General Service Bulletin

CVHE-SB-32A

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Subject: Troubleshooting and Checkout Procedures For CVHE/F/G Units with UCP2 Controls

Introduction:

The purpose of this service bulletin is to provide troubleshooting information on CVHE/F/G Centrifugal Chillers with UCP2 Control Panel. Additional UCP2 information is found in the following manuals:

CVHE-OM-8, Operation/Maintenance Manual

CVHE-IN-9,10,11, Installation Manual

CVHE-W-8A, Wiring Manual

CVHE-CLD-1A, Clear Language Display Manual

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UCP2 Control Panel and Module Description

Unit Control Panel

Safety and operating controls are housed in the UCP2 Unit Control Panel, the Starter Panel and the Purge

Control Panel (Control Panel layout is illustrated in Figure 1).

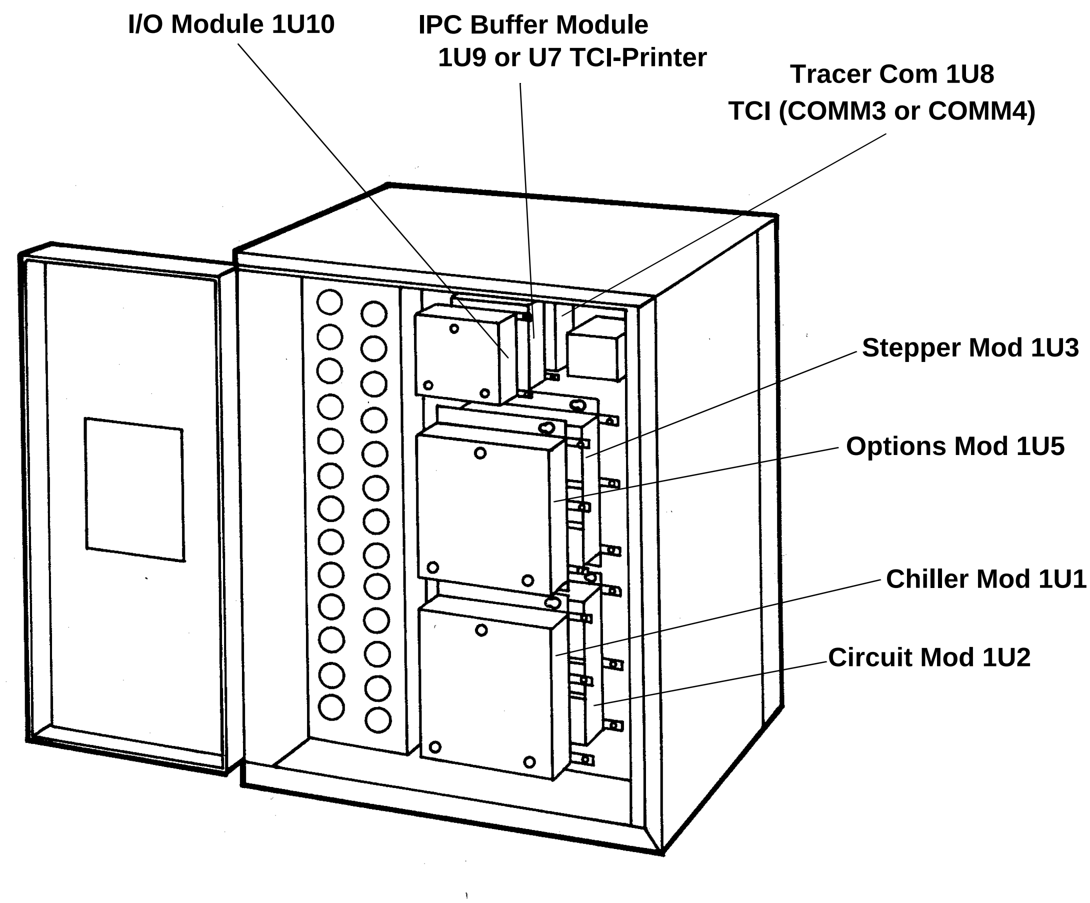
The UCP2 control consists of a modular design partitioned by major function or group of functions. All modules communicate with each other through the IPC circuit.

Major components within each of these control groups are described below.

Unit-mounted temperature sensors, pressure transducers and functional switches provide analog and binary inputs to the various modules.

The “microprocessor-based” modules described are shown below. All connections to the modules are made with pluggable phoenix connectors.

Figure 1
UCP2 Control Panel



UCP2 Control Panel
and Module Description

Chiller Module

The Chiller module is the Master-of-the-Chiller communicating commands to other modules and collecting data/status/diagnostic information from other modules over the IPC (Interprocessor Communications Link). The Chiller module performs the leaving chilled water temperature and limit control algorithms arbitrating capacity against any operating limit the chiller may find itself working against. The Chiller module checks for valid setpoints and contains non-volatile memory (NOVRAM), to retain them on any power loss. Inputs and Outputs are chilled water system level such as, but not limited to, evaporator and condenser water temperatures, evaporator and condenser water pump control, status and alarm relays, and external auto/stop.

Circuit Module

The Circuit module serves as an input/output expander and is assigned inputs and outputs associated with the refrigerant and lubrication circuits. The Circuit module also receives a 4-2OmA signal from an external refrigerant monitor and converts the signal to ppm for display at the Clear Language Display.

Module Setpoints relating to the circuit module.

1. condenser refrigerant pressure output: (J7 1,2) 2-10 VDC; 2 V = 0 psia (14.7 psig); 10 V = 14.7 psia (29.7 psig)

2. Refrigerant monitor input. (J5 5,6) 4-20 mA input suitable for factory or field connection. 4-20 mA range is 0 to 100 ppm.

Stepper Module

The Stepper module is designed to drive the stepper motor inlet guide vane actuator on CenTraVac chillers. On CenTraVac chillers the Stepper module receives from the Chiller module the direction and distance to drive the inlet guide vanes and then generates the appropriate signals to operate the stepper motor. The Stepper module also has other I/O capabilities used to support functions on the stepper module and/or just I/O expansion. These are Evap. temperature, Cond. discharge, Bearing temperature and Cond. temperature.

Starter Module

The Starter module physically resides in the Compressor Motor Starter Panel providing control of the starter when starting, running and stopping the motor. The Starter module provides interface to and control of Y-Delta, X-Line, P-Reactor, A-Transformers, Solid State Starters and Trane® Adaptive Frequency Drive. The Starter module also provides protection to both the motor and the compressor in the form of running overload, phase reversal, phase loss, phase unbalance, momentary power loss, and compressor surge, in addition to others.

Purge Module

The Purge module provides control of the purge used on R-11 and R-123 low pressure CenTraVac models. The Purge module provides all the inputs and outputs to control the purge optimizing both purge and chiller efficiency. The Purge module resides in the purge control panel and communicates with the Chiller module over the IPC (Interprocessor Communications Link) uploading set points and downloading data and diagnostics.

Local Clear Language Display

The Local CLD (Clear Language Display) resides at the Chiller providing a display of chiller data and access to operator/serviceman controls, set points and chiller setup information. All information is stored in non-volatile memory in the Chiller module. The Local Clear Language Display and the Chiller module work together to display and store information requiring non-volatility.

Remote Clear Language Display Panel and Remote Clear Language Display Interface Module

As an option, the Remote Clear Language Display permits the operator to remotely operate 1-4 chillers. The Remote Clear Language Display Panel works like the Local Clear Language Display with two exceptions, (1) a Local Stop command takes precedence over all other remote or external devices, and (2) the Remote Clear Language Display's Custom Report and display language are independent of the Local Clear Language Display Panel.

Options Module

The Options module satisfies control or interface requirements for a number of options. Some of these options are stand alone, such as Generic BAS Interface; other options support either additions or modifications to the chiller itself, such as Free Cooling. Features supported by the Options module include Ice-Making, Heat Recovery, External Chilled Water Setpoint, and External Current Limit Setpoint.

Module Setpoints relating to the options module:

1. %RLA compressor output (J7 3,4) 2-10 VDC out; 2 VDC = 0% RLA; 10 VDC = 120% RLA
2. External current limit input (J7 11,12) 2-10 VDC or 4-20 mA in; The range is 40% to 120% RLA.
3. External chilled water setpoint. Input (J9 4,5) 2-10 VDC or 4-20 mA in; The range is 0 to 65°F.

Tracer Communications Interface

TCI COMM 3 is an optional module that provides a 1200 baud isolated communications link to TRACER.

TCI COMM 4 (Tracer Summit) is an optional module that provides a 9600 baud non-isolated link to Summit.

Printer Interface Module

The Printer Interface module provides a pre-formatted chiller log to a printer. The Printer Interface can be programmed via the Clear Language Display to print a chiller log on command, at the time of a diagnostic, and/or on a periodic basis. Each printed event is time and date stamped.

The *preferred* printer to be used is Okidata Microline 184 Turbo. Serial cables required are (DB25 male to DB9 Female). The maximum distance allowed between the printer module and the printer is 50 feet.

Secondary Printer Options

Epson: not all Epson printers support serial communications. For a low cost printer that does support serial communications, Epson recommends the LX810 Printer with the Serial interface option (C823032).

IBM ProPrinters: Use either the “2380’ + or the “2390+’ along with the Serial interface option “1363110”.

Other: Any printer/computer with 232 capabilities should be capable interfacing with the TCI Printer module (allowing for different cables and jumper configurations).

Duplex Control Module (DCM)

Duplex control is accomplished by the Duplex Control module that resides in the downstream Unit Chiller “A”. It’s tasks are setpoint control (chilled water and current limit) and compressor staging. All other setpoints are controlled at each individual compressor UCP2 Clear Language Display panel. Each unit can be reset or stopped separately through each CLD. The dip switch setting on the board is ON-OFF-ON. IPC communication with the downstream chiller “A” panel connects to J1, 1 & 2. IPC communication with the upstream chiller “B” panel connects to J3, 1 & 2.

General Troubleshooting Information

Problem 1: AFD (adaptive frequency drive) diagnostics

Corrective Action:

1. Correctly input all AFD parameters called out and specified in the AFD Operation Maintenance manuals, such as AFDA-OM-1 and AFDB-OM-1.
2. Review and follow the specific trouble shooting sections of the appropriate drive.

Problem 2: Failure to accelerate or did not accelerate

Corrective Action:

1. Set the appropriate acceleration Timers 1 and 2 in machine configuration menu.
2. Set correct starter type in machine configuration menu.
3. Replace defective CTs.
4. Defective Starter module, ct input. Replace Starter module.
5. Defective IGV linkage.
6. Defective Stepper module.
7. Fast Restart. Change Starter to a X-13650453-16 or newer and Chiller modules. For X-13650450-15 or newer, reference Trane *CVHE-SB-46*.

Problem 3: Approach Temperature reads -40°F

Corrective Action:

1. A CLD X-13650448-04 or newer is required with a Chiller module X-13650450-04 or newer.

Problem 4: Auto X-former starter: Runs (3) seconds and trips. Unit will not transition.

Corrective Action:

1. Verify Starter module. If X-13650453-07 or later, it requires transition circuit.
2. No voltage on transition complete J4 circuit. Trace circuit path. Reference Trane *CVHE-SB-36*.

Problem 5: IGV BPI not found or low

Corrective Action:

1. BPI switch location may have changed. Reposition/calibrate BPI switch.
2. Defective BPI switch and/or wire.
3. Incorrect Stepper motor wiring.
4. Replace the Stepper module.
5. Correctly program the BPI maximum travel setpoint in service settings.

Problem 6: Bearing Temperatures 1 and 2 Locations.

Corrective Action:

1. Bearing temperature I (Stepper module J5-5, 6) goes to the front Journal bearing.
2. Bearing temperature 2 (Stepper module J5-7, 8) goes to the rear Thrust bearing.

Problem 7: Capacity Limited by High Current when the phase current as read from the Compressor report reads zero amps. Getting this message during the run mode.

Note: The Chiller module takes the three phase currents as sent by the Starter module, selects the highest one and limits based on this.

Corrective Action:

1. Check the phase currents as displayed in the Compressor Report.
2. Check the Active Current Limit Setpoint. It is possible it is a very low value or even zero amps is loaded in.
3. If the current limit source is the external current limit setpoint, check this input on the Options module.

Problem 8: Current Overload

Corrective Action:

1. Correctly program in the overload information in the machine configuration menu.
2. Defective CTs.
3. Check CT wiring and polarity.
4. Check for the correct number of turns through the CTs.

Problem 9: Chiller Loss of Communication with Circuit module and IGV overdriving close.

Corrective Action:

1. IPC to Circuit module disconnected or reversed.
2. Circuit module not powered.
3. Verify that a good ground exists between all modules including the CLD that needs a dedicated green wire ground.

Problem 10: Check Clock (IFW) Informational Warning Diagnostics. On a loss of power, the clock does not keep time if there is an extended power loss (greater than 15 seconds).

Corrective Action:

This diagnostic is shown in active diagnostic menu.

Note: If you clear this IFW diagnostic while the machine is running, you will shut down the unit. Wait to clear the diagnostic when the unit is off.

Problem 11: Chiller Loss of Communication with Starter and the IGV calibrates.

Corrective Action:

1 IPC to Starter module disconnected or reversed.
2 Starter module not powered up.
3 Verify that a good ground exists between all modules including the CLD that needs a dedicated green wire ground.

Problem 12: Chiller Loss of Communication with Starter or Circuit Loss of Communication with Chiller Diagnostics

Corrective Action:

1 The 120 VAC side of the 3KVA transformer should be grounded at only one spot and it is in the Starter. Both the 120 VAC and the 24 VAC in the UCP should not be grounded.
2 Verify the IPC wire is shielded twisted pair between the Starter and Chiller modules and its shield is grounded at J1-6.
3 Verify there is a dedicated ground between the remote starter and the chiller.
4 Verify that a good ground exists between all modules including the CLD that needs a dedicated green wire ground.

Problem 13: Clear Language Display won’t go into Demo mode.

Corrective Action:

1 You must press Custom report and Compressor report at the same time while the display is showing software part number on power-up. It will not go into Demo mode if there is IPC communication.

Problem 14: Communication diagnostic; None or Degraded Communications.

Corrective Action:

1 Starter module must have the A phase on pin 2 of J2 24 Vac
2 IPC wires must be connected
3 IPC wires must have correct (+ -) polarity on J1.
4 The TCI and CLD modules have LEDs to indicate the sending and receiving of chiller packets. Green (RxA) is receive and should be blinking constantly. Red (TxA) is send and blinks every 1-2 seconds.

Problem 15: Loss of Communication with Starter Diagnostics at Startup with no Inlet Guide Vane action. Mode is “Resetting” and can move through the menus.

Corrective Action:

1 IPC to Starter module disconnected or reversed
2 Starter module not powered up.
3 Verify that a good ground exists between all modules including the CLD that needs a dedicated green wire ground

Problem 16: Loss of Communication or Intermittent Communication between any of the modules. (Chiller, Starter, Tracer, Circuit, Stepper, Options, Purge, etc.)

Corrective Action:

1 Verify the Chiller and CLD versions are compatible with Tracer.

2 Reference Trane *CTV-CSB-90* and *92* for module compatibility numbers.

3 ICS address at CLD should match with Tracer.

4 Are the DIP switches set correctly? They should be all off for COM 3; OFF-ON-OFF for Comm 4.

5 In the Tracer module, verify the IPC LEDs near J1 are blinking. Red LED is transmit and should be blinking constantly showing lots of IPC action (even if not for the TCI). The green LED is for receive and should only be blinking rapidly in a row once every 1-2 seconds which is the IPC cycle time.

6 Verify the COM 3 LEDs near J3 are blinking. Red LED is transmit and should be blinking showing lots of COM 3 action (even if not for the TCI). The green LED is for receive and should only be blinking rapidly in a row once every minute which is the Tracer cycle time.

7 The Starter module or other modules are not grounded well. The IPC needs the modules to be grounded together.

8 Go to service test menu and verify that Chiller thinks a TCI 4 is installed.

9 Look at the voltage of each line with respect to ground. A logic 0 should be .5 V or less; a logic 1 should be 4.5 volts or more.

~ For COM 3 lines less that 1000 Ft., a 300 Ohm terminating resistor put across the two wires is needed. Install the resistor first at the chiller end of the link.

~ Radio frequencies generated from sources like airplanes and radio towers may be inducing noise in the communication lines. Tie matched capacitors of around 200pF at either ends or both ends from each line to ground.

10 De-install TCI option and power up and see it self install within 10 seconds. If not, something is wrong in TCI module.

11 De-install Tracer option and power up and see if it self installs within three minutes. If not, something is wrong with the Tracer side.

12 Tracer option is self-installed. No need to enable it manually. If enabled manually and no Tracer on the communication line, then a Loss of Communication with Tracer will be called. If a Tracer is put on communication line, then communication side diagnostics are called: Loss of Communication with Tracer.

Problem 17: ***No Communication, on a power up, get message "No Communication, Data Not Valid" and no action in the IGV.***

Corrective Action:

1 Chiller module not powered up.

2 IPC to Chiller module not connected.

3 IPC shorted.

4 Disconnect all modules from the IPC to CLD except the Chiller module. If a communication is established, try plugging one of the other modules one at a time. When it then fails, this module is pulling down the line.

~ Check the LEDs at the rear of the CLD. The left one is "TEST and should be on if all is normal.
~ The second LED from the left is the "+5VDC" and should be on all the time if all is normal.
~ The third LED from the left is the transmit and should only blink rapidly every 2 seconds when the CLD talks on the line.
~ The fourth LED from the left is the receive and should be blinking rapidly all the time since there is constant bus action.
~ Verify that the CLD is grounded to the other modules.
~ Module Grounding Problem. On the Starter module DO NOT ground the IPC. IPC is grounded at the Chiller module.

Problem 18: ***No Communication, on a power up, get message "No Communication, Data Not Valid" but the Inlet Guide Vane calibrates.***

Corrective Action:

1 IPC to the Local Clear Language Display reversed.

2 IPC to Local Clear Language Display disconnected.

3 Verify that a good ground exists between all modules including the CLD which needs a dedicated green wire ground.

Problem 19: ***Starter Loss of Communication with Chiller. No other diagnostic.***

Corrective Action:

1 Verify IPC connections are good to Starter module and cable is shielded. Chiller module X-13650450-01 is not compatible with Starter module X-13650453-02 and later.

Problem 20: ***TCI Loss of Communication with Chiller.***

Corrective Action:

1 Need a X-13650460-02 or newer TCI module.

Problem 21: High compressor Discharge temperature
The compressor discharge temperature exceeded 200°F.

Corrective Action:

1 Check unit operating conditions for something that would generate high gas discharge temperatures, such as condenser water flow.

2 Extended operation in hot gas bypass. Set the hot gas bypass timer lower.

Problem 22: *Cond. Pressure 2-10 VDC output will not work.*

Corrective Action:

1 The Chiller module must be a X-13650450-04 or later. Earlier versions did not support this option.

2 Check wiring between transducer (located near the purge) and the Circuit module J7.

3 Faulty transducer (See ***Transducer Checkout procedure)***.

Problem 23: Condenser Pressure Delta-pressure output does not show up.

Corrective Action:

1 In the service settings menu, enable% condenser.

2 The Circuit module must be X-13650451-10 or greater.

3 The chiller module must be X-13650450-09 or greater.

4 Clear language display must be X-13650448-09 or greater.

Problem 24: Cond. Refrig. Temp. Sensor diagnostic, when the displayed Cond. Refrig. Temp. is reading fine.

Corrective Action:

1 Chiller software found in X-13650450-01 Rev. D or earlier mis-diagnosed Cond. Refrig. Press. Replace with new Chiller module.

Problem 25: Condenser and Evaporator entering and leaving water temps. changing rapidly and reading incorrectly, i.e. -25°F to 900°F.

Corrective Action:

1 Bad Chiller module; it must be replaced.

Problem 26: Condenser Water Flow lost diagnostic. Unit will not restart until manually reset.

Corrective Action:

1 Phase A and B Chiller module software were actually an MMR. Phase C (X-13650450-04) changed to a MAR. Time changed from 3 minutes to 4-1/4 minutes.

Problem 27: Capacity limited by current limit

Corrective Action:

1 Correct overload settings.

2 Check for correct number of turns through the CTs.

3 Starter module ct input bad.

4 Defective CT.

Problem 28: Custom menu - Unwanted items that you did not install and you cannot remove.

Corrective Action:

1 The initial problem was if you had installed an option, put it in the Custom menu, then de-

uninstalled it without first removing it from the Custom menu.

Problem corrected on CLD X-13650448-02, Rev. E.

Problem 29: Display is locked up. No communication, Data Not Valid Diagnostic.

Corrective Action:

1 Check the (4) LEDs on the back of the CLD. Left to right.

~ #1 is the Test Light and should be on all the time.
~ #2 is the 5VDC and should be on all the time.
~ #3 is the Transmit and should blink every 2 seconds.
~ #4 is the Receive and should blink continuously.

2 There may be a IPC communication problem with one of the boards. Disconnect the IPC from all modules except leave the IPC connected from the CLD to Chiller module. Start connecting the IPC at one at a time until we find which one is the problem.

3 Check the Chiller module 24 VDC, 5 VDC and 24 VAC.

4 Check the CLD (Clear Language Display) grounding. It has to be grounded from the clear language display to the chassis/back panel.

5 Starter module IPC should not be grounded. Ground is on the Chiller module end. A double ground will lock up the display.

Problem 30: Display on the CLD is flashing.

Corrective Action:

1 The +5V LED should also be flashing.

2 Verify the 24 VAC delivered to the CLD is within range of 20-28 VAC. Disconnect the IPC to verify it is not causing this.

Problem 31: External Chilled Water Setpoint Problems.

Corrective Action:

1 Polarity must be (minus) (plus) on J9 4,5 of the Option module.

2 If the 4-20 MA and the 2-10 VDC are out of range, the active chilled water setpoint source reverts back to front panel and does not work. The 4-20 mA and 2-10 VDC corresponds to 0 to 65°F.

3 Setpoints: SW3-1 should be: OFF for 2-10 VDC and ON for 4-20 mA

4 Chilled Water Reset type is Disabled.

5 Chilled Water Setpoint source is External.

6 Setpoint source override is None.

7 External Chilled Water Setpoint is Installed in machine configuration.

8 Clear any active options module diagnostics.

9 Input type must be selected in the field start-up menu.

10 May need to install an isolation device (DC to DC converter),

11 Set to 2-10 VAC and hook an 8-volt battery to the input to verify the module works.

Problem 32: External Current Limit setpoint does not work.

1. Polarity must be (-, +) on the option module J7 11,12.
2. Isolated 2-10 VDC or 4-20 mA analog input is required. The 2-10 VDC and 4-20mA corresponds to 40% to 120% RLA.
3. SW2,1: OFF for 2-10 VDC and ON for 4-20 mA.
4. Current limit setpoint source: set to external.
5. External current limit setpoint: set to installed.
6. Setpoint type: 2-10 VDC or 4-20 mA. Input type must be selected in the field start-up menu.
7. May need to install an isolation device (DC to DC converter),
8. Set to 2-10 VAC and hook an 8-volt battery to the input to verify the module works.

Problem 33: Fault Relay open on an AFD (air cooled adaptive frequency Drive)

Corrective action:

1. In machine configuration, check for correct starter type.
2. Wiring problem on the drive.
3. 2U2 logic module problem.
4. Starter module.

Problem: 34 Fault relay open on Solid State Starter (SSS)

Corrective action:

1. Bad SSS fault input on Starter module. Replace Starter module.
2. Wiring problem to Starter module.
3. Program correct starter type in machine configuration.
4. Set the correct HPC setting in machine configuration.
5. Replace the HPC.
6. Replace the Circuit module. Faulty HPC input.

Problem 35: Free cooling (FC) operation problems.

Free cooling can be controlled manually from the front panel or automatically via a on/off binary input (called external free cooling switch) at the Options module.

Corrective action:

1. Free cooling can be entered via an on/off switch manually at the front panel automatically via an on/off switch input called external free cooling switch on the Options module J3 5,6
2. Free cooling cannot be entered if the unit is in the stop mode, it has to be entered from the auto mode. You cannot use the Manual vane control in free cooling.
3. If the chiller is in auto, and not running the UCP2 will start the condenser water pump just as with the powered cooling.
4. Once the condenser water pump is running and confirmed. The FC valve relays #1 & #2 and the FC aux relay are all energized. If the FC valve-closed limit switches do not close within 3 minutes, a MMR diagnostic will be generated.

5 If the chiller is in auto and running powered cooling, the chiller will do a normal friendly shutdown when the FC command is given before going into FC.

6 FC can be terminated from either the front panel, external switch input or Tracer.

7 Enable free cooling in machine configuration menu.

8 Install compatible modules.

9 Connect power and IPC to the options module.

10 Defective Options module.

11 Free cooling actuator.

Problem 36: Evaporator Water Temperatures are reversed (2 pass units only).

Corrective Action:

1 Reverse the sensor leads at the module.

Problem 37: Low Evaporator refrigerant temperature

Corrective action:

1 Defective Stepper module.

2 Missing or incorrect wiring to Stepper module.

3 Defective sensor.

4 Unit charge.

Problem 38: 2F1, 2F2 and 2F3 Fuses blow - On 200-575 volt units when switching the starter disconnect from OPEN to CLOSED.

Corrective Action:

See Trane manual *CVHE-CSB-31*

Problem 39: GPM/Tonnage option problems

Corrective action:

1 Correct Flow Coefficients and Exponents settings.

2 Reference Trane service bulletin *CHVE-CSB-45C*. For upgrade modifications, CLD X-13650782-01 or newer is required to see all new screens. Updated chiller module X-13650450-15 or newer is required.

3 Install GPM/tonnage option in machine configuration.

4 Debris in the strainers.

5 Defective transducer.

6 Defective Chiller module.

7 Automatic calibration performed.

Problem 40: High Vacuum Lockout

Corrective action:

1 Select correct refrigerant type in machine configuration.

2 Check and correct oil sump pressure transducer wiring.

3 Program correct local atmospheric pressure.

4 Replace the oil sump pressure transducer.

5 Replace the Circuit module, bad oil sump pressure input.

6 Replace Circuit module. Software improvement in modules X-13650451-12 and greater.

Problem 41: Hot Gas Bypass (HGBP) Does Not Work.

Corrective Action:

1 Module Compatibility:

~ Chiller must be X-13650450-04 or newer
~ CLD module must be X-13650448-05 or newer
~ Option module is X-13650452-01 or newer.

2 Hot Gas Bypass Option must be installed in the machine configuration. Installing HGBP control sets up the display features associated with HGBP.

3 Hot Gas Valve Control in the service test menu must be in the Auto Mode.

4 Hot Gas Bypass Control enabled in the field startup group. With this enabled, the IGV target% screen comes up along with the HGBP timer. Enable and Maximum HGBP time.

5 IGV target% has a default of 10%. This is a good place to start. The goal is to keep the unit out of surge.

6 The Inlet Guide Vane must be closed or at a minimum to go into Hot Gas. Set the guide vane travel stop in the service settings. ROM default is 0%.

7 The Chilled Water Setpoint minus the actual chilled water temperature must be 0.6°F or greater, i.e., Setpoint of 45°F and leaving temperature of 44°F for more than 20 seconds would show the need for Hot Gas.

