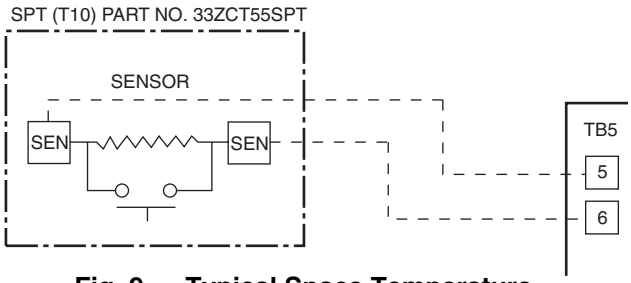


Fig. 9 — Typical Space Temperature Sensor Wiring

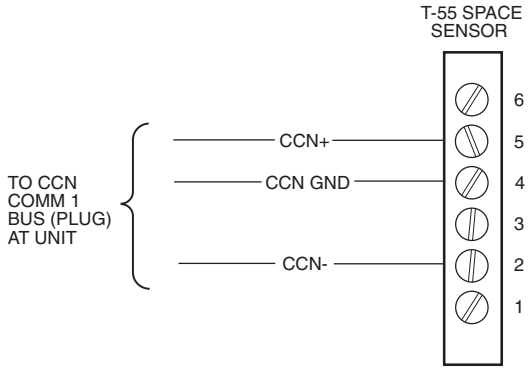


Fig. 10 — CCN Communications Bus Wiring to Optional Space Sensor RJ11 Connector

Energy Management Module (Fig. 11) — This factory-installed option (FIOP) or field-installed accessory is used for the following types of temperature reset, demand limit, and/or ice features:

- 4 to 20 mA leaving fluid temperature reset (requires field-supplied 4 to 20 mA generator)
- 4 to 20 mA cooling set point reset (requires field-supplied 4 to 20 mA generator)
- Discrete inputs for 2-step demand limit (requires field-supplied dry contacts capable of handling a 24 vac, 50 mA load)
- 4 to 20 mA demand limit (requires field-supplied 4 to 20 mA generator)
- Discrete input for Ice Done switch (requires field-supplied dry contacts capable of handling a 24 vac, 50 mA load)

See Demand Limit and Temperature Reset sections on pages 44 and 43 for further details.

⚠ CAUTION

Care should be taken when interfacing with other manufacturer's control systems due to possible power supply differences, full wave bridge versus half wave rectification. The two different power supplies cannot be mixed. *Comfort*Link™ controls use half wave rectification. A signal isolation device should be utilized if a full wave bridge signal generating device is used.

Loss-of-Cooler Flow Protection — A proof-of-cooler flow device is factory installed in all chillers. It is recommended that proper operation of the switch be verified on a regular basis.

Thermostatic Expansion Valves (TXV) — All units are equipped from the factory with conventional TXVs. Each refrigeration circuit is also supplied with a factory-installed liquid line filter drier and sight glass.

The TXV is set at the factory to maintain approximately 8 to 12° F (4.4 to 6.7° C) suction superheat leaving the cooler by metering the proper amount of refrigerant into the cooler. All TXVs are adjustable, *but should not be adjusted unless absolutely necessary.*

The TXV is designed to limit the cooler saturated suction temperature to 55 F (12.8 C). This makes it possible for unit to start at high cooler fluid temperatures without overloading the compressor.

Capacity Control — The control system cycles compressors, and minimum load valve solenoids (if equipped) to maintain the user-configured leaving chilled fluid temperature set point. Entering fluid temperature is used by the Main Base Board (MBB) to determine the temperature drop across the cooler and is used in determining the optimum time to add or subtract capacity stages. The chilled fluid temperature set point can be automatically reset by the return fluid temperature, space, or outdoor-air temperature reset features. It can also be reset from an external 4 to 20-mA signal (requires Energy Management Module FIOP or accessory).

