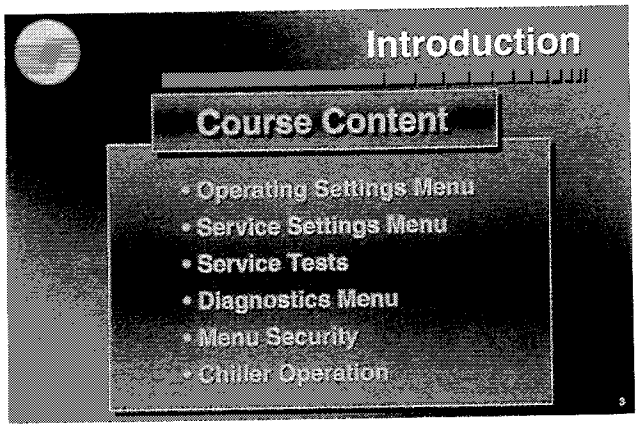

Figure 3

(Figure 3) With this course, we will continue discussion of the UCP2 clear language display. We begin with the four menus of the Settings Group, which are:

Operator Settings menu
Service Settings menu
Service Tests menu, and;
Diagnostics menu

We will also look at the UCP2 control system security measures. The course concludes with coverage of the UCP power-up and operational sequences, a discussion of chiller logging procedures, diagnostic handling routines and remote clear language display (CLD) operation.

SETTINGS GROUP KEYS

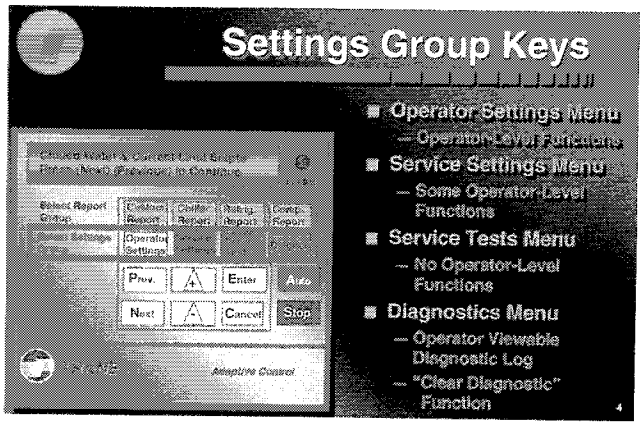

Figure 4

(Figure 4) As previously mentioned, the second row of four keys on the CLD is the settings group keys. They are used to access four menus of machine and system settings. They are:

Operator Settings Menu: It contains the majority of operator-level functions; no machine safety setpoints.

Service Settings Menu: Only the "Basic Setups" or top level settings of this menu are typically used by operating personnel.

Service Tests Menu: Use of this menu is reserved for qualified service technicians.

Diagnostics Menu: Operator views diagnostics log and clears diagnostics preventing chiller operation.

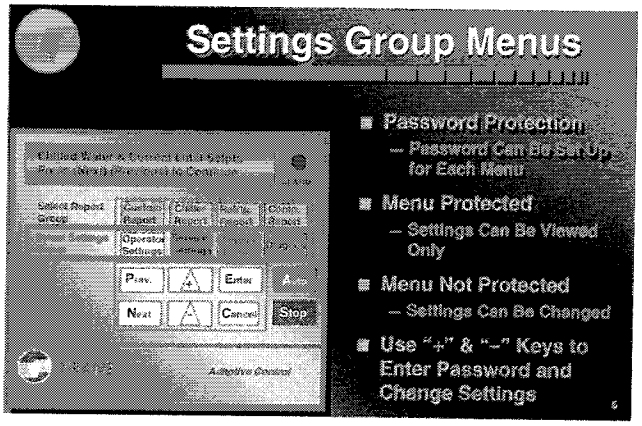

Figure 5

(Figure 5) Passwords can be set up for each menu. If menus are password protected, menu items can be viewed only, not changed. If menus are not protected, items can be both viewed and changed. Use the Previous and Next keys to scroll through menus. Use (+) and (–) keys to change settings. Use Enter key to enter changes into memory after each menu change.

Operator Settings

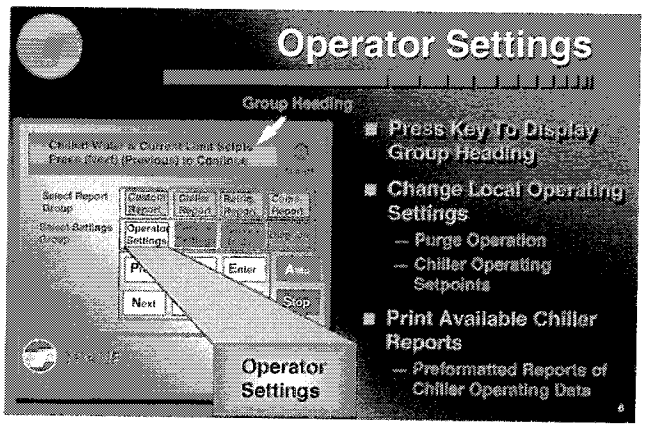

Figure 6

(Figure 6) Pressing the Operator Settings key displays the Operator Settings group or menu heading. If the group (menu) heading does not appear, the headings have been disabled. They can be restored from the Basic Setups area of the Service Settings menu.

Operator settings are used to set local chiller operating parameters and control purge operation (for CHVE/F units). The Operator Settings menu allows the operator to output the available printed reports also. Press Next to continue to the Menu Settings Password screen.

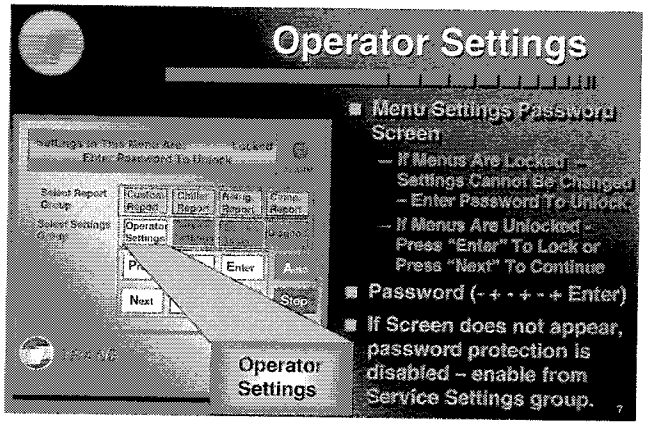

Figure 7

(Figure 7) This screen indicates that the settings in the menu are either locked or unlocked and displays the correct password on the second line for operator convenience. If settings are locked, the operator can unlock them by entering the Menu Settings password. The password is (– + – + – +) followed by Enter.

If the settings are already unlocked, then the operator can change the settings in this menu. Alternately, at this time, the operator can choose to lock the settings in this menu by pressing Enter or can continue on to the next screen by pressing Next.

Note: Any time you are entering a password with the (+) and (–) keys, up to 20 characters can be entered. The CLD uses the last six characters entered as the password, so in this case, the last six characters must be (– + – + – +) followed by the Enter key. So, up to 14 "nonsense" characters could be entered before keying in the correct password. If too many characters or an incorrect password are entered, the CLD will display "Incorrect Password".

If the screen in Figure 7 does not appear, then the menu settings display feature has been disabled from Field Startup menu of the Service Settings Group.

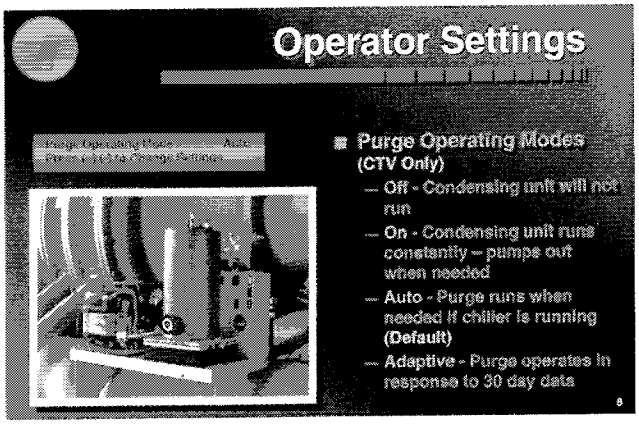

Figure 8

(Figure 8) This screen will not appear if "Stand Alone Purge" type has been selected from the Machine Configuration menu. The purge operating mode screen allows the operator to set one of the four purge operating modes. These modes are:

Off (Stop)

– Purge condensing unit will not operate.

On

– Purge condensing unit runs continuously. Pumpout compressor runs when needed to purge chiller.

Auto

– Condensing unit runs whenever needed if the chiller is running. This is the factory default setting.

Adaptive

– Purge operates in response to 30 day purge data accumulated from past operation.

Use the Plus / Minus keys to change operating modes. This can only be done when In "Settings" groups; the second line of this screen will be "Press (+) (-) to Change Setting".

Use the Enter/Cancel keys to enter new data into memory. Enter must be pressed to store any new setting in memory. If the menu is scrolled to the next item, without pressing Enter, the setting will be lost.

Use cancel if a new setting has been entered but should not be stored. This can only be done when in "Settings" groups. Remember, settings or sensed data are updated on the screen every 2 seconds.

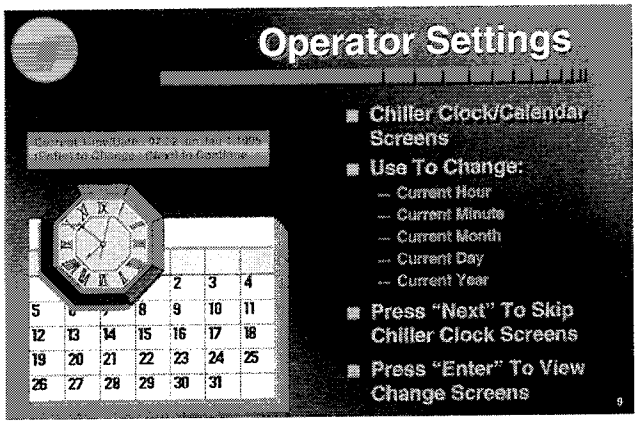

Figure 9

(Figure 9) The chiller Clock / Calendar screens are used to set the proper time and date on the chiller clock. It's important to have the correct time and date set on the chiller clock in order to perform time-related functions, print on time intervals and properly label printed reports.

When the Current Time / Date screen appears, the operator can choose to enter the screens that change the clock / calendar settings or not. To view these screens, press Enter. To skip the clock / calendar change screens, press Next.

When power is removed from the UCP, the clock does not continue to keep time. When the UCP is repowered, a Check Clock screen will display to remind the operator to reset the chiller clock.

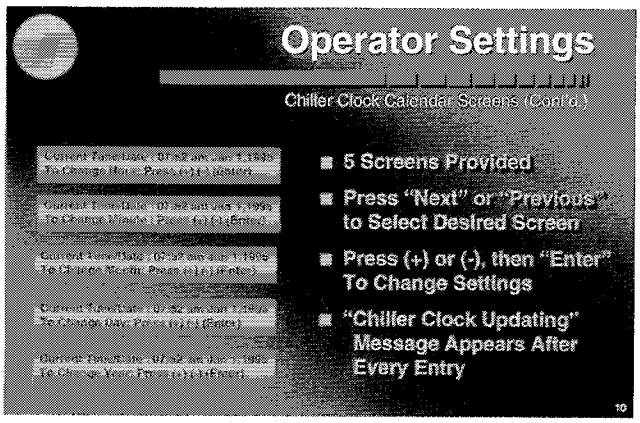

Figure 10

(Figure 10) There are five chiller clock settings screens.

Change Hour
Change Minute
Change Month
Change Day
Change Year

Press Next or Previous to scroll through the screens. Press (+) or (–), then Enter to change the value (remember, Enter must be pressed after each individual change). The Chiller Clock Updating screen will appear momentarily each time Enter is pressed.

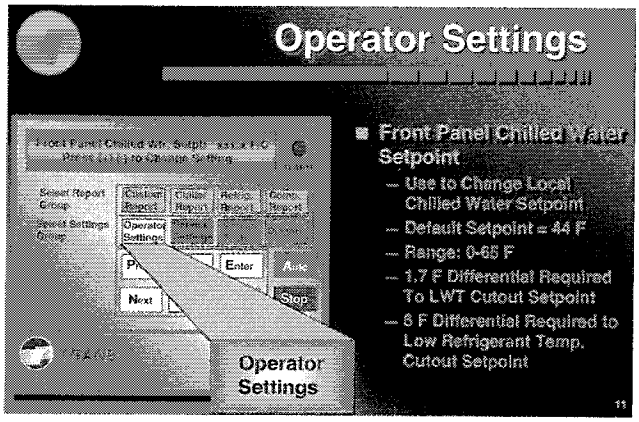

Figure 11

(Figure 11) The Front Panel Chilled Water Setpoint (CWS) is the primary chiller operating point. Press (+) or (–) to change displayed setpoint up or down (in degrees F or C). The programmed factory default setpoint is 44 F. The setting range is from 0 to 65 F.