8 Verify the Hot Gas Timer is installed and max HGBP time is greater than zero.

9 Verify that the module software numbers are being displayed in the Service Test Menu.

10 Verify that the IPC Communications wire is connected to J1 of all modules and we have good 24 VAC and 5 VDC.

Problem 42: *Ice Making*

UCP2 will accept a contact closure (Options module J3 7,8) input to initiate Ice building. When in ice making the compressor will be fully loaded.

Corrective action:

1 Enable ice making in machine configuration.

2 Binary input required on the Options module J3 7,8. If you enter ice making externally or a remote communicated input (Tracer) to initiate ice building.

3 Operator settings:

~ Ice building enable. DO NOT enable this or you will not be able to exit ice building. ROM default is disable. *NOTE: This is typically used by Service to manually enable ice making*.
~ Set Front panel ice termination setpoint. ROM default is 27°F
~ Set the ice making to normal cooling transition timer. ROM Default is 5 min.

4 Ice building shall be able to be terminated by one of three methods:

~ Opening the external ice contacts/remote communicated (Tracer)
~ Satisfying an evaporator entering water temperature setpoint
~ Surging for 15 minutes.

Problem 43: IGV will not move in the Service Test Manual mode.

Corrective Action:

1. Verify the CLD LED comes on solid. Verify there are no Stepper module diagnostics.
2. Verify we are in a Stop mode, Diagnostic Stop mode, or Run mode. All other modes the Manual Vane Control will not work.
3. Is the IGV travel percentage increasing? If so there is a problem with the motor or Stepper module drive circuit.
4. Are we in a "Stop" mode after being in a Limit mode. The limit bit may be set so do a power down to clear.
5. Will not work in post lube or initialization in preparing to start.
6. On power up, does the Stepper module do a BPI search? If not, the Stepper module could be held up in the Initialize mode internally. On a power up, the Stepper module looks for communication with the Chiller, Starter and Circuit modules. If it doesn't hear from any one of them, it stays in the Initialize mode and will not do BPI or Manual Vane Control. If no BPI, check the IPC wiring. Also, if trying to start the chiller, the mode will stay in initialize.

Problem 44: IPC Buffer Diagnostics

Corrective Action:

1. Clear Language Display is not communicating. Replace the CLD or the Chiller module is not communicating and needs replacing.

Problem 45: KW reads high by a factor of 3, with optional PT installed.

Corrective Action:

1. Software change made 11/93 to CLD. X-13650448-02 Rev. E or later corrects the problem.

Problem 46: Loading Problems

Corrective Action:

1. Unit is in External Stop and when released, requires 3.5 minutes to get the vanes to desired point of operation (typically 50 degrees). This is close to the maximum rate that the compressor can load because the fastest the vanes will move is 1250 steps every 5 seconds.
2. If Soft Load Control is Enabled, the Soft Control parameters can be adjusted to meet the requirements of the system. If the chiller is allowed to ramp up faster than needed it could over shoot the leaving chilled water temperature setpoint and potentially be current limited. If this overshoot is too rapid and causes excessive current draw, the adaptive control will force an unload to approximately 70%. This could cycle several times before stabilizing.

   If Soft Load Control is Disabled or the loading is not from initial startup, The LWT Control Proportional, Integral and Derivative gains can be adjusted to allow system adjustment to properly follow the load. Typical changes should be small. 1-2% proportional gain change or 0.01% integral gain changes. Always adjust proportional gain first. This is the coarse adjustment, while integral is the fine and derivative is the micro adjustment.

3 Item 1 reference the mechanical limitation of the stepper motor while the software limitation is a pulldown rate of 5°F/minute of the leaving water temperature. This maximum cannot be overridden.

Problem 47: Memory Error

Corrective action

1 Replace the Chiller module.

Problem 48: Momentary Power Loss (MPL)

Momentary power losses are temporary interruptions in the power being delivered to the motor. The UCP2 monitors MPL by measuring currents from phase A and C and by monitoring the 24 VAC input power to the Starter module (terminals J2 1,2. Since the UCP2 is looking at actual power flow into the motor, it needs the relationship of voltage and current. MPL is active anytime the compressor is running, but not on startup.

Corrective Action:

1 MPL is active for the Run mode, not in the Start mode.

2 CT wiring on J5 of the Starter module must be wired White-Black per print and Phase A must be on Terminals 1 and 2, Phase B on 3 and 4 and Phase C on 5 and 6. CT polarity must be correct.

3 Wrong CTs installed.

4 Check phasing of the supply voltage. The “A” phase must be delivered to J2-2 of the Starter module. 24 volt AC polarity must be correct.

5 Look at the voltage on J2 for noise. J2 should be a smooth 24 VAC sine wave. If we get electrical noise from things such as inverters or high frequency generators, you will see noise blips off the sine wave.

6 Verify the polarity of the CT circuit is correct. For single CT circuits the White wire must be connected to J5-5 with the dot on the CT facing the line. For dual CTs. The “HI” polarity dot on the line CT must be facing the line, the Brown wire from the X-13650266 transformer primary connected to XI and the White wire from X-13650266 secondary connected to J5-5.

7 Verify that there is voltage delivered to the J6 terminal, if not check the HPC circuit, circuit breaker or Starter Interlock.

8 Check for loose wires.

9 Check the wiring from J8 to 2K1 Coil and Auxiliary.

10 Two wiring errors will allow you to start and go out on Momentary Power Loss when the unit loads up. The CTs and 24 VAC may be wired up improperly. As the loading is changed due to vane movement, then MPL may be called. If the unit starts and runs for a period of time before tripping on MPL (on a regular basis), you probably have one of two issues. Either 2 wiring errors (i.e., polarity on J2 and CT wiring error) or line noise on the incoming J2 24 VAC.

11 Defective HPC (high pressure control).

12 PFCCs installed incorrectly.

13 If the unit trips on Momentary Power Loss, vanes stay where they were and then restart without going through a Vane Closure or BPI search, two modules need to be changed:

~ Chiller module needs to be a X-13650450 -04 or newer.

~ Stepper module must be X-13650455-04 or newer.

14 Starter module X-13650453-13 and greater have a less sensitive MPL diagnostic trip point.

Problem 49: Motor winding temperatures changing rapidly and randomly.

Corrective Action:

1. Electrical noise problem in the Circuit module. X-13650451-04 Rev. D or later corrects the problem by adding a filtering circuit.

Problem 50: Differential Oil Pressure Calibration Diagnostic following post lube. Secondary problem may be the oil pump will not shut off after post lube.

Corrective Action:

1. Diagnostics are active in all non-running modes and the unit has been off for 5 minutes. The UCP2 calibrates the oil pressure sensors and if an error is found greater than 3 PSID a diagnostic is called out.

   ~ Sensors

   ~ Changing system pressures caused by such things as a pressure or changing water temperatures.
2. If the oil pump is running and will not shut off in post lube, the problem is a wiring error on the Starter module. One or both of the following apply.

   ~ 115 VAC is connected to terminal J6-3 of the Starter module. Check to see if it was connected incorrectly to Terminal J3-1.

   ~ Terminal J8 on the Starter module. J8-1 (Wire #13) goes to the 2K1 Contactor. J8-2 (Wire #15) goes to 2K1 Auxiliary. Check to see if Wire #13 and Wire #15 are reversed.

Problem 51: Differential Oil Pressure

On Circuit module revision X-13650451-13 and newer, has a positive oil pressure trip at 2/3 the setpoint with a default setpoint 12 psig and a minimum of 9 psig setpoint.

Corrective Action:

1. The Circuit module was clearing the 3 minute oil pressure establish timer during a remote RESET. This would result in an Oil Pressure Overdue diagnostic. (Exists for Circuit modules X-13650451-06 and earlier).
2. Faulty oil pump motor.
3. Faulty 1F2 fuse.
4. Faulty Circuit module relay output.
5. Faulty oil pump capacitor.
6. Faulty oil pump sensor and/or wiring.
7. Clogged oil filter.
8. Faulty oil pressure regulator.
9. Differential oil pressure when the unit is off. The unit sees current due to Feedback via the PFCCs or CTs. We get a starter interrupt failure. The UCP2 thinks the motor is running and brings on the oil pump and logs differential oil pressure diagnostics.

Problem 52: Oil temperature High.

Corrective action:

1 Check oil temperature setpoint in service settings.
2 Bad Circuit module heater relay output.
3 Defective oil temperature sensor.
4 Compressor bearings.
5 Oil cooler.

Problem 53: Oil temperature Low (Startup)

Corrective Action:

1 Defective Circuit module relay output.
2 Oil temperature sensor.
3 Replace oil heater.
4 Raise the oil temperature setpoint.
5 Excessive refrigerant in the oil. Check the oil eductor valve. It should be 2 turns open.

Problem 54: Low Oil Temperature (Running)

Corrective Action:

1 The refrigerant pump shaft seal is leaking. Remove the refrigerant pump volute and impeller. Check and replace the shaft seal.
2 The oil tank is being flooded with excessive refrigerant. Check the oil eductor valve (evaporator to oil tank line) at the evaporator. Close it and open 2 turns. If the chiller is exposed to outside ambient/cold temperatures, it may be overcooling the oil/tank, in which case the tank needs insulating.
3 The oil tank heater is off when the unit is running (*Trane Service Alert 206*). A UCP2 software change was made 6/98 so that the chiller is allowed to operate at a condition of saturated evaporator temperature plus 30°F. Take this into consideration when diagnosing this problem. Look at the saturated evaporator temperature to see where your are in operation.

Problem 55: Enhanced oil temperature function not working.

Correction Action:

1 Enable enhanced oil temperature in the service setting menu (the default is enabled.) If enhanced oil temperature is disabled, you will get two additional screens to set oil temperature setpoint and low oil temperature setpoint.
2 Chiller module X-13650450-12 or greater is required.
3 Circuit module X-13650451-13 or greater is required.
4 CLD X-13650448-11 or greater is required.

Problem 56: Oil Pump Discharge Pressure Sensor Diagnostic and Oil Pressure Calibration. Corrective Action.

Chiller is in a high vacuum where one or both of the transducers reads -14.9 psig.

This is out of range and thus a sensor diagnostic is being called. The diagnostic may be cleared once the chiller is charged.

Problem 57: Over/Under Voltage Diagnostic on Startup.

Overvoltage is a + 10% must hold and +15% must trip. Undervoltage is a must hold –10% and must trip –15%.

Corrective Action:

1 Check main power supply and wiring.

2 You may get the diagnostic with the following Setup Sequence.

~ Unit Line Voltage enabled in Machine Configuration.
~ Under/Over Voltage is enabled in Field Startup.
~ If you then disable Unit Line Voltage, the Under/Over Voltage screen disappears but is still active. You have to then re-enable Unit Line Voltage in Machine Configuration and disable Over/Under Voltage.

3 Over/Under Voltage is used only with PTs installed. If you enable the option with "No" PTs installed you will get the diagnostics.

4 When the Line Voltage Sensing Option is not installed, the Unit Line Voltage menu item is not displayed nor is the Under/Over Voltage option installed.

Problem 58: Phase Loss

There are 2 variations of this diagnostic:

Less than 10% current was sensed on one or more of the current Transformer inputs. Time to trip is 1 second minimum, 3 seconds maximum. This is a MMR diagnostic.

A second and less common method of receiving phase loss diagnostic is via the phase reversal protection circuit of the Starter module. Phase rotation protection is enabled and either the Phase A current signal or the Phase C current is less than 5% of the CT rating, then phase loss will be called out. Time to trip is 0.7 seconds for CTV during start.

Corrective Action:

1 CT hooked incorrectly relative to incoming power.

2 Defective Primary CT (See ***CT Checkout Procedure***).

3 120 VAC missing from the Stop Relay circuit on J6 of Starter module.

4 Defective High Pressure switch. Wire may be off.

5 Problem in the Start Relay circuit on J8 of Starter module. Check all connections and circuit.

6 Verify currents are over 10% RLA.

7 Check the current overload settings.

8 Defective Starter module.

9 Turns through the CTs may be incorrect.

Table 1
CT's for more than 600V or more than 936A systems:

Motor RLA	CT Part Number	CT Terminal Connections	Number of primary turns
8.0-11.9	X-13580272-01		3
12.0-17.9	X-13580272-01		2
18.0-23.9	X-13580272-02		2
24.0-35.9	X-13580272-01		1
36.0-47.9	X-13580272-02		1
48.0-72.0	X-13580272-01		1
24-36 A	X-13580048-01	X1 to X2	3
28-43 A	X-13580048-01	X1 to X3	3
36-54 A	X-13580048-01	X1 to X2	2
43-64 A	X-13580048-01	X1 to X3	2
48-72 A	X-13580048-01	X1 to X4	2
60-90 A	X-13580048-02	X1 to X2	2
72-108 A	X-13580048-01	X1 to X2	1
86-129 A	X-13580048-01	X1 to X3	1
96-144 A	X-13580048-01	X1 to X4	1
120-180 A	X-13580048-02	X1 to X2	1
144-216 A	X-13580048-02	X1 to X3	1
168-252 A	X-13580048-02	X1 to X4	1
192-288 A	X-13580048-03	X1 to X2	1
240-360 A	X-13580048-03	X1 to X3	1
288-432 A	X-13580048-03	X1 to X4	1
336-504 A	X-13580048-04	X1 to X2	1
384-576 A	X-13580048-04	X1 to X3	1
480-720 A	X-13580048-04	X1 to X4	1
480-720 A	X-13580047-02	X1 to X2	1
576-864 A	X-13580048-05	X1 to X2	1
576-864 A	X-13580047-02	X1 to X3	1
720-1080 A	X-13580048-05	X1 to X3	1
720-1080 A	X-13580047-02	X1 to X4	1
864-1296 A	X-13580047-01	X1 to X2	1
1008-1512 A	X-13580047-01	X1 to X3	1
1200-1800 A	X-13580047-01	X1 to X4	1

10 Defective SCR in a solid state starter.

11 Clean or replace contactor contacts

12 Check the Starter Wiring diagram for other components i.e., power monitoring devices that may be causing phase loss.

13 The Starter contactors may be too slow to respond to the Start signal. Disabling the phase rotation will give us more time by taking out the 0.7 highly aggressive circuit but keeping in the primary phase protection. For Starter software X-13650453-04 Rev. K, the time for detection of the highly aggressive circuit changed from 0.3 to 0.7 seconds.

Problem 59: Severe Phase Unbalance

Three currents supplied to the Starter module are monitored for unequal Amp draw. An imbalance in the motor amp draw can cause the motor windings to heat up. This protection can not be disabled or removed. The Starter module phase unbalance protection was made less aggressive in starter module X-13650453-09 or later, when the current unbalance trip point was increased from 25% to 30%.

Corrective Action:

1 Check for defective or incorrect CTs.

2 Replace Starter module with improved software with X-13650453-08.

3 Replace Starter module, for possible bad CT input.

4 Local power company problem.

Problem 60: Phase Reversal

Corrective Action:

Phase Rotation Protection is based on clockwise ABC Phasing. UCP2 picks up current phasing through the Starter module Terminal J5. Four possible causes are:

1 Phases actually reversed

2 Noise on the Link which may inject an illegal state

3 Bad contactor or all the lighting on (1) circuit/phase or (2) of the CT wires reversed on J5.

4 Two of the CT wires reversed on J5.

Problem 61: Printer will not work.

Corrective Action:

1 Verify printer is compatible with a serial 9 pin RS232.

2 Verify printer setup in the CLD is correct. Machine Configuration Menu: Printer Option is Installed. Service Settings Menu: Set Baud Rate, Parity, Data Bits, Stop Bits, Handshaking. For Handshaking: XON/XOFF is recommended.

3 Verify the printer settings match the CLD setup. Baud Rate, Parity, Data Bits, Stop Bits, and Handshaking must be the same as in the CLD.

4 Verify the printer interface is working properly.

~ Verify there is IP communication

~ RxA (Green LED near J1) is IPC receive and should be blinking

~ TxA (Red LED near J1) is IPC transmit and should not be blinking

- ~ Diagnostic LED (Red) is OFF
- ~ Check DIP switches, they should be OFF-OFF-ON
- ~ RxB (Green LED near J3) is printer receive and should be OFF
- ~ TxB (Red LED near J3) is printer transmit and blinks only when printing

5 Check the printer cable. Usually a 9-25 pin cable with RX (receive) to Rx, and Tx (transmit) to Tx connections.

6 Try to print manually (in Operator Settings menu).

Problem 62: Purge Compressor will not run in the manual "ON" mode.

Corrective Action:

1 In the Operator Setting menu, select "ON" for Purge Operating Mode. Note that "ON" means that the purge compressor and condenser fan will run. The pumpout motor will run only when the Purge Suction temperature gets below 18°F and turns off when the temperature gets above 22°F.

2 If you get "Purge Pumpout Rate Exceeded" message then go to the Service Settings menu, go to Field Startup Group and set "Purge Service Excessive Pumpout Outride Timer" to the amount of time you would like the pump-out motor to run without it incrementing the pumpout rate. The maximum allowed time is 72 hours. When this time is reached, you will get the "Max Pumpout Rate Exceeded" message.

3 Clear all purge diagnostics.

Problem 63: Sensor errors

You may get sensor errors such as: evaporator water temperature, condenser water temperature, outdoor air temperature, condenser or evaporator refrigerant temperature sensor.,motor temperature, discharge temperature, oil temperature or purge suction temperature.

Corrective Action:

1 Check sensor installation.

2 Replace sensor.

3 Check all sensor wiring and connections. Depending on the sensor and which module it connects to, you may have a bad module such as the Chiller, Stepper Circuit Or Purge.

Problem 64: Transition resistors stay in too long.

Corrective Action:

1 If the J8 terminal on the Starter module is loose, the control does not latch in and extends the timing keeping the resistors in longer. Reference *Trane Service Bulletin CVHE-CSB-35*.

Problem 65: Setpoints are not being stored, service tests will not work and we are calling many diagnostics on the CLD.

Corrective Action:

1 IPC to Starter module disconnected or reversed.

2 Starter module not powered up.

3 One wire of the IPC is not connected.

Problem 66: Starter Contactor Interrupt Failure Diagnostic when powering up the UCP.

Corrective Action:

1. Starter module is sensing motor current greater than 10% RLA when motor should be OFF on a power up or in OFF state.
2. Starter module is sensing motor current greater than 10% RLA .68 Sec. after initiating a shutdown.
3. Look at phase currents as read in the Compressor Report.
4. If power factor correction capacitors (PFCCs) are used, these capacitors should be placed on the motor side of the 2K1 and 2K2 contactors so as to be disconnected from the line when the motor is off.
5. Replace the Starter module. Could be a software problem or bad module.
6. Contactor or contactor wiring problem.

Problem 67: Starter Dry Run Test Diagnostic upon entering a Starter Dry Run Test.

Corrective Action:

The Starter module is sensing either the presence of line voltage from the PTs or line current from the CTs.

Problem 68: Starter Dry Run will not work.

Corrective Action:

1. If the PTs are installed, they sense voltage and prevent dry run.
2. A major diagnostic is present.
3. Unit is not in Stop mode.
4. Starter senses the presence of currents.
5. There is a MMR diagnostic present.

Problem 69: Starter Fault type 1, 2 or 3

Corrective Action:

1. Program the correct starter type in the machine configuration menu.
2. Repair or replace contactors.
3. Replace Starter module. Possible faulty relay output.
4. Starter panel wiring.
5. Check CT connections to the Starter module.

Problem 70: Stepper motor is humming.

Corrective Action:

While in the hold mode, the stepper motor is driven with 1.0 amps. This is the case even if the actuator is fully closed. The humming is normal.

Problem 71: Extended surge

Corrective action:

1 Unit operation conditions resulting in surge, such as: high head, air in the unit, condenser tube fouling, low water flow, low charge and condenser water temperature vs. design. Unit operation conditions is the most likely cause.

2 Replace Starter module. Faulty CT input.

3 Stepper motor and/or linkage.

4 Replace options module. Bad head relief request relay.

5 Guide vane linkage.

6 Replace Starter module with more sensitive one (X-13650453-17 or greater).

Problem 72: Pressure Transducer shift in calibration. Diagnostics will be sensor calibration related such as sensor failure or oil pressure sensor calibration.

Corrective Action:

1 Wired incorrectly. Check diagram.

2 Corrosion on transducer contacts.

3 Bad transducer.

4 Disregard diagnostics when the unit is a deep vacuum prior to charging.

Problem 73: Rapid Time of Day Scrolling or Date jumps back one day.

Corrective Action:

1 Problem one is rapid time of day and year scrolling. The problem is in the CLD software when we reach December 29, 30 and 31. Fix: Replace the CLD (Local Clear Language Display) with a X-13650448-03 or newer. To stop the scrolling, press Enter to get a valid date and set before or after Dec. 29/30.

2 Problem two is when the date jumps back one day. The date of January 4,1995 is set and it jumps back to January 3, 1995. This is because 1996 is a leap year and the problem only exists on the year prior to leap year. Replace the CLD with a X-13650448-03 or newer.

Problem 74: Unit did not Transition diagnostics.

Corrective Action:

1 Do a Starter Dry Run Test.

2 Check for 24 VAC input to all modules.

3 Check for 24 VDC and 5VDC on the Starter module.

4 Check all wiring and connections.

5 Check for 120 VAC on the Starter module J4-1 and 2. J4 is an OPTO input circuit that recognizes transition complete. If there is no signal on J4, the unit will not transition.

6 Replace bad Starter module.

Problem 75: Tracer Diagnostics e.g.,Tracer loss of comm with options, starter, etc. as well as other Tracer related diagnostics.

1 Check the IPC wiring connections on the related module with diagnostics.

2 Check tracer to UCP wiring/connections.

3 Make sure the Tracer module is installed, wired correctly and powered up.

4 Set the chillers ICS to match Tracer. Check the Tracer dip switch settings: Tracer Comm 3 should be: “OFF OFF OFF” and Tracer Comm 4 should be: “OFF ON OFF”

Problem 76: Unit Tons Read-out on CLD does not work.

Corrective Action:

1 On the original design up to mid-1998 (with the reversing solenoid valve and plastic piping):

~ Verify that the condenser solenoid is connected to the condenser.
~ Verify that the entering port of the solenoid goes to the entering water line.
~ Verify that the leaving port of the solenoid goes to the leaving water line.
~ With the solenoid de-energized, the entering water line is monitored.
~ Verify that the Evaporator Solenoid is connected to the evaporator.

2 With the new electronic version mid-1998 on (does not have the reversing valve or plastic piping): reference *Trane Service Bulletin CVHE-CSB-45B*.

~ Check for fault transducer.
~ Check y-strainer.
~ Check wiring.
~ Check coefficients in the service settings menu.
~ For an open system, follow special procedures in *Trane CVHE-CSB-45B*

Problem 77: Unknown diagnostics 1217 informational warning.

Corrective action:

1 You have a newer Chiller and Starter module and an OLD clear language display (CLD). Install a new CLD to read the diagnostics.

CVHE/F/G Trim Balance Procedure

This procedure outlines the modifications necessary to the Starter module to allow operation of the motor in the Wye configuration during test runs.

1 Unplug the connector from J10 to prevent the run contactor from coming in.
2 Unplug J14 to prevent transition from occurring.
3 Install a jumper on J12 between terminals 1 & 3 to maintain the shorting contactor closed.
4 Install a jumper through an on/off switch across J6 1,3 to start and stop the motor.

Run Procedure:

1 Lockout power to the chiller to prevent startup, until ready.
2 When ready for the run test, energize power to the chiller. The shorting contactor should close. The motor will be controlled by the Auto push-button on the UCP2 Clear Language Display. Stop will be controlled by the switch on J6.
3 Program the inlet guide vanes to zero target.
4 With the chiller in the “panic stop” mode, press Auto.

Start sequence:

1 Go to the service test menu and put the oil pump to the ON position. This will assure lubrication while the stop signal is bypassed via the J6 Switch.
2 Normal start.
3 During acceleration, close the switch across J6.

Stop/Reset sequence

1 Open the switch across J6.
2 Allow the chiller to coast down.
3 Lockout the chiller.
4 Restore the oil pump to Auto.

Sensor And Transducer Operating Ranges

Temperature range on sensors: 140°F to 212°F ± 2.5°F

Transducer range: 0 to 35 psig.

Temporary Forced Unload Setup

The following will work if you have the need to temporarily unload the unit for a specific requirement.

1 Set the front panel current limit setpoint at your requirements, (say 40%)
2 Set the current limit setpoint source to external source.
3 Provide a 10 VDC or 20 mA input signal to J7 11,12.
4 Provide a binary switch to enable/disable the input to J7.
5 With the binary switch closed the unit will operate with a 100% current limit.
6 With the binary switch open the unit will operate with a 40% current limit.

Communications Test

A communications test is included in the CLD to check the Chiller-to-CLD communications.

To access the communications test:

1. Press the ‘Service Test’ key.
2. For the password, press ‘Next’ and ‘+’ keys at the same time.

This screen can be used as a debugging tool when CLD-Chiller IP communications are suspect. The first line on the screen indicates which Chiller packets the CLD is checking. The second line on the screen indicates how many times in a 15 second interval the particular packet was received by the CLD. If a packet is received more than 9 times in the interval, a ’+’ is displayed. The counters are reset to 0 every 15 seconds. Hitting any key while on this screen will cause an exit.

```
Packet #:   2 3 4 5 6 7 8 9 10 11 12 14 15
Received:   x x x x x x x x x  x  x  x  x
```

Troubleshooting IPC Communication Diagnostics

1. Check the IPC connections to all modules. Make sure the twisted pair wires that plug into each modules' J1 connector are making good contact with the wire. Be sure each connector is not clamping down on the wire insulation.
2. Verify that the polarity of the IPC link is correct. The twisted pair IPC link is two color twisted pair wire. Be sure the same color wire is on top for each twisted pair connection.
3. Using a voltmeter set to AC volts, measure the voltage at the J2 connector on each module. It should read between 20 and 28 VAC. Also check the green connector to make sure it is securely plugged into the module. Inspect each screw terminal to be sure they are not clamping down on the wire insulation.
4. Most of the UCP2 modules have 24 VDC and 5 VDC test points on the board. They are clearly labeled and accessible without removing the sheet metal covers. For the Starter and I/O modules, the test points are located in the upper left hand corner of the module. For the other modules, they are located on the upper right hand corner of the module.

Using a voltmeter set to DC volts, measure the 5 volt test point. It should be between 4.75 VDC and 5.25 VDC. Measure the 24 volt test point. It should be between 23 VDC and 25 VDC. **Note: The I/O module's 24 VDC test point will read 0 VDC.** If any of the voltage measurements are not within the acceptable range, replace the module.

5. Verify that a good ground exists between all modules. The CLD requires a dedicated green wire ground. Verify this is in place, and has a good connection. Paint may need to be scraped away to insure a good connection.
6. **For remote starters only:** It is very important that a good ground exists between the starter panel and the chiller control panel. Use a continuity checker to verify a good ground exists between the two panels. If there is not a good ground, run a dedicated ground wire between the starter panel and the control panel.

