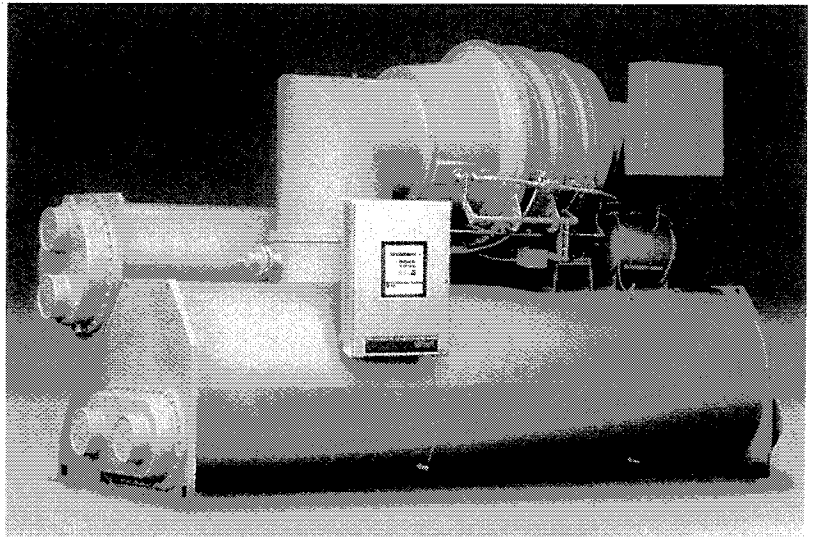




**TRANE™**

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## ***UCP2 – A First Look***



***Technical Training  
Student Handbook***

ST-MNL-4

# UCP2 – A First Look

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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-4.

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

ST-MNL-5 "UCP2 – The Operator's Perspective"

# INTRODUCTION

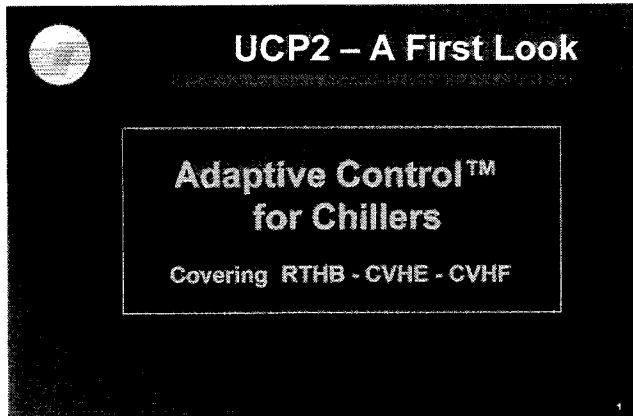


Figure 1

(Figure 1) The purpose of this manual is to introduce technicians and building owner operator personnel to the construction and operation of the Trane "UCP2" control system for heavy refrigeration chillers. This control system employs Trane's Enhanced Adaptive Control™ technology which has evolved from the Adaptive Control™ strategies used by the earlier UCP-695 control system.

UCP2 is not the first microcomputer-based control system used by Trane. It is, however, the most "intelligent" system available so far. This system can adapt to changing conditions in the HVAC system to keep a chiller running at "best" conditions and keep it producing chilled water in situations that would likely result in a shutdown using many other control systems.

The UCP2 system with Enhanced Adaptive Control™ is utilized on several Trane product lines. This course covers model CVHE and CVHF centrifugal chillers and RTHB helical-rotary chillers. These chillers range in capacity from 130 to 1,250 tons.

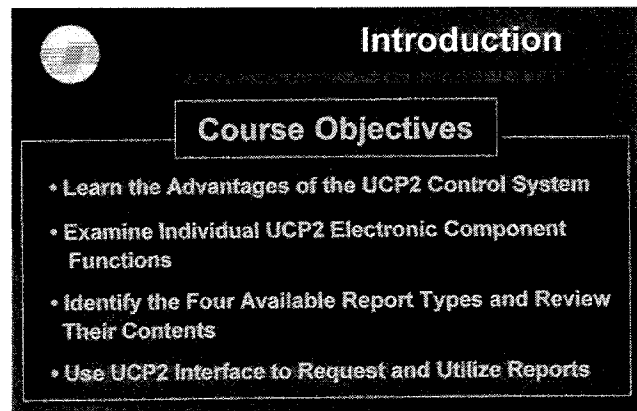


Figure 2

(Figure 2) This manual will show how Trane's UCP2, using Enhanced Adaptive Control™, has added flexibility, reliability and improved system performance to what was already the best chiller control system in the industry. It will show the overall physical organization of UCP2 system components and explain their functions. Finally, this manual will teach the reader how to use the UCP2 operator panel to access and utilize the unprecedented amount of data that UCP2 makes available.

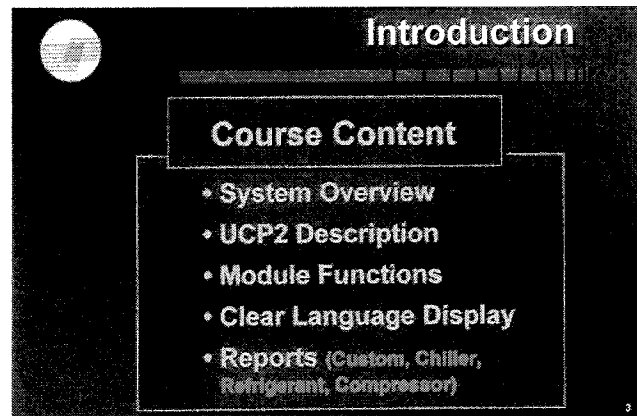


Figure 3

(Figure 3) The first generation Trane microprocessor chiller control system was officially designated UCP-695, although many people referred to it as the 'micro panel' because it was the first microprocessor control used on large centrifugal and helical rotary chillers. To simplify matters, this manual will refer to the older UCP-695 as the 'UCP1' and to the current system as 'UCP2'. This manual will examine the UCP2 control, first as an overall system, then its individual components. It will discuss the clear language display or CLD, which is the operator control panel for the system, and explain the benefits of the information this control can provide the chiller operator.

# SYSTEM OVERVIEW

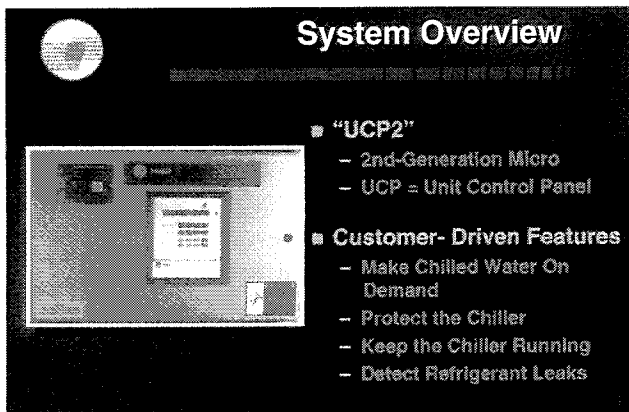


Figure 4

(Figure 4) UCP2 is the 2nd-generation microcomputer control system for Trane heavy-refrigeration water chillers. The acronym UCP2 simply stands for “unit control panel number two”. UCP2 refers to the panel itself, all internal components and all peripheral devices (sensors, relays, communication links, etc.) needed for its proper operation. Some of these devices are not even located inside the panel.

UCP2 is the ‘brain’ of the chiller system. It evolved from UCP1 through customer feedback about what more they want a unit-level chiller control system to do. What they told us is that “a **good** chiller control system should”:

- Produce chilled water at setpoint when needed
- Protect the chiller
- Keep the chiller on-line as long as possible during adverse operating conditions (This is where the term “Adaptive Control” comes in. The control system adapts chiller operation to changing conditions in the system to keep it performing.)
- Detect refrigerant loss - both long term leakage and catastrophic release

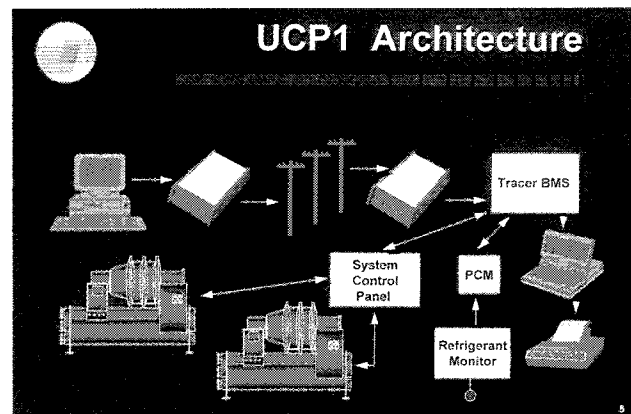


Figure 5

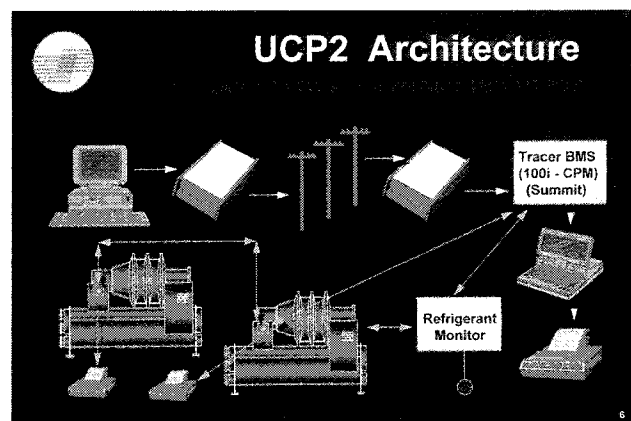


Figure 6

(Figure 5) (Figure 6) These two figures make a few basic system-level comparisons of UCP1 and the new UCP2:

UCP1 required a Trane SCP (System Control Panel) in order to communicate with higher-level devices such as the Trane Tracer or other building management systems (BMS). UCP2 communicates directly with the building management system.

UCP2 receives input directly from same-level or lower-level devices and reports to higher-level devices, such as a Tracer, through a direct communication link (no SCP needed). Also, UCP2 is backward and forward-compatible with all generations of Tracer equipment.

With UCP1, a programmable control module (PCM) was needed to allow device such as a equipment room refrigerant vapor level monitors to communicate with a Tracer or another BMS. UCP2 can accept equipment room refrigerant concentration level data directly from a refrigerant monitor and report the data back to the system level BMS.

Using UCP1, printed reports of chiller activity or refrigerant monitor data could only be generated at the system (BMS) level. The UCP2 can output reports directly to a printer within 50 feet of the chiller and/or to a printer at system level (Tracer) at a remote location.