It is necessary to maintain at least a 1.7 F differential between the CWS and the low water temperature cutout setting and a 6 F differential to the low refrigerant temperature cutout setting. When the Front Panel Chilled water Setpoint is within 1.7 F of the leaving water temperature cutout setpoint, or within 6 F of the low refrigerant temperature cutout setpoint, the second line of the display will read:

"Limited by Cutout Setpoint
Press (+) to Continue"

Plus / Minus Keys

Use to change all setpoints up (+) or down (–). This can only be done when in "Settings" groups. The second line of each screen in a settings menu will be "Press (+) (–) to Change Setting".

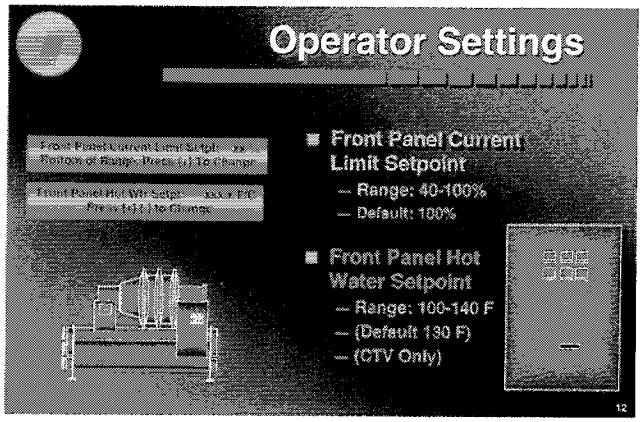

Figure 12

(Figure 12) The Current Limit Setpoint (CWS) is the point at which it is necessary to limit compressor loading because the compressor motor is drawing excessive amperage. This setpoint is set as a percentage of chiller nameplate full load amps (FLA). Press (+) or (–) to change displayed setpoint up or down (in degrees F or C). The factory default setpoint is 100%. Setting range is 40 to 100%.

If you try to establish a setpoint above or below the possible range, one of these two messages is displayed on the second line of the screen:

"Top of Range, Press (–) to Advance"
or;
"Bottom of Range, Press (+) to Continue"

When the chiller is in Hot Water Temperature Control operating mode, the hot water setpoint is the primary operating control point. This is used when heating (not cooling) is the primary mission of the chiller (rare application). In this situation, the UCP controls off leaving condenser water temperature instead of evaporator leaving water temperature.

Press (+) or (–) to change displayed setpoint up or down (in degrees F or C). The factory default setpoint is 100%. The setting range is 100 to 140 F.

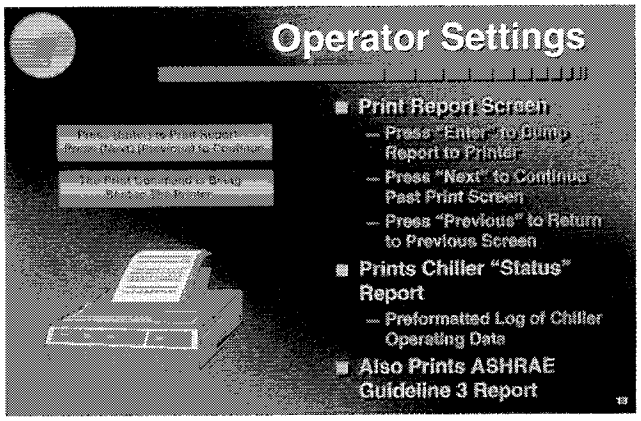

Figure 13

(Figure 13) The Print Report screen gives the operator the opportunity print out a chiller status or ASHRAE Guideline 3 report on demand. These reports can be printed on demand regardless of whether the UCP is configured to print reports at certain time intervals or on a diagnostic, too. To print reports, just press Enter. The Print Report Being Sent screen appears momentarily.

The chiller status report is a preformatted report of chiller data. The ASHRAE Guideline 3 report is a compilation of data from various UCP2 reports that ASHRAE recommends be monitored and logged daily to prevent refrigerant loss. Items in this report can be viewed at the second screen of the Chiller Report. This report is not found on earlier-model UCP2 panels. This is discussed again later in this manual.

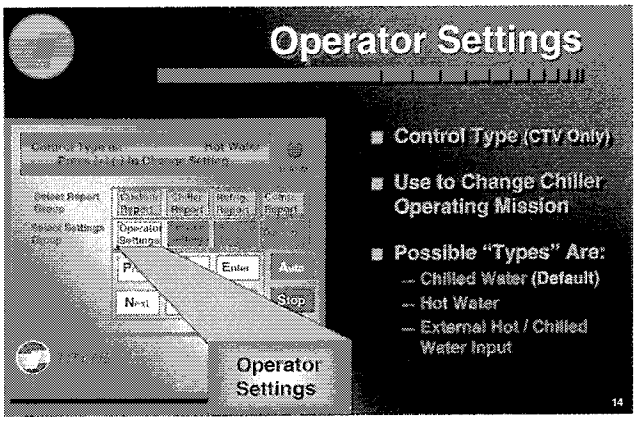

Figure 14

(Figure 14) This screen is used to switch the chiller operating control mode between chilled water control and hot water control. When the chiller is in Hot Water Temperature Control operating mode, the hot water setpoint is the primary operating control point.

This is used when heating (not cooling) is the primary mission of the chiller (rare application). The UCP controls off leaving condenser water temperature instead of evaporator leaving water temperature.

This screen will not appear unless this feature was installed from the Machine Configuration menu of the Service Settings group. The External Hot / Chilled Water Input is provided in the case where is it desirable to be able to switch between producing cold water and producing hot water from a Tracer location.

In this type of application the leaving evaporator water temperature is allowed to drift wherever it needs to be to satisfy the condenser heating load. The evaporator is normally piped into a lake, well or other source of constant temperature water for the purpose of extracting heat from it.

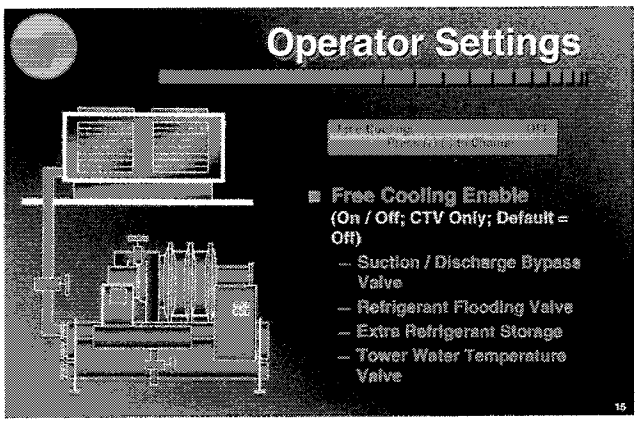

Figure 15

(Figure 15) This screen allows the operator to manually switch between normal powered cooling operation and free cooling. This can also be done automatically from a binary input on the options module or from a Tracer or Chiller Plant Manger (CPM).

Note: Free cooling has to be installed from the Machine Configuration menu of the Service Settings group.

Free cooling is a method to obtain up to 45% cooling without the running the compressor. In order to do this, first there must be a source of condensing water whose temperature is lower than the required chilled water temperature setpoint (i.e., you have an indoor load with low ambient outside air condition).

Free cooling requires a number of factory modifications to the chiller, including; installing a refrigerant gas line and liquid return line with automatic valves between evaporator and condenser, adding a liquid refrigerant storage vessel and providing extra refrigerant.

During free cooling, the water pumps operate and refrigerant circulates between the evaporator and condenser due to the pressure/temperature differential between them. The amount of cooling obtained depends on the magnitude of this differential. When the cooling load exceeds free cooling capacity or low temperature condenser water is no longer available, the operator manually switches back to normal cooling or this is done automatically via the input on the options module, a Tracer or Chiller Plant Manger (CPM).

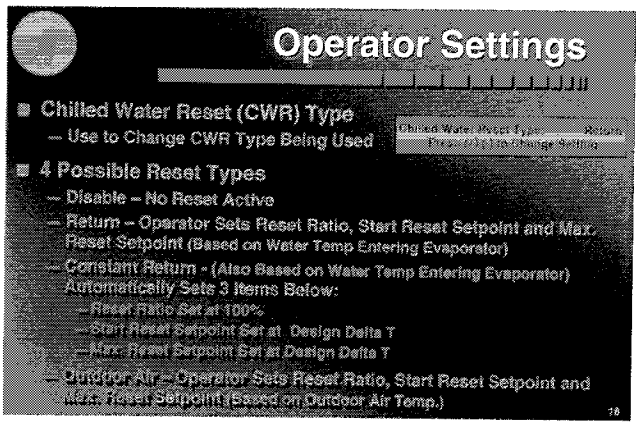

Figure 16

(Figure 16) Chilled water reset (CWR) is a means of reducing energy consumption during periods of the year when cooling loads are reduced. By resetting the chilled water setpoint upward as cooling load falls off, the chiller can satisfy the setpoint at lower load conditions, reducing electrical power consumption.

This screen allows the operator to select the type of chilled water reset to use or to disable reset altogether. The setpoint is based on a temperature such as return chilled water temperature (Return & Constant Return) or outside ambient air temperature (Outside Air). The most common use of chilled water reset is to provide a constant return chilled water temperature, so the settings for constant reset are the default settings.

If Constant Return is selected, then the reset ratio, start reset setpoint and maximum reset setpoint are set by the UCM. If chilled water reset is disabled or constant return is selected, the next three related subscreens will not appear (i.e., reset ratio, start reset setpoint and maximum reset setpoint). If chilled water reset type is set at return or outdoor air, then the next three related subcreens will follow. Then, it may be necessary for the operator to adjust the desired reset ratio, start reset setpoint and maximum reset setpoint (if the factory settings are not getting the job done).

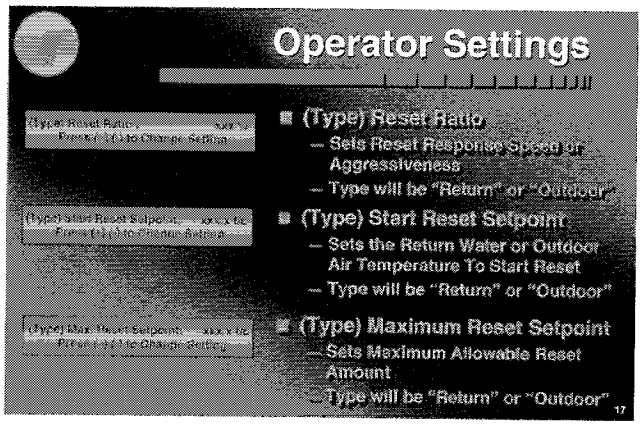

Figure 17

(Figure 17) Return and Outdoor reset setpoints can be calculated using the formulas provided in the chiller installation, operation and maintenance manuals.

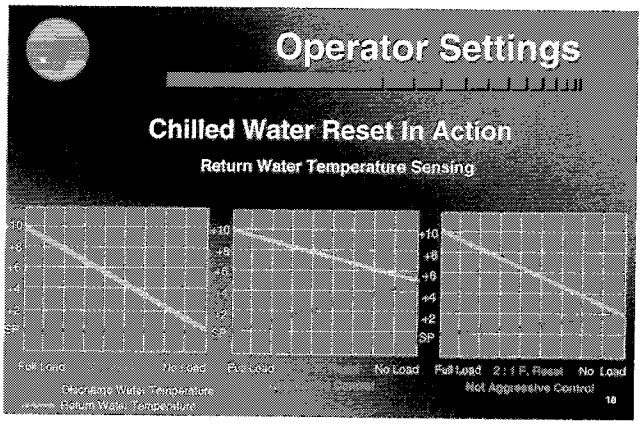

Figure 18

(Figure 18) In the "No Reset" example of the left chart, the chiller provides a constant discharge water temperature regardless of the return water temperature (return water temperature can drift anywhere).

In the "One-to-one" reset example of the middle chart, the UCP allows discharge water temperature (thus the chilled water setpoint) to raise at the same rate as return water temperature drops. This is considered aggressive reset control.

In the "Two-to-one" reset example in the right chart, the UCP raises discharge water temperature at only half the rate that the return water temperature drops. This is less aggressive reset control.