For a "No Communication, Data Not Valid" message on the Clear Language Display:

1. Perform the above checkout procedure.
2. If the message still did not go away, unplug all of the IPC connections from the Chiller module except for the IPC link that goes to the Clear Language Display.
3. Establish communication with only the Chiller module and then plug the other IPC connections back onto the Chiller module one at a time. If the "No Communication, Data Not Valid" message suddenly reappears when you plug one of the connections back in, you have identified the IPC link that is causing the fault. Carefully check that link for a lead to lead short or a short to ground.

For a "Loss of comm with Stepper" diagnostic:

1. Make sure the wiring to the stepper motor is correct. If the wiring is not correct it will destroy the power supply on the module, and a loss of comm with Stepper will result.

The Correct stepper wiring follows:

Table 2
Stepper Motor Connections

J6 or J8 Connector Pin# on Stepper Module	Motor Winding Output Signal Name	RTH 34X1BEHH Motor Terminal Connection	CTV, ABS M091-FD8109 Motor Terminal Connection
4	1+	1	3
3	2+	3	5
2	1-	2	1
1	2-	4	4

Heat Sink Temperature

This temperature is monitored on the Cutler-Hammer Solid State Starters Only. The Starter module monitors the Solid State Starters Heat Sink Temperature, displays it in the compressor report on the Clear Language Display, and provides a Heat Sink Temperature Start Inhibit mode. The Start Inhibit Temperature is ROM based (Not adjustable at the Human Interface) by Solid State Starter, and Chiller size.

Chiller Nameplate RLA	SSS Heat Sink High Temp. Start Inhibit
0-200 Amps	67°C (152.6°F)
201-360 Amps	77°C (170.6°F)
361-560 Amps	77°C (170.6°F)
561-700+ Amps	78°C (172.4°F)

On a call for cooling if the heat sink temperature is above the value shown in the table above the unit shall enter the Heat Sink Temperature Start Inhibit mode until either the heat sink temperature drops 1.8°F (1°C) below the Start Inhibit Temperature, at which time the unit will complete the pre-start procedures and start, or there is no longer a call for cooling.

The heat sink temperature sensor connects to Starter module terminals J7-1 and J7-2.

Module Compatibility

UCP2 Module Compatibility

1. Chiller modules X-13650450-02 or greater when installed in a system with a CLD of X-13650448-01 will call out a diagnostic of (Unknown Diagnostic 905). The machine requires a CLD of X-136504489-02 or greater.
2. Starter module X-13650453-02 and greater requires Chiller Packet 20.
3. Chiller module X-13650450-01 does not support Packet 20. You need a Chiller module of X-13650450-02 or greater along with the Starter module X-13650453-02 through 6 or you will get a diagnostic of starter loss of communication with chiller. Beginning with Starter module X-13650453-07, the Starter module no longer expects to receive Chiller Packet 20.

   Chiller module X-13650450-03 and earlier do not have the bit that the Stepper module looks for to determine if it should do an inlet vane motor BPI search on startup. These modules will do a BPI search on each startup.
4. TCI COM3 module X-13650460-01, the TCl packet time to receive the information from Tracer is 15 seconds. The information is sent out every 10 seconds and you may get repeat (IFW) informational warning diagnostics filling up the diagnostic logs. TCI COM3 module X-13650460-02 or greater is required.
5. To read evaporator approach temperature, you need a CLD of X-13650448-04 and later along with a Chiller module of X-13650450-04 and later.
6. See *Trane service bulletins CVHE-SB-90 and 91* for additional module compatibility information.

Description of UCP2 Options

1. Tracer Communications Interface Module (Com 3 Module)

This option must be ordered if the chiller is to communicate over a serial communication link to a TRACER 100.

2. Tracer Communications Interface Module (Com 4 Module)

This option must be ordered if the chiller is to communicate over a serial communication link to a Tracer Summit.

3. Remote Clear Language Display Module

Enables the UCP2 to communicate serially with the remote CLD.

The remote CLD panel (COPT:RCPL) communicates serially with 1-4 UCP2-equipped chillers that have the optional remote CLD. The local CLD Stop command function has precedence over the remote function. The Custom Report and display language at the local CLD and remote CLD are independent.

4. Options Module

The Options module is required to implement any/all of the following control options. Some require additional sensor/transducers.

(a) Chilled water setpoint by external/remote source. Allows a remote source to set the chilled water setpoint via 4-20 mA or 2-10 VDC signal. The range is 0°F to 65°F.

(b) Current limit setpoint by external source. Allows a remote source to set the current limit setpoint via a 4-20 mA or 2-10 VDC SIGNAL. Range is 40% to 120%.

(c) Compressor percent (%) RLA output Allows a remote system to receive a 2-10 VDC signal proportional to the chillers % RLA. Range is 0% TO 120%.

(d) Head relief request output. Allows a remote system to receive a binary signal for use with compressor surge protection and condenser limit by requesting lower entering cond. water temp. This option requires an additional transducer on the condenser.

(e) Maximum capacity output. Allows a remote system to receive a binary signal indicating the chiller is at maximum capacity.

(f) Heat recovery/auxiliary condenser entering and leaving water temperatures. This option includes the Options module. Allows UCP2 to monitor the entering and leaving heat recovery or auxiliary cond. water temps which are displayed at the local CLD.

(g) Free cooling machine mode enable/disable and valve control. Allows a remote source to re-enable/disable the chillers free cooling.

5. Printer Interface Module

This option must be ordered if the UCP2 is to have a direct connect serial printer. The printer and cable must be ordered separately. This option includes ASHRAE Guideline 3 Report.

6. Chilled Water Reset Outdoor Air Temperatures

Provides for outdoor air temperature reset of the UCP2 front panel chilled water setpoint. Includes display of outdoor air temperature.

7. Water Pressure Sensors For Evap And Cond System Pressure Less Than 150 Psig.

Includes sensing of the entering and leaving water pressures of the evaporator and condenser, factory-mounted in the water boxes. The Options module is not required. The following data will be shown:

~ Entering/leaving evaporator & condenser water pressure (psig)
~ Evaporator and condenser differential water pressure (psid)
~ Evaporator/condenser GPM
~ Evaporator tons (Approximate)

Water Pressure Sensors For Evap And Cond System Greater Than 150 Psig includes sensing of the differential evaporator and condenser water pressures. The Options module is included and required. The following data will be shown:

~ Evaporator and condenser differential water pressure (PSID)
~ Evaporator/condenser GPM
~ Evaporator tons (Approximate)

8. Bearing Oil Temperature Sensors

Includes factory installed sensors and safety cutouts (On high temp) to monitor the leaving bearing oil temperature: Sensor (#1) monitors the journal bearing temperature and Sensor (#2) monitors the Thrust bearing temperature.

9. Phase Voltage Sensors

Includes factory installed potential transformers in the starter for monitoring/displaying phase voltage and this provides over/under voltage protection. The following is displayed: Compressor phase voltage, Kilowatts, Power Factor.

10. Enhanced Condenser Limit

Includes factory installed cond pressure tranducer, piping and wiring.

Provides enhanced high pressure cut-out over cond limit which is standard.

The head relief request relay will energize when cond. limit is approached. The Options module is included.

11. Discharge Temp Sensor

Includes a factory installed sensor and safety cutout on high compressor discharge temp. Allows the UCP2 to monitor compressor discharge temperature. When the chiller is selected with hot gas bypass this sensor is included.

12. Starter By Others

When the starter is being furnished by others, Trane furnishes the Starter module in the UCP2, and other wiring/components as needed. The starter must be built per Trane starter specifications.

UCP2 Modules

Chiller Module

1U1 is the "Master module," collecting data, status conditions, diagnostic information, etc. from modules (over the IPC link) from sensors and remote contacts and, in turn, communicating commands to other modules.

1U1 performs leaving water temperature and limits control algorithms, trading off chiller capacity against various "limits" that the chiller may be working against. 1U1 checks for valid setpoints and identifies unit type for other modules.

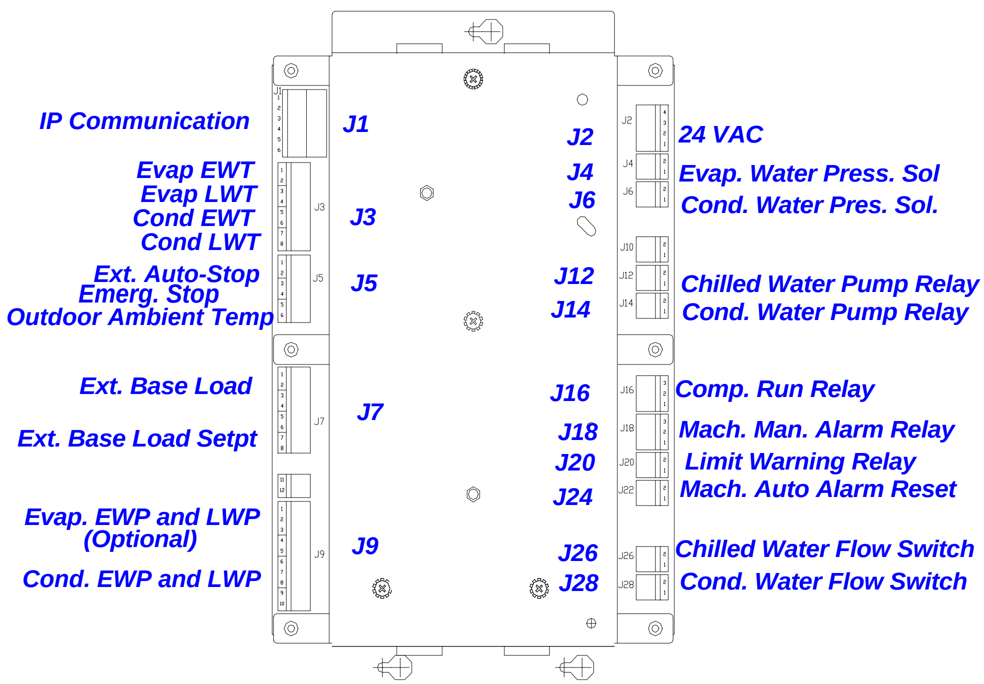
Low Voltage (<30VAC) Inputs:

> 24 VAC, IPC Links to Internal, to Purge and to Starter modules; Evap. EWT and LWT; Cond. EWT and LWT; External Auto Stop; Emergency Stop; Ambient Air CWR; Heat Pump Control; Evap. Water Delta P; Cond. Water Delta P

High Voltage (>30VAC) Outputs:

> Evap. Water Pressure Solenoid; Cond. Water Pressure Solenoid; Evap. Water Pump Relay; Cond. Water Pump Relay; Compressor Run Relay; MMR Alarm Relay; MAR Alarm Relay; Limit Warning Relay

Figure 2
Chiller Module



Circuit Module

1U2 assigned functions associated with compressor motor, lubrication system and refrigerant monitoring.

Low Voltage (<30VAC) Inputs:

- 24 VAC, IPC link
- Compressor motor winding temp. sensors 1, 2, 3
- Oil tank temperature
- Refrigerant monitor equipment room ppm level
- Condenser refrigerant pressure
- Oil sump pressure
- Oil discharge pump pressure

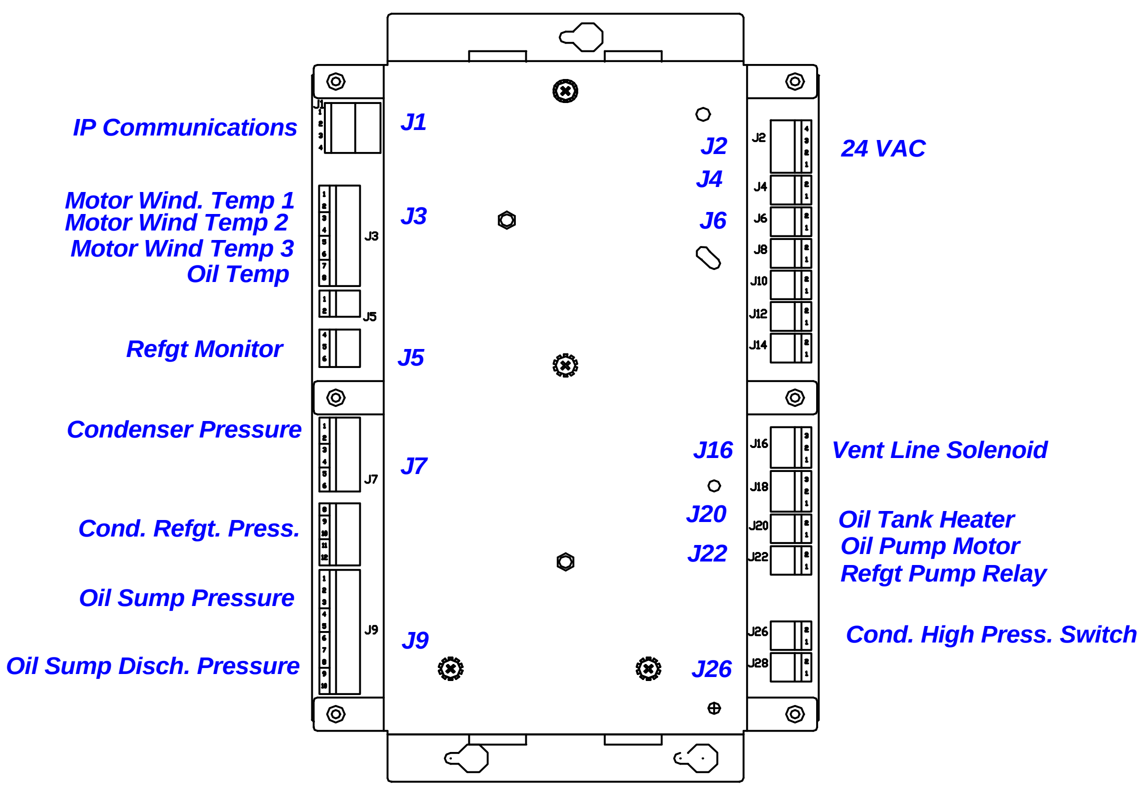
High Voltage, High Amperage (120 VAC) Inputs:

- High Condenser Pressure

High Voltage, High Amperage (120 VAC) Outputs:

- Vent line solenoid valve; oil tank heater; oil pump motor

Figure 3
Circuit Module



Input/Output Module

Provided only when chiller is equipped with Hot Gas Bypass (HGBP) option.

The I/O module (1U10) 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.

Low Voltage (<30VAC) Inputs:

115 V HGBP valve drive signal

High Voltage (>30VAC) Inputs

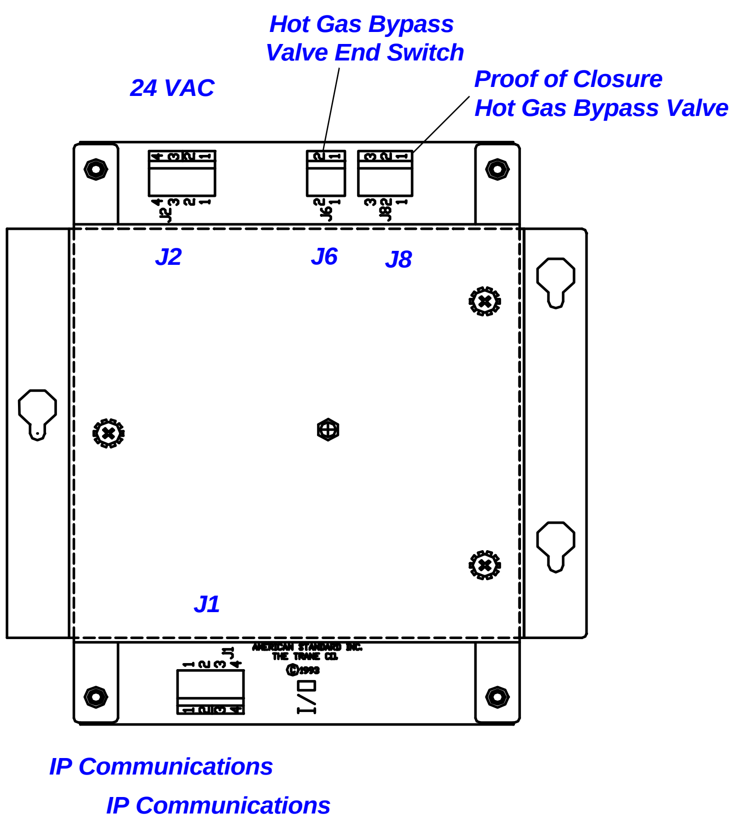
10 V HGPB valve proof-of-closure signal from valve end switch

High Voltage (>30VAC) Outputs:

HGBP Open Triac

HGBP Close Triac

Figure 4
Input/Output Module



Options Module

As its name indicates, 1U5 provides the control or interface requirements for many of the options available with the UCP2.

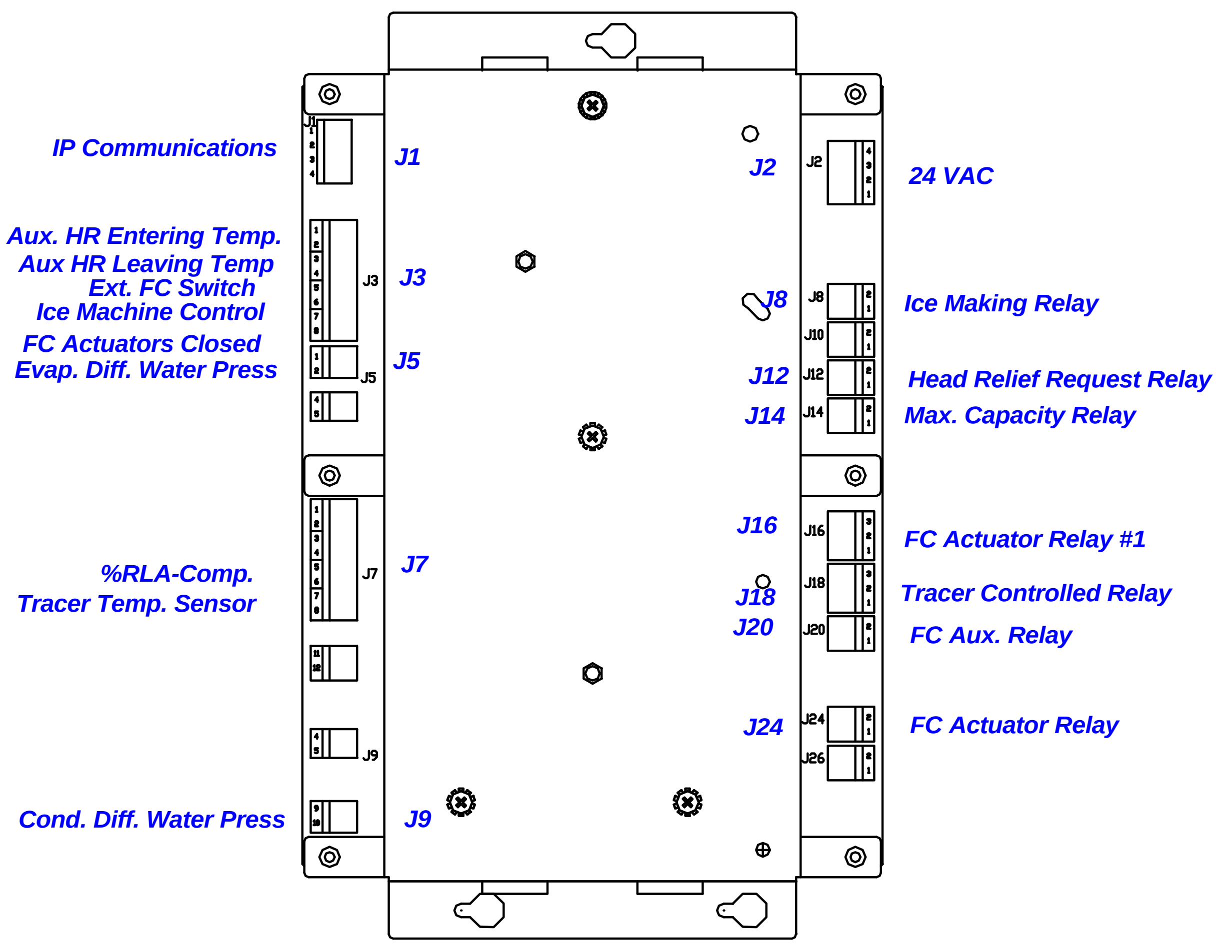
Low Voltage (<30VAC) Outputs:

- Heat Recovery Actuator
- % RLA Compressor

High Voltage (>3OVAC) Outputs:

- Ice-Making Relay; Head Relief Request Relay; Max. Capacity Relay
- Free Cooling Actuator Relay 1 (Liquid Line Valve)
- Free Cooling Auxiliary Relay
- Free Cooling Actuator Relay 2 (Gas Line Valve)

Figure 5
Options Module



Purge Module

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

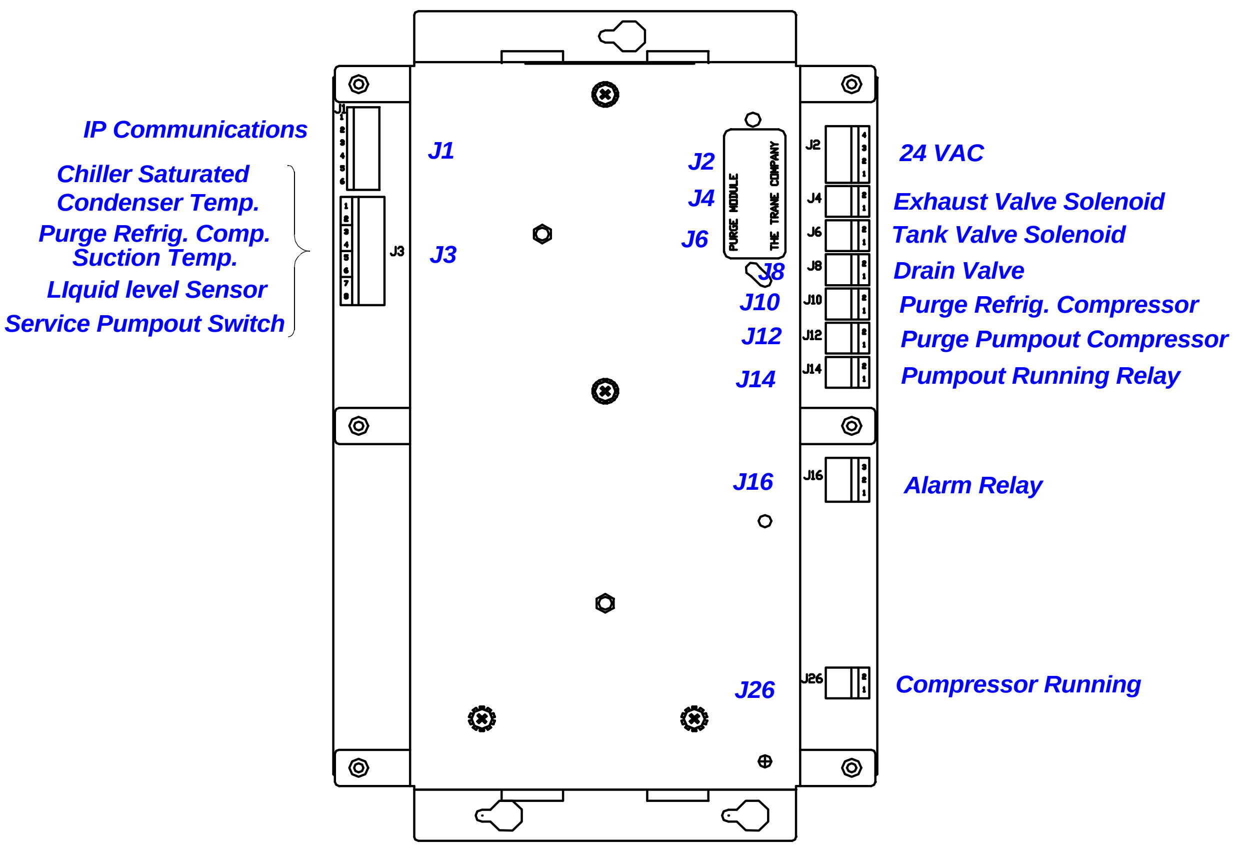
Low Voltage (<30VAC) Inputs:

- 24 VAC; PC link to Chiller module
- Purge refrigeration compressor suction temperature
- Purge tank liquid level sensor
- Service pumpout switch

High Voltage (>30VAC) Outputs:

- Exhaust valve solenoid; tank valve solenoid
- Purge refrigerant compressor purge pumpout compressor
- Purge pumpout running (Tracer); purge alarm

Figure 6
Purge Module



Starter Module Values

The starter module (2U1) is present in all Trane-provided starter panels, whether unit-mounted or remote. For CTVs, if no Trane starter is provided and the customer is providing the starter, 2U1 is mounted in an extension of the unit control panel. It is still designated as 2U1.

2U1 controls the starter when starting, running and stopping compressor motor and provides an interface to all types of starters and AFDs (adjustable frequency drives).

2U1 provides compressor motor protection for running overload, phase reversal, phase loss, phase unbalance and momentary power loss.

Low Voltage (<30VAC) Inputs:

> 24 VAC; IPC link to chiller module; phase voltages (optional); phase currents; solid-state heat sink temperature (optional); starter driver fault.

Low Voltage (<30VAC) Outputs:

> Speed signal output (0-10 VDC - optional)

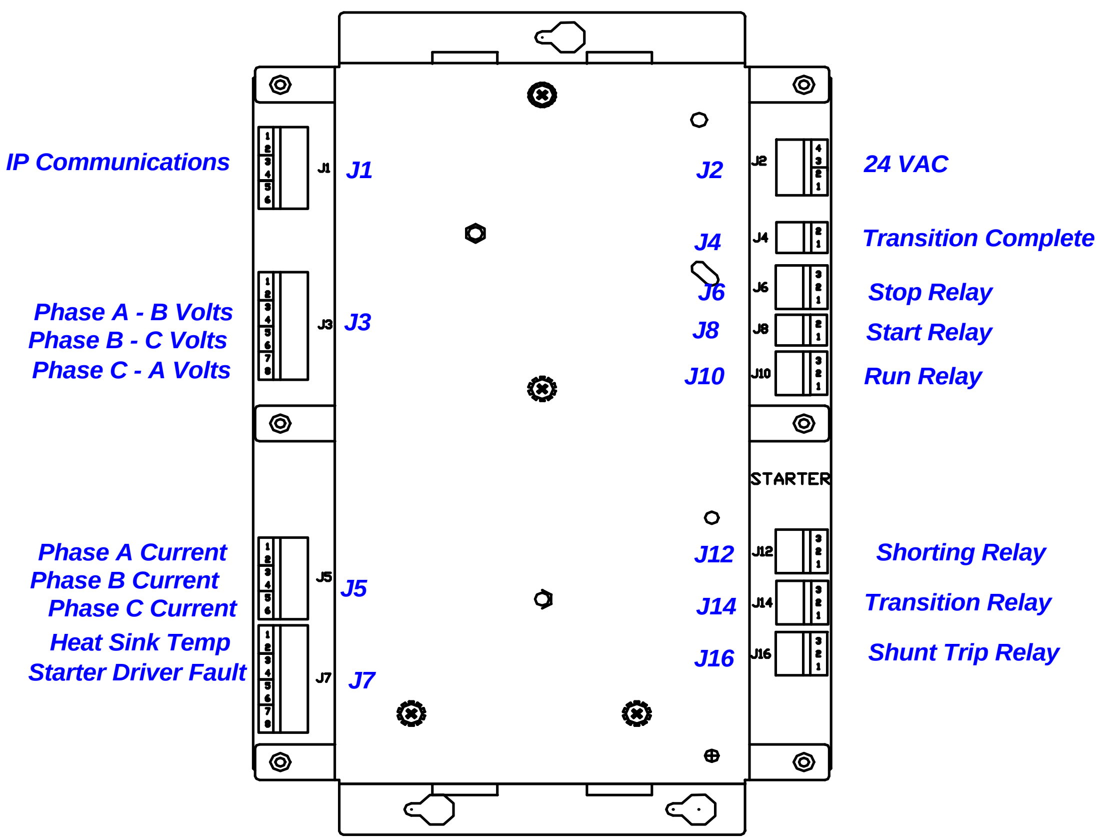
High Voltage (>30VAC) Inputs:

> Transition complete CTV only)

High Voltage (>30VAC) Outputs:

> Stop relay; starter relay; run relay; shorting relay; transition relay, shunt trip relay.