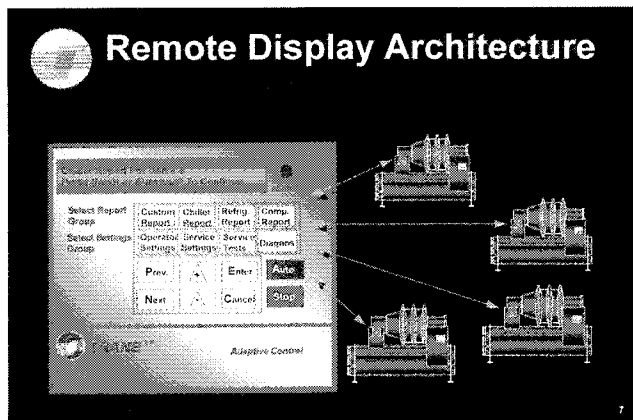


Figure 7

(Figure 7) In addition to its enhanced unit and system-level features, a “remote-control” version of the UCP2 operator panel is available that will control the chiller from as far away as 1,500 feet. This single low-cost panel will also control up to three additional UCP2-equipped chillers.

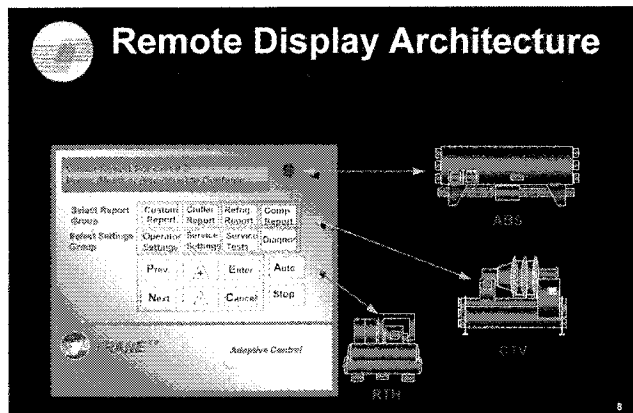


Figure 8

(Figure 8) The remote display can even communicate with different types of chillers, as long as they are equipped with a Trane UCP2 control system.

Remote control of multiple chillers is discussed in more detail later in this manual.

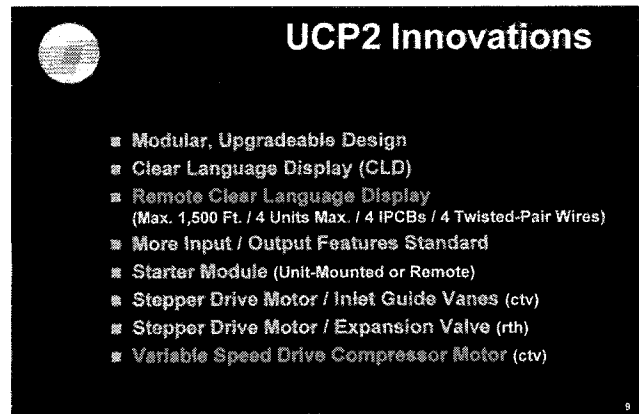


Figure 9

(Figure 9) The text items in these figures are color-coded. Yellow indicates standard equipment or features, while optional items are shown in aqua.

The UCP2 system design is modular by function. The chiller can be equipped with options that customize its control for the building system it is applied to. Also, the control system can be upgraded in the future as needed to meet changing building system or equipment room requirements. This also results in lower replacement parts costs, since individual modules are less expensive to replace than the old all-in-one UCM.

All data acquisition and chiller control are accomplished at the UCP2 operator control panel (i.e., clear language display). Information provided by the display is presented in clear language (i.e., English, French, German, etc.) rather than in code as with UCP1.

As previously mentioned, UCP1 needed a System Control Panel (SCP) to control chillers remotely or to access multiple chillers. UCP2 can be controlled by an inexpensive remote display panel or can talk directly to a Tracer.

Many features that were costly options for UCP1 are standard on UCP2. All that is required is that they be enabled from a menu. Most other optional features can be provided with the purchase of only one additional electronic module.

UCP2 brings a higher level of motor and compressor protection, including improved motor winding and oil pressure protection systems and simplified wiring between the motor terminal box and remote-mounted starter panels.

UCP2 has more precise capacity control. Stepper actuator motors for guide vanes and expansion valves do not use limit switches. The control system knows chiller loading condition at all times.

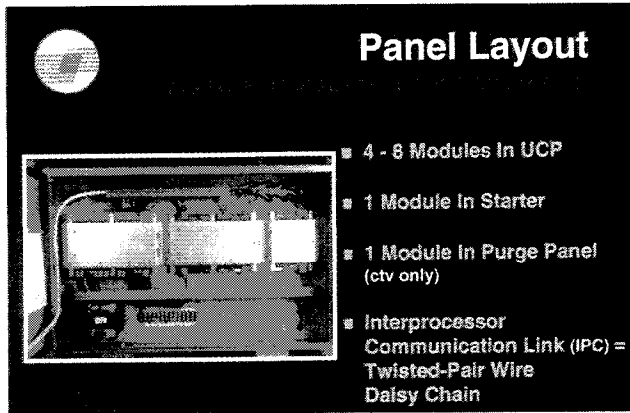


Figure 10

(Figure 10) The UCP2 panel will contain anywhere from four to eight electronic modules, depending on the type of chiller and features ordered. One module is mounted in the motor starter panel and one in the purge control panel on centrifugal chillers.

The Interprocessor Communications Link (twisted-pair wire) provides the communication path between modules. The Purifier Purge™ system used on low pressure chillers is also controlled and monitored at the UCP2 display panel.

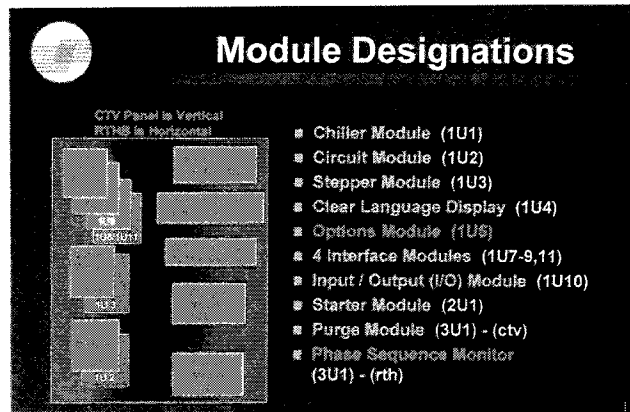


Figure 11

(Figure 11) The individual UCP2 electronic modules mounted in the panel are:

- 1U1 = Chiller Module;
- 1U2 = Circuit Module;
- 1U3 = Stepper Module;
- 1U4 = Clear Language Display;
- 1U5 = Options Module;
- 1U7 = Printer Interface Module;
- 1U8 = Tracer COM3 Interface;
- 1U9 = IPC Buffer;
- 1U10 = Input/Output Module;
- 1U11 = Tracer COM4 Interface

The clear language display (1U4) is mounted in the control panel door so that it is visible with panel door closed. All of the modules except 2U1 (the starter module) and 3U1 (the purge module) are located inside the UCP.

When RTHB units use a remote-mounted starter, a 3U1 module is mounted inside the motor terminal junction box on the chiller. On the RTHB, this 3U1 module is actually a phase sequence monitor for the compressor motor instead of a purge control device.

This is used because making the wrong electrical connections at the RTHB motor will cause reverse rotation of the compressor, resulting in immediate, catastrophic compressor damage.

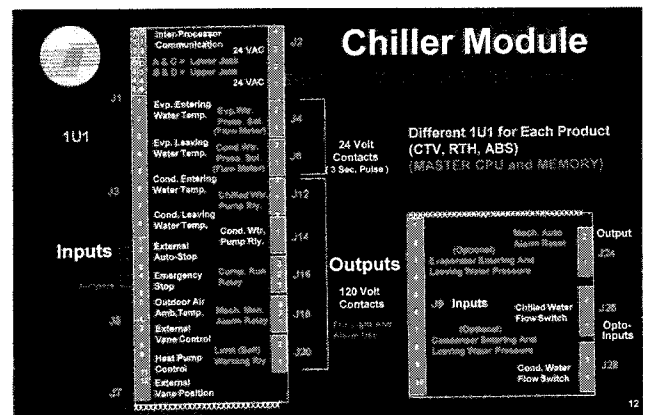


Figure 12

(Figure 12) The chiller module (1U1) is the “master module”, collecting data, status conditions, diagnostic information, etc. from the other modules (over the IPC link) from sensors and remote contacts and in turn, communicating commands to other modules.

The chiller module performs leaving water temperature and limit control algorithms, trading off chiller capacity against various “limits” that the chiller may be working against.

It checks for valid setpoints and identifies the chiller type for the other modules. 1U1 also maintains all stored setpoints in non-volatile memory in the event of a power loss.

Chiller module electrical inputs and outputs are shown on the chiller control system wiring schematics.

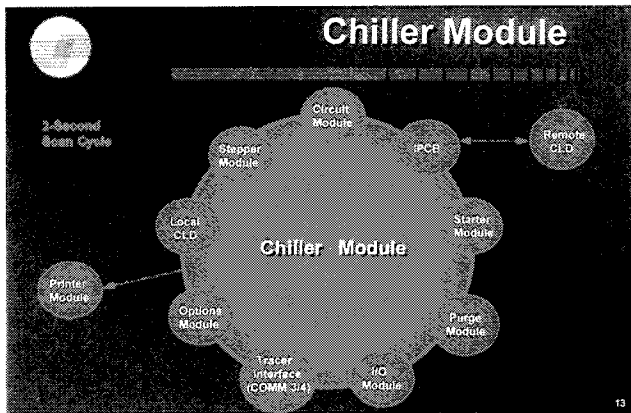


Figure 13

(Figure 13) During operation, the chiller module continuously “scans” the various modules for information over the IPC link. It completes a scan of the system about every two seconds.

This scan includes communication with any remote display used in the system and sending data to the local printer.