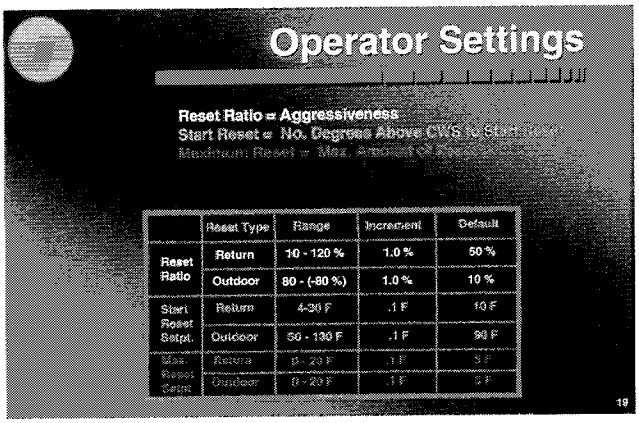

Figure 19

(Figure 19) Reset ratio is simply an arbitrary point that sets the rate of reset. Even though the default point is 50%, this will be set at the proper level for the job at the factory. If the operator feels that an increase or decrease in the reset rate (speed of reset) is needed, then the ratio must be adjusted up or down, accordingly.

At the default settings (reset ratio = 50%), when any chilled water reset is enabled, the UCP steps the chilled water setpoint toward the new (reset) setpoint at a rate of 1 F every 5 minutes until active chilled water setpoint matches the desired new setpoint.

When any type of reset is ordered, the setpoints are factory set for all chillers for the application. Resetting these values in the field is seldom necessary. If for some reason, the settings stored in memory were lost, then the default settings would take over. These setpoints are not lost when power is removed from the UCP.

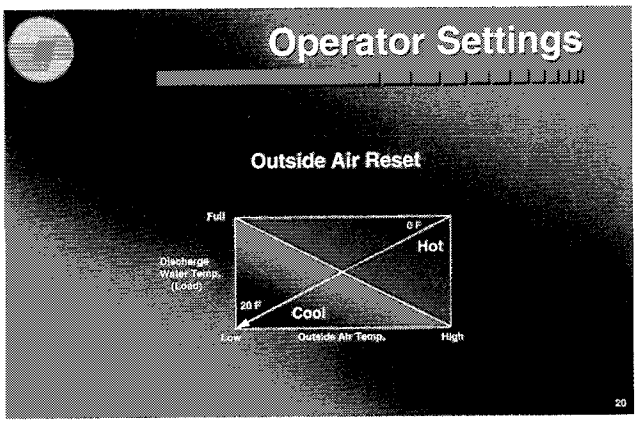

Figure 20

(Figure 20) For outside air reset, the chilled water setpoint is reset as outdoor temperature and cooling load decrease. In this example, maximum reset is set at 20 F.

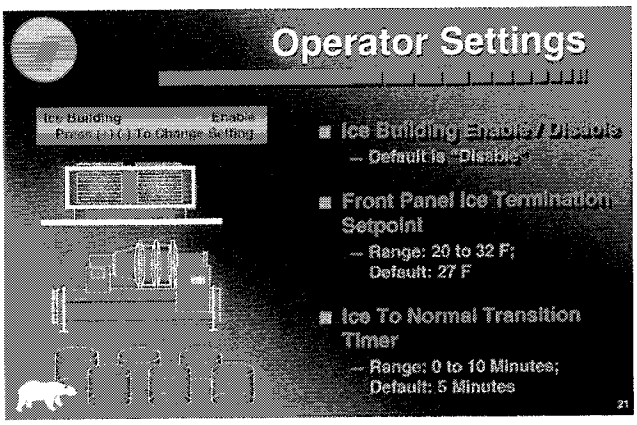

Figure 21

(Figure 21) Ice storage systems allow the chiller to operate at full load (build ice) during electrical off-peak periods (night) and use the stored ice as a cooling source during high electrical demand periods (day). During ice making operation, the chiller will be in "Ice-Building" operating mode.

Use the Ice Building Enable / Disable screen to select or turn off ice-making operation. Press (+) or (–) to change the setting. The Front Panel Ice Termination Setpoint is the return water (entering evaporator) temperature at which to stop making ice. Ice making can also be stopped by an external signal (Tracer) or opening of the External Ice Contact. The setting range is 20 to 32 F in 1 degree increments. The default setting is 27 F.

The transition timer is used when ice-making is terminated by a Tracer input or External Ice contacts to make the chiller run at minimum load for a set time period after the compressor unloads. The setting range is 0 to 10 minutes. The default setting is 5 minutes.

When ice-making is terminated, the chiller goes into "Ice-Making Complete" operating mode. If a CVHE/F operates in a surge condition for over 15 minutes, the chiller will shut down on the "Surge Shutdown: Ice Making" MMR diagnostic.

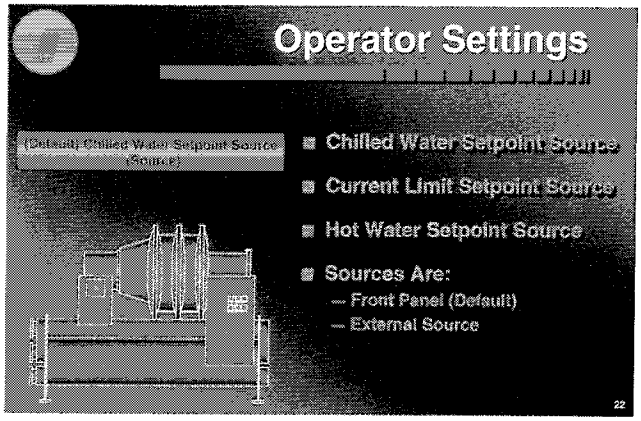

Figure 22

(Figure 22) The next five screens on the CLD (Figures 22 & 23) identify the sources for the present chilled water, current limit, hot water and ice termination setpoints and the setpoint override source and allow the operator to change the source if additional sources are installed. So, in order to change chilled water setpoint from the front panel to external source, the external chilled water setpoint inputs must be connected and that option installed from the Field Setup group.

Press (+) or (–) to change the displayed source. Possible sources are:

Front Panel (default)
External Source
Future 1, 2, 3 (Reserved for new sources options when available.)

The word "default" will appear at the beginning of all of the above source screens if the Tracer option is installed. If the Tracer does not provide a setpoint, then the default (front panel) is used. It is the valid setpoint source if there is no Tracer.

The Hot Water Setpoint Source screen will only display if the hot water control option is installed.

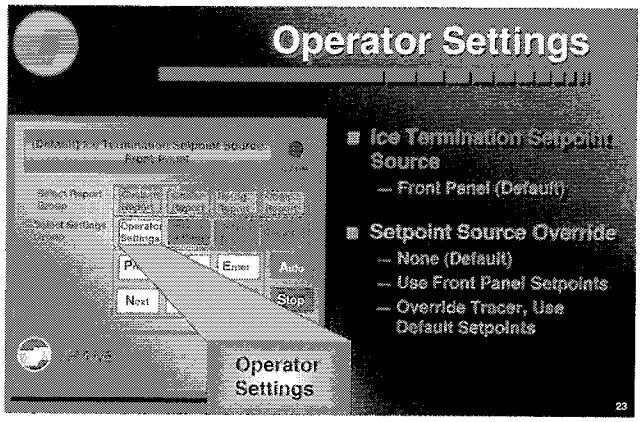

Figure 23

(Figure 23) The word "default" will appear at the beginning of the Ice Termination Setpoint Source screen if the Tracer option is installed. If the Tracer does not provide a setpoint, then the default (front panel) is used. It is the valid setpoint source if there is no Tracer.

The Setpoint Source Override screen allows the operator to override remote setpoints established by a Tracer or other generic input. Possible "sources" for this screen are:

None
Use Front Panel Setpoints
Override Tracer – Use Default Setpoints

"None" is the default setting.

Service Settings

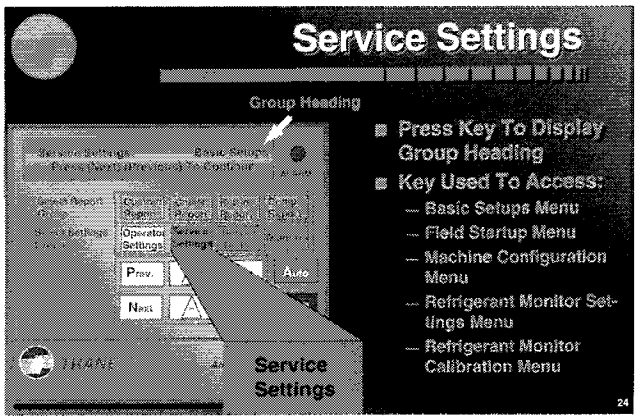

Figure 24

(Figure 24) The Service Settings Group consists of five separate menus. These are:

Basic Setups menu;
Field Startup menu;
Machine Configuration menu;
Refrigerant Monitor Settings menu;
Refrigerant Monitor Calibration menu

Each menu is protected by a different password, except for the Basic Setups menu. Although this menu does not have a password, the settings in it can be locked, just as in the previous menus we have discussed.

The Basic Setups menu consists of settings that would not often be accessed by the operator, and changes in them will not seriously affect the safety or reliability of the chiller.

The remaining password protected menus of this group are for changing parameters and settings for field commissioning, for setting fundamental protection of the chiller systems or for programming the UCP as to how the chiller was actually built in the factory.

Caution: Once these items are set they should never be changed again without specific knowledge of the effects these changes will have.

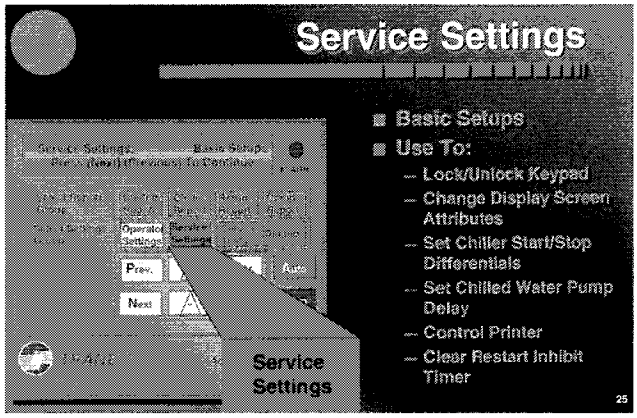

Figure 25

(Figure 25) Pressing the Service Settings key displays the Service Settings menu heading. If the group (menu) heading does not appear, the headings have been disabled. They can be restored from this settings menu. Press Next to continue to the Menu Settings Password screen. Service settings are used to set local chiller operating parameters and control settings.

Generally, the **Basic Setups** menu is used to:
– lock and unlock the keypad
– change display screen attributes (turn on / off group headings and menu setting password screens)
– set the chiller start and stop temperature differentials
– set the chilled water pump off time delay
– control printer operating settings
– clear the chiller restart inhibit timer

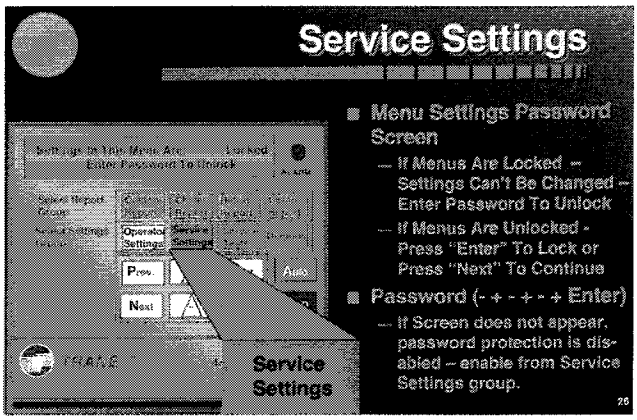

Figure 26

(Figure 26) This display screen indicates that the settings in the menu are either locked or unlocked and it displays the correct password on the second line for operator convenience. If the settings are locked, the operator can unlock them by entering the Menu Settings password. The password is (– + – + – +) followed by the Enter key.

If the settings are already unlocked, then the operator can change the settings in this menu. Alternately, at this time, the operator can choose to lock the settings in this menu by pressing Enter or can continue on to the next screen by pressing Next.

Note: Remember, any time you are entering a password with the + and – keys, up to 20 characters can be entered. The CLD uses the last six characters entered as the password, so in this case, the last six characters must be (– + – + – +) followed by the Enter key. So, up to 14 "nonsense" characters could be entered before keying in the correct password.

If too many characters or an incorrect password are entered, the CLD will display "Incorrect Password". If this screen does not appear, then the menu settings display feature has been disabled from Field Startup menu of the Service Settings Group.

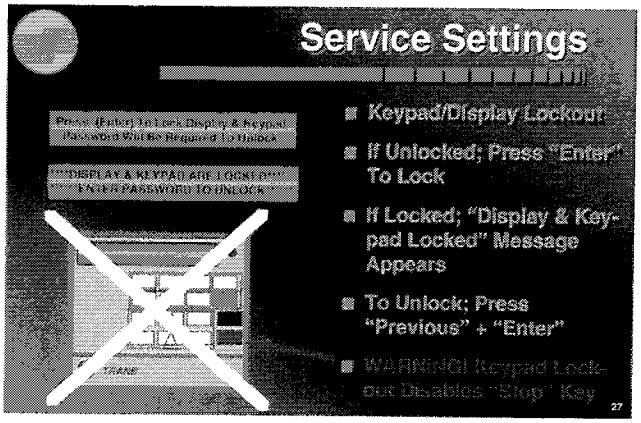

Figure 27

(Figure 27) If the Display and Keypad Are Locked, this screen appears when you attempt to use the UCP. Don't panic. Simply press the Previous and Enter keys simultaneously unlock the CLD.