Figure 7
Starter Module (Wye-Delta)



Stepper Module

The main function of 1U3 is to drive the Inlet Guide Vane Stepper motor (CTV) along with other functions. It does this in response to signals received from Chiller module 1U1.

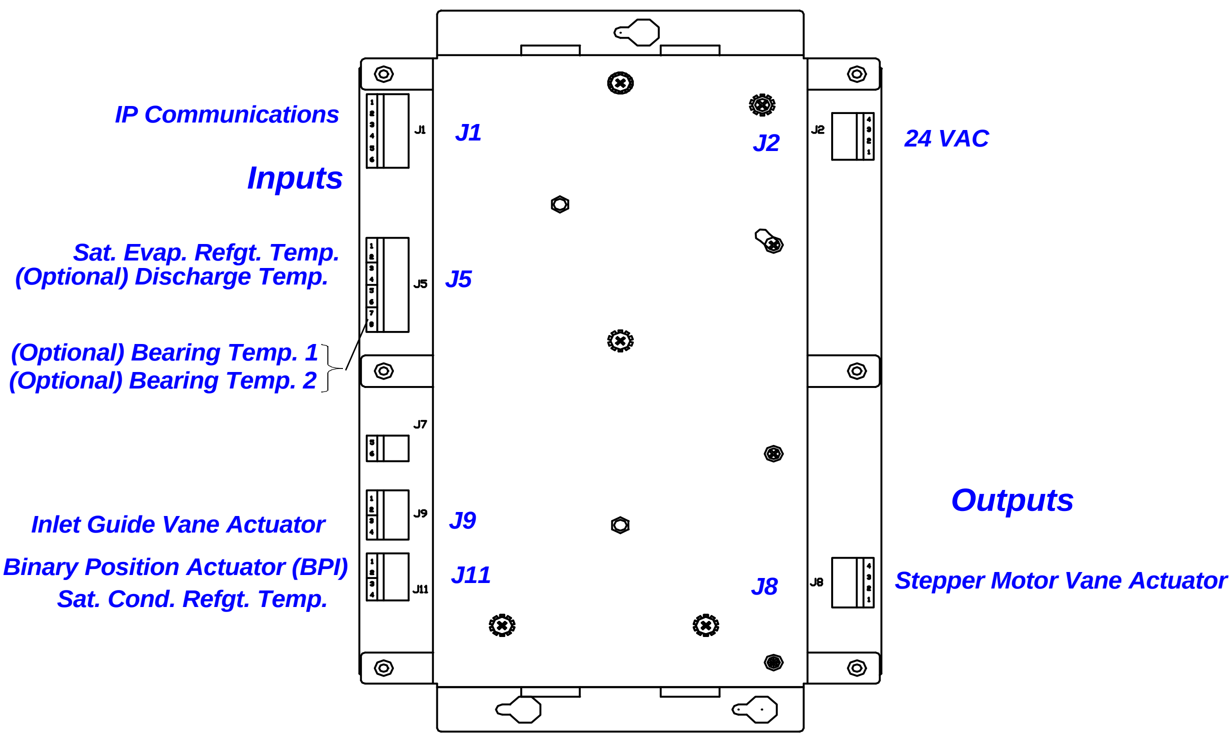
Low Voltage (<30VAC) Inputs:

- 24VAC; IPC link
- Evaporator saturated refrigerant temperature
- Compressor discharge temperature (optional)
- Bearing temps, 1 and 2
- Inlet guide vane actuator Binary position indicator
- Condenser saturated refrigerant temperature

Low Voltage, High Amperage (30 VAC) Outputs:

- Vane actuator stepper motor

Figure 8
Stepper Module

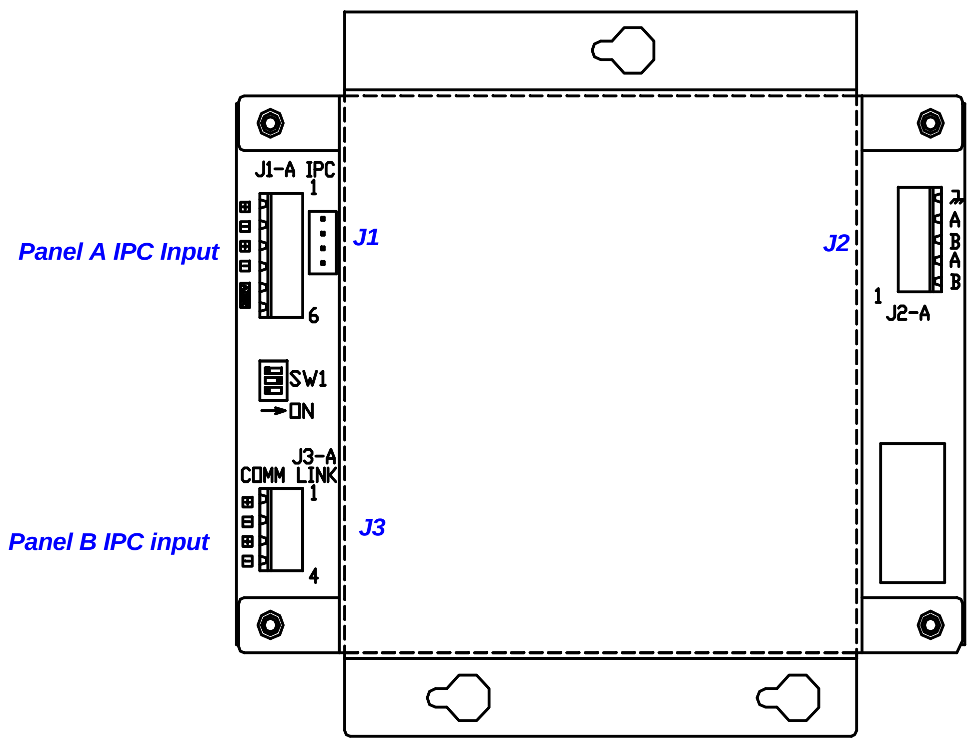


Duplex Module

The Duplex Chiller control is accomplished by the Duplex Control Module (DCM). The DCM is a Trane Communications Interface (TCI) based module. Its two main tasks are setpoint control and compressor staging/control

The DCM will actually control two separate UCP2 panels ("Panel A" and "Panel B"). These panels are for the most part identical and know nothing of each other. All coordination between panels is handled with the DCM.

Figure 9
Duplex Module



Module Dip Switch Settings

UCP2 Board Dip Switch Settings

Several of the UCP2 modules have dip switch settings on them, used to set up the board for 2-10 VDC or 4-20 mA signal inputs and/or outputs of the boards. The following are the various switch settings.

Chiller Module

	Switch	0-10V	4-20mA
External Base Loading	SW2-1	OFF	ON (SW2-2 and SW2-3 are not used)

Options Module

	Switch	0-10V	4-20mA
External Current Limit	SW2-1	OFF	ON (SW2-2 and SW2-3 are not used)
External Chilled Water	SW3-1	OFF	ON (SW3-2 and SW3-3 are not used)

Tracer COM 3

Switch	-1	-2	-3
SW1	OFF	OFF	OFF

Tracer COM 4

Switch	-1	-2	-3
SW1	OFF	ON	OFF

IPC Buffer

Switch	-1	-2	-3
SW1	OFF	OFF	ON

Duplex Control Module (DCM)

Switch	-1	-2	-3
SW1	ON	OFF	ON

Printer

Switch	-1	-2	-3
SW1	OFF	OFF	ON

The printer settings in the service settings menu must be set exactly the same on the printer being used. This includes:

~ printer baud rate
~ printer parity
~ printer data bits
~ printer stop bits
~ printer handshaking

The above settings are usually configured on a printer by DIP switches. The dip switch settings can be found in the manufacturers information provided with the printer.

Dip switch settings for the Okidata Microline 184 turbo printer follow:

Table 3
Switch Bank1

Parity Type odd parity even parity	Switch 1 on off
Parity No parity With parity	Switch 2 on off
Data Bits 8 bits 7 bits	Switch 3 on off
Handshaking Ready/Busy X-on/X-off	Switch 4 on off
Test Select Circuit Monitor	Switch 5 on off
Mode Select Print mode Test mode	Switch 6 on off

Busy Line Selection SSD-Pin 11 SSD+ Pin 11 DTR- Pin20 RTS- Pin 4	Switches 7,8 off, on off,off on, on on, off

Table 4
Switch Bank 2

Transmission Speed 19200 9600 4800 2400 1200 600 300 110	Switch 1,2,3 on, on, on off, on, on on, off, on off, off, on on, on, off off, on, off on, off, off off, off, off
DSR Input Signal Active Inactive	Switch 4 on off
Buffer 32 bytes 256 bytes	Switch 5 on off
Busy Signal Timing 200 ms 1 second	Switch 6 on off
DTR Signal After power on Printer selected	Switch 7 on off
Not Used	Switch 8

Diagnosing A Non-Working Stepper Module

Method to Troubleshoot a UCP2 Stepper Module and Actuator

I. Overview

The UCP2 Stepper module is used to drive a Stepper Motor, which is used to open and close a valve or actuator. The big difference between a Stepper Motor and other types of motors, is that instead of just making the motor turn, you can control the angular position of the rotor inside the motor, and therefore control the position of your valve or actuator.

The Stepper Motor has two windings inside. To distinguish between the two, we call them Winding 1 and Winding 2. The Stepper module contains one drive circuit for each winding. Most of the failures you will probably deal with will result in the two internal fuses, F1 and F2, inside the Stepper module to open. These fuses protect the motor from damage, and are not easily accessible. Replacing these fuses in the field is not an acceptable option, because the original fuses have been through some special UL testing. We cannot guarantee safety to the customer if a blown fuse is replaced with another of a different type.

The Stepper Motor three states: Moving, Holding and Off:

1 In the Moving state, current flows bi-directionally through each of the two windings. The frequency and amount of current is electronically controlled by the Stepper module.

2 In the Holding State, current flows one way through each of the two windings. The amount of current is electronically controlled by the Stepper module.

3 The Off state occurs only when the Stepper module power is cycled. Until the Stepper receives an order from the Chiller module to move, no current flows through the Stepper Motor windings.

II. Quick Test of Stepper Board

A.This section will show how to test the main power points of the Stepper Board to get an idea of where the problem is.

1 If the UCP2 Control Panel is unpowered, unplug the J2 connectors from the Stepper board and continue to Section III to check motor and wiring resistances.

2 If the UCP2 Control Panel is powered, measure and compare the Power Input (J2) and the 4 Test Points at the right side of the Stepper board with Table 5 .

Table 5
<u>UCP2 Stepper Module Test Point Voltage Limits</u>

Connector	VAC	VDC
J2 -(1 to 2) or (3 to 4) J2 -(1 to case) or (2 to case) TP2: 5V to ground	20.4 to 33.12 VAC	0 VDC
	10 to 17 VAC	13.12 to 21.81 VDC
	0 VAC	4.8 to 5.2 VDC
TP4: 24V to ground	0 VAC	23.2 to 25.1 VDC
TP3: 14V to ground	0 VAC	11.45 to 15.75 VDC
TP1: 35V to ground	100m VAC to 72m VAC	26 to 48 VDC

If any of the voltages are out of range, there is a malfunction on the Stepper Board.

The majority of these malfunctions may be diagnosed by using . The ones marked with an asterisk have been seen in the field before:

Table 6
UCP2 Stepper Module Troubleshooting

Condition(s)	Possible Problem	Possible Cause(s)	(Solution(s)
Voltage at Test Points TP1-TP4 on Stepper module Motor winding Resistance check Pin to conduit Motor does not move.	Wiring between Stepper module and actuator motor is shorted to ground.	1. Wire insulation bared inside conduit. 2. Wire insulation bared or pinched inside motor junction box.	1. Seal wire or run new wire through conduit. 2. Seal wire, or restrip and rewire motor junction box. See Table 4 for wiring diagram.
Voltage at Test Points TP1-TP4 on Stepper module Motor winding resistance check pin to pin fails. Motor does not move.	Wiring shorted together inside conduit between Stepper module and actuator motor.	Insulation bared.	Seal wire or run new wire through conduit. See Table 4 for wiring diagram.

Table 6
UCP2 Stepper Module Troubleshooting (Continued)

Condition(s)	Possible Problem	Possible Cause(s)	(Solution(s)
	Wiring shorted together at board edge connector J6 or J8	*1. metal shavings from drilling into UCP2 Panel form bridge. 2. Loose wire strands form bridge.	1. Inspect J6 and J8 connectors. Remove any metal shavings bridging the wires before powering mod-ule. 2. Restrip and rewire board edge connector.
	Wires shorted together inside motor junction box.	Insulation bared.	Seal wire or run new wire through conduit. See Table 4 for wiring diagram.
Stepper module TP1 - TP4 OK. Motor winding resistance check OK. Motor does not move.	Motor does not move and steps display does not change on CLD when using manual vane control.	UCP2 is not in Stop Mode and Chiller module is overriding manual vane control.	Hit stop button on CLD, and try again.
Stepper module TP1 - TP4 OK. Motor winding resistance check OK. Motor runs backward.	Motor runs backward	Motor is miswired.	Unplug motor connec-tor (J6 or J8) from the Stepper module. Use Tables 3 and 4 to sway wire pairs (1, 3) or ((2, 4) so the motor is wired properly.

II. Check Stepper Motor and Wiring for Shorts and Opens

A. During this stage, motor winding and wire resistances will be measured to ensure proper continuity.

1 If the unit is powered, hit the stop button on the CLD and use manual mode in the service tools menu to step the actuators all the way to position 0.

2 Unplug power (J2 connector) from the Stepper module.

3 Unplug J6 and J8 from the board.

4 Measure the DC resistance of one of the motor windings by measuring between what would be Pin (1,3) or Pin (2,4) on the Stepper Board at the unplugged connector (See Table 7).

5 If the resistance is lower than the limits in Table 7 there is a short in the wiring between the Stepper module and the motor or the in motor winding. Note that nominal values are not including wire resistances.

6 If the resistance is higher than the limits in Table 7 the wiring between the Stepper module and the motor or a winding is open. Note that nominal values are not including wire resistances.

Table 7
<u>Motor Winding Resistance</u>

J6 or J8 Connector Pin	Acceptable DC Resistance Range	CLV Nominal Resistance
(4 to 3)	Open Circuit	NA
(4 to 2): WI	50 mOhm to 5 Ohm	1.68 Ohm
(4 to 1)	Open Circuit	N/A
(3 to 2)	Open Circuit	N/A
(3 to 1):W2	50 mOhm to 5 Ohm	1.68 Ohm
(2 to 1)	Open Circuit	N/A
(4 to Conduit)	Open Circuit	N/A
(3 to Conduit)	Open Circuit	N/A
(2 to conduit)	Open Circuit	N/A
(1 to conduit)	Open Circuit	N/A

7 If the winding resistance is in the range, plug the J connector back into the appropriate socket.

8 Perform steps 3-7 for each winding of the motor on the Stepper module.

9 If there is a short or an open, you will need to check the wiring to the motor, and then check the motor.

10 If the windings resistance check passes, and you have not measured the Stepper module voltages while it is powered, then plug J2 back into the module and go back to Section II, Quick Test of Stepper Board.

B. If you need to disconnect the wires going to the motor for any reason, Table 8 is a wiring table you can use to reconnect them.

Table 8
Stepper Motor Connections

JB or J8 Connector Pin# on Stepper	Motor Winding Output Signal Name	Stepper Motor Terminal Connection
4	1+	3
3	2+	5
2	1-	1
1	2-	4

IV. Motor Voltages for CTV Stepper Motor

A. With the motor connector J6 (or J8) connected to the Stepper Board, and the Stepper powered, measure the AC and DC voltages of the connector pins, and compare to Table 9 and Table 10 .

Table 9
<u>Motor</u> <u>Voltages with Actuator Holding</u>

Connector Pin	AC Voltage	DC Voltage
J6 - (4 to 3)	0 or (5.8 to 10)	- 400 mV to +400 mV
J6 - (4 to 2)	5.8-8.2	+ 400 mV, but not 0mV
J6 - (3 to 1)	0 or(5.8-10)	- 400 mV to +400 mV
J6 - (3 to 2)	0 or(5.8-10)	- 400 mV to +400 mV
J6-(3 to 1)	5.8 to 8.2	+400 mV, but not 0 mV
J6- (2 to1)	0 or (5.8-10)	- 400 mV to +400 mV
J6 -(4 to conduit)	0 or (5.8-8)	(0.3-0.43) or (1.04- 1.135)
J6 -(3 to conduit)	0 or (5.8-8)	(0.3-0.43) or (1.04- 1.135)
J6 -(2 to conduit)	0 or (5.8-8)	(0.3-0.43) or (1.04- 1.135)
J6 -(1 to conduit)	0 or(5.8 -8)	(0.3-0.43) or (1.04- 1.135)

Table 10
<u>Motor</u> <u>Voltages with Actuator Moving</u>

Connector Pin	AC Voltage	DC Voltage
J6 - (4 to 3)	(16.6-25.9)	-720 mV to +720 mV
J6 - (4 to 2)	(20.8-27.5)	-720 mV to +720mV
J6 - (4 to 1)	16.6-25.9)	-720mVto +720mV
J6 - (3 to 2)	16.6-25.9)	-720mV to +720mV
J6 - (3 to 1)	20.8-27.5)	-720mV to+720mV
J6 - (2 to 1)	(16.6 - 25.9)	-720 mV to +720mV
J6 - (4 to conduit)	(11.4 - 17.3)	(9.1 -10.1)
J6 - (4 to conduit)	(11.4 - 17.3)	(9.1 -10.1)
J6 - (4 to conduit)	(11.4 - 17.3)	(9.1 -10.1)
J6 - (4 to conduit)	(11.4 - 17.3)	(9.1 -10.1)

Procedures For Module Set-Up

External Current Limit Setpoint

Option module J7-11, -12 (-, +)

Isolated 2-10 VDC or 4-20 mA

UCP2 will accept either a 2-10 VDC or 4-20 mA analog input suitable for customer connection to set the unit external current limit setpoint. 2-10 VDC and 4-20 mA shall each correspond to a 40 to 120% RLA range. UCP2 will limit the maximum ECLS to 100%.

The following must be "Set'.

1 SW2-1 OFF for 2-10 VDC
  ON for 4-20 mA
2 Current Limit Setpoint Source: External Source
3 External Current Limit Setpoint: Installed Machine Configuration menu
4 External Setpoint Inputs: 2-10 VDC or 4-20 mA (Machine Configuration menu)

Refrigerant Monitor Input

Analog type input

4-20 mA input signal to the Circuit module J5-5 and J5-6. This represents 0-100 ppm.

Under machine configuration "Refrigerant Monitor Type" is '01' for Analog.

Typical input if using an RMWC generation Monitor.

IPC Monitor (Requires RMWD monitor with Version 2 Software) Direct communication to the CLD via the IPC.

Under Machine Configuration "Refrigerant Monitor Type" is '02' for IPC Monitor.

Also allows monitor calibration and setup. Please note that the monitor cannot have a local display and communicate with the UCP2. If the customer requires a local display, he can connect an RMWD style monitor up like an analog type previously described.

% RLA Output

Options module J7-3,-4

-2-10 VDC

As an option, the UCM shall provide a 0-10 VDC analog output to indicate % RLA. The transfer function shall be 2 to 10 VDC corresponding to 0 to 120% RLA.

External Chilled Water Setpoint

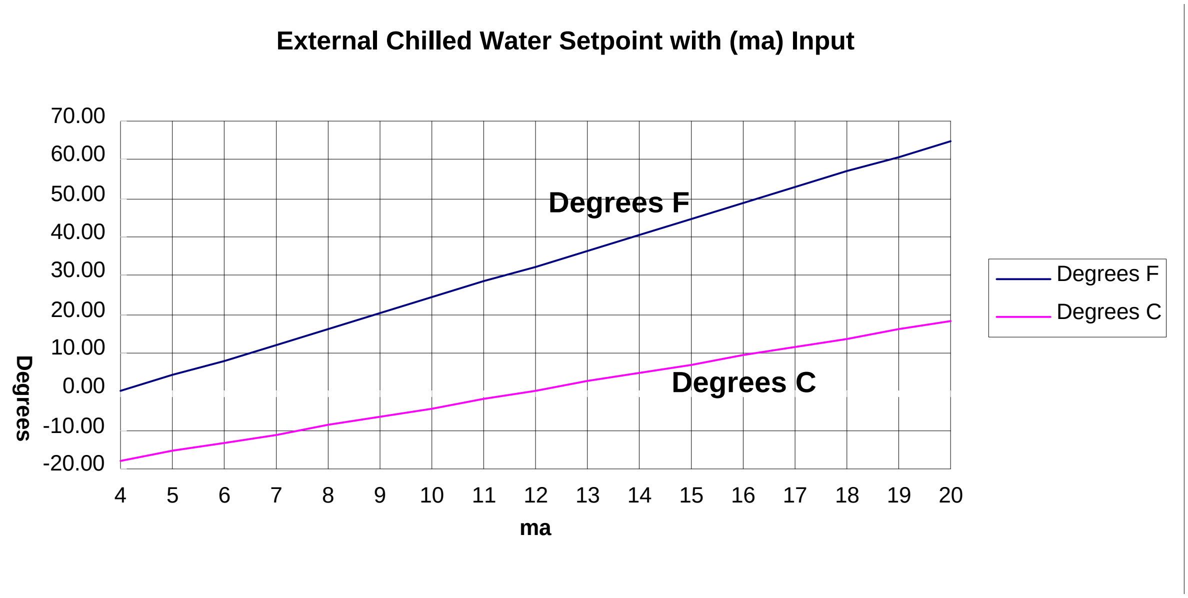
The External Chilled Water Setpoint allows a customer to change the chilled water setpoint from a remote location. The External Chilled Water Setpoint is found on Options module terminals J9-4 and J9-5.

UCP2 accepts either a 2-10 VDC or 4-20 mA analog input suitable for customer connection to set the unit leaving chilled water setpoint. 2-10 VDC and 4-20 mA shall each correspond to a 0 to 65°F (-17.8 to 18.3°C) CWS range. For input signals beyond the 2-10 VDC or 4-20 mA range, an information diagnostic is called and the active chilled water setpoint will default to the front panel.

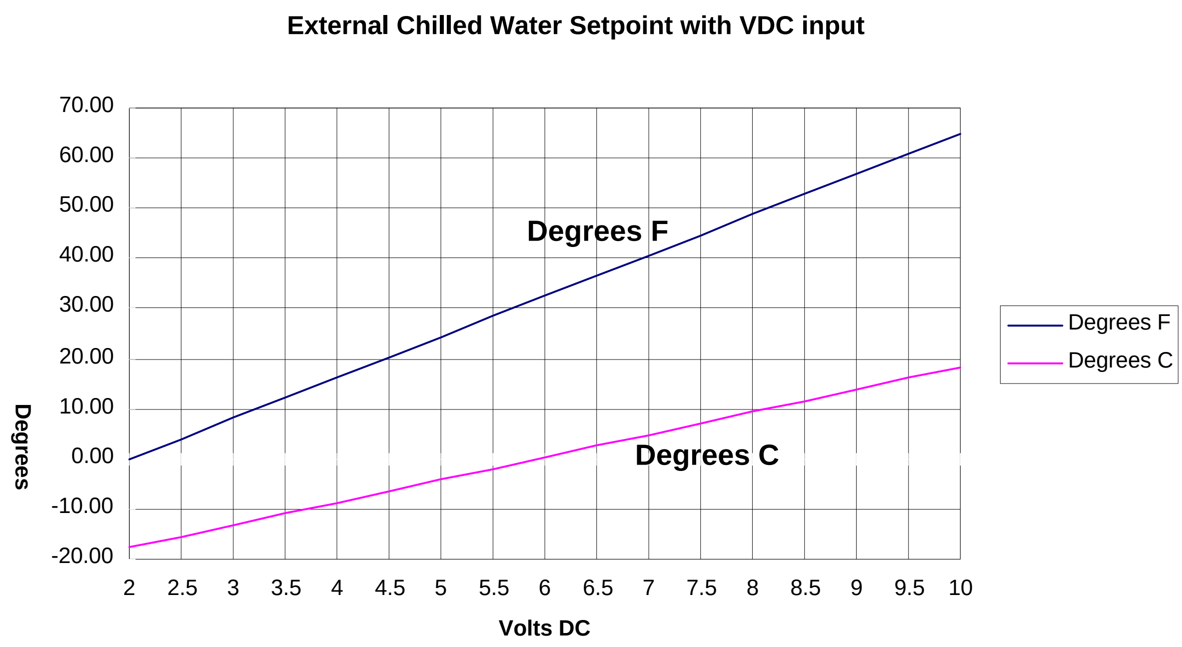
UCP2 uses the following equations:

	Voltage Signal	Current Signal
As generated from external source	VDC=.12308*(°F)+2	mA=.24615(°F)+4
As processed by UCP2	°F=8.125*(VDC)-16.25	°F=4.0625(mA)-16.25

The following graph shows External Chilled Water Setpoint with a 4-20 mA input:



The following graph shows External Chilled Water Setpoint with a 2-10 VDC input:



The following items need to be set:

1. SW3-1 OFF for 2-10 VDC, ON for 4-20 mA.
2. Chilled Water Reset type: Disable - Operator Settings Group
3. Chilled Water Setpoint Source: External - Operator Settings Group
4. Setpoint Source Override: None - Operator Settings Group
5. External Chilled Water Setpoint: Installed - Service Settings Group Machine Configuration
6. In Machine Configuration, set to 4-20 mA or 2-10 VDC; 4-20 is default
7. Grounding of the BAS and UCP2 systems may be different. To clear this, connect a 9 VDC battery to J9 (4, 8). This acts as an isolated source and you should read 9 VDC. If you do not read 9 VDC, a grounding problem exists.

External Auto-Stop:

The external Auto-Stop input allows the operator to enable and disable chiller operation through a remotely located set of contacts.

A binary input to the UCP2 is provided that will enable the chiller to operate when it is closed and disable operation when it is open. An indication is displayed on the front panel when the chiller is disabled through the remote Auto-Stop.

The Auto-Stop input allows the operator to use a remote signal, such as a time clock or a generic BAS, to signal the start of the chiller. Disabling the chiller through this input will not result in a diagnostic since it is an expected routine shutdown.