The control has an automatic lead-lag feature built in which determines the wear factor (combination of starts and run hours) for each compressor. If all compressors are off and less than 30 minutes has elapsed since the last compressor was turned off, the wear factor is used to determine which compressor to start next. If no compressors have been running for more than 30 minutes and the leaving fluid temperature is greater than the saturated condensing temperature, the wear factor is still used to determine which compressor to start next. If the leaving fluid temperature is less than the saturated condensing temperature, then the control will start either compressor A1 or compressor B1 first, depending on the user-configurable circuit lead-lag value.

The TXVs will provide a controlled start-up. During start-up, the low pressure logic will be bypassed for $2^1/_2$ minutes to allow for the transient changes during start-up. As additional stages of compression are required, the processor control will add them. See Table 6 and 7.

If a circuit is to be stopped, the compressor with the lowest wear factor will be shut off first in most cases. Certain override conditions may shut off the smaller of two compressors on a circuit first.

The capacity control algorithm runs every 30 seconds. The algorithm attempts to maintain the Control Point at the desired set point. Each time it runs, the control reads the entering and leaving fluid temperatures. The control determines the rate at which conditions are changing and calculates 2 variables based on these conditions. Next, a capacity ratio is calculated using the 2 variables to determine whether or not to make any changes to the current stages of capacity. This ratio value ranges from –100 to +100%. If the next stage of capacity is a compressor, the control starts (stops) a compressor when the ratio reaches +100% (–100%). If installed, the minimum load valve solenoid will be energized with the first stage of capacity. Minimum load valve value is a fixed 30% in the total capacity calculation. The control will also use the minimum load valve solenoid as the last stage of capacity before turning off the last compressor. If the close control feature (CLS.C) [Configuration, OPT2] is enabled the control will use the minimum load valve solenoid whenever possible to fine tune leaving fluid temperature control. A delay of 90 seconds occurs after each capacity step change. Refer to Tables 6 and 7.