If this screen does not appear, then the keypad lockout feature has been disabled from Field Startup menu of the Service Settings Group.

Locking out the keypad can be a dangerous thing to do, since this also disables the Auto and Stop keys. However, if the chiller is being controlled remotely from a remote CLD or Tracer, locking out the local keypad could be a good way prevent unauthorized personnel from inadvertently interfering with chiller operation.

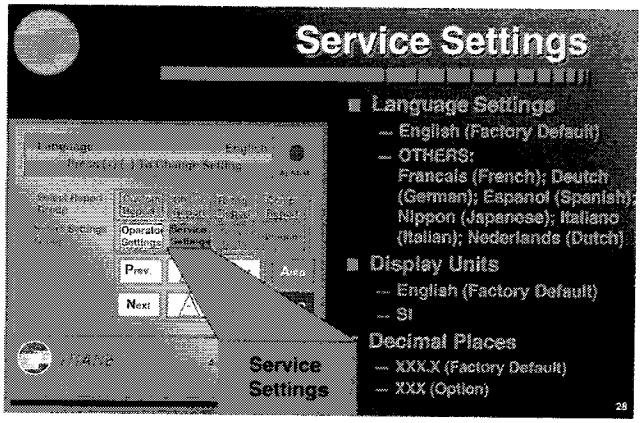

Figure 28

(Figure 28) The Language Setting screen is used to select the desired language for the CLD to use. The number of languages available depends on which software version is installed in the UCP. The factory default language is English. Press the (+) or (–) key and Enter to change languages.

The Display Units screen allows the operator to select to display data in either English or SI units. (i.e., temperatures in Fahrenheit or Celsius). The factory default units are English. Press the (+) or (–) key and Enter to change unit types.

Use the Decimal Places screen to select no decimal places displayed (i.e., 14) or tenths displayed (i.e., 14.0). The factory default is tenths displayed (i.e., 14.7). Press the (+) or (–) key and Enter to change the decimal display setting.

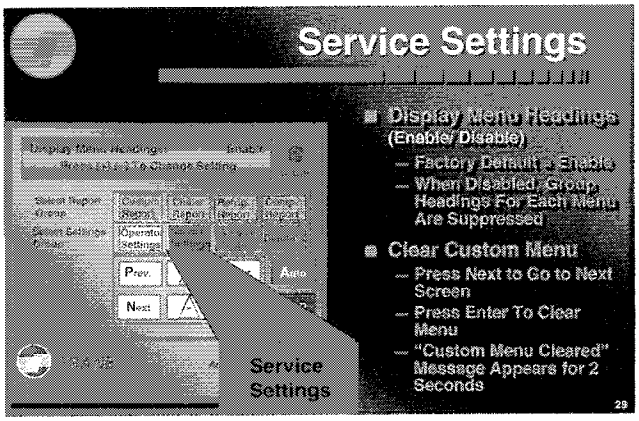

Figure 29

(Figure 29) The Display Menu Headings screen is where the group or menu headings are turned on and off. The operator has a choice of whether or not to view these headings as the first screen that appears when a menu key is pressed.

On one hand, turning off the headings saves the operator from having to scroll through this screen every time a new menu key is pressed. On the other hand, however, this screen verifies which menu the operator is accessing. It is easy to become confused and enter the wrong menu if these are turned off. The factory default is "headings enabled".

Press the (+) or (–) key and Enter to enable or disable the menu headings.

The Clear Custom Menu screen is a feature added at customer request. Pressing Enter at this screen clears all items from the Custom Report. With early versions of the UCP, the operator was required to enter the Custom Report menu and view each item individually in order to remove it from the report. There was no provision to allow the operator to totally clear the report of all items.

Press the Enter key to clear the Custom Report. Press Next to go to the next screen. If Enter is pressed, the Custom Menu Cleared screen will appear for two seconds.

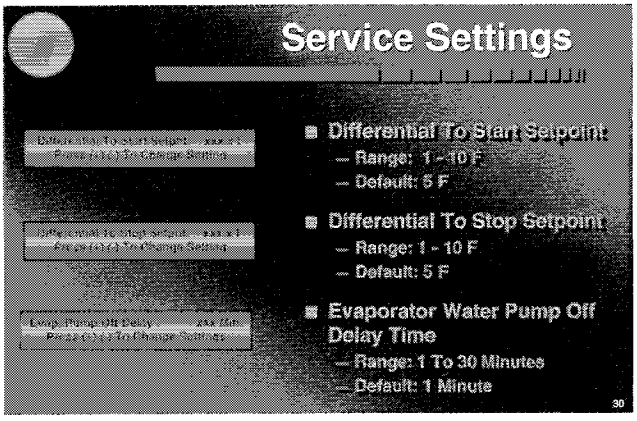

Figure 30

(Figure 30) The Differential To Start Setpoint is the number of degrees above chilled water setpoint that return water temperature must drift before the chiller will start.

Press (+) or (–) to change the displayed setpoint up or down (in degrees F or C). The programmed factory default setpoint is 5 F. The setting range is 1 through 10 F.

The Differential To Stop Setpoint is the number of degrees below setpoint that supply water temperature must drift before the chiller will shut down. Press (+) or (–) to change the displayed setpoint up or down (in degrees F or C). The programmed factory default setpoint is 5 F and the setting range is 1 through 10 F.

The Evaporator Water Pump Off screen allows the operator to adjust amount of time that the chilled water pump will operate after compressor shutdown. Press (+) or (–) to change the displayed setpoint up or down (in minutes). The programmed factory default setpoint is one minute. The setting range is 1 through 30 minutes.

If you try to establish a setpoint above or below the possible range, one of these two messages is displayed on the second line of the screen:

"Top of Range, Press (–) to Advance"
or;
"Bottom of Range, Press (+) to Continue"

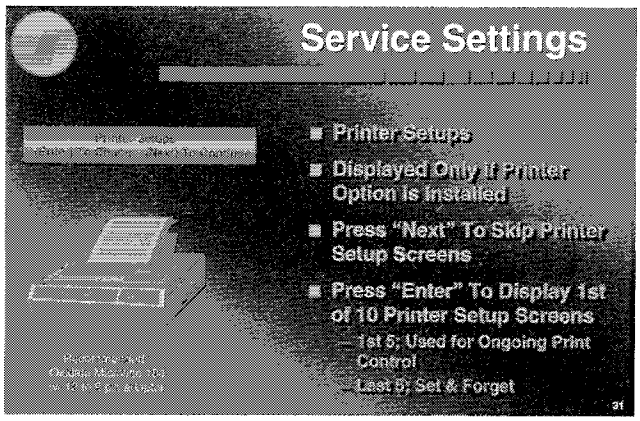

Figure 31

(Figure 31) If a printer is connected to the UCP (which requires the printer interface module), and the printer option has been installed from the Machine Configuration menu, the Printer Setups screen is displayed.

Press Next to go on to next Service Setting screen. Press Enter to view the ten printer setup screens.

The first five of these screens are used for ongoing control of the printer. The rest of the screens are used to set up the permanent printer configuration (as long as that particular printer is connected).

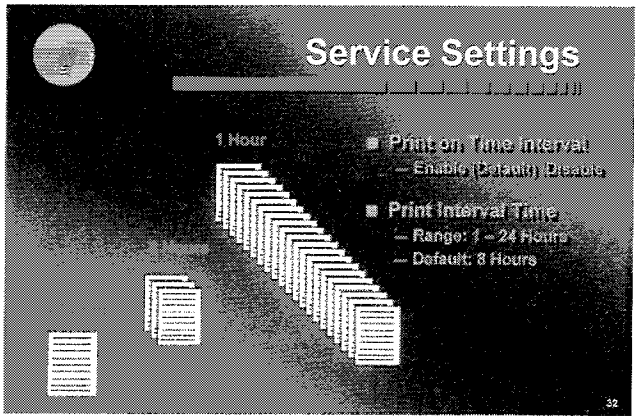

Figure 32

(Figure 32) As you will recall, a set of printed reports can be obtained on demand from the Print Report screen of the Operator Settings. The set consists of a chiller status report and an ASHRAE Guideline 3 report. These two screens allow the operator to select a set of printed reports at specific time intervals.

The operator uses the Print On Time Interval screen to enable or disable time interval report printing. The display will indicate whether this feature is enabled or disabled. Press (+) or (–) to change the setting.

The Print Interval Time screen allows the operator to choose how often the report set is printed. The time interval between printed reports can be set anywhere from 1 hour to 24 hours at one hour intervals.

If the operator sets the interval to 24 hours, then one report is printed every 24 hours. If the operator sets the interval to one hour, then 24 report sets would be printed in a 24 hour period. The default setting is eight hours, which results in the production of three printed report sets every 24 hours.

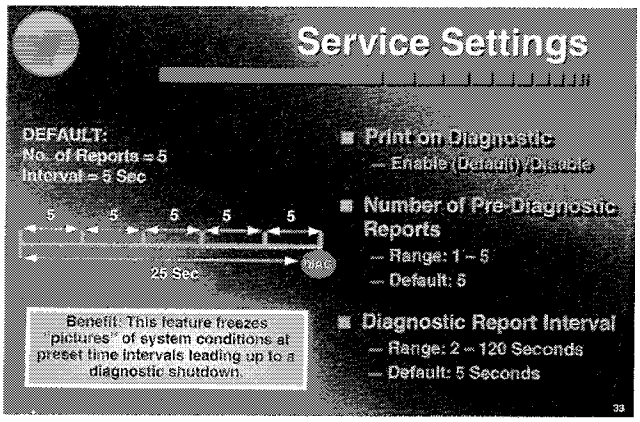

Figure 33

(Figure 33) The Print on Diagnostic screen is used to enable and disable diagnostic printing. The display will indicate whether this feature is enabled or disabled. Press (+) or (–) to change the setting.

These three screens allow the operator to select a specific number of printed report sets at specific time intervals whenever a diagnostic occurs. The Number of Pre-Diagnostic Reports screen allows the operator to choose to print between one and five reports each time a diagnostic occurs. The Diagnostic Report Interval screen lets the operator select the time interval between printed reports when a diagnostic occurs. This can be set anywhere from 2 to 120 seconds at two second intervals.

The default setting is one report every five seconds. The number of reports printed depends on the Number of Pre-Diagnostic Reports setting in the screen above.

The illustration in Figure 33 shows that at the default setting of 5 reports to be printed at 5-second intervals on a diagnostic, you would get a printout of system conditions covering a 25-second period before the diagnostic occurred.

The UPC2 is able to do this because, as we mentioned before, the chiller module is updating the CLD every two seconds, so the UCP is "freezing" a set of data every two seconds during operation.

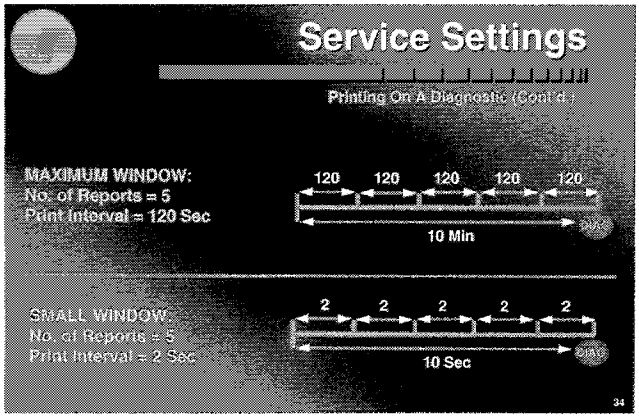

Figure 34

(Figure 34) The Maximum Window example in this figure shows the largest amount of time that can be covered before a diagnostic occurs. (Still using the maximum number of 5 reports).

This example shows that at a setting of five reports to be printed at the maximum 120-second (two minute) intervals on a diagnostic, you would get five printouts of system conditions covering a 10 minute period before the diagnostic occurred.

The Small Window example in Figure 34 shows the minimum amount of time that can be covered before a diagnostic occurs. (Still using the maximum number of 5 reports).

This example shows that at a setting of five reports to be printed at the minimum 2-second intervals on a diagnostic, you would get five printouts of system conditions covering a 10-second period before the diagnostic occurred.

By varying printed report output, the operator can pinpoint problems that may be developing that could cause diagnostics to occur.