UCP2 accepts an isolated contact closure input suitable for customer connection to put the unit in either AUTO or STOP from a remote device. This input has priority over the unit switch when the unit switch is in AUTO. This input does not have priority over the unit switch when the unit switch is in STOP. The input is closed for external AUTO operation and open to put the unit in external STOP. The external stop is a friendly shutdown, i.e. the chiller will unload before the stop command is given.

The External Auto-Stop input is located on Chiller module terminals J5-1 and J5-2.

Analog Input Table Abbreviations

The information below is an explanation of abbreviations used in Analog Input Tables that are shown in this section.

Oil Pressures

Water Pressures

A1: Entering and Leaving Evap Temp. Purge Compressor Suction Temp.

A2: Oil Temp.

Entering and Leaving Condenser

Aux HR Entering and Leaving Temp.

Compressor Discharge Ref Temp.

Bearing Temps 1 and 2

Saturated Cond. Refrigerant Temp.

Outdoor Air Temperature.

A4: Saturated Evap Temp.

A6: Compressor Motor Winding Temp 75 Ohm

NOTE: *A1, A2 and A4 are the same sensor.*

NOTE:
1. Min. Res. and Max. Res. = Minimum and Maximum Resistance in Ohms.
2. Min Vterm. and Max. Vterm = Minimum and Maximum DC Voltage measure at the appropriate module terminal.

Table 11
Pressure vs Voltage for Oil Pressures

Oil Pressure (PSIG)	Differential Voltage		
	Min	Nom	Max
-15	-0.0017	0.0000	0.0017
-10	0.0033	0.0050	0.0067
-5	0.0083	0.0100	0.0117
-4	0.0093	0.0110	0.0127
-3	0.0103	0.0120	0.0137
-2	0.0113	0.0130	0.0147
-1	0.0122	0.0140	0.0158

Table 11
Pressure vs Voltage for Oil Pressures (Continued)

Oil Pressure (PSIG)	Differential Voltage		
	Min	Nom	Max
0	0.0132	0.0150	0.0168
1	0.0142	0.0160	0.0178
2	0.0151	0.01 70	0.0189
3	0.0161	0.0180	0.0199
4	0.0171	0.0190	0.0209
5	0.0180	0.0200	0.0220
6	0.0190	0.0210	0.0230
7	0.0199	0.0220	0.0241
8	0.0209	0.0230	0.0251
9	0.0218	0.0240	0.0262
10	0.0228	0.0250	0.0272
11	0.0237	0.0260	0.0283
12	0.0247	0.0270	0.0293
13	0.0256	0.0280	0.0304
14	0.0266	0.0290	0.0314
15	0.0275	0.0300	0.0325
16	0.0285	0.0310	0.0335
17	0.0294	0.0320	0.0346
18	0.0303	0.0330	0.0357
19	0.0313	0.340	0.0367
20	0.0322	0.0350	0.0378
25	0.0369	0.0400	0.0431
30	0.0417	0.0450	0.0483
35	0.0464	0.0500	0.0536

Table 12

Voltages and Resistances of Oil Pressure Input Terminals			
	Min	**Nom**	**Max**
+5V to GND	4.75	5.0	5.25
V- to GND	1.6	2.0	2.5
V+ to GND	1.6	2.0	2.5

Voltages and Resistances of Water Pressure Transducers Input Terminals			
	Min	**Nom**	**Max**
+5V to GND	4.75	5.0	5.25
V- to GND	1.6	2.0	2.5
V+ to GND	1.6	2.0	2.5

Table 13
Pressure vs Voltage for Water Pressures

Water Pressure (PSIG)	Nom	Water Pressure (PSIG)	Nom
0	0.0	76	0.0253
1	0.0003	77	0.0257
2	0.0007	78	0.0260
3	0.0010	79	0.0263
4	0.0013	80	0.0267
5	0.0017	81	0.0270
6	0.0020	82	0.0273
7	0.0023	83	0.0277
8	0.0027	84	0.0280
9	0.0030	85	0.0283
10	0.0033	86	0.0287
11	0.0037	87	0.0290
12	0.0040	88	0.0293
13	0.0043	89	0.0297
14	0.0047	90	0.0300
15	0.0050	91	0.0303
16	0.0053	92	0.0307
17	0.0057	93	0.0310
18	0.0060	94	0.0313
19	0.0063	95	0.0317
20	0.0067	96	0.0320
21	0.0070	97	0.0323
22	0.0073	98	0.0327
23	0.0077	99	0.0330
24	0.0080	100	0.0333
25	0.0083	101	0.0337
26	0.0087	102	0.0340

Table 13
Pressure vs Voltage for Water Pressures (Continued)

Water Pressure (PSIG)	Nom	Water Pressure (PSIG)	Nom
27	0.0090	103	0.0343
28	0.0093	104	0.0347
29	0.0097	105	0.0350
30	0.0100	106	0.0353
31	0.0103	107	0.0357
32	0.0107	108	0.0360
33	0.0110	109	0.0363
34	0.0113	110	0.0367
35	0.0117	111	0.0370
36	0.0120	112	0.0373
37	0.0123	113	0.0377
38	0.0127	114	0.0380
39	0.0130	115	0.0383
40	0.0133	116	0.0387
41	0.0137	117	0.0390
42	0.0140	118	0.0393
43	0.0143	119	0.0397
44	0.0147	120	0.0400
45	0.0150	121	0.0403
46	0.0153	122	0.0407
47	0.0157	123	0.0410
48	0.0160	124	0.0413
49	0.0163	125	0.0417
50	0.0167	126	0.0420
51	0.0170	127	0.0423
52	0.0173	128	0.0427
53	0.0177	129	0.0430
54	0.0180	130	0.0433
55	0.0183	131	0.0437
56	0.0187	132	0.0440
57	0.0190	133	0.0443
58	0.0193	134	0.0447
59	0.0197	135	0.0450
60	0.0200	136	0.0453

Table 13
Pressure vs Voltage for Water Pressures (Continued)

Water Pressure (PSIG)	**Nom**	**Water Pressure (PSIG)**	**Nom**
61	0.0203	137	0.0457
62	0.0207	138	0.0460
63	0.0210	139	0.0463
64	0.0213	140	0.0467
65	0.0217	141	0.0470
66	0.0220	142	0.0473
67	0.0223	143	0.0477
68	0.0227	144	0.0480
69	0.0230	145	0.0483
70	0.0233	146	0.0487
71	0.0237	147	0.0490
72	0.0240	148	0.0493
73	0.0243	149	0.0497
74	0.0247	150	0.0500
75	0.0250		

Voltages and Resistances of Pressure Input Terminals			
	Min	**Nom**	**Max**
+5V to GND	4.75	5.0	5.25
V- to GND	1.6	2.0	2.5
V+ to GND	1.6	2.0	2.5
Water Pressure			
Rin	420	470	520
Rout	600	900	1.2K

Table 14

Purge Compressor Suction Temp.

AI Analog Input

Thermistor Accuracy = 0.54°F from -14 to 79°F

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 24900 Ohms.

Used to sense temperatures at the following point:

1. Purge Compressor Suction Temp. CVHE/F/G

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
-10.0	119172	123480	4.115	4.145
-5.0	101107	104703	3.992	4.024
-4.0	97868	101337	3.966	3.999
-3.0	94743	98090	3.940	3.973
-2.0	91726	94957	3.913	3.946
-1.0	88816	91934	3.886	3.920
0.0	86006	89016	3.858	3.893
1.0	83293	86199	3.830	3.865
2.0	80675	83480	3.802	3.837
3.0	78146	80855	3.773	3.809
4.0	75705	78320	3.743	3.780
5.0	73347	75873	3.714	3.751
10.0	62706	64832	3.560	3.600
15.0	53738	55532	3.399	3.441
16.0	52119	53854	3.366	3.408
17.0	50554	52231	3.332	3.375
18.0	49040	50663	3.299	3.341
19.0	47577	49145	3.265	3.308
20.0	46161	47678	3.231	3.274
25.0	39742	41029	3.058	3.102
30.0	34292	35386	2.881	2.926
35.0	29713	30628	2.705	2.750
40.0	25830	26611	2.532	2.577
45.0	22512	23180	2.361	2.405
50.0	19668	20242	2.194	2.237
55.0	17225	17718	2.033	2.075
60.0	15120	15546	1.879	1.919
65.0	13303	13670	1.731	1.770
70.0	11729	12048	1.592	1.629
75.0	10364	10641	1.462	1.496

Table 15
Evap. Entering and Leaving Water Temp.

A1 Analog Input

Thermistor Accuracy = 0.54°F from 15 to *140*°F

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 24900 Ohms.

Used to sense temperatures at the following point:

1. Evap. Entering and Leaving Water Temp. Pair CVHE/F/G

Table 15

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
15.0	53738	55532	3.399	3.441
20.0	46161	47678	3.231	3.274
21.0	44791	46259	3.196	3.240
22.0	43466	44886	3.162	3.206
23.0	42183	43558	3.127	3.171
24.0	40943	42273	3.092	3.137
25.0	39742	41029	3.058	3.102
26.0	38580	39826	3.022	3.067
27.0	37455	38661	2.987	3.032
28.0	36367	37534	2.952	2.997
29.0	35312	36442	2.916	2.962
30.0	34292	35386	2.881	2.926
31.0	33304	34363	2.845	2.891
32.0	32358	33365	2.810	2.855
33.0	31448	32423	2.775	2.820
34.0	30566	31511	2.740	2.785
35.0	29713	30628	2.705	2.750
36.0	28886	29773	2.671	2.715
37.0	28086	28944	2.636	2.681
38.0	27310	28142	2.601	2.646
39.0	26559	27364	2.566	2.611
40.0	25830	26611	2.532	2.577
41.0	25125	25881	2.497	2.542
42.0	124441	25174	2.463	2.508
43.0	23778	24489	2.429	2.473
44.0	23135	23824	2.395	2.439
45.0	22512	23180	2.361	2.405

Table 15 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
46.0	21908	22556	2.327	2.371
47.0	21322	21950	2.294	2.337
48.0	20754	21363	2.260	2.304
49.0	20203	20794	2.227	2.270
50.0	19668	20242	2.194	2.237
55.0	17225	17718	2.033	2.075
60.0	15120	15546	1.879	1.919
65.0	13303	13670	1.731	1.770
70.0	11729	12048	1.592	1.629
75.0	10364	10641	1.462	1.496
80.0	9177	9418	1.339	1.372

Table 16
Saturated Cond. Refrigerant Temp.

A2 Analog Input

Thermistor Accuracy = 0.54°F from 15 to 140°F

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 6980 Ohms.

Saturated Cond. Refrigerant Temp CVHE/F/G

Table 16

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
15.0	53738	55532	4.416	4.435
17.0	50554	52231	4.384	4.404
19.0	47577	49145	4.350	4.372
21.0	44791	46259	4.316	4.338
23.0	42183	43558	4.280	4.303
25.0	39742	41029	4.242	4.266
27.0	37455	38661	4.204	4.228
29.0	35312	36442	4.163	4.189
31.0	33304	34363	4.122	4.149
33.0	31448	32423	4.080	4.107
35.0	29713	30628	4.037	4.065
37.0	28086	28944	3.992	4.021
39.0	26559	27364	3.946	3.976
41.0	25125	25881	3.900	3.930
43.0	23778	24489	3.852	3.883
45.0	22512	23180	3.803	3.835
47.0	21322	21950	3.752	3.785
49.0	20203	20794	3.701	3.735
51.0	19150	19706	3.649	3.684
53.0	18158	18682	3.596	3.631
55.0	17225	17718	3.542	3.578
57.0	16346	16810	3.488	3.524
59.0	15517	15955	3.432	3.469
61.0	14735	15148	3.376	3.413
63.0	13998	14388	3.319	3.357
65.0	13303	13670	3.262	3.300
67.0	12646	12993	3.204	3.243

Table 16 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
69.0	12026	12354	3.146	3.185
71.0	11441	11750	3.088	3.127
73.0	10887	11180	3.029	3.068
75.0	10364	10641	2.970	3.010
77.0	9870	10131	2.911	2.951
79.0	9402	9649	2.851	2.891
81.0	8959	9193	2.792	2.832
83.0	8539	8761	2.733	2.773
85.0	8142	8353	2.674	2.714
87.0	7766	7965	2.615	2.655
89.0	7410	7599	2.557	2.597
90.0	7239	7422	2.528	2.567
91.0	7072	7251	2.498	2.538
92.0	6910	7084	2.470	2.509
93.0	6751	6921	2.441	2.480
94.0	6597	6763	2.412	2.452
95.0	6447	6608	2.383	2.423
96.0	6301	6458	2.355	2.394
97.0	6159	6312	2.326	2.366
98.0	6020	6169	2.298	2.337
99.0	5885	6030	2.270	2.309
100.0	5754	5895	2.242	2.281
101.0	5625	5763	2.214	2.253
102.0	5500	5634	2.187	2.225
103.0	5378	5509	2.159	2.198
104.0	5260	5387	2.132	2.170
105.0	5144	5268	2.105	2.143
107.0	4921	5039	2.051	2.089
109.0	4709	4821	1.999	2.036
111.0	4507	4614	1.946	1.983
113.0	4315	4417	1.895	1.931
115.0	4133	4230	1.845	1.880
117.0	3959	4051	1.795	1.830
119.0	3794	3882	1.747	1.781
121.0	3636	3720	1.699	1.733

Table 16 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
123.0	3487	3566	1.653	1.686

Table 17
Bearing Temp., Oil Temp. and Compressor Discharge Temp.

A2 Analog Input

Thermistor Accuracy = 3.24°F from 32 to 100°F.

Thermistor Accuracy = 0.72×F from 100 to 201°F.

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 6980 Ohms.

Used to sense temperatures at the following points:

1. Bearing #1 Temp CVHE/F/G (Journal Bearing)

2. Bearing #2 Temp CVHE/F/G (Thrust Bearing)

3. Oil Temp CVHE/F/G

4. Compressor Discharge Temp CVHE/F/G

Table 17

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
90.0	6798	7862	2.453	2.642
91.0	6643	7679	2.424	2.613
92.0	6492	7501	2.395	2.583
93.0	6345	7328	2.367	2.554
94.0	6201	7159	2.338	2.525
95.0	6062	6994	2.310	2.496
96.0	5925	6834	2.282	2.467
97.0	5793	6678	2.254	2.438
98.0	5663	6526	2.226	2.409
99.0	5537	6378	2.199	2.381
100.0	5730	5918	2.238	2.285
101.0	5603	5786	2.210	2.257
102.0	5478	5657	2.183	2.229
103.0	5357	5531	2.155	2.202
104.0	5238	5408	2.128	2.174
105.0	5123	5289	2.101	2.147
106.0	5011	5172	2.074	2.120
107.0	4901	5058	2.048	2.093
108.0	4794	4948	2.021	2.066
109.0	4690	4840	1.995	2.039
110.0	4589	4734	1.969	2.013
111.0	4490	4632	1.943	1.987
112.0	4393	4532	1.917	1.961

Table 17 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
113.0	4299	4434	1.892	1.935
114.0	4207	4339	1.866	1.909
115.0	4117	4246	1.841	1.884
116.0	4029	4155	1.816	1.859
117.0	3944	4067	1.792	1.834
118.0	3861	3980	1.767	1.809
119.0	3779	3896	1.743	1.785
120.0	3700	3814	1.719	1.760

Table 18
Bearing Temp., Oil Temp. and Compressor Discharge Temp.

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
121.0	3623	3734	1.696	1.736
122.0	3547	3655	1.672	1.712
123.0	3474	3579	1.649	1.689
124.0	3402	3505	1.626	1.666
125.0	3332	3433	1.604	1.643
126.0	3264	3362	1.581	1.620
127.0	3197	3293	1.559	1.598
128.0	3132	3226	1.537	1.575
129.0	3069	3160	1.516	1.553
130.0	3006	3096	1.494	1.531
131.0	2946	3033	1.473	1.510
132.0	2886	2971	1.452	1.488
133.0	2828	2912	1.431	1.467
134.0	2772	2853	1.411	1.447
135.0	2716	2796	1.391	1.426
136.0	2662	2740	1.371	1.406
137.0	2610	2685	1.351	1.385
138.0	2558	2632	1.331	1.365
139.0	2508	2580	1.312	1.346
140.0	2458	2529	1.293	1.326
141.0	2410	2479	1.274	1.307

Table 18
Bearing Temp., Oil Temp. and Compressor Discharge Temp. (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
142.0	2363	2431	1.256	1.288
143.0	2317	2383	1.237	1.269
144.0	2272	2336	1.219	1.251
145.0	2228	2291	1.201	1.233
146.0	2185	2246	1.184	1.215
147.0	2143	2203	1.166	1.197
148.0	2101	2160	1.149	1.179
149.0	2061	2119	1.132	1.162
150.0	2022	2078	1.115	1.145
151.0	1983	2039	1.099	1.128
153.0	1909	1962	1.066	1.095
155.0	1837	1888	1.035	1.063
157.0	1769	1818	1.004	1.031
159.0	1704	1750	0.975	1.001
161.0	1641	1685	0.946	0.971
163.0	1581	1624	0.917	0.942
165.0	1524	1564	0.890	0.915
167.0	1468	1508	0.864	0.887
169.0	1416	1453	0.838	0.861
171.0	1365	1401	0.813	0.835
173.0	1316	1351	0.789	0.810
175.0	1270	1303	0.765	0.786
177.0	1225	1257	0.742	0.763
179.0	1182	1213	0.720	0.740
181.0	1141	1170	0.699	0.718
183.0	1102	1130	0.678	0.697
185.0	1064	1091	0.658	0.676
187.0	1027	1053	0.638	0.656
189.0	992	1017	0.619	0.636
191.0	959	983	0.601	0.617
193.0	926	949	9.583	0.599
195.0	895	917	0.565	0.581
197.0	865	887	0.549	0.564
199.0	837	857	0.532	0.547
201.0	809	829	0.517	0.531

Table 19
Auxiliary HR Ent. and Condenser Ent. and Leaving Water Temp.

A2 Analog Input

Thermistor Accuracy = 0.54°F from 15 to 140°F

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 6980 Ohms.

Used to sense temperatures at the following point:

1. Auxiliary HR Entering and Leaving Water Temp. Pair CVHE/F

2. Condenser Ent. and Leaving Water Temp. Pair CVHE/F

Table 19

Temp F	Min Res	Max Res	Min Vterm	Max Vterm
15546	15120	15546	3.404	3.441
61.0	14735	15148	3.376	3.413
62.0	14361	14762	3.348	3.385
63.0	13998	14388	3.319	3.357
64.0	13645	14024	3.291	3.329
65.0	13303	13670	3.262	3.300
66.0	12970	13327	3.233	3.272
67.0	12646	12993	3.204	3.243
68.0	12332	12669	3.175	3.214
69.0	12026	12354	3.146	3.185
70.0	11729	12048	3.117	3.156
71.0	11441	11750	3.088	3.127
72.0	11160	11461	3.058	3.098
73.0	10887	11180	3.029	3.068
74.0	10622	10907	2.999	3.039
75.0	10364	10641	2.970	3.010
76.0	10113	10383	2.940	2.980
77.0	9870	10131	2.911	2.951
78.0	9632	9887	2.881	2.921
79.0	9402	9649	2.851	2.891
80.0	9177	9418	2.822	2.862
81.0	8959	9193	2.792	2.832
82.0	8746	8974	2.763	2.803
83.0	8539	8761	2.733	2.773
84.0	8338	8554	2.704	2.744
85.0	8142	8353	2.674	2.714

Table 19 (Continued)

Temp F	Min Res	Max Res	Min Vterm	Max Vterm
86.0	7952	8156	2.645	2.685
87.0	7766	7965	2.615	2.655
88.0	7586	7779	2.586	2.626
89.0	7410	7599	2.557	2.597
90.0	7239	7422	2.528	2.567
91.0	7072	7251	2.498	2.538
92.0	6910	7084	2.470	2.509
93.0	6751	6921	2.441	2.480
94.0	6597	6763	2.412	2.452
95.0	6447	6608	2.383	2.423
96.0	6301	6458	2.355	2.394
97.0	6159	6312	2.326	2.366
98.0	6020	6169	2.298	2.337
99.0	5885	6030	2.270	2.309
100.0	5754	5895	2.242	2.281
101.0	5625	5763	2.214	2.253
102.0	5500	5634	2.187	2.225
103.0	5378	5509	2.159	2.198
104.0	5260	5387	2.132	2.170
105.0	5144	5268	2.105	2.143
106.0	5031	5152	2.078	2.116
107.0	4921	5039	2.051	2.089
108.0	4813	4929	2.025	2.062
109.0	4709	4821	1.999	2.036
110.0	4607	4716	1.972	2.009
111.0	4507	4614	1.946	1.983
112.0	4410	4514	1.921	1.957
113.0	4315	4417	1.895	1.931
114.0	4223	4322	1.870	1.906
115.0	4133	4230	1.845	1.880
116.0	4045	4139	1.820	1.855
117.0	3959	4051	1.795	1.830
118.0	3876	3965	1.771	1.806
119.0	3794	3882	1.747	1.781
120.0	3714	3800	1.723	1.757

Table 19 (Continued)

Temp F	Min Res	Max Res	Min Vterm	Max Vterm
121.0	3636	3720	1.699	1.733
122.0	3561	3642	1.676	1.709
123.0	3487	3566	1.653	1.686
124.0	3415	3492	1.630	1.662
125.0	3345	3420	1.607	1.640
126.0	3276	3350	1.585	1.617
127.0	3209	3281	1.562	1.594
127.0	3209	3281	1.562	1.594
127.0	3209	3281	1.562	1.594
128.0	3144	3214	1.540	1.572
129.0	3080	3148	1.519	1.550
130.0	3017	3084	1.497	1.528
131.0	2956	3022	1.476	1.507
132.0	2897	2961	1.455	1.486
133.0	2839	2901	1.434	1.464
134.0	2782	2843	1.414	1.444
135.0	2726	2786	1.393	1.423
136.0	2672	2730	1.373	1.403
137.0	2619	2676	1.354	1.383
138.0	2567	2623	1.334	1.334
139.0	2517	2571	1.315	1.315
140.0	2467	2520	1.296	1.296

Table 20
Outdoor Air Temp.

A2 Analog Input

Thermistor Accuracy = 0.90°F from -10 to 0°F

Thermistor Accuracy =0.540°F from 0 to 700°F

Thermistor Accuracy = 1.80°F from 70 to 150°F

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 6980 Ohms.

Used to sense temperatures at the following point:

1. Outdoor Air Temp. CVHE/F/G

Table 20

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
-10.0	117759	124893	4.713	4.729
-5.0	99928	105882	4.666	4.685
0.0	86006	89016	4.617	4.630
5.0	73347	75873	4.557	4.573
10.0	62706	64832	4.490	4.508
15.0	53738	55532	4.416	4.435
20.0	46161	47678	4.333	4.355
25.0	39742	41029	4.242	4.266
30.0	34292	35386	4.143	4.169
35.0	29713	30628	4.037	4.065
40.0	25830	26611	3.923	3.953
45.0	22512	23180	3.803	3.835
50.0	19668	20242	3.675	3.709
55.0	17225	17718	3.542	3.578
60.0	15120	15546	3.404	3.441
65.0	13303	13670	3.262	3.300
70.0	11367	12410	3.083	3.190
75.0	10049	10956	2.935	3.044
80.0	8903	9692	2.787	2.896
85.0	7903	8592	2.640	2.748
90.0	7029	7632	2.494	2.601
95.0	6264	6792	2.350	2.456
100.0	5592	6056	2.210	2.313

Table 20 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
105.0	5002	5410	2.074	2.174
110.0	4482	4841	1.943	2.039
115.0	4022	4340	1.816	1.909
120.0	3616	3897	1.696	1.784
125.0	3259	3506	1.581	1.665
130.0	2941	3161	1.473	1.552
135.0	2658	2854	1.371	1.446
140.0	2406	2581	1.274	1.345
145.0	2181	2337	1.184	1.250
150.0	1980	2120	1.099	1.161

Table 21
Saturated Evap. Refrigerant Temp.

A4 Analog Input

Type U Thermistor Temperature Versus Resistance and Terminal Voltage Table

for a pullup resistor of 38300 Ohms.

Used to sense temperatures at the following point:
1. Saturated Evap. Refrigerant Temp. CVHE/F/G

Table 21

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
10.0	62706	64832	3.084	3.129
11.0	60788	62843	3.047	3.093
12.0	58935	60921	3.011	3.057
13.0	57144	59063	2.974	3.020
14.0	55412	57268	2.937	2.984
15.0	53738	55532	2.900	2.947
16.0	52119	53854	2.863	2.910
17.0	50554	52231	2.826	2.873
18.0	49040	50663	2.789	2.836
19.0	47577	49145	2.752	2.799
20.0	46161	47678	2.715	2.762
21.0	44791	46259	2.678	2.725
22.0	43466	44886	2.641	2.688
23.0	42183	43558	2.604	2.651
24.0	40943	42273	2.567	2.614
25.0	39742	41029	2.530	2.577
26.0	38580	39826	2.493	2.540
27.0	37455	38661	2.457	2.503
28.0	36367	37534	2.420	2.467
29.0	35312	36442	2.384	2.430
30.0	34292	35386	2.347	2.394
31.0	33304	34363	2.311	2.357
32.0	32358	33365	2.276	2.321
33.0	31448	32423	2.240	2.286
34.0	30566	31511	2.206	2.250
35.0	29713	30628	2.171	2.216
36.0	28886	29773	2.137	2.181
37.0	28086	28944	2.102	2.146

Table 21 (Continued)

Temp °F	Min Res	Max Res	Min Vterm	Max Vterm
38.0	27310	28142	2.069	2.112
39.0	26559	27364	2.035	2.078
40.0	25830	26611	2.002	2.045
41.0	25125	25881	1.969	2.012
42.0	24441	25174	1.936	1.979
43.0	23778	24489	1.904	1.946
44.0	23135	23824	1.872	1.913
45.0	22512	23180	1.840	1.881
46.0	21908	22556	1.809	1.850
47.0	21322	21950	1.778	1.818
48.0	20754	21363	1.747	1.787
49.0	20203	20794	1.717	1.756
50.0	19668	20242	1.687	1.726
51.0	19150	19706	1.657	1.696
52.0	18647	19186	1.628	1.666
53.0	18158	18682	1.599	1.637
54.0	17685	18193	1.570	1.608
55.0	17225	17718	1.542	1.579
56.0	16779	17257	1.515	1.551
57.0	16346	16810	1.487	1.523
58.0	15925	16376	1.460	1.496
59.0	15517	15955	1.434	1.469
60.0	15120	15546	1.407	1.442
65.0	13303	13670	1.282	1.314
70.0	11367	12410	1.140	1.222
75.0	10049	10956	1.036	1.111
80.0	8903	9692	0.940	1.009
85.0	7903	8592	0.853	0.915
90.0	7029	7632	0.773	0.830
95.0	6264	6792	0.701	0.753
100.0	5592	6056	0.635	0.682
105.0	5002	5410	0.576	0.619
110.0	4482	4841	0.523	0.561
115.0	4022	4340	0.474	0.509
120.0	3616	3897	0.430	0.462

Table 22
Compressor Motor Winding Temp.