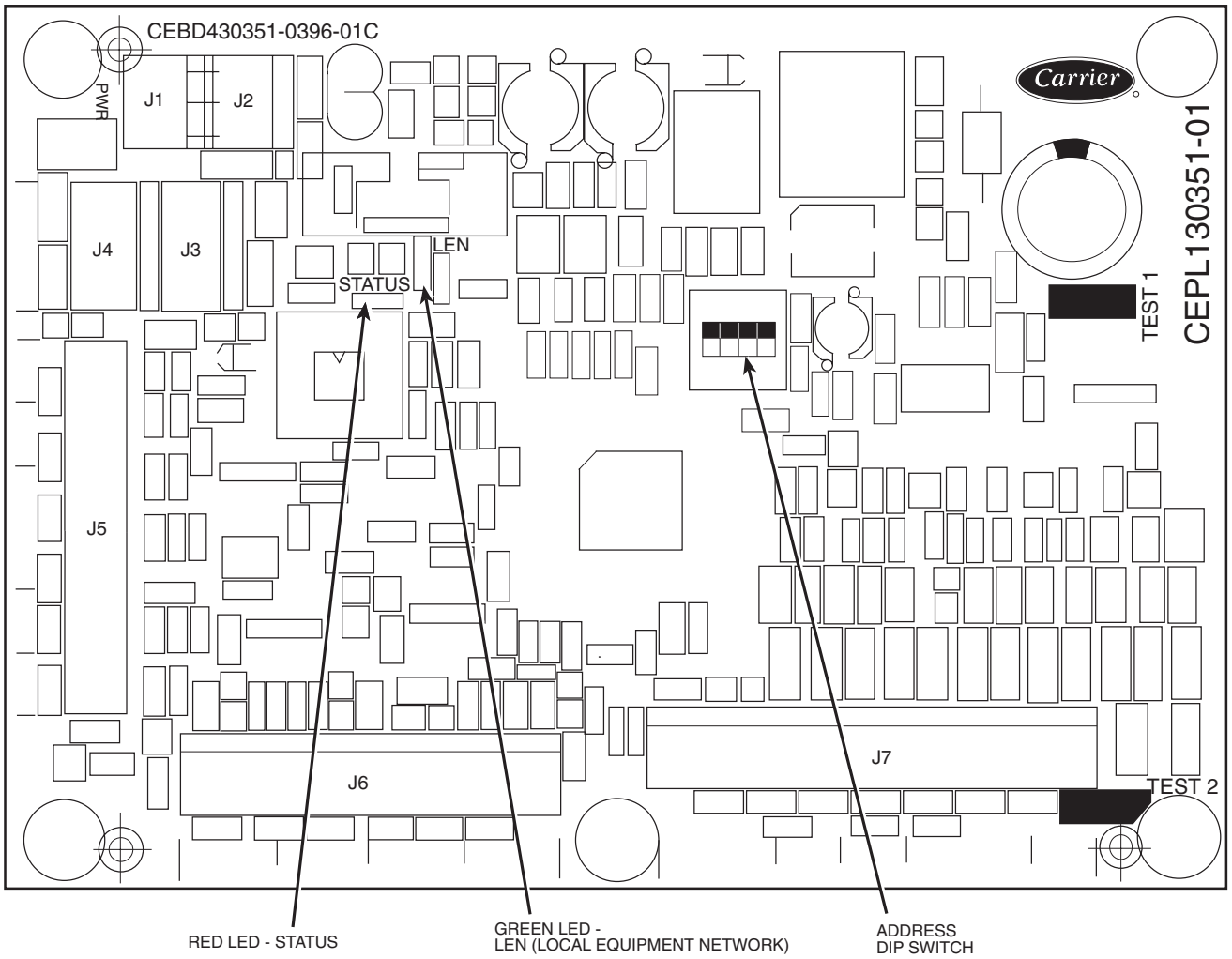


Fig. 11 — Energy Management Module

Table 6 — Part Load Data Percent Displacement, Standard Units without Minimum Load Valve

30RA UNIT SIZE	CONTROL STEPS	LOADING SEQ A		LOADING SEQ B	
		% Displacement	Compressor	% Displacement	Compressor
010,015 (60 Hz)	1	100	A1	—	—
015 (50 Hz), 018	1 2	50 100	A1 A1,A2	— —	— —
022 (60 Hz)	1 2	42 100	A1 A1, A2	— —	— —
022 (50 Hz), 025, 030	1 2	50 100	A1 A1,A2	— —	— —
032, 035 (60 Hz)	1 2 3	25 60 100	A1 A1,A2 A1,A2,B1	40 65 100	B1 A1,B1 A1,A2,B1
035 (50 Hz)	1 2 3	33 67 100	A1 A1, A2 A1, A2, B1	33 67 100	B1 A1, B1 A1, A2, B1
040	1 2 3	32 63 100	A1 A1, A2 A1, A2, B1	37 68 100	B1 A1, B1 A1, A2, B1
042, 045 (50 Hz), 050, 055	1 2 3 4	25 50 75 100	A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	25 50 75 100	B1 A1,B1 A1,B1,B2 A1,A2,B1,B2
045 (60 Hz)	1 2 3 4	22 44 72 100	A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	22 44 72 100	B1 A1,B1 A1,B1,B2 A1,A2,B1,B2

NOTE: These capacity steps may vary due to different capacity staging sequences.

Table 7 — Part Load Data Percent Displacement, Standard Units with Minimum Load Valve