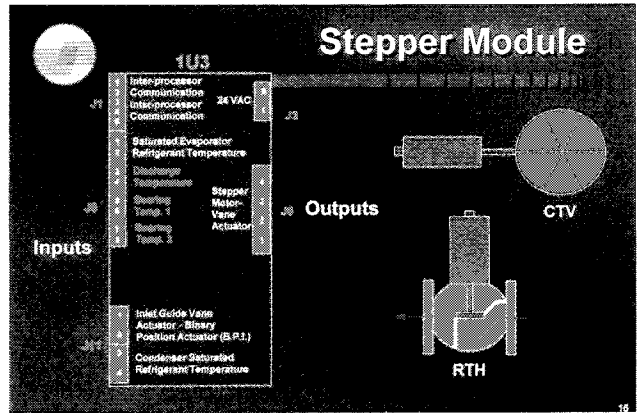


Figure 15

(Figure 15) The main function of the stepper module (1U3) is to drive the inlet guide vane stepper motor (CTV) or electronic expansion valve stepper motor (RTHB), in response to signals received from chiller module 1U1. This module also receives feedback on the actual open/closed position of the inlet guide vanes or the electronic expansion valve. The circuit module also monitors evaporator and condenser saturated refrigerant temperature and provides inputs for the discharge temperature and bearing temperature sensors. The module electrical inputs and outputs are shown on the chiller control system wiring schematics.

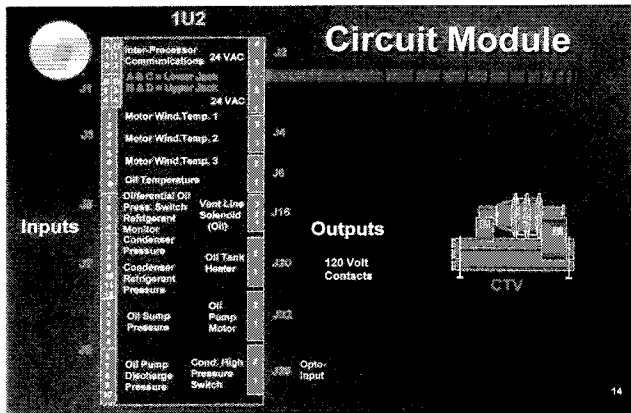


Figure 14

(Figure 14) The circuit module is assigned functions associated with compressor motor protection, the chiller lubrication system and refrigerant monitoring.

Circuit module electrical inputs and outputs are shown on the chiller control system wiring schematics.

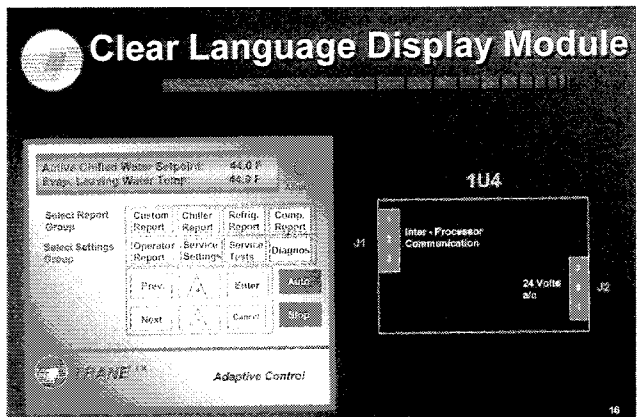


Figure 16

(Figure 16) The clear language display module, or CLD, is the operator panel for the UCP2 control system. It is the bridge between man and machine. Mounted in the control panel door, the CLD is viewed from the front of the panel. The module allows the operator to monitor system conditions as it displays chiller data, including chiller operating status, setpoints, operating conditions, unit configuration, purge conditions, service and diagnostic settings on the LCD screen. The operator controls chiller operation by pressing combinations of the keys provided on the panel. Electrical inputs and outputs are shown on the chiller wiring schematics.

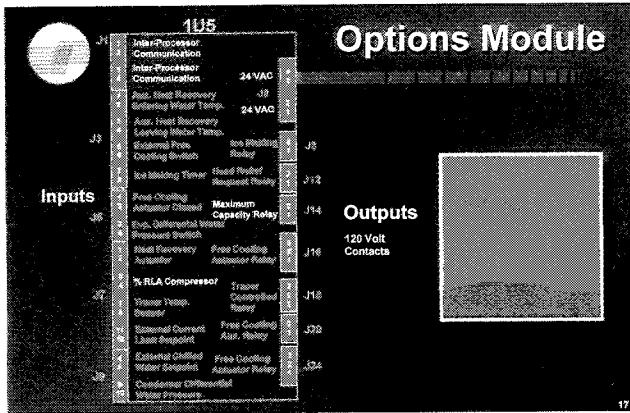


Figure 17

(Figure 17) As its name implies, the options module (1U5) provides the control or interface requirements for many of the options available with the UCP2. Some features provided by this module include ice-making, heat recovery, free cooling, head relief request and eternal chilled water setpoint, to name a few.

The options module electrical inputs and outputs are shown on the chiller control system wiring schematics.

The Tracer COM4 interface module (1U11) provides a non-isolated, 9600-baud, bi-directional serial communication link to the Tracer Summit or Tracer i.

The IPC Buffer Module (1U9) is the communication interface needed between the UCP2 and any Remote CLD. If a remote panel is not used, this module is not required. It must be provided on any chiller (maximum of four) talking to a Remote CLD.

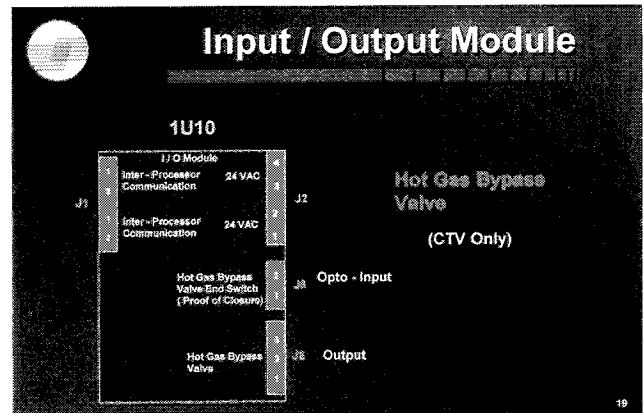


Figure 19

(Figure 19) The Input/Output module, (1U10) is provided only when a centrifugal chiller is equipped with the hot gas bypass (HGBP) option. This module operates the hot gas bypass valve on CVHE and CVHF units in response to signals from stepper module 1U3. The module also receives input on HGBP valve position from the HGBP valve end switch.

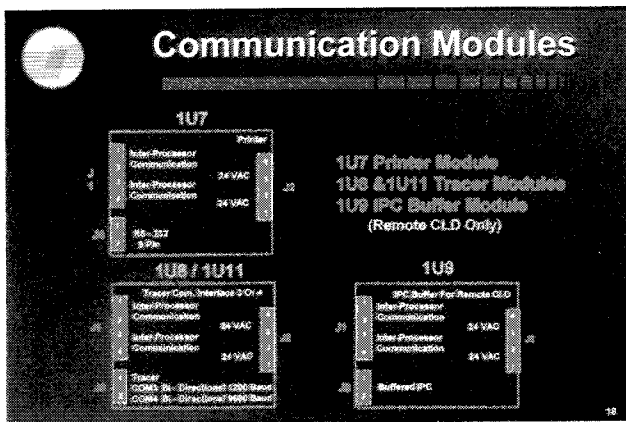


Figure 18

(Figure 18) The optional printer interface module (1U7) allows a preformatted chiller log to be output at a printer right at the chiller location. The UCP2 can be programmed using the CLD to print a chiller log on command, at the time of a diagnostic, or on a periodic basis.

There are two optional Tracer communication interfaces available, depending on which Tracer it will be communicating with. The Tracer COM3 interface module (1U8) provides an isolated, 1200-baud, bi-directional serial communication link to a Tracer 100/Tracer i/Chiller Plant Manager or a generic BMS panel.

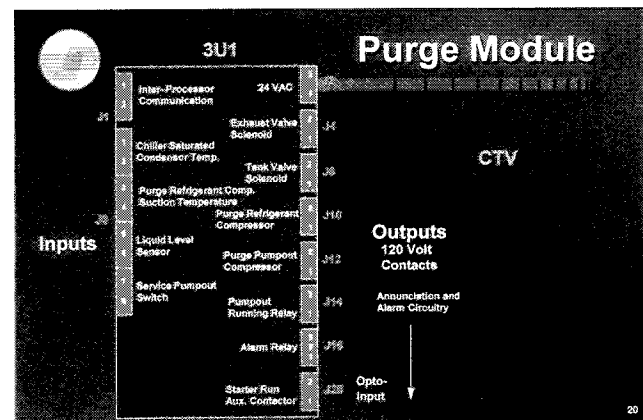


Figure 20

(Figure 20) The purge module (3U1) is provided with the Trane Model PGRC Purifier Purge used on CVHE and CVHF chillers. It is located in the purge control panel at the purge location. It provides all inputs and outputs for the UCP2 to control purge operation.

Purge module electrical inputs and outputs are shown on the chiller control system wiring schematics.

**IMPORTANT:** Although the RTHB chiller does not have a purge, it does utilize a device designated as 3U1 in certain cases. When the RTHB chiller uses a remote starter, a phase-sequence monitor (3U1) is mounted in the unit-mounted motor terminal junction box.

Proper phase-sequencing is critical to prevent reverse compressor rotation which will cause extensive damage almost instantly. Although the starter module provides this protection, if the starter is remotely mounted, it is possible to cross leads from the starter to the compressor motor.

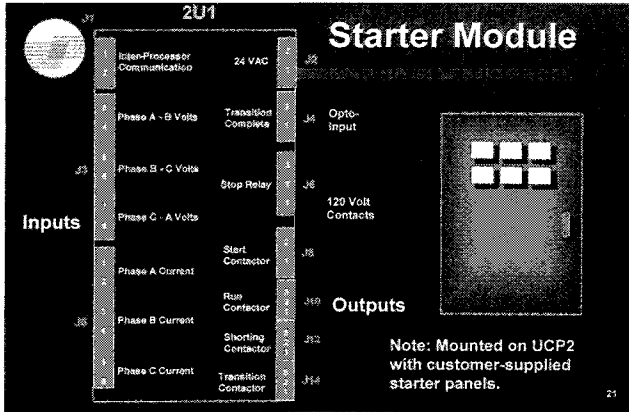


Figure 21

(Figure 21) The starter module (2U1) is present in all Trane-provided starter panels, whether unit-mounted or remote.

For centrifugal chillers, if no Trane starter is provided and the customer is providing the starter instead, 2U1 is mounted in an extension of the unit control panel. It is still designated as 2U1, however. For RTHB units, 2U1 is always located in the starter panel.

2U1 controls the starter when starting, running and stopping the compressor motor and provides an interface to all types of starters and AFD's (adjustable frequency drives). 2U1 provides compressor motor protection for running overload, phase reversal, phase loss, phase unbalance and momentary power loss.