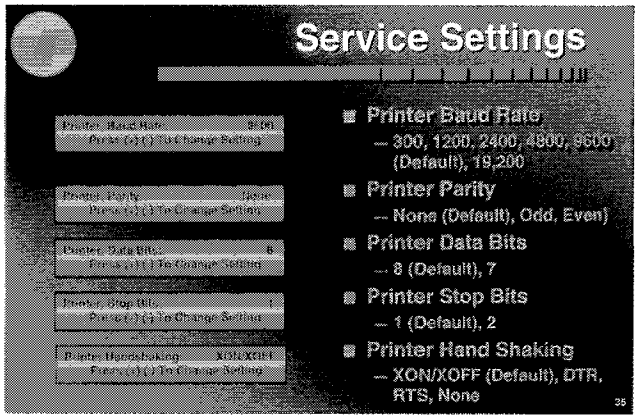

Figure 35

(Figure 35) The remaining printer setup screens are used to set printer configuration parameters that are permanent once they are set for the printer being used. These settings are printer baud rate, printer parity, printer data bits, printer stop bits and printer hand-shaking.

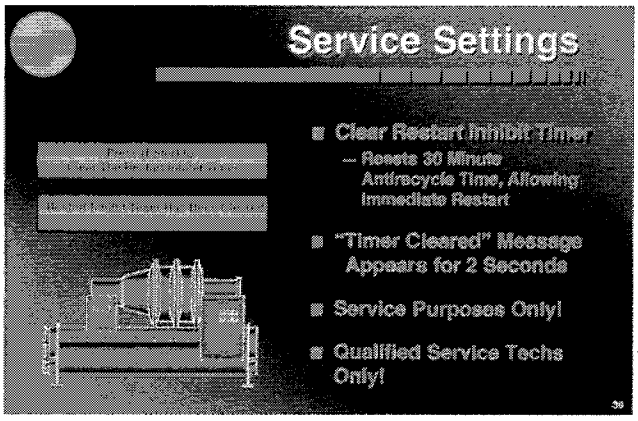

Figure 36

(Figure 36) The Clear Restart Inhibit Timer screen is provided to allow servicing personnel convenient access to a means of zeroing the restart inhibit timer so the machine can be restarted. To zero the timer, just press Enter when viewing this screen.

The restart inhibit timer protects the compressor motor and starter from damage that can be caused by short cycling (too frequent restarts). The amount of time on the timer varies with the type of chiller and size of compressor. Minimum time setting is 30 seconds for all chillers. Maximum is 8 minutes for RTHB and 60 minutes for CVHE/F units. This time can vary with each restart, because the timing also depends on motor temperature.

Service Tests

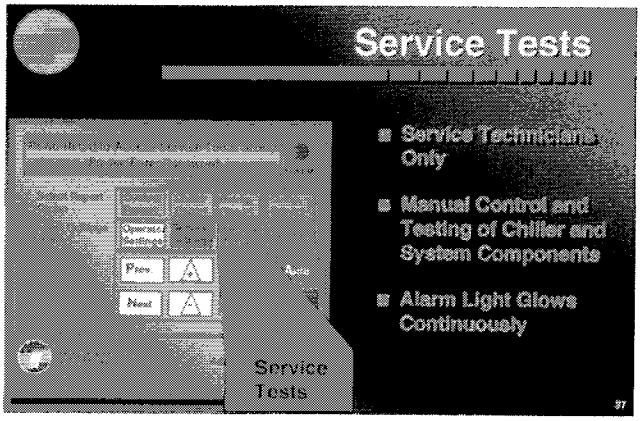

Figure 37

(Figure 37) The Service Tests menu, which is not discussed in detail in this course, provides a service technician the ability to manually control and test the functioning of the following components:

- Evaporator (chilled) water pump
- Condenser water pump
- CTV oil pump
- CTV inlet guide vanes
- RTHB electronic expansion valve
- RTHB slide valve
- Condenser and evaporator water flow switches

This menu, which is intended for use by qualified service personnel only, also allows the technician to test starter contactor integrity by performing a starter "dry run" test.

Note: The "Alarm LED" on the CLD will be lighted continuously when any service test procedure is being conducted.

Diagnostics

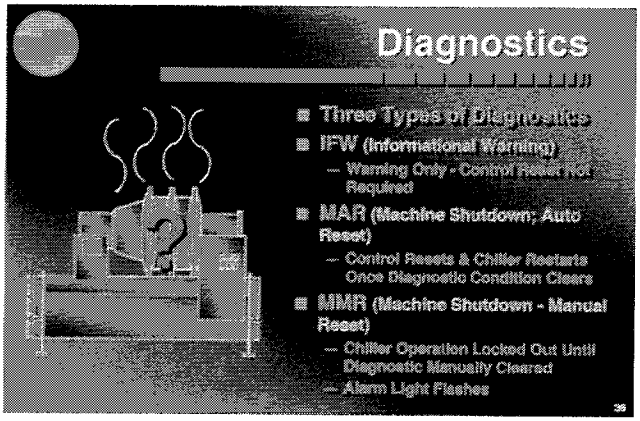

Figure 38

(Figure 38) The UCP2 recognizes three types or "levels" of diagnostics. The lowest level diagnostic, the informational warning (IFW) **does not** shut down the chiller. Both of the other two diagnostic types, MAR (machine shutdown / auto reset) and MMR (machine shutdown / manual reset) **will** shut down the chiller.

Only the highest level diagnostic, the MMR type, requires a manual reset of the control system to restart the chiller. MAR type diagnostics will allow the chiller to automatically continue operation once the diagnostic condition is corrected.

When an MMR occurs and the chiller shuts down, the alarm light on the face of the CLD flashes until the UCP is reset.

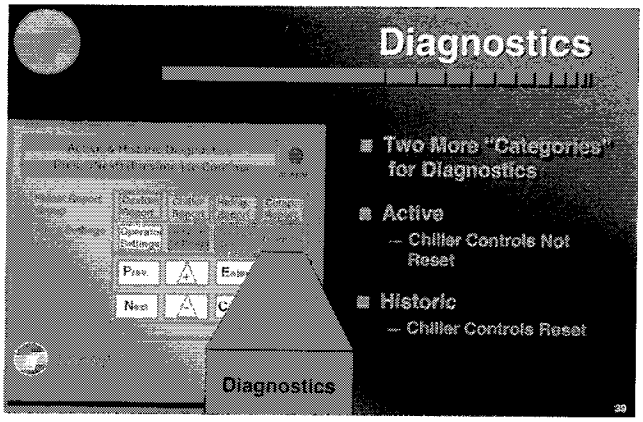

Figure 39

(Figure 39) Pressing the Diagnostics key displays the Diagnostics group or menu heading shown in this slide. If the group (menu) heading does not appear, the headings have been disabled. They can be restored from the Basic Setups area of the Service Settings menu.

The Diagnostic menu is used to view the diagnostic log and clear active and historic diagnostics from the UCP memory. Press Next to continue to the Menu Settings Password screen.

In addition to diagnostic types or levels, diagnostics are also categorized as being either "active" or "historic". Once active diagnostics are cleared, they become historic diagnostics.

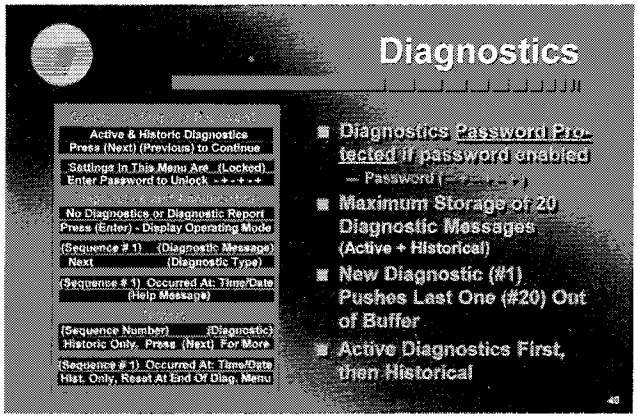

Figure 40

(Figure 40) Figure 40 shows the initial display screens and the organization of the diagnostic menu. As in all other menus, the Password Settings screen indicates that the settings in the menu are either locked or unlocked. If they are locked, the operator can unlock them by pressing (– + – + – +) followed by the Enter key.

Once unlocked, the operator can use the menu. If this screen does not appear, then the menu settings display feature has been disabled from Field Startup menu of the Service Settings Group. If there are no diagnostics present in the log, the only screen that displays is "No Diagnostics Present / Press (Next) Previous to Continue". If there are diagnostics in the log, the Diagnostic Report Follows / Press (Next) for More screen is displayed.

The next screen is "Press (Enter) to Display Operating Mode At Time of Last Diagnostic or (Next) for More". Pressing Enter displays the operating mode screen that was active when the diagnostic occurred. Pressing Next goes straight to the diagnostic log.

The log will display up to 20 **total** diagnostics (active + historic), in order of occurrence and are numbered one through 20. If the buffer is full, the last (#20) diagnostic is pushed out of the buffer when a new one is added.

In the log, active diagnostics are displayed on two screens. The first screen for each lists the diagnostic number, name and type. The second screen gives the diagnostic number, the time and date of occurrence and a help message, suggesting possible service procedures to consider.

Historic diagnostics are listed after active ones. If there are 20 active diagnostics, there can be no historics, since the log only holds 20 diagnostics. Historic diagnostics are also displayed on two screens. The first gives diagnostic number, type and shows that it is historic only. The second gives diagnostic number, the time and date of occurrence and shows that it is historic.

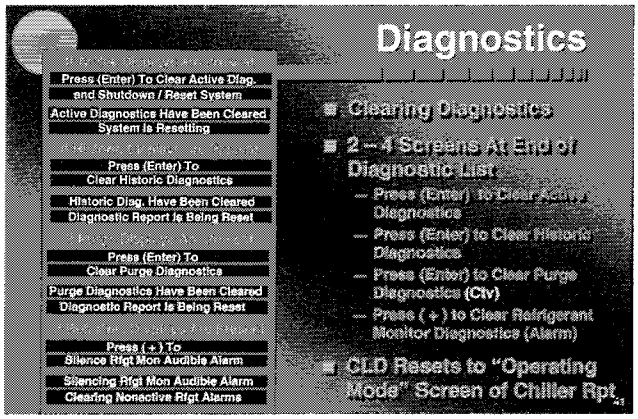

Figure 41

(Figure 41) Once the CLD is displaying the diagnostic log, the operator should scroll through the log, noting the types of <u>all</u> diagnostics present, the times that they occurred and any help messages displayed. This is recommended because once active diagnostics are reset they enter the history buffer. This may cause some entries already in the history buffer to be deleted before the operator could see them. All active diagnostics will be lost on a loss of power.

Note: All purge and refrigerant monitor diagnostics will be listed in the history buffer and they could be pushed out before the operator can view them.

All diagnostics can be cleared from the <u>local</u> CLD. The Clear Diagnostics screens are located at the end of the diagnostic log.

When the operator clears the active diagnostics they enter the Historic buffer and the Cleared / Resetting screen appears for 2 seconds. When the operator clears the historic, purge or refrigerant monitor diagnostics, the Cleared / Resetting screen appears for 4 seconds. Once diagnostics have been cleared, the CLD reverts to the Operating Mode screen of the Chiller Report menu.

Note: If the condition that caused the diagnostic to appear is not corrected, the diagnostic will be re-established.

MENU SECURITY REVIEW

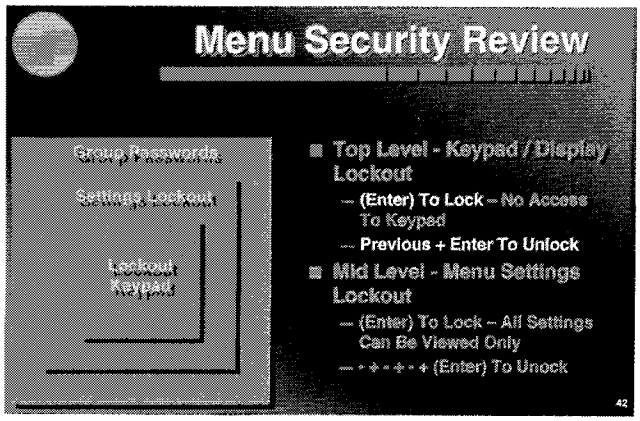

Figure 42

(Figure 42) Figures 42 and 43 provide a review of the UCP2 menu security system. At the top level of security, the whole keypad can be locked out. NO KEYS FUNCTION!

Remember:

The keypad is locked from one of the first screens in the Basic Setups of the Service Settings group. To unlock a locked keypad, press the Previous and Enter keys simultaneously.

Locking out the keypad disables the Auto and Stop keys.

At the next level, the settings in any settings menu can be locked by enabling the Menu Settings Password screens.

Remember:

The menu settings password protection is enabled (and disabled) from the Field Setup menu of the Service Settings group. (This enables the menu settings password screen for <u>all</u> menus at once. You can have all enabled or disabled but not just certain ones.)

The settings for each menu can be locked or unlocked at the second screen of each menu if this feature has been enabled.

Press Enter to lock or press (– + – + – +) and Enter to unlock.