30RA UNIT SIZE	CONTROL STEPS	LOADING SEQ A		LOADING SEQ B	
		% Displacement	Compressor	% Displacement	Compressor
010 (50/60 Hz)	1 2	69/ 71 100/100	A1* A1	— —	— —
015 (60 Hz)	1 2	79 100	A1* A1	— —	— —
015 (50 Hz)	1 2 3	28 50 100	A1* A1 A1,A2	— — —	— — —
018 (50/60 Hz)	1 2 3	32/ 31 50/ 50 100/100	A1* A1 A1,A2	— — —	— — —
022 (50/60 Hz)	1 2 3	27/ 35 42/ 50 100/100	A1* A1 A1,A2	— — —	— — —
025 (50/60 Hz)	1 2 3	38/ 37 50/ 50 100/100	A1* A1 A1,A2	— — —	— — —
030	1 2 3	39 50 100	A1* A1 A1,A2	— — —	— — —
032	1 2 3 4	15 25 60 100	A1* A1 A1,A2 A1,A2,B1	30 40 65 100	B1* B1 A1,B1 A1,A2,B1
035 (50/60 Hz)	1 2 3 4	16/25 25/33 60/67 100	A1* A1 A1,A2 A1,A2,B1	32/25 40/33 65/67 100	B1* B1 A1,B1 A1,A2,B1
040	1 2 3 4	24 32 63 100	A1* A1 A1,A2 A1,A2,B1	29 37 68 100	B1* B1 A1,B1 A1,A2,B1
042	1 2 3 4 5	18 25 50 75 100	A1* A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	18 25 50 75 100	B1* B1 A1,B1 A1,B1,B2 A1,A2,B1,B2
045 (60 Hz)	1 2 3 4 5	15 22 44 72 100	A1* A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	15 22 44 72 100	B1* B1 A1,B1 A1,B1,B2 A1,A2,B1,B2
045 (50 Hz), 050	1 2 3 4 5	19 25 50 77 100	A1* A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	19 25 50 77 100	B1* B1 A1,B1 A1,B1,B2 A1,A2,B1,B2
055	1 2 3 4 5	20 25 50 75 100	A1* A1 A1,B1 A1,A2,B1 A1,A2,B1,B2	20 25 50 75 100	B1* B1 A1,B1 A1,B1,B2 A1,A2,B1,B2

*Minimum Load Valve energized.

NOTE: These capacity steps may vary due to different capacity staging sequences.

MINUTES LEFT FOR START — This value is displayed only in the network display tables (using Service Tool, ComfortVIEW™ or ComfortWORKS® software) and represents the amount of time to elapse before the unit will start its initialization routine. This value can be zero without the machine running in many situations. This can include being unoccupied, ENABLE/OFF/REMOTE CONTACT switch in the OFF position, CCN not allowing unit to start, Demand Limit in effect, no call for cooling due to no load, and alarm or alert conditions present. If the machine should be running and none of the above are true, a minimum off time (DELY, see below) may be in effect. The machine should start normally once the time limit has expired.

MINUTES OFF TIME (DELY) [Configuration OPT2] — This user-configurable time period is used by the control to determine how long unit operation is delayed after power is applied/restored to the unit. Typically, this time period is configured when multiple machines are located on a single site. For example, this gives the user the ability to prevent all the units from restarting at once after a power failure. A value of zero for this variable does not mean that the unit should be running.

LEAD/LAG DETERMINATION — This is a configurable choice and is factory set to be automatic for all units. The value can be changed to Circuit A or Circuit B leading as desired. Set at automatic, the control will sum the current number of logged circuit starts and one-quarter of the current operating hours for each circuit. The circuit with the lowest sum is started first. Changes to which circuit is the lead circuit and which is the lag are also made when total machine capacity is at 100% or when there is a change in the direction of capacity (increase or decrease) and each circuit's capacity is equal.

CAPACITY CONTROL OVERRIDES — The following overrides will modify the normal operation of the routine.

Deadband Multiplier — The user configurable Deadband Multiplier (Z.GN) [Configuration, SLCT] has a default value of 1.0. The range is from 1.0 to 4.0. When set to other than 1.0, this factor is applied to the capacity Load/Unload Factor. The larger this value is set, the longer the control will delay between adding or removing stages of capacity. Figure 12 shows how compressor starts can be reduced over time if the leaving water temperature is allowed to drift a larger amount above and below the set point. This value should be set in the range of 3.0 to 4.0 for systems with small loop volumes.