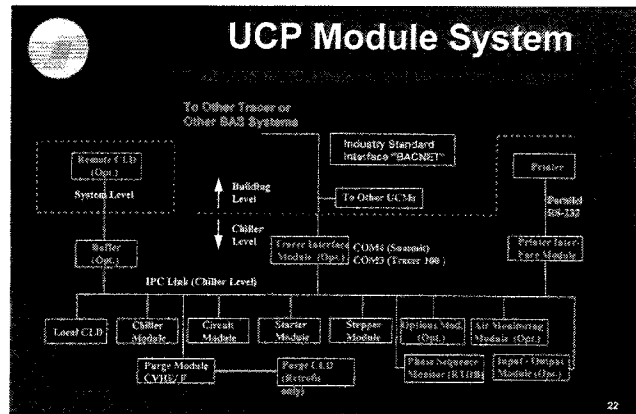


Figure 22

(Figure 22) This figure provides a summary of module organization and function. It also identifies their communication hierarchy (i.e., BMS level, System level, Unit level).

All UCP2 modules are at unit-level, either in the UCP2 panel, in the purge panel, starter panel or in the immediate vicinity of the chiller (i.e., a printer). A printer could also be located at the Tracer or other BMS level.

A remote clear language display would be considered to be located at system (i.e., chilled water system) level.

A Tracer or any other building management system and their communication links to unit control modules (UCMs) on HVAC or other types of equipment are on the BMS or building level. In addition to chillers, the BMS could be controlling air handlers, VAV systems, lighting and electrical equipment, etc.

## CRUISING THE MENU

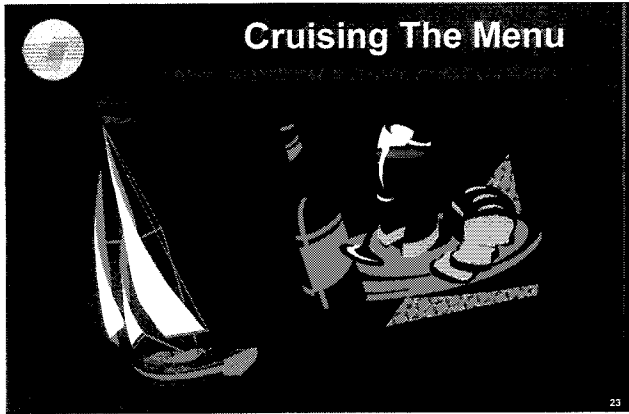


Figure 23

(Figure 23) The next portion of this manual examines the UCP2 menu structure and the functions of the clear language display and operator control keypad.

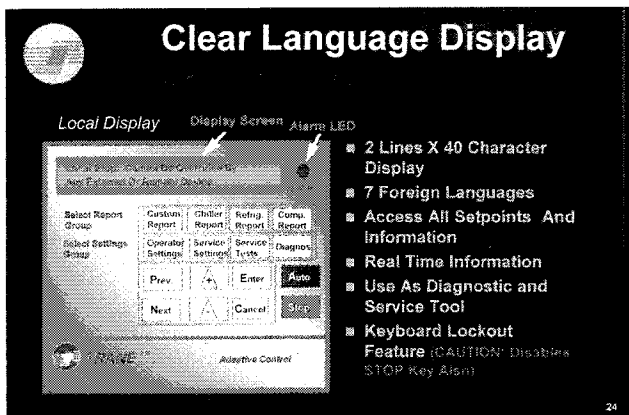


Figure 24

(Figure 24) The liquid crystal display screen and the sixteen-key membrane keypad together are referred to as the “Clear Language Display” or abbreviated as the “CLD”. The CLD is mounted in the door panel of the UCP2. It is designated as the “local” CLD. An identical, remote CLD is available also.

The chiller is controlled by pressing appropriate key combinations on the keypad. It provides access to control setpoints, and chiller setup information. All settings and adjustments are made from the menus in the CLD.

The two-line, forty-character liquid crystal display (LCD) screen will display the chiller data. The display screen backlights anytime a key is pressed. Chiller operators will be able to choose their preference of seven languages to display this information.

An “Alarm” light emitting diode (LED) is also located on the face of the CLD. The LED will flash if a diagnostic condition has locked out chiller operation that requires manual reset at the chiller (local) CLD. The LED will glow steadily when the control is in “Service Test” mode. This indicates that a service technician is running a service test procedure from the Service Tests menu.

Keyboard use can be locked out at the Service Setup Menu. If all keys are non-functional, contact a Trane service technician.

**Note:** Use this feature with caution. Locking out the keypad also prevents the operator from stopping chiller operation at the Stop key.

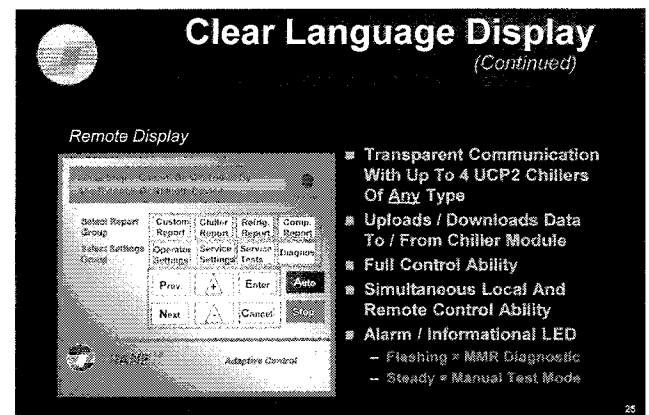


Figure 25

(Figure 25) As mentioned previously, a remote CLD is available that will communicate with and control any UCP2-based chiller by uploading and downloading data from the chiller module. The chiller(s) can be controlled at the local (chiller) CLD or from the remote CLD at any time.

The remote CLD will perform all of the functions of the local CLD except reset of certain latching diagnostics. The remote CLD can be located up to 1,500 feet away from the chiller(s).

All variable information such as temperatures and pressures, are updated on the screen every two seconds while it is being displayed.

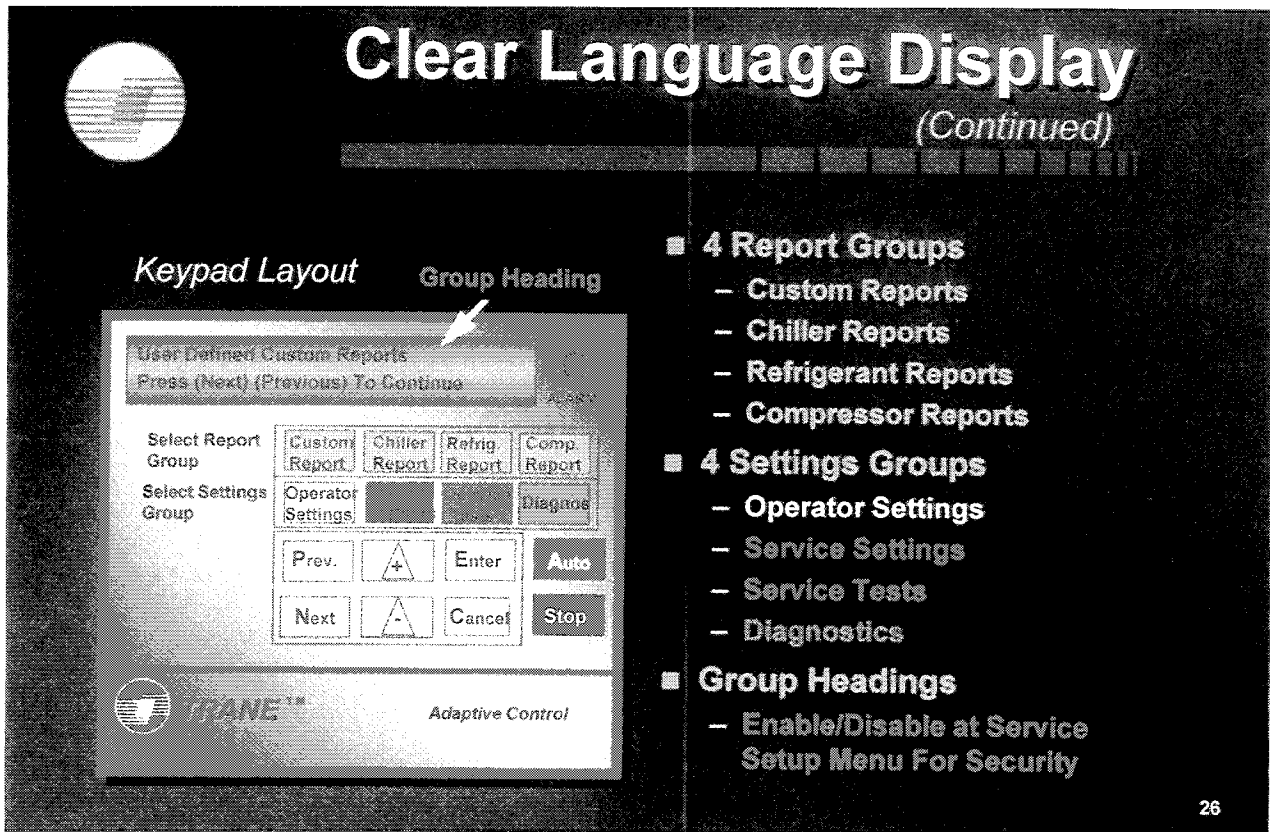


Figure 26

(Figure 26) The CLD displays all chiller operating data and provides access to controls, setpoints and setup and diagnostic information. The keys on the CLD keypad are arranged as follows:

### REPORT GROUP KEYS

The top row of four keys are the Report Group Keys. Pressing one of these keys allows the operator or technician to view one of four “reports” available from the UCP2. These reports contain information on chiller operation, system setpoints and control settings. Access to these keys is usually not protected by a password. This allows the viewer to look at the data available but does not allow setpoints or control settings to be changed.

#### Custom Report Key

The Custom Report contains data that has been specifically selected to appear in this report. It can contain up to twenty items taken from the chiller, refrigerant and compressor reports.

#### Chiller Report Key

The Chiller Report contains current chiller operating status information, water temperatures and operating setpoints.

#### Refrigerant Report Key

The Refrigerant Report contains refrigerant-related data, including pressures, temperatures, purge and equipment room refrigerant monitor data.

#### Compressor Report Key

The Compressor Report contains all available compressor data, including total operating time, number of starts, oil system data, inlet guide vane position (CTV), bearing temperatures (CTV), and electrical data.

### SETTINGS GROUP KEYS

The second row of four keys are the Settings Group Keys. Pressing one of these keys allows the operator or technician to not only view, but change chiller operating setpoints, and control and setup settings.

## Operator Settings Key

Pressing the Operator Settings key accesses the Operator Settings menu, where the user may view and change operator-level chiller and purge operating setpoints.

## Service Settings Key

Pressing the Service Settings key accesses the Service Settings menu where the user may view and change technician-level field setup data and factory chiller configuration settings.