A6 Analog Input

Motor Winding RTD Temperature Versus Resistance and Terminal Voltage Table for a pullup resistor of 1000 Ohms.

Used to sense temperatures at the following point:

1. Compressor Motor Winding Temp. #1- CVHE/F/G

2. Compressor Motor Winding Temp. #2 CVHE/F/G

Table 22

Temp °F	Nom. Resistance	Nom. Vterm
50.0	70.4616	0.3322
55.0	71.3567	0.3361
60.0	72.2589	0.3400
65.0	73.1679	0.3439
70.0	74.0839	0.3479
75.0	75.0067	0.3519
80.0	75.9363	0.3559
85.0	76.8727	0.3600
90.0	77.8158	0.3640
95.0	78.7656	0.3681
100.0	79.7219	0.3722
105.0	80.6848	0.3763
110.0	81.6542	0.3805
115.0	82.6301	0.3846
120.0	83.6124	0.3888
125.0	84.6011	0.3930
130.0	85.5960	0.3973
135.0	86.5972	0.4015
140.0	87.6047	0.4058
145.0	88.6183	0.4100
150.0	89.6380	0.4143
155.0	90.6638	0.4187
160.0	91.6955	0.4230
165.0	92.7333	0.4273
170.0	93.7770	0.4317
175.0	94.8265	0.4361

Table 22 (Continued)

Temp °F	Nom. Resistance	Nom. Vterm
180.0	95.8818	0.4405
185.0	96.9430	0.4449
190.0	98.0098	0.4493
195.0	99.0823	0.4538
200.0	100.1604	0.4582
205.0	101.2441	0.4627
210.0	102.3333	0.4672
215.0	103.4280	0.4717
220.0	104.5281	0.4762
225.0	105.6336	0.4807
230.0	106.7444	0.4852
235.0	107.8604	0.4898
240.0	108.9817	0.4944
245.0	110.1082	0.4989
250.0	111.2398	0.5035
255.0	112.3765	0.5081
260.0	113.5182	0.5127
265.0	114.6648	0.5173
270.0	115.8164	0.5220

Information on the Oil Pressure Sensor Calibration Diagnostic

UCP2 uses two pressure sensors (one in the sump, one in the discharge) to detect oil flow. When the oil pump has been off for at least 5 minutes, the sump and discharge pressures are compared. If the absolute difference between the sensors is less that 3 psid, the difference is zeroed. If the absolute difference is greater than 3 psid, a sensor calibration diagnostic is called out.

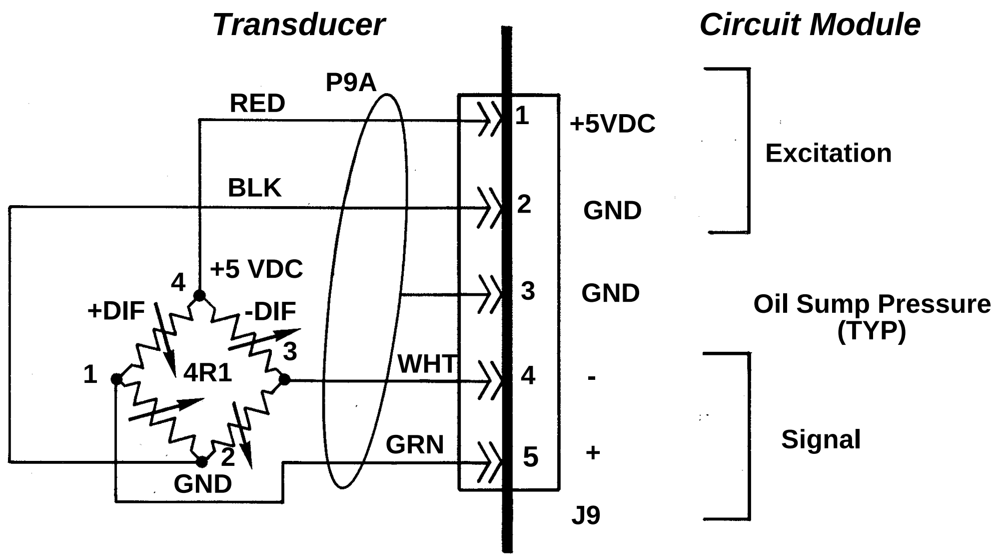
Changes made to -11 Circuit Software (X-13650451-09 hardware) to improve Prevac performance:

The 3 psid calibration check was modified to require 90 consecutive seconds of greater than 3 psid before a diagnostic is issued.

During Prestart, the calibration check is stopped when the evaporator flow is first sensed. Previously the calibration calculation and diagnostic check were terminated when the oil pump turned on. The change was implemented to avoid nuisance pressure fluctuations caused by the start of evaporator water flow and the guide vanes bpi search.

Suspend calling out the oil pressure sensor calibration diagnostic until evaporator water has been flowing for a minimum of 5 minutes.

Transducer Checkout Procedure



Quick Test Procedure For Mediamate Water Pressure Transducer

1. Set regulated power supply to 5 VDC. Connect 5 VDC to Pins 2 and 4 on the Transducer.
2. Check zero balance at ambient pressure by attaching Transducer lead wires of a Digital Volt Meter to Pin 1 and Pin 3 of the Transducer.

   ~ Pin 4 Excitation (Supply) > Connect 5 VDC Power Supply
   ~ Pin 2: Excitation (Supply)
   ~ Pin 1: Signal Connect Volt Meter
   ~ Pin 3: Signal

(A cable assembly with a mating Hirschmann connector could be made up and used for all tests.)
Allow transducer to stabilize under power (approximately 15 - 30 seconds).

Readings:

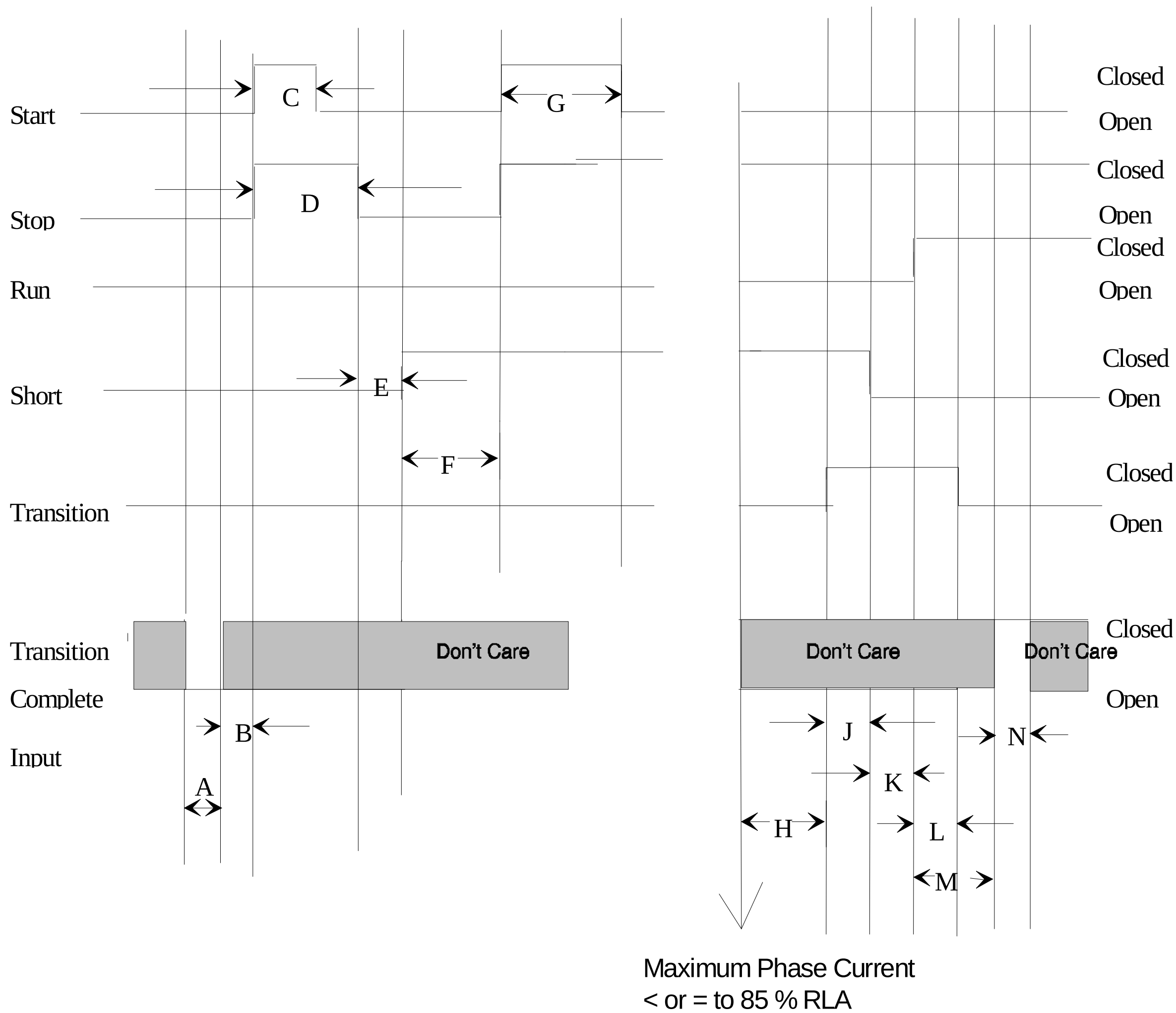
1 Transducer used for Condenser Pressure, Oil Discharge Pressure and Oil Sump. Trane Part Number TDR0272. A good Transducer reading is: 15 mV ± 1mV

2 Evaporator and Condenser Water Flow Transducer and Part Number TDR0274 A good Transducer reading is: 0 mV ± 1 mV.

3. Insert a Q-Tip or small wooden dowel into the pressure port and gently apply force to the diaphragm and watch the DVM for a corresponding change in output.

Starter Contactor Sequence

Timing requirements to operate the "Stop," "Start," "Short," "Transition," and "Run" contact closure outputs are shown below. Prior to closing the "Short" contact, the transition complete input is verified to be open, otherwise a MMR diagnostic is generated.



Key:

Interval	Units	Actual
A. (Test for transition complete input open)		160 to 240 msec
B. (Just delay time)		20 msec
C. Close 1M (2K1) Contactor and test for no current.) (Starter integrity test)		500 msec
D.		1 sec
E. (Open1M (2K1)		200 msec
F. (Close Shorting Contactor (2K3) and test for no current, then wait for Start command) (Starter integrity test)		1.0 sec (Min.)
G. (Close 1M (2K1)	sec	2sec
H. (Wait 1.5 sec after phase currents drop to 85%)	sec	1.5 sec
J. (Close 2K4 Transition Contactor)	msec	100 msec
K. (Open S (Shorting) Contactor	msec	260 msec
L. (Close 2M (2K2) Contactor)		140 msec
M. (Wait to look for Transition complete) N. (Filtering time on Transition complete input)	msec	2.32 to 2.38sec
N. (Filtering time on Transition complete input)	msec	160 to 240 sec

Note: The transition complete contact closure is expected to be an auxiliary contact to the "Run Contactor' (2K2).

Starter Module CT Voltage and Currents

There are two configurations of CTs used. One is the single stage, the other is the dual stage. A different transfer function exists depending on whether a single or dual stage configuration is used. The two configurations appear the same to the UCP2 by normalizing each. Thus a different equation is used to take the actual line current and convert it to a common 'Normalized Line Current' that may be used in Table 23 . Note that the 'Terminal Volts' is the AC voltage seen at the current input terminal pairs of the Starter module. These pairs are J5-1,2, J5-3,4 and J5-5,6.

For a single stage CT:

Normalized Line Current (%) = Actual Line Current(Amps)*100%*Primary Turns CT-Rated
Primary Current (Amps)

For a two stage CT:

Normalized Line Current (%) = Actual Line Current(Amps)*138.89%*Primary Turns Line CT
Rated Primary Current (Amps)

Table 23-Current Input Transfer Function

Normalized Line Current	Terminal Input Current (mA RMS)	Terminal Volts (V RMS) (± 5%)	Normalized Line Current%	Terminal Input Current (mA RMS)	Terminal Volts (V RMS) (± 5%)
0	0	0	115	115	4.23
5	5	1.19	120	120	4.36
10	10	1.37	125	125	4.49
15	15	1.53	130	130	4.62
20	20	1.67	135	135	4.75
25	25	1.81	140	140	4.88
30	30	1.95	145	145	5.02
35	35	2.09	150	150	5.15
40	40	2.23	160	160	5.41
45	45	2.36	170	170	5.67
50	50	2.50	180	180	5.94
55	55	2.63	190	190	6.20
60	60	2.77	200	200	6.46
65	65	2.90	210	210	6.72
70	70	3.03	220	220	6.99
75	75	3.17	230	230	7.25
80	80	3.30	240	240	7.51
85	85	3.43	250	250	7.77
90	90	3.57	260	260	8.03
95	95	3.70	270	270	8.29
100	100	3.83	280	280	8.56
105	105	3.96	290	290	8.82
110	110	4.10		300	9.08

The Current Transformers should conform to the following resistance tables:

For Single Stage CTs:

Part Number	CT Size	Winding Resistance (±10%)
X-13580253-01	100 A	23 Ω
X-13580253-02	150 A	35 Ω
X-13580253-03	200 A	46 Ω
X-13580253-04	275 A	67 Ω
X-13580253-05	400 A	68 Ω
X-13580253-06	500 A	84 Ω
X-13580253-07	700 A	128 Ω
X-13580253-08	1000 A	235 Ω
X-13580253-09	50 A	12 Ω
X-13580253-10	75 A	17 Ω

Two-Stage CTs:

Two-stage CTs are used on systems that have primary voltages in excess of 600 VAC or line currents higher than 936 amps. The first-stage CT part numbers are in the X-13580047 and X-13580048 families. The second stage is a custom current transformer (X-13580266-01) which has a transformation ratio of 3.6A:0.1A. The secondary of this transformer is then applied to the Starter module.

Trane Part Number	Resistance in Ohms		
X-13580266-01	Primary: 0.020 red and brown leads	Secondary: 5.5 black and white leads	
X-13580047-01	X1 to X4 0.468	X1 to X3 0.374	X1 to X2 0.312
X-13580047-02	X1 to X4 0.697	X1 to X3 0.565	X1 to X2 0.502
X-13580048-01	X1 to X4 0.031	X1 to X3 0.028	X1 to X2 0.023
X-13580048-02	X1 to X4 0.076	X1 to X3 0.065	X1 to X2 0.054
X-13580048-03	X1 to X4 0.104	X1 to X3 0.086	X1 to X2 0.069
X-13580048-04	X1 to X4 0.170	X1 to X3 0.136	X1 to X2 0.119
X-13580048-05	X1 to X3 0.255	X1 to X2 0.204	N/A
X-13580271-01		0.026	
X-13580272-01		0.031	
X-13580272-02		0.044	

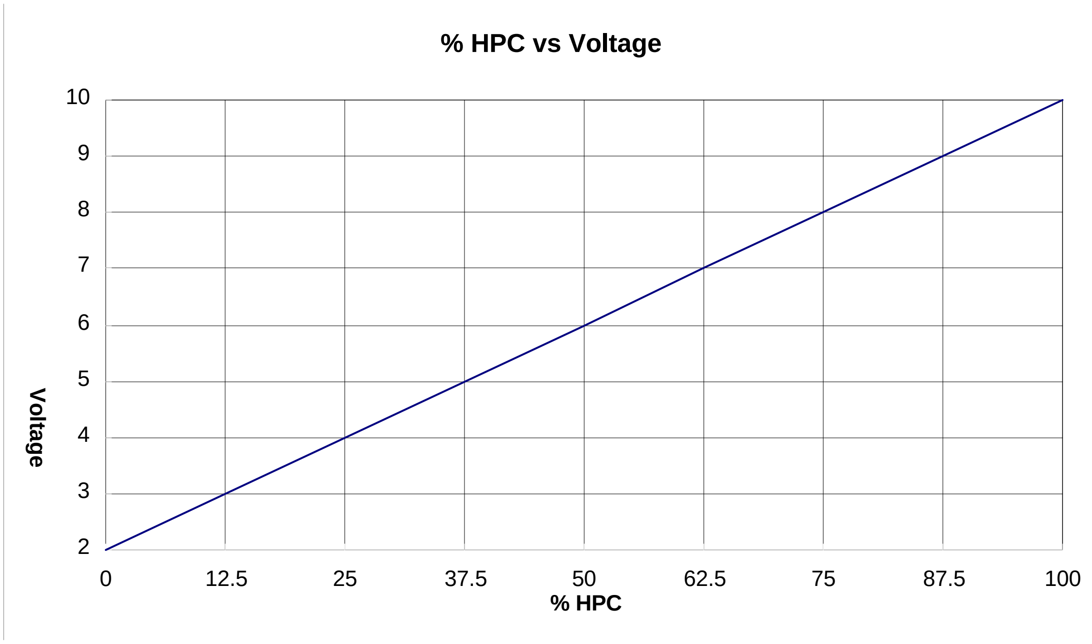
Troubleshooting The Percent Condenser Output:

1 While the unit is running, hook up a DC Volt meter between Circuit module terminals J7-1 and J7-2

2 Select '% cond' for the Rfgt Pressure Output Option in the Field Startup menu.

3 View the High Pressure cutout setting in the machine configuration menu.

4 View the condenser refrigerant pressure in the refrigerant report.



5 The voltage reading on the voltmeter should correspond to the following graph within 5 percent.

Note: *The zero point on the graph corresponds to 0 PSIA.*

The transfer function is 2 to 10 VDC corresponding to 0 Psia to the HPC setting (psig) plus the local atmospheric pressure setting or, said another way, 0 Psia to HPC in psia. The Percent Condenser Pressure indication output is based on the Condenser Refrigerant Pressure sensor if the Condenser Pressure Option is selected as 'Installed' at the CLD. The Percent Condenser Pressure indication output is based on the Saturated Condenser Refrigerant Temperature sensor if the Condenser Pressure Option is selected as ' Not Installed' at the CLD.

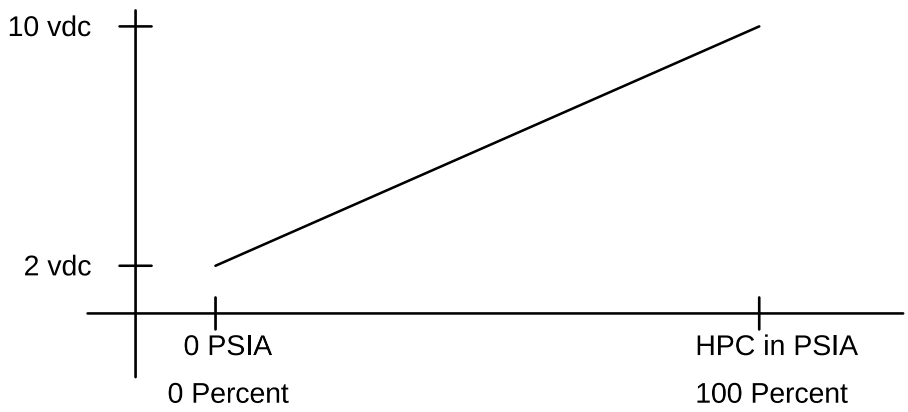
From UCP2 Initial Release (July 93) to 10/21/96 Software Release:

When a Temperature Sensor Only is Used and A Temperature to Pressure Conversion is Made: If the Condenser Saturated Temperature Sensor goes out of range due to an open or short, a pressure sensor diagnostic will be called and the output will also go to the respective out of range value. That is, for an out of range low on the sensor, the output will be limited to 2.0 VDC. For an out of range high on the sensor, the output will be limited to 10.0 VDC.

When a Condenser Pressure Sensor is Used (Optional): If the Condenser Pressure sensor goes out of range, like due to an open or short, a pressure sensor diagnostic will be called and the output will go to end of range low. That is, for an out of range low on the sensor, the output will be limited to 2.0 VDC. For an out of range high on the sensor, the output will be limited to 2.0 VDC.

As of the 10/21/96 Software Release Including Fastpak and UCP2 Enhancements:

When a Temperature Sensor Only is Used and A Temperature to Pressure Conversion is Made, or When a Condenser Pressure Sensor is Used (Optional): If the Temperature Sensor (or Condenser Pressure sensor) goes out of range due to an open or short, a Temperature Sensor (or Pressure Sensor) diagnostic will be called and the output will go to end of range low. That is, for an out of range low on the sensor, the output will be limited to 2.0 VDC. For an out of range high on the sensor, the output will be limited to 2.0 VDC.



Refrigerant Differential Pressure Indication

The transfer function is 2 to 10 VDC corresponding to the menu entered “Min Delta Pressure Calibration” setting to the menu entered “Max Delta Pressure Calibration” setting. The Min Delta Pressure Calibration setting has a range of 0-400 psid (0-2758 kPa) in increments of 1 psid (1 kPa). The Max Delta Pressure Calibration setting has a range of 1-400 psid (7-2758 kPa) in increments of 1 psid (1 kPa). The condenser refrigerant pressure is based on the Condenser Refrigerant Pressure sensor if the Condenser Pressure Option is selected as ‘Installed’ at the CLD. The condenser refrigerant pressure is based on the Saturated Condenser Refrigerant Temperature sensor if the Condenser Pressure Option is selected as ‘Not Installed’ at the CLD. The evaporator refrigerant pressure is based on the Saturated Evaporator Refrigerant Temperature Sensor.

The Percent Condenser Pressure/Refrigerant Differential Pressure Indication Output is located on the Circuit module at J7-1,2

If the saturated condenser temperature is used to determine condenser pressure, it takes about 11.5 seconds for UCP2’s % condenser pressure output to respond to a step change in saturated condenser temperature.

The Percent Condenser Pressure output can source a maximum of 30mA of current.

External Current Limit Setpoint

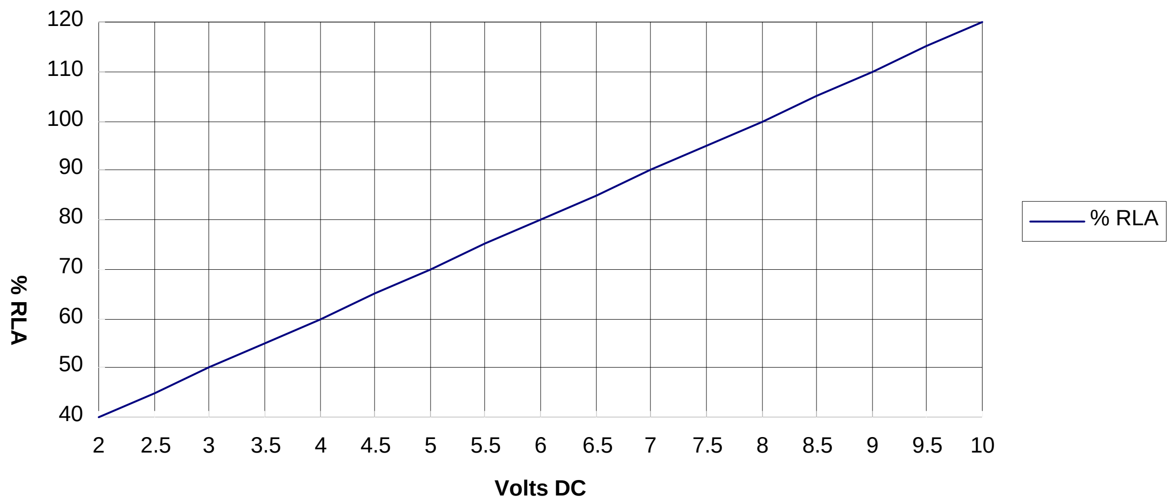
External Current Limit is an option that allows the customer to change the current limit setpoint from a remote location. The External Current Limit Setpoint is found on Options module terminals J7-11 and J7-12.

UCP2 accepts either a 2-10 VDC or 4-20 mA analog input to set the chillers external current limit setpoint. 2-10 VDC and 4-20mA each correspond to a 40 to 120% RLA range.

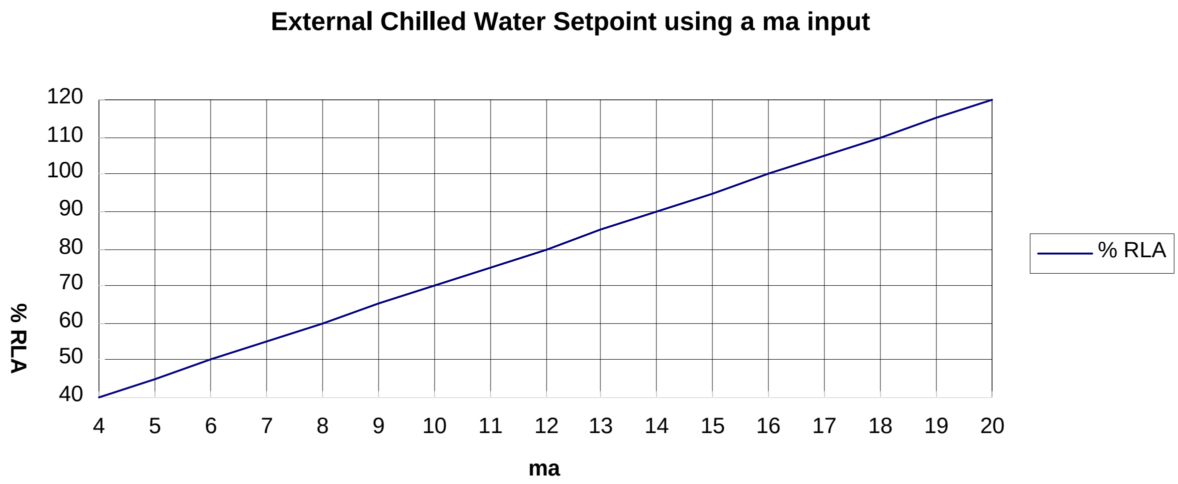
The following equations are what UCP2 uses:

	Voltage Signal	Current Signal
As generated from external source	VDC=.10*(%)-2.0	mA=.20(%)-4.0
As processed by UCP2	%=10.0*(VDC)+20.0	%=5.0(mA)+20.0

The following graph shows External Current Limit Setpoint with a 2-10 VDC input:



The following graph shows External Current Limit Setpoint with a 4-20 mA input:

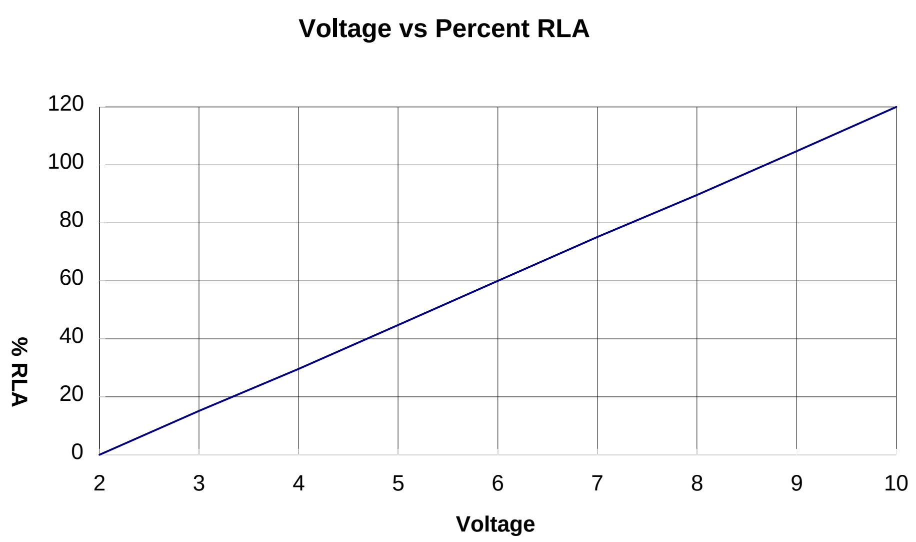


The Options module DIP switches control what type of input is used. To use a 2-10 VDC signal switch 2-1 should be in the off position. To use a 4-20 mA signal, switch 2-1 should be in the on position.