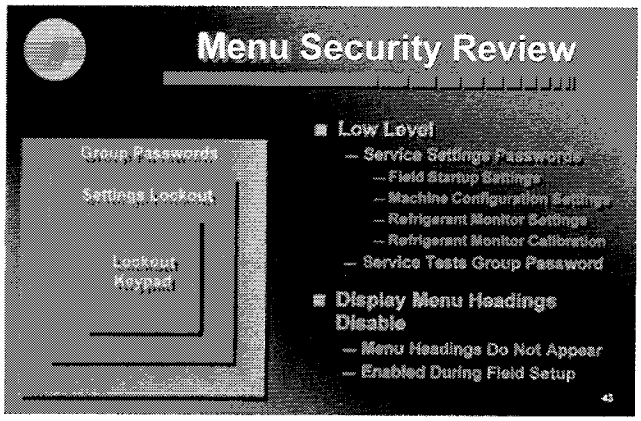

Figure 43

(Figure 43) At the lowest level, certain individual menus have specific passwords. They are:

- **Service Settings Passwords**
  - **Field Startup Settings**
  - **Machine Configuration Settings**
  - **Refrigerant Monitor Settings**
  - **Refrigerant Monitor Calibration**
- **Service Tests Group Password**

These passwords are provided in the chiller IOM manual.

Although not really intended as part of the menu security scheme, the ability to prevent the menu headings from being displayed could be used to discourage unauthorized UCP use, since it is likely more difficult for an person unfamiliar with the menu system to use the clear language display without the menu headings.

OPERATING WITH UCP2

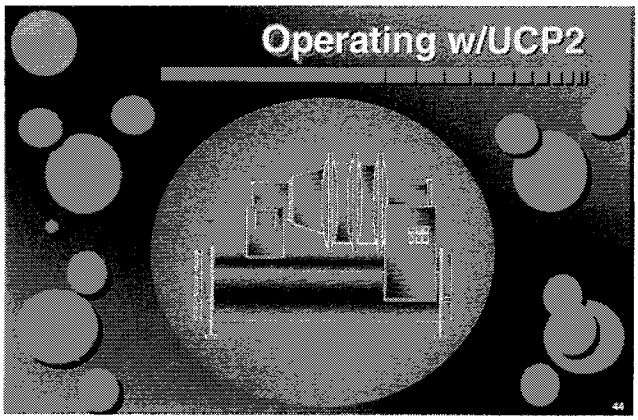

Figure 44

(Figure 44) The final section of this manual describes basic chiller operation, including specific operating sequences; auto operation and the chiller stop sequence. It also discusses routine chiller logging procedures, report printing duties, briefly reviews what to do when diagnostic shutdowns occur and how the remote clear language display is used.

Power-Up Sequence

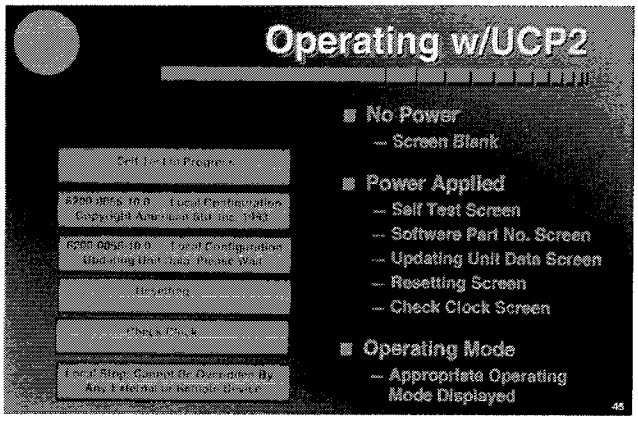

Figure 45

(Figure 45) When electrical power is off, the CLD screen is blank as shown in the first screen of Figure 45. When power is first applied, the UCP goes through a "power up" routine. The power up sequence takes 20 seconds before the CLD enters the Stop operating mode. During power up, the UCP performs a series of self-diagnostics (Self-Test screen).

The Software Part No. screen is the identifier of the software version that is installed in the UCP.

The Check Clock screen is a reminder to be sure that the chiller clock is set correctly. It doesn't keep time when power is removed from the UCP.

While the Updating Unit Data screen is displayed, the CLD is retrieving all available data from the chiller module memory about unit configuration and setup.

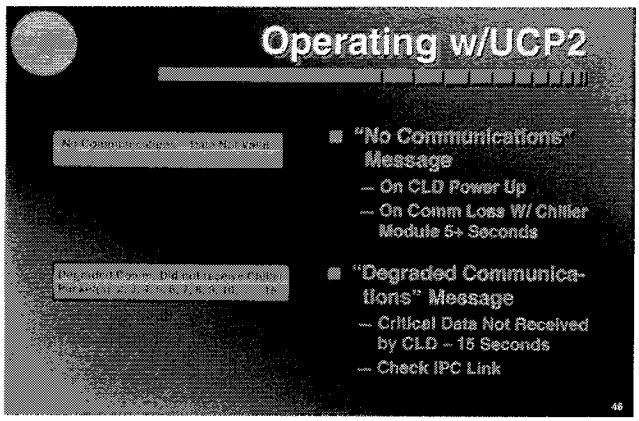

Figure 46

(Figure 46) The settings used by the chiller are stored in the chiller module, not in the CLD. The chiller module contains the non-volatile memory that stores these settings when power is removed. It also has to verify that none of the settings in memory have been corrupted. If any have, it will substitute default settings instead.

The CLD just stores copies of settings so it can display and change them. The original settings in the chiller module are not changed until Enter is pressed after making a change.

If upon power up, there is no communication with the chiller module, the No Communications screen is displayed. This screen will reappear any time that all chiller module communications are lost for more than five seconds.

Note: If certain critical data is not received by the CLD from the chiller module every 15 seconds, an IFW diagnostic (Degraded Communications screen) is generated. The chiller can run in this condition, using setpoints already in memory. Check the IPC link wiring and connections. The CLD will return to normal once communications are re-established.

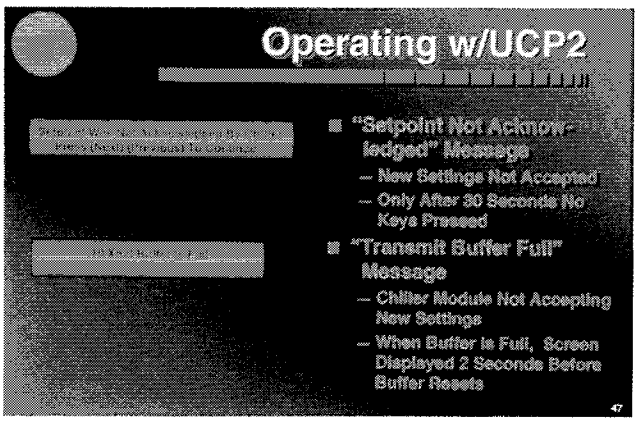

Figure 47

(Figure 47) During operation, if a settings change is made and communicated to the chiller module, but is not accepted after 30 seconds of no key activity on the CLD, the Setpoint Not Acknowledged screen is displayed at the end of the chiller report.

If you enter a lot of settings changes (send them to the chiller module) that are not acknowledged by the chiller module, then the CLD transmit buffer will become full of data and won't be able to take any more changes. If this happens, the Transmit Buffer Full message is displayed for two seconds before the CLD clears the buffer and all the changes are lost. If you get this message, there is a problem between the chiller module and the CLD.

Auto Key

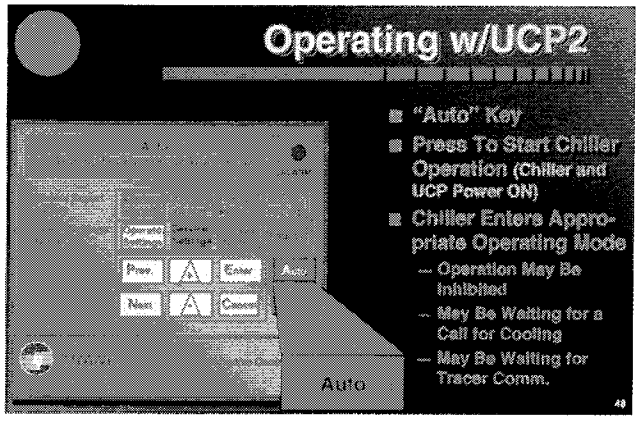

Figure 48

(Figure 48) To start the chiller from a power up or from a Stop condition after a normal shutdown, press the Auto key. Whether or not the chiller starts, depends upon many variables, including differential to start condition, whether the restart inhibit timer is timed out, whether or not Tracer communications have been established, etc. The CLD will indicate what is happening by displaying the appropriate operating mode screen.

Chiller Operating Sequence

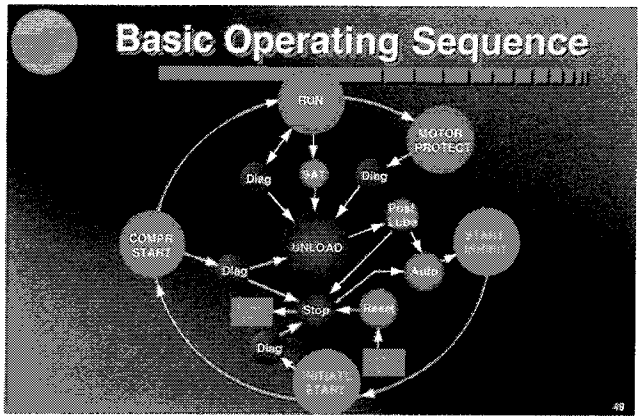

Figure 49

(Figure 49) As we have just seen, from a Power Off condition following a normal shutdown, the UCP goes through a power up (reset) sequence that performs self diagnostic tests and resets the control system for renewed operation.

Once this procedure is complete, the control enters a Stop condition (operating mode) and waits for a start command. Then the restart inhibit timer begins timing out and on CenTraVacs, the inlet guide vanes are driven closed for 50 seconds to insure that the compressor starts unloaded. Also during this time, inlet guide vane operation is tested. This is done on all control resets and on a call for cooling after 24 hours of no cooling.

When operating mode is set to Auto by pressing the Auto key, the chilled water pump starts. Chilled water flow must be proven in 3 minutes. If the UCP has received a call for cooling and 30 seconds or less remain on the restart inhibit timer, the UCP will enter the Initiate Start mode, starting the condenser water pump. Condenser water flow must be proven in 3 minutes.

On CenTraVacs, the oil pump starts also. 9 psid oil pressure must be proven in 3 minutes. On entering Initiate Start for RTHB units, the master oil line solenoid is energized, the oil heater is turned off and the unload solenoid valve is energized for 30 seconds to insure an unloaded compressor start. At the end of the restart inhibit time period, the UCP performs a starter test.

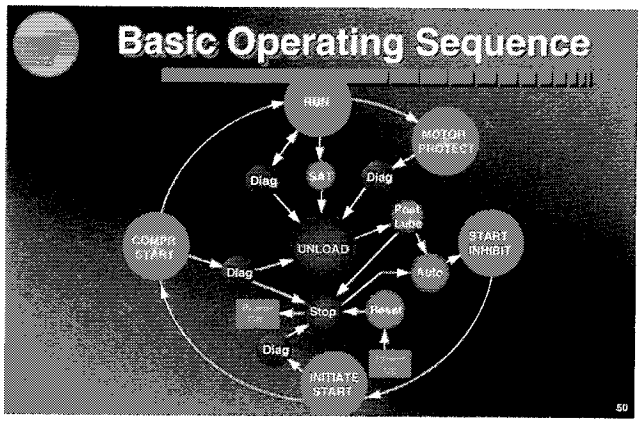

Figure 50

(Figure 50) After a successful starter integrity test, the UCP sends a start signal to the compressor motor. The motor starts in Wye configuration and the maximum acceleration timer starts timing out. On CenTraVacs, the vent line solenoid valve closes temporarily. Once the compressor has accelerated and maximum phase current drops below 85% of name-plate RLA for 1.5 seconds, the starter initiates transition to Delta configuration. Proof of transition must occur within 2.5 seconds of transition initiation. During compressor start, diagnostics can occur that will cause the compressor to unload or unload / stop. Once compressor is running normally, inlet guide vanes (CTV) or unloader slide valve (RTH) are modulated to satisfy the chilled water setpoint. During operation, numerous diagnostics can occur that will cause the compressor to unload or unload / shut down. Also, the compressor may stop due to the fact that the cooling load is satisfied. During normal operation, motor protection devices are active that can generate diagnostics that will unload or unload and shut down the compressor.