## Service Tests Key

Pressing the Service Tests key accesses the Service Tests menu which can be used by a technician to test or override chiller operation to conduct operating tests of certain chiller components.

## Diagnostics Key

Pressing the Diagnostics key allows the technician to view a log of historical and active diagnostics and also allows the chiller operator to clear a diagnostic lockout condition and restore normal chiller operation.

## DATA CONTROL KEYS

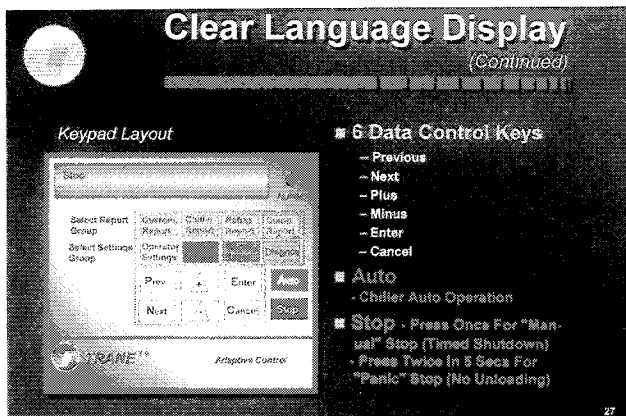


Figure 27

(Figure 27) The six Data Control keys are grouped together in the bottom two rows of the keypad. These keys are the Previous & Next, Plus & Minus and Enter & Cancel keys. They are used to manipulate the information that appears on the CLD screen.

## Previous & Next Keys

These keys are used to scroll forward or backward through report items or menus. The screen will wrap back to the top or bottom of the menu when the end or beginning of the group is reached.

## Plus & Minus Keys

Use these keys to change setpoints and control settings up (+) or down (-). This can only be done when viewing a “settings” menu where the second line of the screen is “Press (+) (-) to Change Setting”.

## Enter & Cancel Keys

Use the Enter key to enter a new setpoint or control setting into memory once it has been changed. Enter must be pressed to store any new setting into memory. Press Cancel if a new setting is inadvertently entered but should not be stored into memory. Again, this can only be done when in a “Settings” group or menu.

## AUTO KEY

Pressing the AUTO key selects “automatic” chiller operation. This allows the chiller to start on a call for cooling at any time, based on the current differential-to-start setpoint. When in “auto” mode, the chiller stops when cooling load is satisfied. The chilled water pump continues to run, however, and the chiller module monitors leaving chilled water temperature to restart the chiller on a demand for cooling.

## STOP KEY

Pressing the STOP key selects “manual” stop of chiller operation. The chiller still goes through its normal shutdown sequence, except that the chilled water pump stops also.

**IMPORTANT:** Pressing STOP two times within 5 seconds initiates an “emergency stop”. The stop sequence is the same as a normal manual stop except that the compressor motor stops immediately and the chiller is not unloaded as it is during the normal stop sequence.

## REPORTS

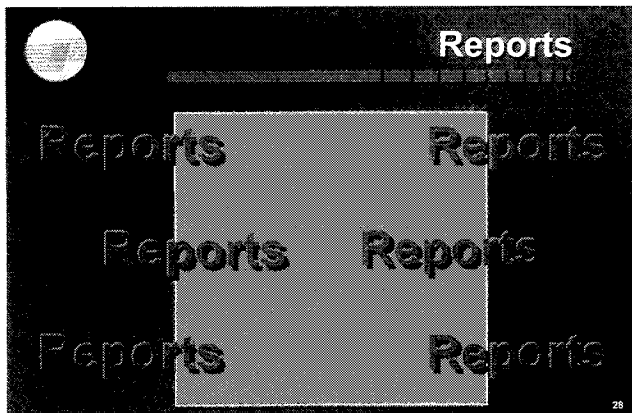


Figure 28

(Figure 28) As discussed previously, reports allow the chiller operator to view chiller operating conditions, settings and setpoints and provides a means of generating a report of selected information. There are four reports available. They are:

- Custom Report**
- Chiller Report**
- Refrigerant Report**
- Compressor Report**

Each individual point of any report can be viewed at the CLD at any time by pressing the desired report group key and using the Next and Previous keys to scroll through the report items.

The remainder of this manual will discuss the items contained in each of these reports and demonstrate how to access this information using the UCP2 clear language display.

## Custom Report

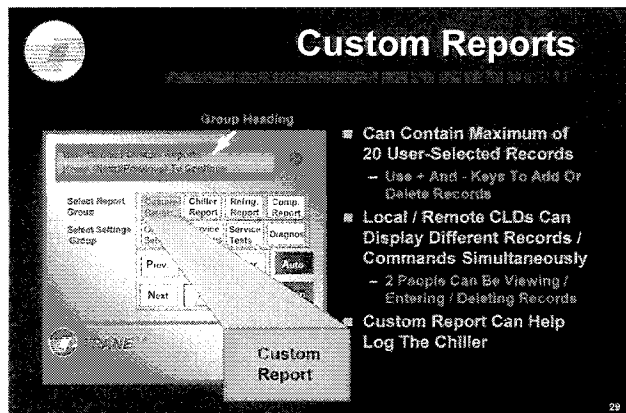


Figure 29

(Figure 29) The chiller operator can create a "Custom Report" by selecting individual points from the Chiller, Refrigerant and Compressor Reports. In this manner, data that is critical to the specific job can be viewed in one menu.

When the Custom Report key is pressed, the report heading will display as shown in Figure 29. If no items have been selected for this report, pressing Next or Previous will display:

**"No Items Are Selected For Custom Report - See Operator's Manual to Select Entries"**

To add an item to the Custom Report, enter the report that contains the item and using Next or Previous, scroll to the item. While viewing the item, press the (+) key. The item will be added to the Custom Report.

To view the item in the Custom Report, press the Custom Report key and scroll to the item. To remove an item from the Custom Report, view the item in the Custom Report and press the (-) key.

The Custom Report can contain up to 20 items. Use the Next and Previous keys to scroll through the items. If an attempt is made to add a 21st item to the report the display will indicate:

**"Custom Report is Full, Report Not Added"**

If an attempt is made to add an item already in the report, the display will indicate:

**"Report Already In Custom Menu"**

# Chiller Report

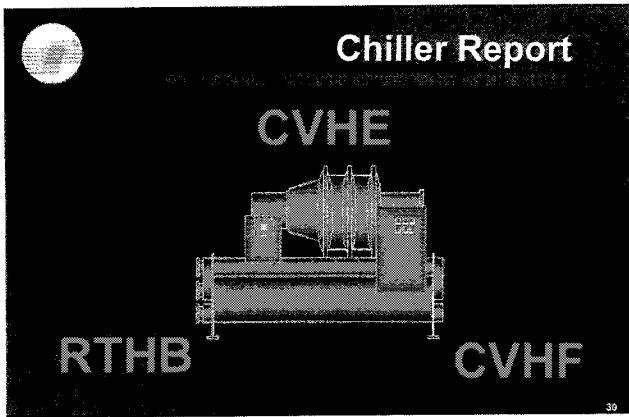


Figure 30

(Figure 30) The chiller report contains chiller operating data and setpoints such as current chiller operating mode and status, water temperatures and operating setpoints.

The operating mode message will indicate if the chiller is stopped, starting, running full load, running inhibited, locked out on a diagnostic condition, in free cooling, waiting for water flows, in hot gas bypass, ice making, shutting down, in extended unloading (RTHB), etc.

Continuing to press the Next key will scroll through the remaining chiller report items; system water temperatures and active chiller operating setpoints.

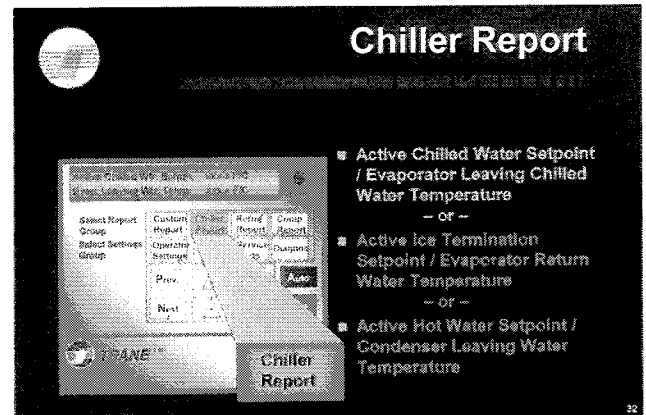


Figure 32

(Figure 32) The bulleted text items that are shown in Figures 32 through 51 are color-coded as follows:

- The items presented as yellow text are standard UCP2 features.
- Items presented as aqua text are options available with UCP2.

Only one of the items in Figure 32 can be displayed, depending upon chiller operating mode. Even if the chiller has one or both of the options (aqua) shown here, only one of these items can be displayed, depending on chiller operating mode.

When the chiller is in normal cooling operation, the “Active Chilled Water Setpoint / Evap. Leaving Water Temp.” screen will be displayed. Setpoint temperatures are shown in degrees Fahrenheit or Celsius, depending on whether English or Metric (SI) display units have been selected from the Service Settings menu.

If the chiller is in “ice-making” or “ice-making complete” mode, then the “Active Ice Termination Setpoint / Evaporator Return Water Temperature” display will appear instead of “Active Chilled Water Setpoint / Evap. Leaving Water Temp.”

If the chiller is in “Hot Water Control” mode, “Active Hot Water Setpoint / Condenser Entering Water Temperature” is displayed instead of “Active Chilled Water Setpoint / Evap. Leaving Water Temp.”