The user must also specify the type of External Setpoint Input (4-20 mA or 2-10 VDC) in the machine configuration menu.

Percent RLA Output

UCP2 provides a 2-10 VDC analog output to indicate % RLA. The transfer function shall be 2 to 10 VDC corresponding to 0 to 120% RLA with a resolution of 0.146%



The following graph illustrates the output:

The % RLA output is found on the Options module terminals J7-3 and J7-4. The % RLA output is polarity sensitive.

J7-3 is +

J7-4 is -

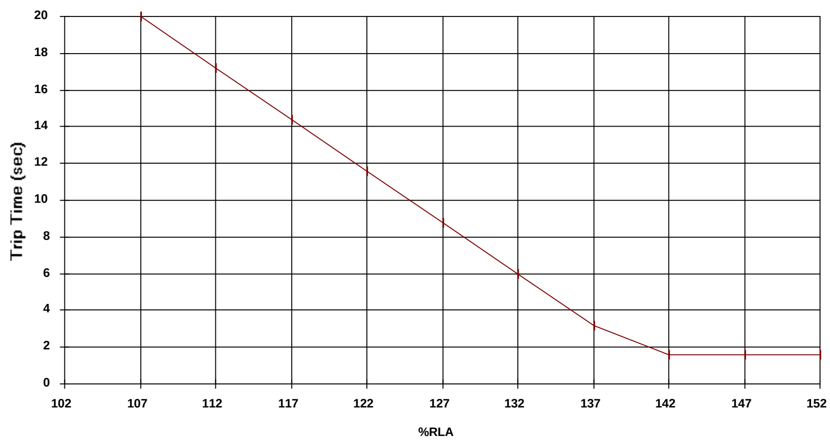
The % RLA output’s maximum source capability is 30mA.

Current Overload Protection:

In the run mode, a “time-to-trip” curve is looked at to determine if a diagnostic should be called. UCP2 continuously monitors the compressor current to provide running overcurrent and locked rotor protection. Overcurrent protection is based on the phase with the highest current. It will trigger a manually resettable diagnostic shutting down the compressor when the current exceeds the time-trip curve. The compressor overload is based on unit RLA.

The time-trip curve follows:

Figure 10
Overload Trip Time vs % RLA



Evaporator Refrigerant Temperature Limit

The Evaporator Refrigerant Temperature Limit is a multistage control that acts to prevent chiller shutdown when the evaporator refrigerant temperature approaches the cutout setpoint by reducing chiller capacity. Chiller capacity is reduced by the following steps, providing increasingly aggressive action as the trip point is approached:

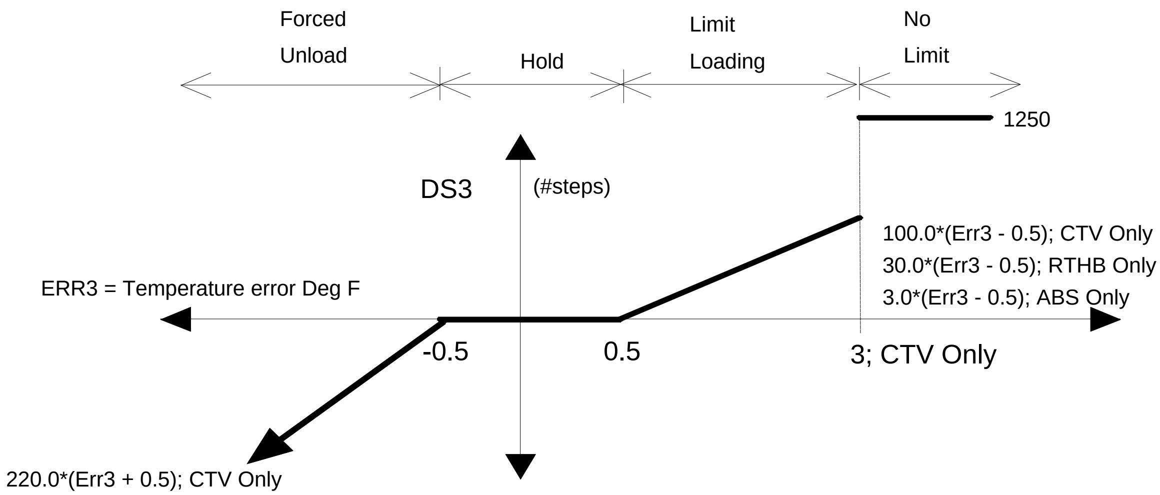
1 Limit requests for capacity increases.

2 Prohibit requests for capacity increases.

3 Initiate stepped capacity reduction.

4 Initiate maximum capacity reduction.

The purpose of this limit is to provide maximum capacity while preventing chiller shutdown due to low evaporator refrigerant temperatures.



The Low Refrigerant Temperature Cutout setpoint is found in the Field Startup menu.

Design:

Lowest standard chilled water setpoint (CWS) = 37°F

Lowest standard low refrig. temp. cutout (LRTC) = 28.5°F

Lowest standard refrig. temp. limit setpoint (LRTLS) (28.5 + 2) = 30.5°F

Minimum differential between LRTC and CWS = 6.0°F

Condenser Refrigerant Pressure Limit

Prevents chiller shutdown due to High Condenser Pressure.

Explanatory Comments:

This is a multistage control that acts to prevent chiller shutdown when the condenser refrigerant pressure approaches the cutout setpoint by reducing chiller capacity. Chiller capacity is reduced via the following steps, providing increasingly aggressive action as the trip point is approached:

1. Limit requests for capacity increases.
2. Prohibit requests for capacity increases.
3. Initiate stepped capacity reduction.
4. Initiate maximum capacity reduction.

The intent of this control is to provide maximum capacity while preventing chiller shutdown due to high condenser pressures.

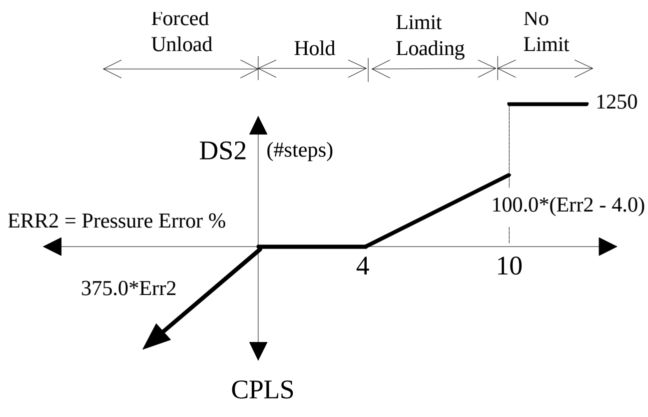
The condenser pressure limit function is based on the Condenser Pressure sensor if the Condenser Pressure sensor option is selected as 'Installed' on the CLD. The limit is based on the Saturated Condenser Refrigerant Temperature if the Condenser Pressure sensor is selected as 'Not Installed' on the CLD.

Setpoint (CPLS)   range: (80 - 120)% HPC (Factory set to 93% HPC)

Figure 11 provides a graphical representation of the condenser pressure limit control regions for an arbitrary setpoint and the condenser pressure limit control output Ds2.

Where ERR2 = CPLS(% HPC) - actual pressure (% HPC)

Figure 11
Condenser Pressure Limit Control Regions for an Arbitrary Setpoint



Head Relief Request

Keeps chiller on line and/or signals operator when the chiller experiences high head.

This output relay provides the customer with a “hook” into UCP2 to signal the Tower that the current tower temperature is too high. A customer may use this relay to energize multiple fans to reduce the tower water temperature.

UCP2 provides a relay output (Options module terminals J12-1 and J12-2) that can be used to operate some function in the condenser cooling system. Contacts should be compatible with a 115/240VAC control circuit.

For CTV units, the Head Relief Request relay is energized anytime the unit is in condenser limit. In addition, the Head Relief Request relay is energized anytime a surge condition is detected.

The Head Relief Request relay is accessible by Tracer such that Tracer can command it on and off if one of the above criteria is not already energizing the relay.

> *NOTE: The Head Relief Request relay is energized based only on the mode of the chiller. For example, the relay will follow either the condenser limit mode or the surge mode. In the case of condenser limit, the relay is not directly dependent on pressure; again, it is only dependent on mode.*
>
> *It is recommended that an adjustable off-delay relay be used to provide some control adjustment. It is not recommended that a tower fan be turned on and off solely based on the condenser limit mode; excessive cycling may result.*

Free Cooling Relay Checkout

1 Disable Free Cooling in the Operator Settings menu.

2 Unplug the free cooling relay connectors from J-16 and J24 on the Options module.

3 Using a DVM, measure the resistance between J16-3 and J16-2. Record in the table below.

4 Measure and record the resistance between J16-3 and J16-1.

5 Measure and record the resistance between J24-3 and J24-2.

6 Measure and record the resistance between J24-3 and J24-1.

7 Enable Free Cooling in the Operator Settings menu.

8 Using a DVM, measure the resistance between J16-3 and J16-2. Record in the table below.

9 Measure and record the resistance between J16-3 and J16-1.

10 Measure and record the resistance between J24-3 and J24-2.

11 Measure and record the resistance between J24-3 and J24-1.

12 If any of the recorded resistances are out of the specified values, the free cooling relays are not functioning properly.

Terminals	Recorded Resistance	Value when Free Cooling is Disabled	Value when Free Cooling is Enabled
J16-3 to J16-2		Less than 5 Ohms	Greater Than 1M Ohm
J16-3 to J16-1		Greater Than 1M Ohm	Less than 5 Ohms
J24-3 to J24-2		Less than 5 Ohms	Greater Than 1M Ohm
J24-3 to J24-1		Greater Than 1M Ohm	Less than 5 Ohms

UCP2 provides Free Cooling control as follows:

1 The Options module shall provide the following Binary Inputs/Outputs:

~ Class II Binary Input: External Free Cooling Switch
~ Class II Binary Input: FC Actuators Closed FC valve closed limit switches are wired in series to this input.
~ Class I Form C Binary Output: FC Actuator Relay #1 Operates first FC valve.
~ Class I Form A Binary Output: FC Aux. Relay Customers choice.
~ Class I From C Binary Output: FC Actuator Relay #2 Operates second FC valve

2 The operator has the ability to control Free Cooling On/Off manually at the Front Panel, Automatically via a On/Off binary input (called External Free Cooling Switch) at the Options module, and from a command from Tracer. At the binary input at the Options module, an open shall command Free Cooling Off, and a Short will command Free Cooling On.

3 For display and mode purposes, the FC mode shall be displayed when the FC valves are open. That is, when the FC valve relays are energized and the FC valve limit switches open the FC mode shall be displayed. Likewise, when the FC valve relays are de-energized and the FC valve limit switches close, the FC mode shall be terminated.

4 FC cannot be entered if the chiller is in STOP; FC can only be entered from AUTO. Either setting the FP CLD to FC On or closing the Ext FC Switch binary input, or receiving a

command from Tracer will initiate the sequence to enter FC.

If the chiller is in AUTO and not running UCP2 will start the condenser water pump just as it does for powered cooling (Since the unit is in AUTO the chilled water pump should already be running. Once condenser water flow is confirmed the FC valve relays #1, #2, and the FC Aux. relay are all energized. If the FC valve closed limit switches do not open within 3 minutes a MMR diagnostic is generated. Once the FC valve closed limit switches open the unit is considered in FC.

If the chiller is in AUTO and is running powered cooling, the chiller will do a normal friendly shutdown when FC is commanded from either source. The compressor will enter RUN: UNLOAD, POST LUBE, and overdrive the IGVs closed as usual. Once the IGV's have been overdriven closed and condenser water flow has been confirmed, the three FC relays will be energized.

In FC manual vane control shall not be active.

It is not necessary to check the status of the IGVs during FC. The IGVs must be closed during FC; it is sufficient to assume that they are closed since they are overdriven closed on all compressor shutdowns and hard (powerup) resets.

Once the FC valves have opened, a FC valve closure will generate an MMR diagnostic.

If there is a diagnostic in FC, Stop FC as normal and Stop the Condenser Water Pump.

5 FC can be terminated from either the Front Panel CLD, the Ext. FC Switch input at the Options module, or the Tracer (or a diagnostic). Once commanded to Off, the Two FC relays are de-energized. If the FC valve closed limit switches do not close within 3 minutes a MMR diagnostic is generated. Once the limit switches are closed the chiller status should revert back to AUTO and powered cooling may be entered if there is a call for cooling.

6 **On all FC chillers (FC is installed),** the FC valve limit switches must be closed to both start and run powered cooling, otherwise a MMR diagnostic will be generated. The IGVs must be held closed for 3 minutes on each startup following a free cooling mode.

7 On FC units the failure of communications between the Options module and the Chiller module will cause a MMR diagnostic at the Chiller module.

Hot Gas Bypass

Customer Benefit:

Hot Gas Bypass eliminates or reduces cycling on process or other installations having load variations that occasionally include brief periods of no or very light load. Eliminating cycling shortens the time required to respond to load increases, and prevents chiller starts during periods when chiller starts are prohibited.

HGBP is also used as a way to correct applications where the chiller has been oversized.

Explanatory Comments:

Hot Gas Bypass is a chiller option that is intended to reduce the capacity of the chiller at minimum load conditions by bypassing condenser gas to the evaporator. On standard chillers, minimum load is determined by the amount of gas that leaks through the inlet guide vanes when they are fully closed. By adding HGBP a portion of this gas comes directly from the condenser, thus reducing the amount of cooling done by the chiller.

For CVHE/F/G/B Chillers:

See also High Compressor Discharge Temperature Protection.

In the Machine Configuration menu, UCP2 has an entry to indicate that hot gas bypass is installed. The installation of HGBP will enable all of the HGBP valve diagnostics, HGBP screens in the CLD, and communications diagnostics with the I/O module. The HGBP valve can be independently controlled in the Service Tests menu. Tracer is also be able to Enable/ Disable HGBP.

When HGBP is Enabled, HGBP control will check to see if the IGV position is less than or equal to the larger of either Fully Closed or the “Guide Vane Closed Travel Stop”. When this condition is satisfied and the ELWT is 0.5°F below the chilled water setpoint an integral is permitted to ramp up. When the integral reaches a predetermined value, the HGBP mode is Entered.

Once the HGBP mode is entered, the output of the evaporator leaving water temperature control algorithm will be scaled for tics (versus steps) and sent to the I/O module to modulate the HGBP valve. The inlet guide vanes are given a loading pulse until the “HGBP Mode, IGV Target” is attained.

Exiting Hot Gas Bypass:

While in the HGBP mode, the same integral that allowed HGBP to be entered is ramped if the ELWT is 0.5°F above the chilled water setpoint. This allows the HGBP mode to be terminated if the load increases. When this integral is greater than or equal to some preset value, HGBP control is terminated, and LWT control is directed to the inlet guide vanes.

If the user Enables the “Maximum HGBP Time” timer, the algorithm shuts the CenTraVac down after the timer has expired. The “Maximum HGBP Time” will be user adjustable. When the timer is Enabled, the mode display is modified to show the Hot Gas Bypass time remaining.

During HGBP, the normal differential to stop is obeyed. If the differential to stop or the "Maximum HGBP Time" timer requires the Centravac to shutdown, the HGBP valve will be held while the inlet guide vanes are driven closed. When the inlet guide vanes are fully closed, the Centravac will shutdown.

Hot Gas Bypass Valve Operation:

The HGBP valve is constantly driven closed when neither in the HGBP mode nor under manual HGBP valve control. During this time, the I/O module will be checking for a valve closed indication from the HGBP valve switch input and will issue a valve diagnostic if the valve is not found to be closed. Upon seeing a transition from either HGBP mode or manual HGBP valve control, the I/O module will allow 3 minutes to expire before calling out a Hot Gas Bypass Valve closure overdue diagnostic.

Manual Hot Gas Bypass Valve Control:

The HGBP valve is capable of manual control while the unit is running and during the stop mode. The manual HGBP control is based on a load, hold, or unload signal from a user specified duration setpoint every 5 seconds.

Design:

The HGBP feature is designed as specified above. The following is added for further clarity.

Hot gas bypass (HGBP) is a control option designed to avoid chiller cycling during low load conditions while still maintaining the chilled water temperature set point. This is accomplished by artificially increasing the load on the compressor. The compressor load is artificially increased using the hot gas bypass valve to divert refrigerant gas from the condenser back into the suction side of the compressor. The hot gas bypass valve is modulated by appropriately scaling the output of the ELWT control algorithm.

HGBP Control Actuator Characteristics: Single phase induction motor moving a butterfly valve

HGBP Control Algorithm Inputs: ELWT control error, IGV target position

HGBP Control Algorithm Output: number of tics to open/close the hot gas bypass valve

HGBP Control Algorithm Sample Rate: Sample Rate: = 5 sec

Install and Enable

To get the HGBP control option to function it must first be installed. To install the HGBP control option enter the **Machine Configuration Group**. In this group make sure to

1 Install Hot Gas Bypass Control.

Installing HGBP control sets up the display features associated with HGBP. However, for the control algorithm to be operational it must be enabled. To enable the HGBP control algorithm enter the **Field Start-up Group**.

2 Enable Hot Gas Bypass Control.

In addition, this group also has three user adjustable setpoints associated with the HGBP control option. The three setpoints are:

1) HGBP mode, IGV Target:%

In the HGBP mode, the HGBP valve modulates capacity while the inlet guide vanes move to a target position set by the user. The inlet guide vanes move to the target position by a maximum of 40 steps every sample period.

2) Guide Vane Closed Travel Stop:%

In order for the hot gas bypass staging integral to begin integrating, the inlet guide vane step position must be below a minimum step position known as the guide vane closed travel stop. In addition, the ELWT must be 0.5°F below the chilled water setpoint.

3) Maximum HGBP Time:

When the maximum HGBP time is enabled the maximum HGBP timer is used to determine how long the chiller is allowed to operate in the hot gas bypass mode.

Hot Gas Bypass Control Algorithm

The HGBP staging integral begins to execute once the ELWT falls below the CWS by 0.5°F, and the inlet guide vanes are below a user specified minimum position (usually zero). Once the HGBP staging integral has reached a preset number, capacity control transitions to the HGBP valve. The HGBP value is modulated by converting ELWT step commands into time based (tic) commands. Once transition occurs, the inlet guide vanes are loaded by 40 steps every sample period until they reach a user specified target value. To exit the HGBP modulating mode, the evaporator leaving water temperature must begin to rise above the CWS. If the ELWT exceeds the CWS by 0.5°F, the staging integral begins to integrate. Once the staging integral reaches a preset number, capacity control transitions back to the inlet guide vanes.

Ice Machine Control

UCP2 will accept a contact closure input to initiate Ice building. When in the ice making mode, the compressor will be fully loaded and will continue to operate until the ice contacts open or the return water temperature reaches an Adjustable Termination Setpoint. If terminated on return setpoint, UCP2 will not allow the chiller to restart until the ice making contact is opened.

UCP2 will provide an output contact closure that can be used as a signal to the system that ice making is in operation. This relay will be closed when ice making is in progress and open when ice making has been terminated by either UCP2 or the remote interlock. It is used to signal the system changes required to convert to and from ice making.

Ice mode operation will be indicated by an “Ice Building” operation mode that can be displayed at the unit or communicated over the communications link.

The UCM shall provide a Service level Enable/Disable menu entry for the Ice Building feature when the Ice Building Option is installed.

The UCM shall accept either an isolated contact closure (call it External Ice) or a Remote Communicated input (Tracer) to initiate an Ice building mode where the unit runs fully loaded at all times. Ice building shall be terminated either by opening the contact or based on entering evaporator water temperature. The UCM shall not permit the Ice Building mode to be entered again until the unit is switched to the Non-Ice Building mode and back into the Ice Building mode.

It is not acceptable to reset the CWS low to achieve a fully loaded compressor; the UCM shall force the compressor to full load.

When entering ICE-BUILDING the compressor is loaded at its maximum rate and when leaving ICE-BUILDING the compressor is unloaded at its maximum rate. For CTV only: while loading and unloading the compressor all surge detection is ignored.

> *Implementation Note: Surge detection is not explicitly prevented while loading and unloading the chiller. While the above requirement is valid it is not expected that a surge would be detectable during the relatively short load and unload intervals.*

In Ice building, softloading and current limit setpoints less than the maximum are all ignored. For example, if the Front Panel Current Limit setpoint is set to 80%, in Ice Building the Active Current Limit setpoint is automatically reset to its maximum value.

In the Ice Building mode if the unit gets down to the freezestat setting (water or refrigerant) the unit will shutdown on a diagnostic, just like in normal operation.

Condenser, current and evaporator limits are active during Ice Building.

If any other limits are placed on IGV or Slide Valve stroke during Normal Cooling, the UCM will ignore these limits during ICE-BUILDING; that is, the IGVs or Slide Valve will be fully loaded/stroked/extended during ICE BUILDING.

ICE-BUILDING and ICE-BUILDING COMPLETE are modes displayed by the UCM at the front panel and communicated to the Tracer.

If the UCM has the capacity for some other feature to reset the cooling tower temperature, the cooling tower temperature is reset to its minimum value or the cooling tower commanded to run at full capacity.

ICE-BUILDING may be terminated by one of three means:

1 Opening the External Ice Contacts/Remote communicated input (Tracer), or satisfying an evaporator entering water temperature setpoint, or surging for 15 minutes at full open IGV

or

2 In general, if there is an MAR diagnostic during either ICE-BUILDING or ICE BUILDING COMPLETE and the diagnostic clears the chiller shall return to either ICE-BUILDING or ICE-BUILDING COMPLETE, respectively

or

3 If the ice building complete mode is reached and the ice building complete mode is exited due to a diagnostic or a system stop command, removing the diagnostic or returning the system to the auto mode will cause the system to return to the ice building complete mode. The system will leave ice building complete when the ice building command is released in any mode.

During ICE-BUILDING, any other action specified for Normal Cooling due to surge detection is overridden. If surge is detected continuously for 15 minutes while in ICE-BUILDING and while the IGVs are fully open, shutdown the chiller on a latching MAR diagnostic; the chiller is latched out of ICE-BUILDING until the Ice-Building command is cycled; Normal Cooling is permitted. (Notice in both ICE-BUILDING and NORMAL COOLING a surge diagnostic is a MMR diagnostic., however, if there was a surge diagnostic. when in ICE-BUILDING the diagnostic is automatically cleared when the ice-building command is withdrawn.)

The UCM shall accept a non-volatile “Front Panel Ice Termination Setpoint” adjustable from 20 to 31°F (-6.7 to -0.5°C) in at least 1°F (0.1°C) increments. When the evaporator entering water temperature drops below the ice termination setpoint the chiller will enter it's shutdown sequence.

If ICE-BUILDING is terminated by either the External Ice contacts opening or the Remote Communicated input (Tracer) while the compressor is running, as noted above, the compressor will be unloaded at its maximum rate, however, the chiller will continue to operate at minimum capacity for an adjustable 0 to 10 minutes; call this the “Ice-to-Normal Cooling Timer” (default value to be 5 minutes). If during the Ice-to-Normal Cooling Time the LWT becomes greater than the Normal Cooling Differential To Stop shutdown temperature, the chiller will be returned to Normal LWT control and shutdown on the Normal Differential to Stop criteria. If the Normal Cooling Differential to Stop shutdown temperature is not reached during the Ice-to-Normal Cooling Time, the chiller enters its shutdown sequence; chiller restart will then be based on the Normal Cooling Differential to Start criteria.

Ice Building will only be permitted when both the unit is in Auto and the last mode of operation has been normal (non-ice building) AUTO (either running or not running). See the following table:

Unit Status 0 = Stop 1 = Auto	Ext Ice Input	Entr Evap Temp Compared to Ice-ter Setpt	Chiller Mode

0	Ice (Short)	>	Stop
1	Normal (0pen)	>	Auto
1	Ice (Short)	>	Ice-building, Run Full Load.
1	Ice (Short)	<	Ice-completed, Ice-building Terminated Because the Ice Completion Setpt was Met.
1	Ice (Short)	>	Ice Completed, Cannot Restart Ice-building Because the Ext Ice Input was not Cycled Out and Back Into “Ice Building”.
1	Normal (Open)	>	Auto, Normal Chiller Operation Based and Chilled Water Setpoint.
1	Ice (Short)	>	Ice-building.

<u>Pumps:</u>

Condenser pump control shall be as in Normal Cooling.

Chilled Water pump control shall be as in Normal Cooling.

Upon termination of Ice Building based on evaporator entering water temperature, either the UCM or Unit must provide a contact closure that can be used to turn off the pump system. This requirement shall be satisfied as follows:

During the ICE-BUILDING COMPLETE mode the CHWP relay shall be de-energized immediately upon entering “Ice Building Complete” (following the “post lubrication” mode) as if the chiller had been manually put to STOP. Assuming the chiller is still in the AUTO mode when the External Ice Contacts are opened, the CHWP relay shall be re-energized.

<u>Ice Building Relay:</u>

The ice building relay will be held on as long as there is a valid ice building command and the Ice building complete mode has never occurred. If ice building is interrupted by a diagnostic or some type of stop command, the relay will be held on. This is because clearing of the diagnostic or re-entering the auto condition will allow ice building to resume. Said another way, the ice building relay is on whenever there is a Ice Building command (External or Remote Communicated (Tracer)) but we are not in the Ice Building Complete mode.

Recommended Wire Lengths for PTs

The maximum recommended wire length for PTs in a single PT system:

Wire Gauge	Max lead length(ft)	Max lead length (m)
8	5339	1627
9	4234	1291
10	3357	1023
11	2663	811
12	2112	643
13	1674	510
14	1328	404
15	1053	321
16	835	254
17	662	201
18	525	160
19	416	126
20	330	100
21	262	79
22	207	63

The maximum recommended wire length for PT leads in a dual PT system are:

Wire Gauge	Max Wire Length Primary (ft)	Max Wire Length Primary (m)	Max Wire Length Secondary (ft)	Max Wire Length Secondary (m)
8	3061	933	711	217
9	2428	740	564	172
10	1924	586	447	136
11	1526	465	355	108
12	1211	369	281	85
13	960	292	223	68
14	761	232	177	53
15	603	184	140	42
16	478	145	111	33
17	379	115	88	26
18	301	91	70	21
19	238	72	55	16
20	189	57	44	13
21	150	45	34	10
22	119	36	27	8

Note: These wire lengths are for copper conductors only

Note: The above lengths are maximum round trip wire lengths. The maximum distance the PT can be located is 1/2 of the listed value.