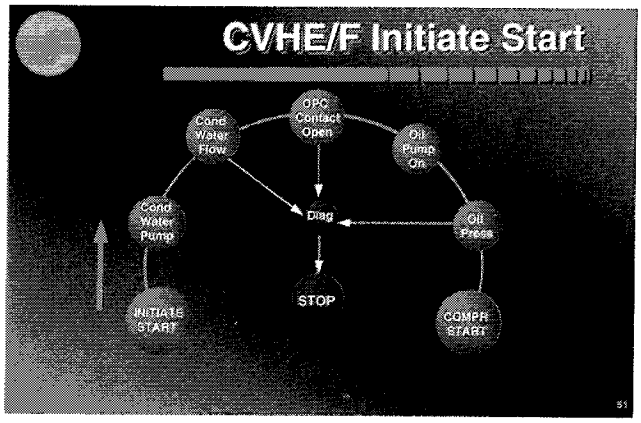

Figure 51

(Figure 51) Initiate Start mode begins when the UCP issues a call for cooling and less than 30 seconds remain on the restart inhibit timer. If the chiller is in a Stop mode, the chilled water pump starts when the Auto key is pressed. If the chiller is already in Auto mode and has shut down because cooling load is satisfied and is just restarting due to a need for cooling, the chilled water pump will have been operating continuously.

For CenTraVac units, when Initiate Start mode begins, the condenser water pump starts. Condenser water flow must be proven within 3 minutes or a diagnostic is generated that sends the chiller into a Stop condition. Also, the UCP checks for an open oil pump start contact. An open contact will result in a diagnostic that sends the UCP back to a Stop condition.

Then the oil pump is started. The UCP must verify nine psid oil pressure for 30 contiguous seconds before compressor start. If not, a diagnostic is generated that sends the chiller back to a Stop mode.

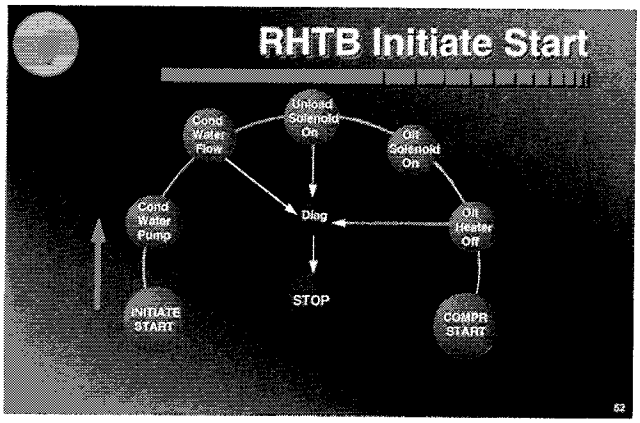

Figure 52

(Figure 52) When Initiate Start mode begins for RTHB units, the condenser water pump starts. Condenser water flow must be proven within 3 minutes or a diagnostic is generated that sends the chiller into a Stop condition. The master oil line solenoid valve is energized, the oil sump heater is turned off and the slide valve unload solenoid valve is energized for 30 seconds to make sure the compressor starts unloaded.

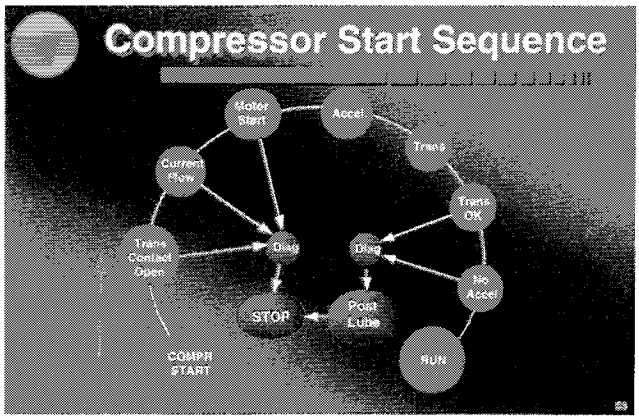

Figure 53

(Figure 53) Compressor Start begins with a UCP test to insure that the transition-complete contact is open. If it is closed, a diagnostic is generated and the chiller enters a Stop condition. The UCP then checks the start (Y-Delta only) and shorting (all starters) contactors for No Current. Current at either contactor generates a diagnostic and the chiller enters a Stop condition.

As previously described, after the starter integrity test, the UCP sends a start signal to the compressor motor. The motor starts and the acceleration timer starts timing out. Once the compressor has accelerated, the starter initiates transition to Delta configuration. Proof of transition must occur within 2.5 seconds of transition initiation. If the compressor motor does not accelerate to proper speed within the limit of the maximum acceleration timer (5 seconds for RTHB, 27 seconds for CVHE/F), a diagnostic is generated and the chiller enters a Stop condition. Then, on CVHE/F units, the vent line solenoid valve opens back up.

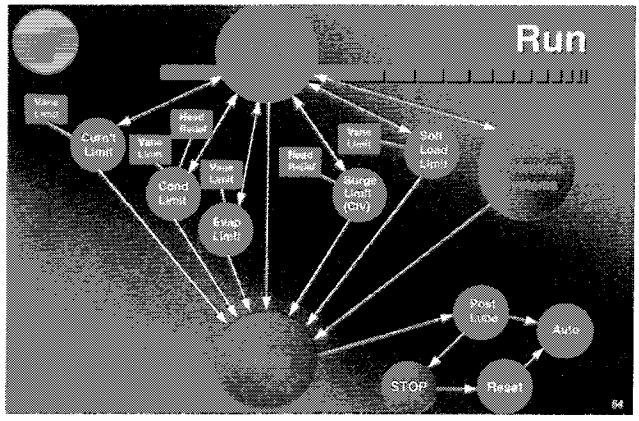

Figure 54

(Figure 54) Once the compressor runs normally, the inlet guide vanes (CTV) or unloader slide valve (RTH) are modulated to satisfy the chilled water setpoint.

Again, during operation, numerous diagnostics can occur that will cause the compressor to unload or unload and shut down. Also, the compressor may stop due to the fact that the cooling load is satisfied.

During normal operation, various motor protection devices are active that can generate diagnostics that will unload or unload and shut down the compressor Once in Run mode, the chiller can operate in various load-limiting sub-modes, depending on system and chiller conditions. These include Current Limit, Evaporator Limit, Condenser Limit, Surge Limit, Softloading, etc. During limit conditions, the UCP utilizes a vane (CTV) or slide valve (RTH) limit function that prevents loading or unloads the compressor as the condition increases. The objective is to keep the chiller on line and avoid a shutdown.

Stop Sequence

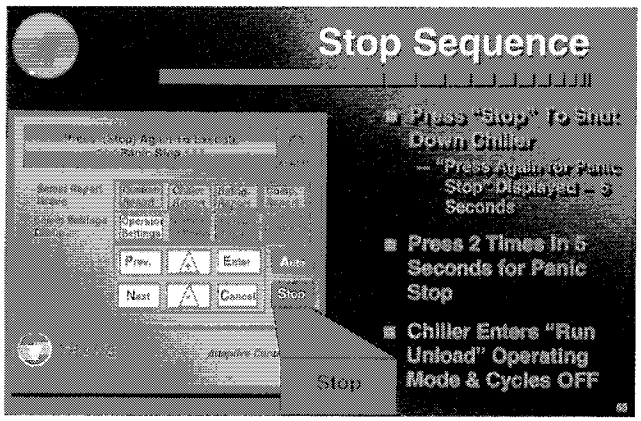

Figure 55

(Figure 55) Press the Stop key to shut down chiller operation. The Press (Stop) Again screen will appear for five seconds, giving the operator a chance to perform a Panic Stop.

If the operator presses the Stop key again while this screen is displayed, the chiller will enter a "Panic Stop" condition. On the other hand, if the Press (Stop) Again screen is allowed to pass, the chiller will enter the "Run Unload" operating mode and shut down normally.

Once shutdown is complete, the CLD reverts to the appropriate Operating Mode screen. This may be the group heading or menu password screen if they are enabled. If not, the CLD will show an actual operation mode. If shutdown is due to an MMR or MAR, a diagnostic warning screen will appear.

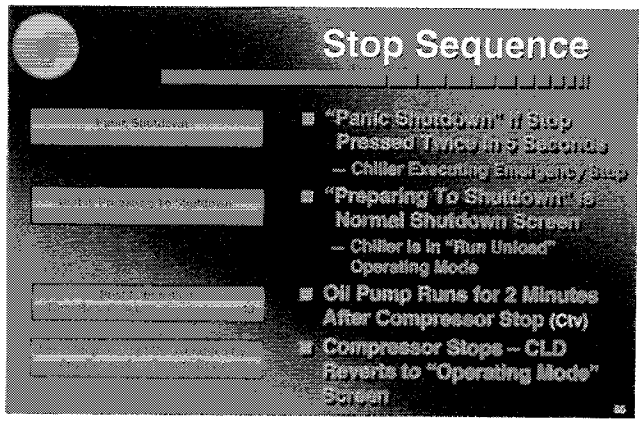

Figure 56

(Figure 56) If the operator selected panic stop, a Panic Shutdown screen appears while panic stop sequence is executed. If the chiller is allowed to shut down normally, it will enter "Run Unload" operating mode and display Unit Is Preparing to Shutdown. If the chiller is shutting down because the cooling requirement has been satisfied, then it goes directly into "Run Unload" mode without displaying the Press Again for Panic Stop screen. The chilled water pump continues to run.

CVHE/F Stop Sequence

During "Run Unload" mode, the compressor is gradually unloaded by closing the inlet guide vanes. Once fully unloaded, the compressor stops, condenser water pump turns off, and the chiller enters "Post Lube" mode (Figure 56). The screen shows the amount of time left for continued oil pump operation. Once the two-minute post lube function times out, CLD reverts to the appropriate Operating Mode screen. The chilled water pump shuts off after the delay timer times out.

RTHB Stop Sequence

During "Run Unload" mode, the unload solenoid energizes (20 seconds) and the load solenoid deenergizes. The compressor continues to run. The slide valves move away from the rotors, unloading the compressor. After 20 seconds, the compressor turns off, the master oil line solenoid turns off, the crankcase heater turns on and the condenser water pump turns off. The electronic expansion valve travels to full open and the CLD reverts to the appropriate Operating Mode screen. The chilled water pump shuts off after the delay timer times out.

Panic vs. Normal Stop

A panic stop differs from a normal stop in that, during a panic stop, the compressor stops immediately without unloading.

Chiller Logging

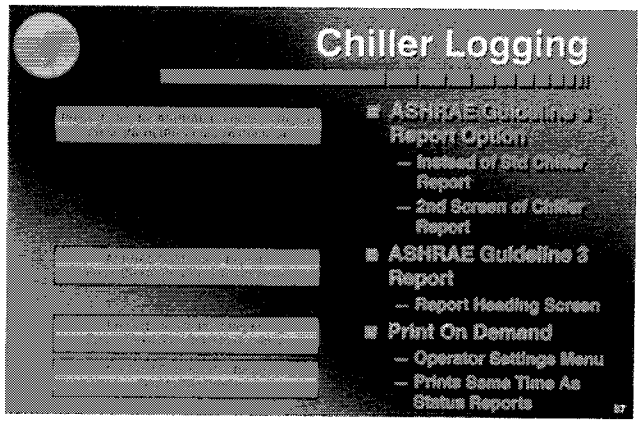

Figure 57

(Figure 57) One of the primary reasons for logging a chiller is to keep a running record of refrigerant and oil usage. In 1995, a new feature was implemented in the Chiller Report to allow an operator to view an ASHRAE Guideline 3 Report (See Note below).

This report is a compilation of data points from various UCP2 reports that ASHRAE recommends be monitored and logged daily to prevent refrigerant loss. This recommendation applies specifically to centrifugal and large positive displacement (medium and high pressure) systems.

This report is accessed at the second screen of the chiller report. At that point, the operator has to decide whether to view the standard UCP2 chiller report, or view the ASHRAE Guideline 3 report. If Enter is pressed, then the ASHRAE Guideline 3 report heading appears. Then press Next to view the report items.

In addition, the "Guideline 3" report can be added to the UCP Custom Report **as a single item**, which greatly increases the number of data points available in it.

The ASHRAE Guideline 3 report can be useful for maintaining proper records for a refrigerant management program. This report will be printed any time that a chiller status report is sent to the printer. If the printer is set up to print on a time interval or on a diagnostic, then the ASHRAE report will print also. Remember, that the print on demand screen (shown above) is located in the Operator Settings menu.

Note: The ASHRAE Guideline 3 report is not found on earlier-model UCP2 panels. This means that on those panels, the operator can view only the normal chiller report and print out only the chiller status report.