First Stage Override — If the current capacity stage is zero, the control will modify the routine with a 1.2 factor on adding the first stage to reduce cycling. This factor is also applied when the control is attempting to remove the last stage of capacity.

Slow Change Override — The control prevents the capacity stages from being changed when the leaving fluid temperature is close to the set point (within an adjustable deadband) and moving towards the set point.

Ramp Loading (CRMP) [Configuration, SLCT] — Limits the rate of change of leaving fluid temperature. If the unit is in a Cooling mode and configured for Ramp Loading, the control makes 2 comparisons before deciding to change stages of capacity. The control calculates a temperature difference between the control point and leaving fluid temperature. If the difference is greater than 4 °F (2.2 °C) and the rate of change (°F or °C per minute) is more than the configured Cooling Ramp Loading value (CRMP), the control does not allow any changes to the current stage of capacity.

Low Entering Fluid Temperature Unloading — When the entering fluid temperature is below the control point, the control will attempt to remove 25% of the current stages being used. If exactly 25% cannot be removed, the control removes an amount greater than 25% but no more than necessary. The lowest stage will not be removed.

Minimum Load Control — If equipped, the minimum load control valve is energized only when one compressor in the circuit is running. If the close control feature is enabled the minimum load control valve may be used as needed to obtain leaving fluid temperature close to set point.

Cooler Freeze Protection — The control will try to prevent shutting the chiller down on a Cooler Freeze Protection alarm by removing stages of capacity. If the cooler fluid selected is Water, the freeze point is 34 F (1.1 C). If the cooler fluid selected is Brine, the freeze point is the Brine freeze Point (BR.FZ) [Set Points, FRZ]. This alarm condition (A207) only references leaving fluid temperature and NOT Brine Freeze point. If the cooler leaving fluid temperature is less than the freeze point plus 2.0° F (1.1° C), the control will immediately remove one stage of capacity. This can be repeated once every 30 seconds.

Low Saturated Suction Protection — The control will try to prevent shutting a circuit down due to low saturated suction conditions by removing stages of capacity. These circuit alert conditions (T116, T117) compare saturated suction temperature to the configured Brine Freeze point (BR.FZ) [Set Points, FRZ]. The Brine Freeze point is a user-configurable value that must be left at 34 F (1.1 C) for 100% water systems. A lower value may be entered for systems with brine solutions, but this value should be set according to the freeze protection level of the brine mixture. Failure to properly set this brine freeze point value may permanently damage the brazed plate heat exchanger. The control will initiate Mode 7 (Circuit A) or Mode 8 (Circuit B) to indicate a circuit's capacity is limited and that eventually the circuit may shut down.