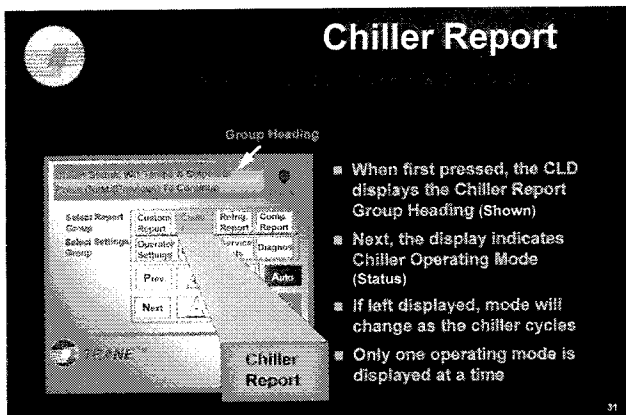


Figure 31

(Figure 31) The operator can view the chiller report by pressing the “Chiller Report” key. This will display the report heading:

**“Chiller Status, Wtr Temps & Setpts - Press (Next) (Previous) To Continue”**

The next screen will display the chiller operating “Mode” on one or both lines. There are many operating modes available. Examples of operating modes are:

**“Auto-  
Waiting For Evaporator Water Flow”  
- or -**

**“Unit Is Running – Capacity Limited By High  
Condenser Pressure”**

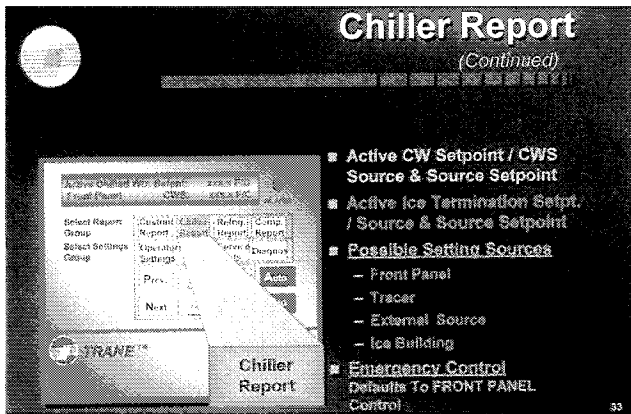


Figure 33

(Figure 33) At this point, the screen will display one of two items, depending upon current chiller operating mode: The active chilled water setpoint (CWS) is displayed on the first line, the setting source and the setting source setpoint on the second line;

or,

The active ice termination setpoint is displayed on the first line, the setting source and the setting source setpoint on the second line.

Possible setting sources for all setpoints are Front Panel, Tracer, Ice Building or External. In the event that the chiller module loses communication with the setpoint source, control will revert to the front panel setpoint.

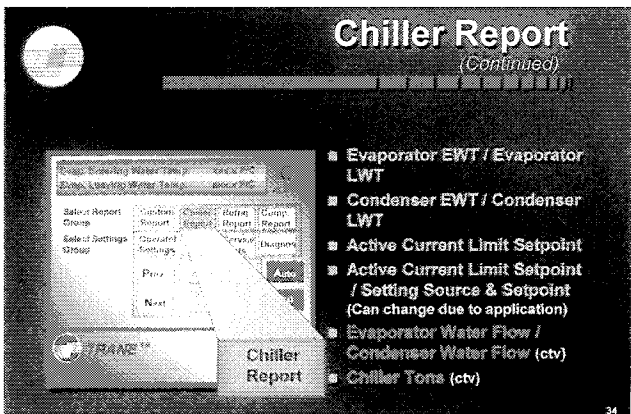


Figure 34

(Figure 34) Entering and leaving water temperature sensors are standard equipment for the UCP2 system. These sensors provide the inputs for the evaporator and condenser temperature differential calculations done by the chiller module.

Next, the CLD will display the active current limit setpoint, as a percentage of full load amps (nameplate). This setpoint indicates the point at which UCP2 will begin to prevent additional compressor loading due to overamperage draw by the compressor motor.

Current limit control is adjustable from 40 to 100 percent of compressor full load amps.

The differential water sensing option must be installed and enabled in order to display water flows and chiller tons. Water flows can be read in gallons per minute (gpm) or in liters per second (lps).

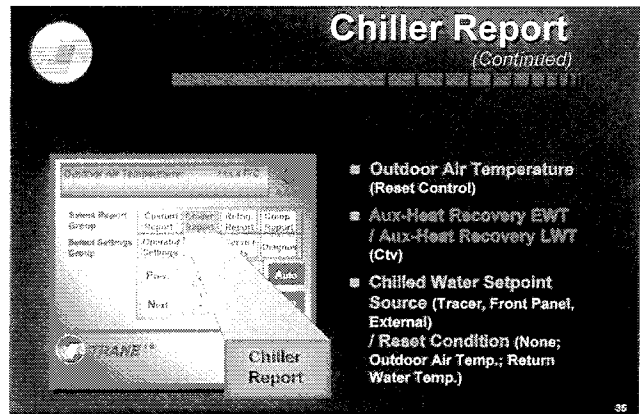


Figure 35

(Figure 35) The first screen in this figure displays the temperature being sensed at the optional (outdoor air temperature sensor). The input for this sensor is located on the chiller module. This sensor is included with the Outdoor Based Chilled Water Reset option. This temperature is received by the CLD from the chiller module.

“Aux/Heat Rcvy” entering and leaving water temperatures will be displayed only if a heat recovery chiller is provided or if the chiller is equipped with an auxiliary condenser tube bundle.

The chilled water setpoint source can be a Tracer, the Local CLD or an external Building Management System. If the Tracer or an external source fails, the local CLD assumes control.

“Reset Condition” identifies the type of chilled water reset control being used. This is either outdoor air temperature or return chilled water temperature.

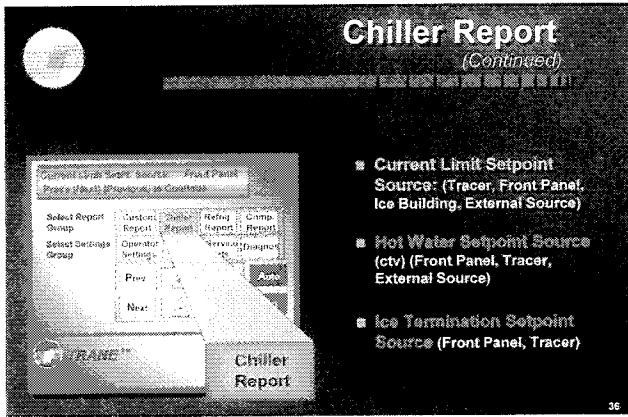


Figure 36

(Figure 36) The Current Limit Setpoint Source screen indicates where the current limiting signal is originating from. The current limit setpoint can originate from several locations or sources. These sources are:

- Tracer
- Front Panel (Local CLD)
- Ice Building
- External Source

The Hot Water Setpoint Source is only available on centrifugal chillers. It is displayed only if “Heat Pump Control” is enabled and the chiller is in “Hot Water Control” mode.

Heat Pump Control is used in rare cases where the CenTraVac is used to provide heating instead of cooling as a primary mission.

The Ice Termination Setpoint Source screen indicates where the signal to stop ice building is coming from. This signal can originate from a Tracer or the Chiller Front Panel (CLD).

## Refrigerant Report

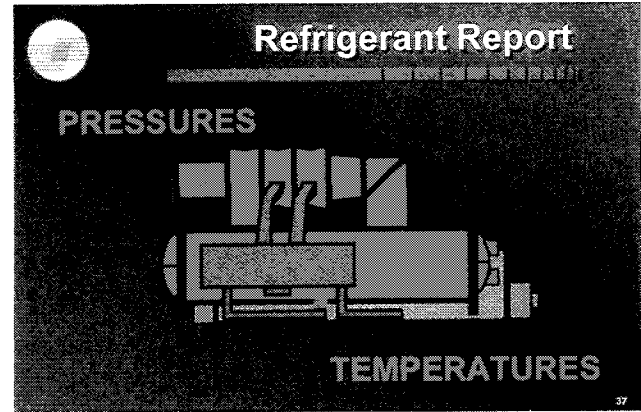


Figure 37

(Figure 37) The refrigerant report contains refrigerant-related information such as pressures, temperatures, purge operating data and equipment room refrigerant monitor log data.

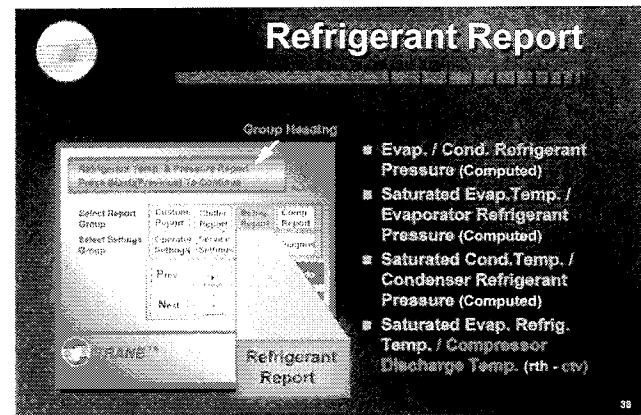


Figure 38

(Figure 38) The operator can view the refrigerant report by pressing the “Refrigerant Report “ key on the CLD. This will display the report heading:

**“Refrigerant Temp & Pressure Report-  
Press (Next) (Previous) To Continue”**

The next screens will display two report items each, one on each line. The first screen is:

**“Evap. Rfgt Pressure:   xxx.x psig-  
Cond. Rfgt Pressure:   xxx.x psig”**

Refrigerant temperatures are provided by the factory-installed temperature sensors. Compressor discharge temperature sensing is standard on RTHB units because electronic expansion valve (EXV) control is derived from a combination of discharge superheat and chilled water temperature differential readings.

Continuing to press the Next key will scroll through the remaining refrigerant report items.

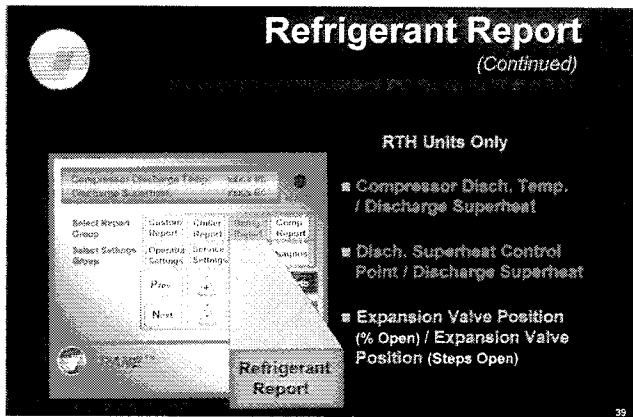


Figure 39

(Figure 39) The three items shown in this figure are displayed for RTHB chillers only, since these features are not provided on low pressure centrifugal chillers. The first screen compares the compressor discharge temperature with the available superheat available at that time.

Discharge superheat is computed from the compressor discharge temperature reading and the saturated condenser refrigerant temperature. Superheat is used to control electronic expansion valve operation to try to maintain the discharge superheat control point.

The second screen shows the discharge superheat control setpoint and the amount of superheat at that moment. The chiller should maintain superheat near the control point. If superheat is too high or too low for too long, the chiller will lock out on a latching diagnostic condition.