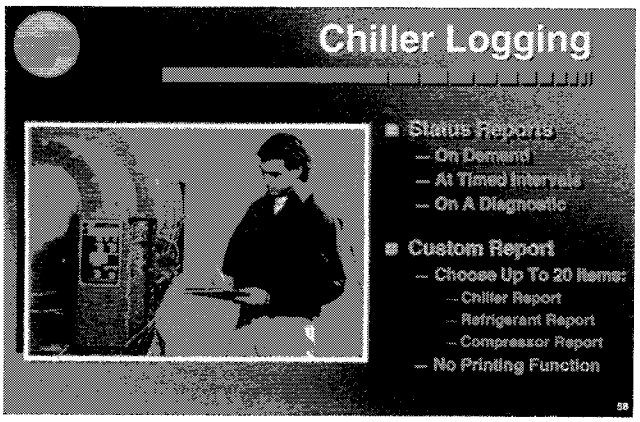

Figure 58

(Figure 58) This slide should be entitled "Chiller Logging Made Easy", because that's one of the biggest benefits of UCP2.

It's standard operating procedure to maintain a regular log of chiller operating conditions. Even with UCP1, this was a laborious procedure, requiring the operator to access each coded item on the UCP display and record it, measure water flows and pressures separately and record them, etc.

With UCP2, nearly all the data you need to view in order to log the chiller is available through your custom, chiller, refrigerant and compressor reports.

If a printer is installed, then your job is even easier. Chiller "Status" and "ASHRAE Guideline 3 Reports" are available whenever you need them. They can be printed on demand, at timed intervals and also any time a diagnostic occurs.

Remember, the "print-on-demand" function is found in the Operator Settings menu and the "print-at-intervals" and "print-on-diagnostics" are set up in the Basic Setups of the Service Settings menu. That's a lot of printed data available at your fingertips without ever having to enter the Chiller, Refrigerant or Compressor Reports.

If you could possibly still need any additional items of data that are not included in the printed reports, you can set up 20 additional items to show up in your Custom Report. The only drawback this is that the Custom Report can't be printed.

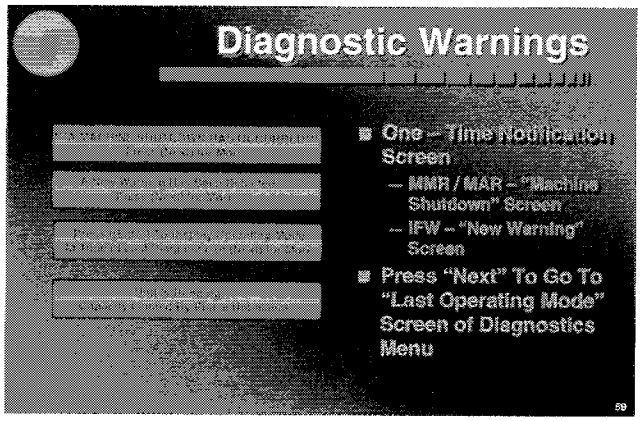

Figure 59

(Figure 59) What happens when a diagnostic occurs? It depends on the kind of diagnostic. If it's a "show-stopper", meaning an MMR (Machine Manual Reset) or an MAR (Machine Auto Reset) type, then the chiller will shut down and the CLD will display the first screen shown above:

"A Machine Shutdown Has Occurred"

Remember, in the case of the MAR, the condition that caused the shutdown may clear itself and the chiller will restart. If not, then the machine will restart once the condition is corrected.

An MMR, however, requires that the operator manually "clear" the diagnostic to reset the system controls before the chiller can restart.

If the diagnostic is an IFW (Informational Warning) type, then the A New Warning Has Been Detected screen is displayed but the chiller does not shut down.

When one of these screens is displayed, the operator must press the Next key. This will take the operator to the 3rd screen shown in this slide which is part of the diagnostics menu:

"Press (Enter) To Display Operating Mode At Time of Last Diagnostic or (Next) for More"

The Operator will press Enter to view the last screen shown on this slide which indicates what operating mode the chiller was in when the diagnostic occurred. The operator can choose to press Next instead, which skips this screen and advances straight to the diagnostic log.

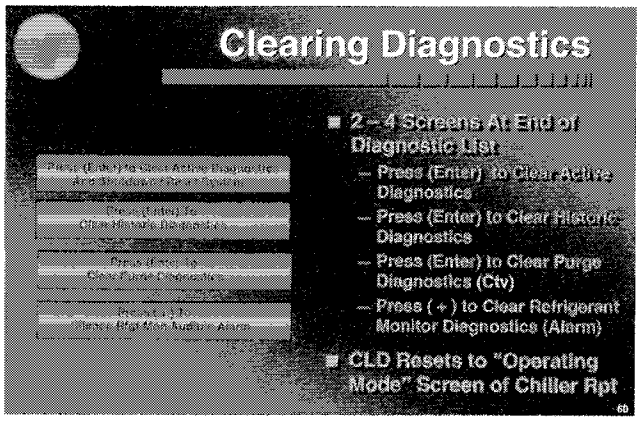

Figure 60

(Figure 60) Once the CLD is displaying the diagnostic log, the operator should scroll through the log, noting the types of diagnostics present, the times that they occurred and any help messages displayed.

The Clear Diagnostics screens are located at the end of the diagnostic log. When the operator clears active diagnostics, the Cleared / Resetting screen appears for 2 seconds. When the operator clears historic, purge or refrigerant monitor diagnostics, the Cleared / Resetting screen appears for 4 seconds. Once diagnostics have been cleared, the CLD reverts to the Operating Mode screen of the Chiller Report menu.

Note: If the condition that caused a diagnostic to appear is not corrected, the diagnostic will repeat.

Remote CLD

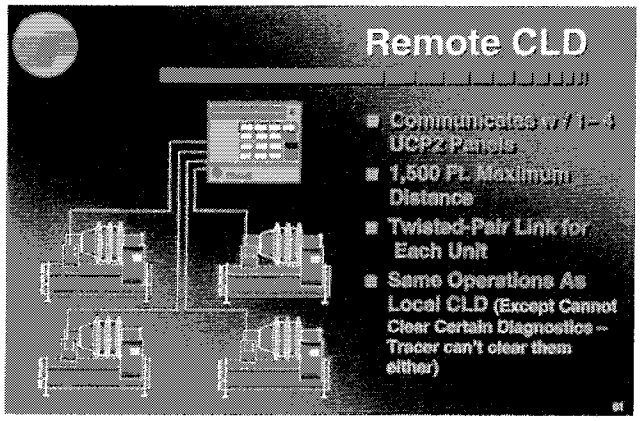

Figure 61

(Figure 61) The last four figures in this manual are a quick review of the remote clear language display (CLD) capabilities and a brief discussion of how the displayed information varies from the screens of the chiller-mounted CLD.

Each UCP2 panel can support two clear language displays, one on the chiller and a remote-mounted one. The remote CLD can be as far away as 1,500 feet from the chiller. The communication link is a simple twisted-pair wire.

The remote CLD will communicate with up to four UCP2 chillers if an optional board is added to it. The chillers do not have to be the same type (CVHE/F, ABS, RTHB). Each chiller must have the optional IPCB (interprocessor communications buffer) module in order to communicate with the remote CLD.

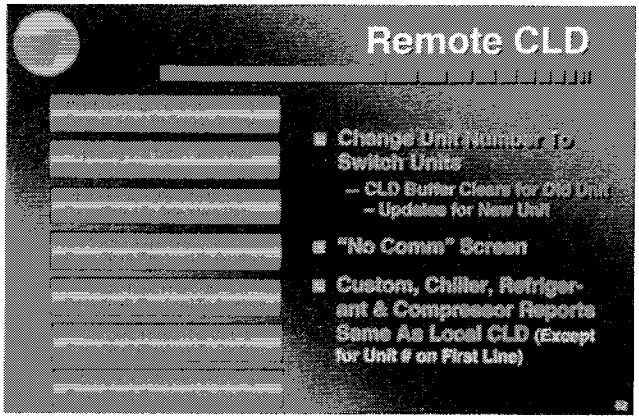

Figure 62

(Figure 62) The displays that appear at the remote CLD are identical to the ones on the unit-mounted CLD except when the "multiple unit" option board is installed. This option enables the remote CLD to communicate with multiple chillers.

When this option is present, the second screen in each group is the Modify Settings for Unit # screen. The operator must enter the number of the chiller being accessed. When the "unit number" is entered, the CLD clears its buffer of data for any other chillers and updates it with the new data.

The Updating Unit Data screen will appear for 5 seconds or until the data is updated, whichever comes first. If data is not received in 5 seconds, the No Communication ... screen appears. Pressing Enter at this time, sends the display back to the first screen above.

When each report or settings group key is pressed, the Report for Unit # or Settings for Unit # screen will be the second screen followed by the Updating Data screen.

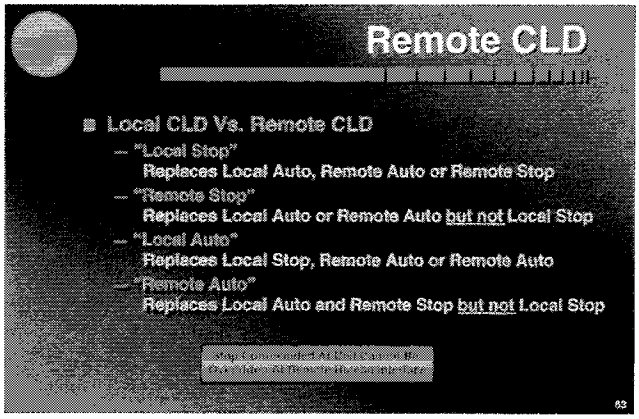

Figure 63

(Figure 63) This slide is provided as a quick review of the UPC2 operating priorities. This is how the UCP determines when an Auto or Stop command will be accepted and stored into memory. The chiller module stores the source of the current Auto or Stop command. If an Auto command is given from the remote CLD when the chiller is "stopped" from the local CLD, the Stop Command at Unit Cannot Be Overidden ... screen shown in this slide is displayed. Local and Remote Stop are highest priority.

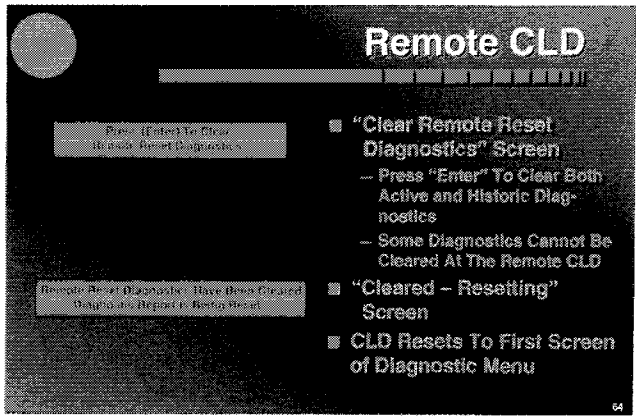

Figure 64

(Figure 64) When using the "clear diagnostic" function at the Diagnostic Menu of the remote CLD, the Press Enter to Clear Remote Diagnostics screen appears. When Enter is pressed, the Remote Reset Diagnostics Have Been Cleared screen appears momentarily, and the display reverts back to the top of the diagnostic menu.

All functions of the chiller-mounted CLD can be accomplished with the remote CLD except for the clearing of certain MMR (manual reset) diagnostics that must be reset at the local CLD on the chiller. Refer to the chiller installation, operation and maintenance manual for a complete list of these diagnostics.

SUMMARY

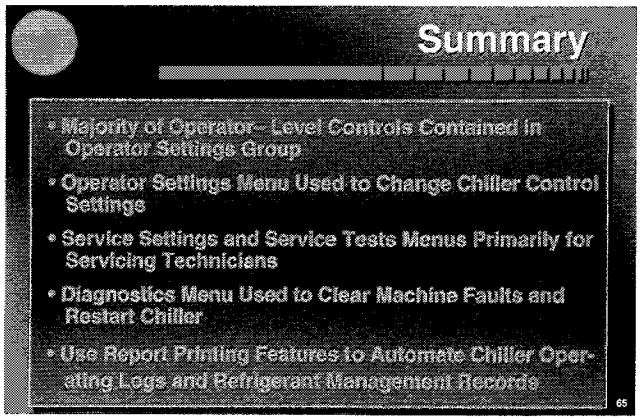

Figure 65

(Figure 65) Most of the control functions that an operator will deal with are located in the Operator Settings menu. There will, of course, be times that it will be necessary to use other portions of the control system. At those times, it will probably be necessary to refer to the IOM literature or consult a service representative.

Factory setup personnel use the Machine Configuration menu of the Service Setting group to establish settings for factory required categories according to the chiller order and design criteria. Once on the job, the setup technician will use the Field Setup menu to tailor the machine to the job.

The only portion of the Service Settings group that the operator will use more or less routinely, is the Basic Setup menu, where the operator can lock and unlock the keypad, change how the CLD displays headings and security menus, set the chiller start and stop differentials, set the chilled water pump delay time, control printer operation and clear the restart inhibit timer.

The operator will have to access the Diagnostic menu in order to look at and clear diagnostics and keep an eye on purge and refrigerant monitor operation.

Finally, with a printer connected, the report printing features of the UCP2 can be used to help keep machine logs, refrigerant usage records, and help pinpoint potential machine problem areas.

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