Checking for an Open, Burnt, or Shorted CentraVac Motor Windings

1 Remove power from the machine and remove the three main fuses.

2 Disconnect the top three leads from the motor lugs.

3 Verify the terminal to terminal and terminal to ground resistances are correct by using the tables below.

For Low to Medium Voltage Machines (Less than 4160 V):

Meas. Point	Chassis GND	T1	T2	T3	T4	T5	T6
Chassis GND	N/A	V x 1,000*	V x 1,000*	V x 1,000*	V x 1,000*	V x 1,000*	V x 1,000*
T1	V x 1,000*	N/A	¥	¥	< 1 ohm	¥	¥
T2	V x 1,000*	¥	N/A	¥	¥	< 1 ohm	¥
T3	V x 1,000*	¥	¥	N/A	¥	¥	< 1 ohm
T4	V x 1,000*	< 1 ohm	¥	¥	N/A	¥	¥
T5	V x 1,000*	¥	< 1 ohm	¥	¥	N/A	¥
T6	V x 1,000*	¥	¥	< 1 ohm	¥	¥	N/A

where:

¥ = Infinity

V = The rated motor voltage.

* The rated motor voltage multiplied by 1,000 is the minimum resistance that you should measure here. The actual resistance that you measure will probably be higher.

For High Voltage Machines (4160 V and higher): Consult Trane Technical Service for this information.

Information on Tracer

Tracer is automatically installed when it does control. If it only does monitoring, it will not automatically install and, in fact, a loss of comm with Tracer will be called if a person manually installs the Tracer option. If the TCI and/or Tracer option are automatically installed by hooking them up, the CLD menus will be automatically changed to 'installed'. If loss of comm occurs with the Tracer or TCI, UCP2 will default to front panel setpoints, but the diagnostic ‘Tracer Communications Lost’ will be called at UCP2 and Tracer will not be de-installed. On a power up, if the Tracer option was previously installed, the TCI module will call out a 'Tracer failed to Establish Comm' if the Tracer does not take control within two minutes.

If Tracer communications are lost for 15 continuous minutes after communication have been established, then front panel setpoints are used by UCP2.

LEDS:

The diagnostic LED in the upper left hand side of the module is only active for the printer module, and should never come on for a TCI module.

The Green LED labeled RXA should be continuously flashing.

The Red LED labeled TXA should blink about once every two seconds.

The Green LED labeled RXB will blink constantly

The Red LED labeled TXB will blink once every minute for comm 3, and once every 20-60 seconds for comm 4.

Dip Switches:

For a TCI comm 3 module, the dip switches should be in the following positions:

1 - Off

2 - Off

3 - Off

For a TCI comm 4 module, the dip switches should be in the following positions:

1 - Off

2 - On

3 - Off

UCP2/Tracer Compatibility List:

Go into the Service Tests menu and display the software revision levels, or view the part numbers on the modules.

Confirm that all of UCP2 modules are equal to or greater than the revision levels listed below.

Module	Module Hardware	Software
CTV Chiller	X-13650450-02	02
Circuit	X-13650451-04	03
CTV Stepper	X-13650455-03	03
LCLD	X-13650448-02	06
TCI Com 4 Baud 9600	X-13650457-03	03
TCI Com 3 Baud 1200	X-13650460-02	02
Options	X-13650452-02	02

Purge	X-13650454-04	03
Starter	X-13650453-04	05

UCP2 Clock:

UCP2 clock will retain it's last time stored in it at power down, but will not increment while powered down. It is necessary to update the time and date if UCP2 is powered down for an extended period of time. If UCP2 has been powered down for an extended period, then a informational warning 'Check Clock' will be announced.

The Year 2000:

UCP2 is year 2000 compliant, because UCP2’s valid range of dates is January 1st, 1980 to February 5th, 2116. No date problems will occur in this range, including the year 2000.

There will be no operating effect for UCP2 going to the year 2000. 90 percent of all Trane centrifugal chillers installed in 1938 were still running in 1994. However, it is unlikely that a chiller installed in 1996 will run twice that amount of time and make it until 2116. If a chiller does live until to the year 2116, the clock will roll over to January 1st, 1980. UCP2 does not use the date for any control functions. The date and time is displayed for the operators information, and as a time/date stamp for diagnostics.

UCP2 has been tested, and transitions to the year 2000 without any problem.

Date information is not required to be entered in the initial configuration of UCP2. However, most people do like to set up the clock on initial startup.

> The format of UCP2’s date follows: Time, Month, Day, Year. Example: 11:59 pm Dec 31, 2116.
>
> The years are input as 4 digits.
>
> The valid range of dates is from January 1, 1980 to February 5, 2116.
>
> When UCP2 reaches the end of the date range, the clock rolls over to January 1, 1980.
>
> Date calculations are not used in the standard operation of the UCP2. UCP2 does not perform any date based feature activation/deactivation.
>
> Diagnostics are time stamped and the time stamp is displayed in the following format: 6:31 pm Feb 12, 1997.
>
> UCP2 does perform leap year calculations, but does not perform daylight savings time calculations.

Chilled Water Reset

The chilled water reset function can provide energy savings and/or better critical zone control and/or better indoor air quality when applied to the right system type.

The chilled water setpoint is reset based on a temperature (return chilled water, zone, outside air), or other input such as humidity or a customer supplied analog signal.

The most common use of chilled water reset is to provide constant return chilled water temperature. UCP2 makes this particular form of chilled water reset very easy to set up. One way to do this is to make it the default setting.

Constant Return Reset is a good starting point in a comfort cooling application. If you think about it, at full load you both cool (sensible) and dehumidify (latent) the air at the coil. The coil is designed to do so much sensible and latent cooling at a given entering water temperature. If you can get sufficient sensible and latent cooling at full load, it follows then that by maintaining a constant leaving water temperature off the coil (entering to the chiller) at part load you have a good chance of satisfying both your sensible and latent loads. Of course, if at part load the customer finds the air is either too wet or too dry, the Chilled Water Reset Ratio can be adjusted up or down to compensate.

Due to extremely low usage, CWR based on Zone Temperature has been eliminated from the basic UCP2.

UCP2 resets the chilled water temperature setpoint based on either return water temperature, or outdoor air temperature. Return Reset is standard, Outdoor Reset is optional.

The following are selectable:

1. One of three RESET TYPEs: no CWR, RETURN WATER TEMPERATURE RESET, OUTDOOR AIR TEMPERATURE RESET, or CONSTANT RETURN WATER TEMPERATURE RESET. The UCP2 will not permit more than one type of reset to be selected.
2. RESET RATIO Setpoints.

For outdoor air temp. reset there shall be both positive and negative reset ratios.

3. START RESET Setpoints.
4. MAXIMUM RESET Setpoints.

The maximum reset's are with respect to the chilled water setpoint.

The equations for each type of reset are:

Return

CWS' = CWS + RATIO (START RESET - (TWE - TWL))

and CWS' > or = CWS

and CWS' - CWS < or = Maximum Reset

Outdoor

CWS' = CWS + RATIO * (START RESET - TOD)

and CWS' > or = CWS

and CWS' - CWS < or = Maximum Reset

where

CWS' is the new chilled water setpoint,

CWS is the active chilled water setpoint before any reset has occurred

RESET RATIO is a user adjustable gain

START RESET is a user adjustable reference

TOD is the outdoor temperature

TWE is entering evap. water temperature

TWL is leaving evap. water temperature

MAXIMUM RESET is a user adjustable limit providing the maximum amount of reset. For all types of reset, CWS' - CWS < or = Maximum Reset.

The values for “RESET RATIO” for each of the reset types are:

Reset Type	Reset Ratio Range	Increment (English Units)	Increment (SI Units)	Factory Default Value
Return:	10 to 120%	1%	1%	50%
Outdoor	80 to -80%	1%	1%	10%

The values for “START RESET” for each of the reset types are:

Reset Type	Start Reset Range	Increment (English Units)	Increment (SI Units)	Factory Default Value
Return	4 to 30°F (2.2 to 16.7°C)	1°F	0.1°C	10°F (5.6°C)
Outdoor	50 to 130°F (10 to 54.4°C)	1°F	0.1°C	90°F (32.2°C)

The values for MAXIMUM RESET for each of the reset types are:

Reset Type	Maximum Reset Range	Increment (English Units)	Increment (SI Units)	Factory Default Value
Return	0 to 20°F (0.0 to 11.1°C)	1°F	0.1°C	5°F (2.8°C)
Outdoor	0 to 20°F (0.0 to 11.1°C)	1°F	0.1°C	5°F (2.8°C)

Both Return and Outdoor Reset do not apply to hot water control mode where UCP2 is controlling the Leaving Condenser Water Temperature.

In addition to Return and Outdoor Reset, UCP2 will provide a menu item at the Clear Language Display for the operator to select a Constant Return Reset. Constant Return Reset will reset the leaving water temperature setpoint so as to provide a constant entering water temperature. The Constant Return Reset equation is the same as the Return Reset equation except on selection of Constant Return Reset, UCP2 will automatically set RATIO, START RESET, and MAXIMUM RESET to the following.

the RATIO = 100%

the START RESET = Design Delta Temp.

the MAXIMUM RESET = Design Delta Temp.

The equation for Constant Return is then as follows:

Constant Return

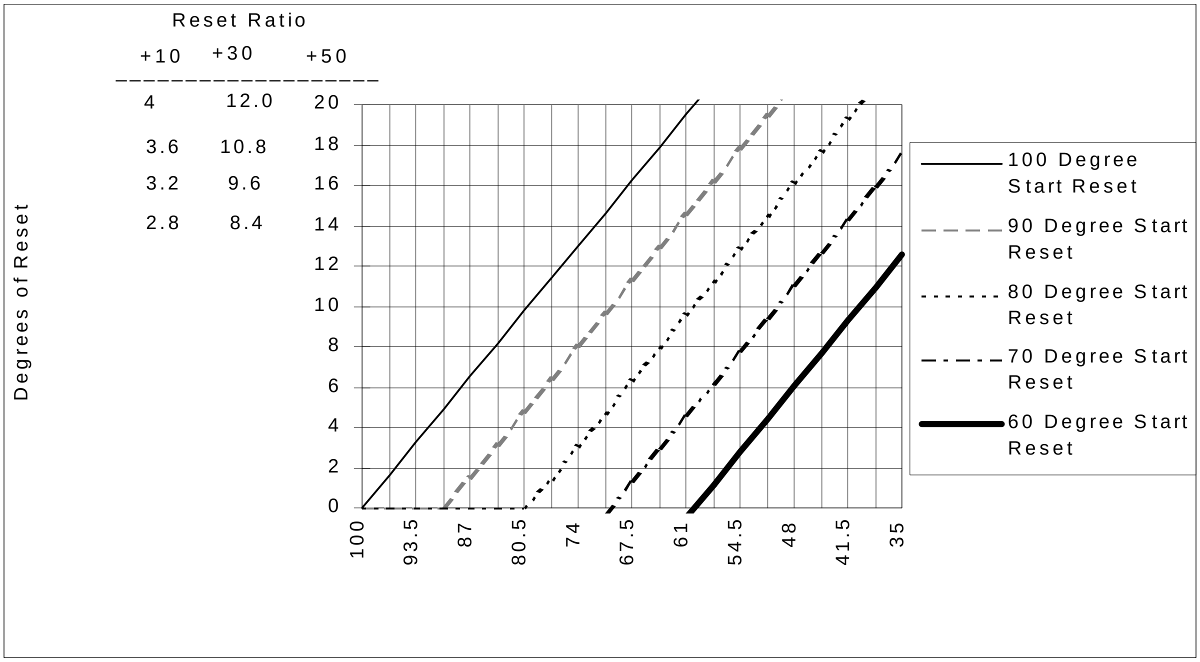
CWS' = CWS + 100% (Design Delta Temp. - (TWE - TWL))

and CWS' > or = CWS

and CWS' - CWS < or = Maximum Reset

Notice that Constant Return is nothing more than a specific case of Return Reset offered for operator convenience.

When any type of CWR is enabled, UCP2 will step the CWS toward the desired CWS' (based on the above equations and setup parameters) at a rate of 1°F every 5 minutes until the Active CWS equals the desired CWS'. This applies when the chiller is running. When the chiller is not running the CWS is reset immediately (within one minute) for Return Reset and at a rate of 1°F every 5 minutes for Outdoor Reset. The chiller will start at the Differential to Start value above a fully reset CWS or CWS' for both Return and Outdoor Reset.



The preceding graph shows the reset function for Outdoor Air Temp:

Note: This graph assumes that Maximum Reset is set to 20 degrees.

Using the Equation for calculating CWR for Outdoor Air Temp

Equation:

Degrees of Reset = Reset Ratio* (Start Reset - TOD)

Degrees of Reset:

Degrees of Reset = Active CWS - Front Panel CWS

or

Degrees of Reset = CWS’ - CWS

To obtain Active CWS from Degrees of Reset:

Active CWS = Degrees of Reset + Front Panel CWS

Reset Ratio:

The Reset Ratio on the CLD is displayed as a percentage. To use it in the above equation it must be converted to it’s decimal form.

Reset Ratio percent /100 = Reset Ratio decimal

Example of converting Reset Ratio:

If the Reset Ratio displayed on the CLD is 50% then use (50/100)=.5 in the equation

TOD = Outdoor Air Temp

Start Reset = Outdoor Air Start Reset

Example of Calculating Reset for Outdoor Air Temp:

If:

Reset Ratio = 35%

Start Reset = 80

TOD = 65

Maximum Reset = 10.5

How many Degrees of Reset will there be?

Degrees of Reset = Reset Ratio* (Start Reset - TOD)

Degrees of Reset = .35*(80-65)

Degrees of Reset = 5.25

If:

Reset Ratio = -70%

Start Reset = 90

TOD = 100

Maximum Reset = 17

How many Degrees of Reset will there be?

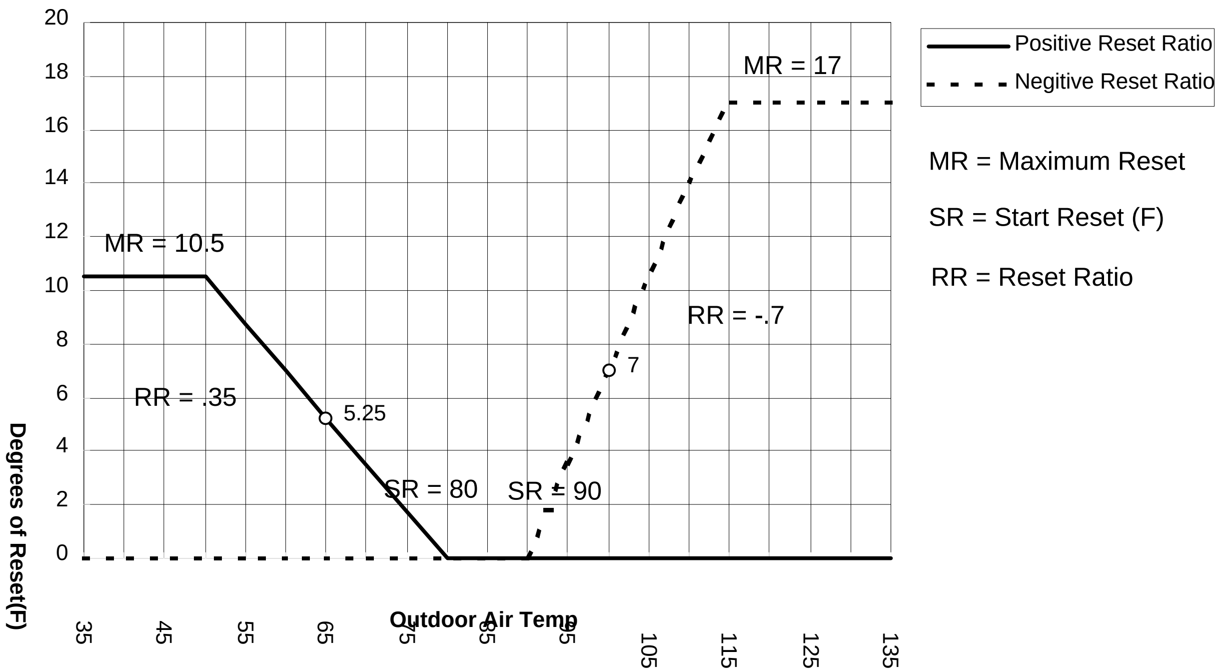
Degrees of Reset = Reset Ratio* (Start Reset - TOD)

Degrees of Reset = -.7*(90-100)

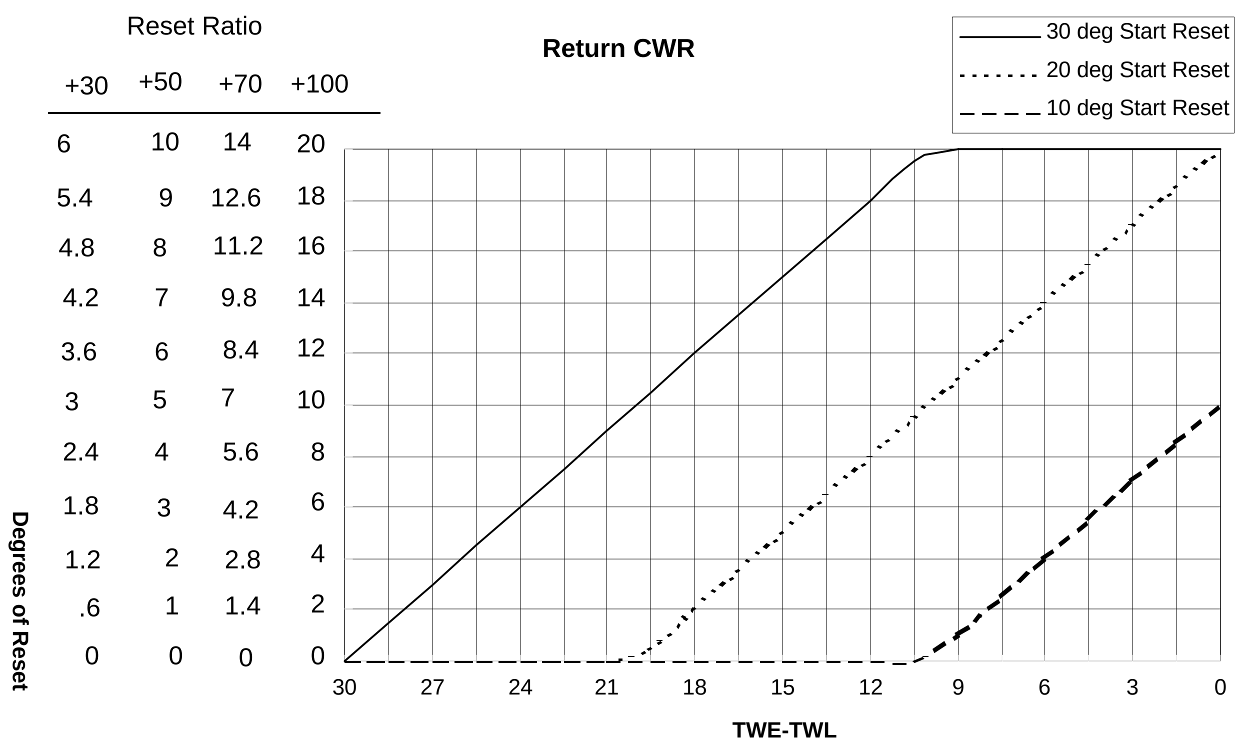
Degrees of Reset = 7

The following graph illustrates the reset functions of the above examples:

Degrees of Reset vs Outdoor Air Temp



The following graph shows the reset function for Return CWR:



Note: This graph assumes Maximum Reset is set to 20 degrees.

Example of Calculating Return Reset:

If:

Reset Ratio = 50%

Start Reset = 25

TWE = 65

TWL = 45

Maximum Reset = 8

How many Degrees of Reset will there be?

Degrees of Reset = Reset Ratio* (Start Reset - (TWE-TWL))

Degrees of Reset =.5*(25-(65-45))

Degrees of Reset = 2.5

If:

Reset Ratio = 70%

Start Reset = 20

TWE = 60

TWL = 53

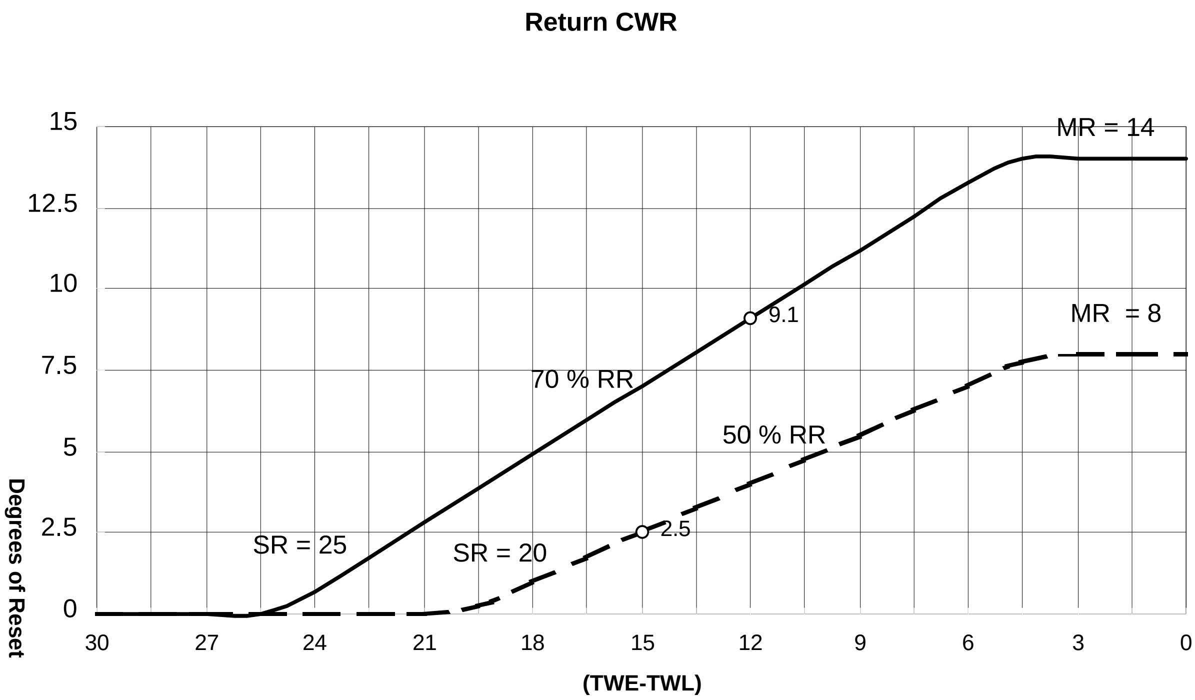
Maximum Reset = 14

How many Degrees of Reset will there be?

Degrees of Reset = Reset Ratio* (Start Reset - (TWE-TWL))

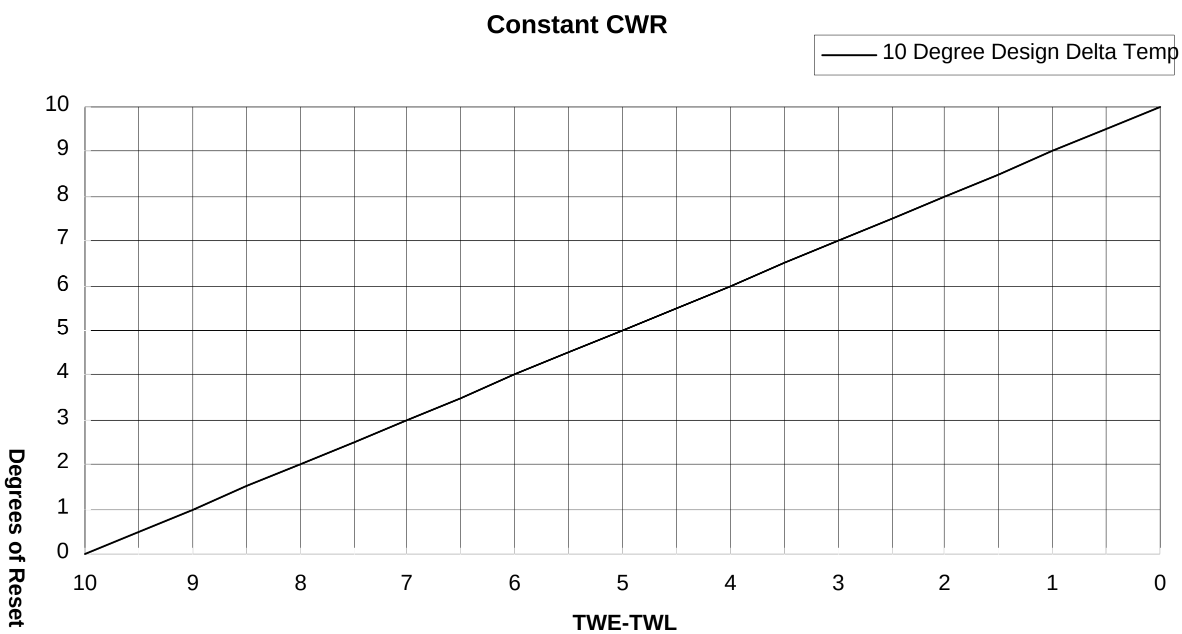
Degrees of Reset =.7*(20-(60-53))

Degrees of Reset = 9.1



The following graph illustrates the Reset Actions of the above examples:

Note: This graph assumes a Design Delta Temp of 10 degrees.



Information on the Printer Option

Th Printer module is essentially a TCI comm 4 board with a daughter board installed to communicate RS232 to the Printer. The Printer module is a listen only device and its software revision level will not show up in service tests.

The diagnostic LED in the upper left hand side of the module is only active for the printer module, and when it is on, this indicates a loss of communications with the Chiller module.

The Green LED labeled RXA should be continuously flashing.

The Red LED labeled TXA should never come on.

The Green LED labeled RXB will blink once every few seconds while the Printer module is printing, only if X-ON X-OFF handshaking is enabled.

The Red LED labeled TXB will blink constantly while the printer is printing.

The DIP switch settings for the Printer module follow:

1-off

2-off

3-on

Dip switch settings for the Okidata Microline 184 turbo printer follow:

Switch Bank 1

Parity Type odd parity even parity	**Switch 1** on off
Parity No parity With parity	**Switch 2** on off
Data Bits 8 bits 7 bits	**Switch 3** on off
Handshaking Ready/Busy X-on/X-off	**Switch 4** on off
Test Select Circuit Monitor	**Switch 5** on off
Mode Select Print mode Test mode	**Switch 6** on off
Busy Line Selection SSD-Pin 11 SSD+ Pin 11 DTR- Pin20 RTS- Pin 4	**Switches 7,8** off, on off,off on, on on, off

Switch Bank 2

Transmission Speed 19200 9600 4800 2400 1200 600 300 110	**Switch 1,2,3** on, on, on off, on, on on, off, on off, off, on on, on, off off, on, off on, off, off off, off, off
DSR Input Signal	**Switch 4**
Active	on
Inactive	off
Buffer	**Switch 5**
32 bytes	on
256 bytes	off
Busy Signal Timing	**Switch 6**
200 ms	on
1 second	off
DTR Signal	**Switch 7**
After power on	on
Printer selected	off
Not Used	**Switch 8**

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