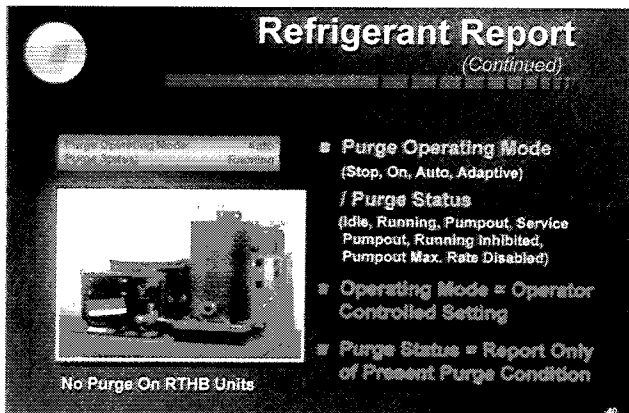


Figure 40

(Figure 40) The next message that appears on the CLD of a low pressure centrifugal chiller is the Purge Operating Mode screen shown here. The first line

displays Purge Operating mode, the second is Purge Status. Operating mode is an adjustable setting, while status is just a condition report.

The next 12 screens following the Purge Operating Mode screen are purge-related. These screens are a report-only function that show how the purge is set to operate at this time and what it is actually doing. You cannot set the purge operating parameters in the Refrigerant Report; you can only view the existing purge operating status and settings.

The four purge operating modes are:

- Stop
- On
- Auto
- Adaptive

Purge operation mode is selected in the Operator Settings Group.

There are six possible purge status conditions. They are:

- Idle
- Running
- Pumpout
- Service Pumpout
- Running Inhibited
- Pumpout Maximum Rate Inhibited

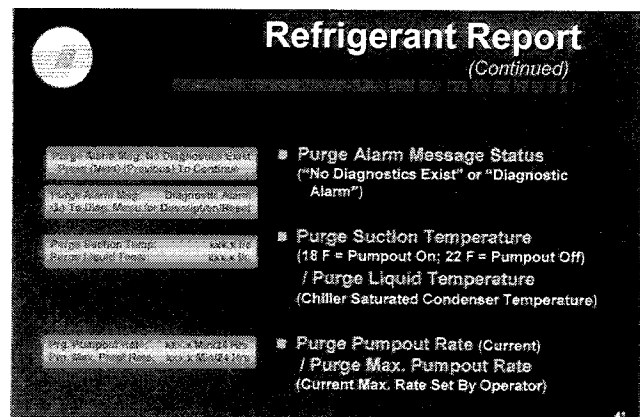


Figure 41

(Figure 41) The Purge Alarm Message screen is provided to inform the operator if non-latching purge diagnostics are occurring. The screen will look like one of the two shown here. The No Diagnostics Exist screen indicates there are no purge diagnostics stored in the diagnostic log at this time. A latching purge diagnostic will cause the purge to shut down and a warning screen to appear on the CLD. This automatically sends the display to the Diagnostic Settings menu so the fault can be viewed and cleared.

Purge Suction Temperature is the suction temperature of the purge air-cooled condensing circuit compressor. This temperature controls pumpout compressor operation, turning it on at 18 F and off at 22 F.

Chiller saturated condenser temperature (purge liquid temperature) is measured so that it can be used to prevent purge operation if the temperature is too low in the chiller condenser.

The top line of the Purge Pumpout Rate screen indicates how many minutes during the last 24 hours the purge pumpout compressor has operated. The maximum number of minutes per day for pumpout is set when the chiller is installed. The second line of this screen shows what the maximum setting is at this time.

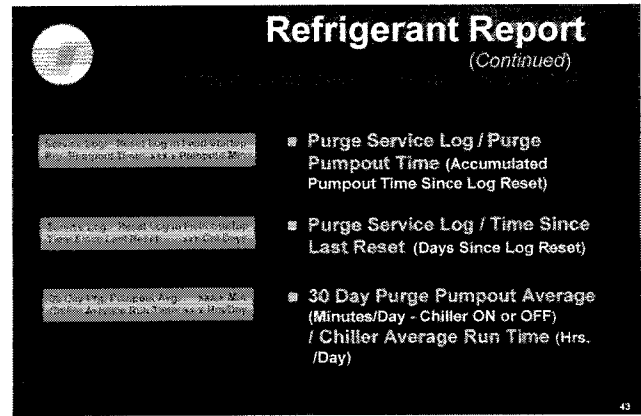


Figure 43

(Figure 43) The Purge Service Log is provided to help schedule purge service and maintenance procedures. The time on these two screens can be reset (zeroed) at any time from the Field Startup menu.

The first service log screen gives pumpout time accumulated since the log was last reset. This should be reset at the completion of purge service to help schedule service or maintenance based on pumpout time.

The second service log screen gives the number of days accumulated since the log was last reset. This should be reset at the completion of purge service to help schedule service or maintenance based on elapsed time or calendar days.

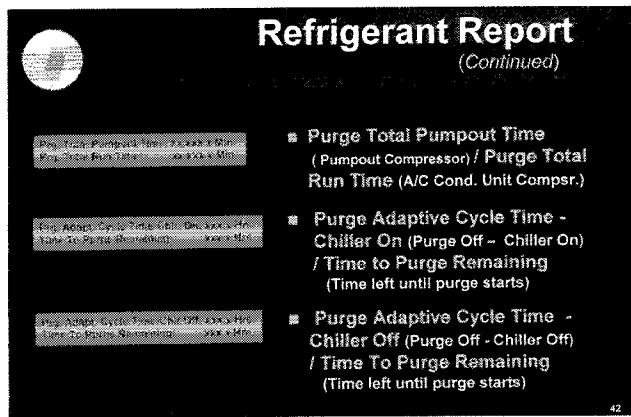


Figure 42

(Figure 42) The Purge Total Pumpout and Run Time screens provide information about the two purge compressors.

Purge Total Pumpout Time is a log of the total number of minutes that the pumpout compressor has operated during the life of the purge. Purge Total Run Time is a log of the total number of minutes that the air-cooled condensing compressor has operated during the life of the purge.

The Adaptive Cycle Time - Chiller On screen shows the length of the purge OFF cycle being used by the Adaptive Control mode with the chiller running and the amount of time left until the purge will restart.

The Adaptive Cycle Time - Chiller Off screen indicates the length of the purge OFF cycle being used by the Adaptive Control mode when the chiller is not running and the amount of time left until the purge will restart.

### 30-Day Summary Data

The last four purge-related screens show data that is accumulated over the previous 30-day period which is called 30-day summary data. Adaptive Control uses this data to automatically adjust purge operational settings.

The first of these is the 30-Day Purge Pumpout Average screen. This shows the average pumpout activity for each 24 hour period over the last 30 days and the Chiller Average Run Time screen which is a summation of chiller run time in hours divided by the number of days of available data.

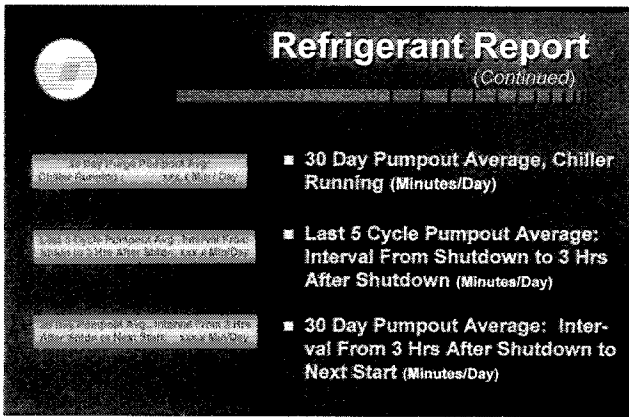


Figure 44

(Figure 44) The next 30-day summary screen is the 30 Day Pumpout Average - Chiller Running screen. This summary records all accumulated pumpout time for periods when the chiller is running. Large service pumpouts are not included if they occurred more than 7 days in the past.

Last 5 Cycle Pumpout Average, Interval From Shutdown To 3 Hours After Shutdown is a screen that gives the average pumpout time needed during the last five chiller shutdowns. Data is available for the last 30 calendar days of pumpout activity during the first 3 hours following chiller shutdown. Large service pumpouts are included. From this data, the average for the last 5 shutdown cycles is computed and shown on this screen.

The final purge screen in the chiller report is the 30 Day Pumpout Average, Interval From 3 Hours After Shutdown To Next Start screen. This summary includes all pumpout data for extended chiller shutdowns (beyond the 3 hour period covered above). Large service pumpouts are not included if they occurred more than 7 days in the past.

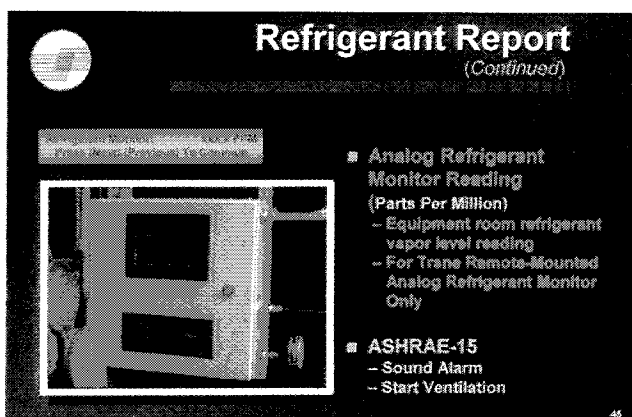


Figure 45

(Figure 45) The refrigerant monitor screens (CTV or RTHB) indicate the current equipment room refrigerant vapor concentration level reading (in parts-per-million), being taken by the refrigerant monitor. This screen will appear only if the refrigerant monitor option has been enabled from the Field Setup menu.

ASHRAE STD. 15-1992 is the current standard that specifies how equipment rooms should be laid out and ventilated and how the refrigerant systems in them should be piped and what safety devices should be provided. At the minimum, an oxygen deficiency monitor should be provided and a refrigerant monitor is recommended.

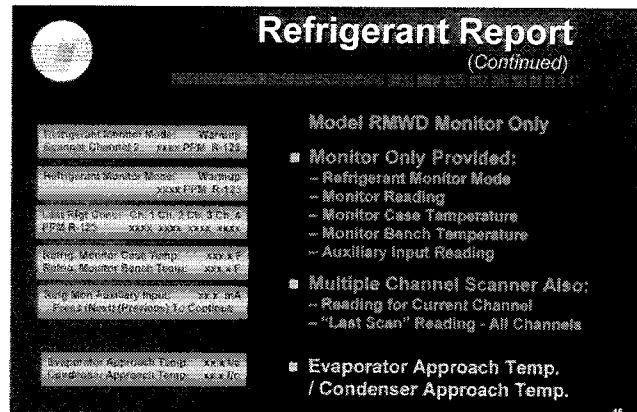


Figure 46

(Figure 46) The Trane Model RMWD digital refrigerant monitor provides more information to the operator than the older, analog monitor does. In addition to equipment room refrigerant vapor level readings, the RMWD shows the monitor's operating mode, case temperature, "bench" temperature and indicates the refrigerant type being read on the chiller's UCP2 display.

The display also indicates the current signal level (mA) being sent to the monitor auxiliary input. This monitor is also available mounted right on the chiller.

If a multiple channel refrigerant scanner is also provided, the display indicates which channel is currently being read and displays the last vapor level reading for each channel.

The monitor's auxiliary input can be used to accept a signal from an external device such as a oxygen level monitor.

The final screen in the CenTraVac Refrigerant Report displays the evaporator and condenser approach temperature readings (not used for RTHB). They are important chiller operating and diagnostic tools.

# Compressor Report

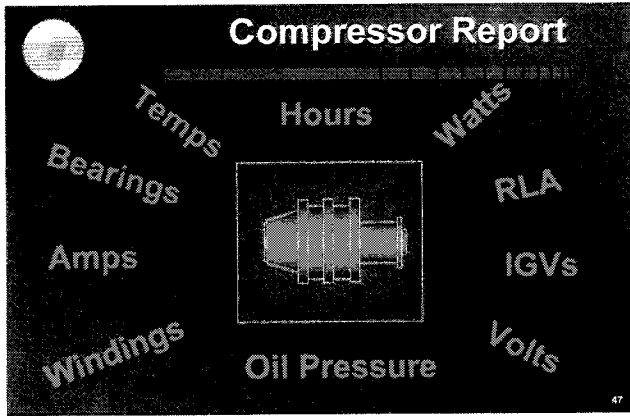


Figure 47

(Figure 47) The Compressor Report is the final Report Group. This report provides information on compressor operation, including oil system data, bearing information (CTV), inlet guide vane position (CTV), operating time and starts, electrical data and operating temperatures.

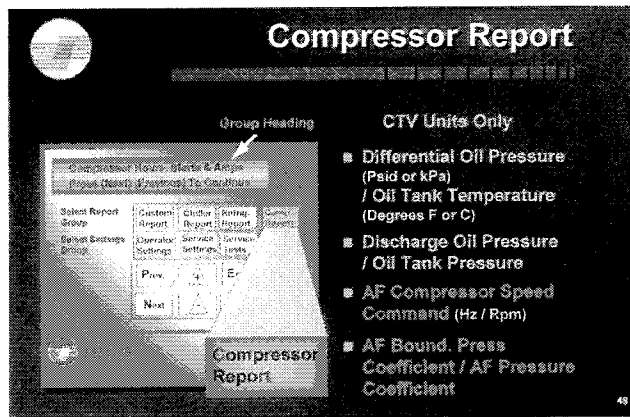


Figure 48

(Figure 48) When the Compressor Report key is pressed, the Compressor Report heading, shown in this figure will be displayed. Pressing Next will scroll through the report items that follow.

The first six compressor report screens shown here appear for CVHE and CVHF chillers only. The RTHB compressor report begins with the “Compressor Phase Currents - % RLA” screen shown in Figure 49.

The Differential (Net) Oil Pressure reading is provided to assure the operator that oil is being supplied properly to the compressor bearings. This reading is equivalent to subtracting evaporator pressure from the oil supply pressure.

Normal operating Differential Oil Pressure reading is 12-18 psid. A minimum of 9 psid for 30 seconds is required for compressor start to take place. The 750-watt oil tank heater should maintain 140-145 F oil temperature during chiller operation. Oil tank temperature can be anywhere between 115-160 F with the chiller OFF.

The discharge oil and oil tank pressure screens show what oil pressure readings are being used to calculate the differential oil pressure.

The Adjustable Frequency Compressor Speed Command screen displays the compressor speed frequency and rpm for CVHE and CVHF only if the starter type is set at “adjustable frequency”.

The Adjustable Frequency Boundary Pressure Coefficient and the Adjustable Frequency Pressure Coefficient are displayed for CVHE and CVHF only if the starter type is set at “adjustable frequency”.

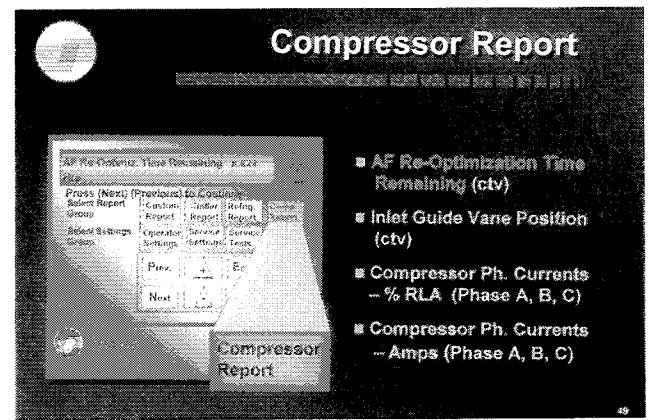


Figure 49

(Figure 49) The Adjustable Frequency Re-Optimization Time Remaining screen displays the amount of time left on the re-optimization timer. This is displayed for CVHE and CVHF only if the starter type is set at “adjustable frequency”.

The Inlet Guide Vane Position screen shows the CVHE/F inlet guide vane position at any given time. Position is displayed in percent of full open and number of degrees open, based on inlet guide vane stepper motor position.

“Compressor Phase Currents – % RLA” is the percentage of Rated Load Amps (nameplate) being drawn at each compressor winding. “Compressor Phase Currents – Amps” is the total amperage being drawn at each compressor winding.

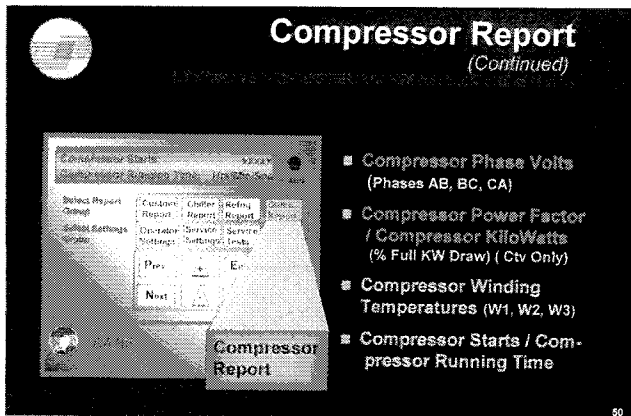


Figure 50

(Figure 50) “Compressor Phase Voltages” is the measured voltage present between Line Phases A-B, B-C and C-A respectively, of the incoming power supply.

“Compressor Power Factor” and “Compressor KiloWatts” readouts are options available for centrifugal chillers if:

- the Line Voltage Sensing Option (PTs) is installed;
- the starter type is not Adjustable Frequency Drive, and;
- “External KW” is not installed.

A RTD-type temperature sensor (W1, W2, W3) is buried in each phase winding of the compressor motor stator to detect motor overheating. The UPC2 monitors the resistance measured at each of the sensors, which varies in direct relation to the motor temperature.

A counter is provided to record the total number of compressor starts since chiller first startup. A digital hourmeter records total compressor run time since first chiller startup in hours, minutes and seconds.

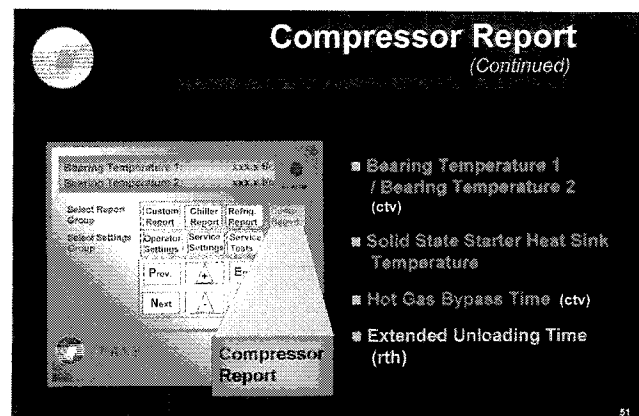


Figure 51

(Figure 51) Inboard and outboard bearing temperature protection is optional on CVHE/F centrifugal chillers. Fixed, high bearing temperature cutouts can be provided to generate a MMR diagnostic and shut down the chiller if temperature at either bearing exceeds 180 F (82.2 C).

Solid State Starter Heat Sink Temperature is displayed if the solid state starter option has been enabled from the Service Settings menus. UCP2 monitors this temperature to prevent chiller start when the starter heat sink temperature is too high.

Hot Gas Bypass Time is a readout of the total amount of time elapsed with chiller operating in hot gas bypass.

Extended Unloading Time indicates the total amount of time currently being allowed for an RTHB unit to operate in “extended unloading” condition. This is used to keep the chiller on line at minimum load by creating an artificial load on the evaporator (similar to hot gas bypass). When chilled water temperature differential falls to its lowest allowed point, UCP2 opens the EXV slightly, to allow more refrigerant to enter the evaporator.

## SUMMARY

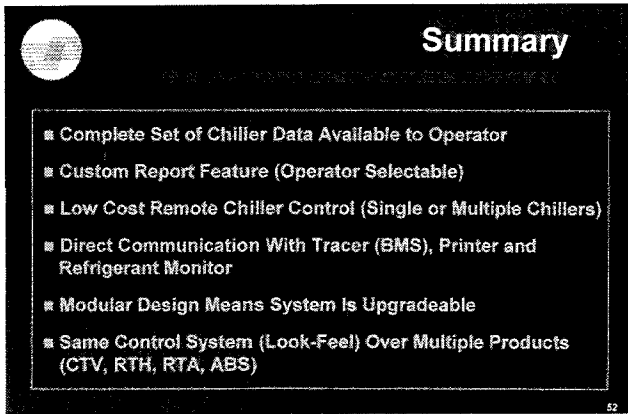


Figure 52

(Figure 52) The Trane UCP2 Enhanced Adaptive Control™ system provides chiller operating and maintenance personnel immediate access to all chiller operating status and setpoint data, pressure and temperature readings, electrical data, loading conditions, oil system information, and purge and refrigerant monitor data.

An operator can access critical information immediately by setting up a custom report for his particular application.

Chiller logs can be printed on demand, periodically, or in the instance of a diagnostic.

Multiple or single UCP2 chillers can be controlled remotely, using the Remote Clear Language Display and, all UCP2 chillers communicate directly with Tracer building management systems.

The UCP2 is so flexible that new features can be added to it at any time.

Finally, once an operator is familiar with UCP2 operation this familiarity will carry over to any other type of chiller using Trane's Adaptive Control technology.

**The Trane Company**  
North American Commercial Group  
3600 Pammel Creek Road  
La Crosse, WI 54601-7599

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Price: \$5.00