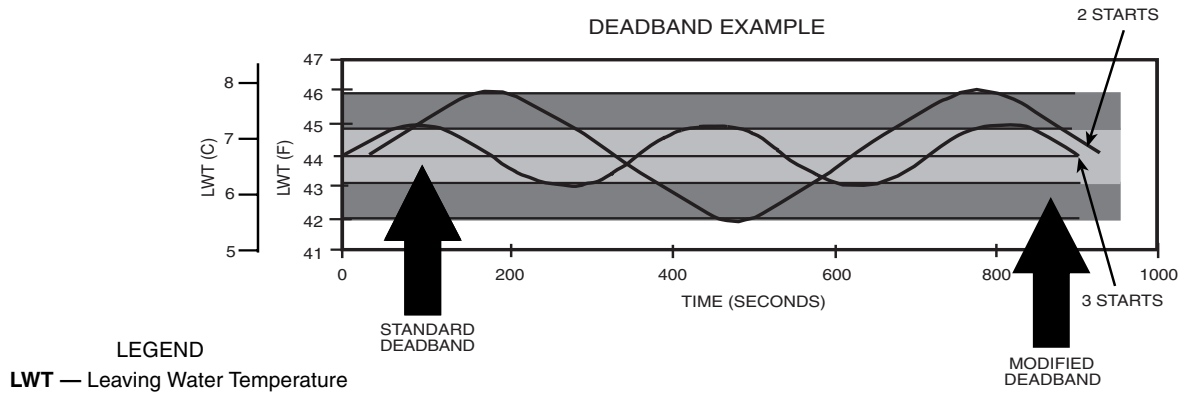
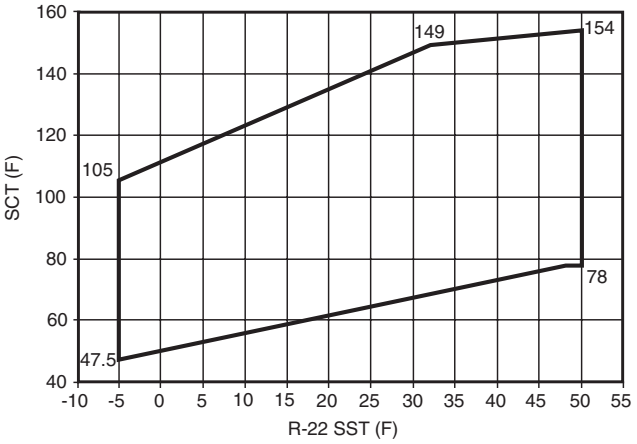


Fig. 12 — Deadband Multiplier

Head Pressure Control — The Main Base Board (MBB) controls the condenser fans to maintain the lowest condensing temperature possible, and thus the highest unit efficiency. The MBB uses the saturated condensing temperature input from the discharge pressure transducer to control the fans. Head pressure control is maintained through a calculated set point which is automatically adjusted based on actual saturated condensing and saturated suction temperatures so that the compressor(s) is (are) always operating within the manufacturer's specified envelope (see Fig. 13). The control will automatically reduce the unit capacity as the saturated condensing temperature approaches an upper limit. The control will indicate through an alert that a high ambient unloading mode is in effect. If the saturated condensing temperature in a circuit exceeds the calculated maximum, the circuit will be stopped. For these reasons, there are no head pressure control methods or set points to enter. If the saturated condensing temperature in a circuit is greater than or equal to 95 F (35 C) at start-up, all available condenser fans will be started to prevent excessive discharge pressure during pull-down. The control will turn off a fan stage when the condensing temperature has been below the calculated head pressure set point by 35 F (19.4 C) for more than 2 minutes. Fan sequences are shown in Fig. 14.



LEGEND

SCT — Saturated Condensing Temperature
SST — Saturated Suction Temperature

Fig. 13 — Operating Envelope for R-22 Maneurop Compressor

MOTORMASTER® V OPTION — For low-ambient operation, the lead fan on a circuit can be equipped with the Motormaster V head pressure controller option or accessory. The control will automatically raise the head pressure set point by 5 F (2.8 C) when Motormaster control is configured. The controller is energized with the first fan stage and adjusts fan speed to maintain a liquid pressure of 135 psig (931 kPa). For sizes 010-018 and Circuit B of sizes 032-040, the two-speed fan is wired for high speed operation and the Motormaster V controller adjusts fan speed. For size 022-030, 042-055 and circuit A of the 032-040 sizes, the lead fan (A1 or B1) in the circuit is controlled. Refer to Fig. 14 for condenser fan staging information. Refer to Fig. 15 for typical pressure transducer location.

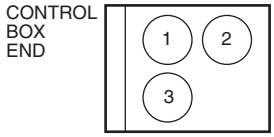
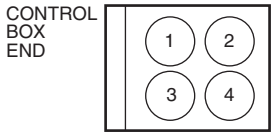
FAN ARRANGEMENT	FAN NO.	FAN RELAY	NORMAL CONTROL
30RAN010-018 	1	FC-LS	Energize Fan at Low Speed
	1	FC-HS	Energize Fan at High Speed
30RAN022-030 	1	FC-A1	First Stage Condenser Fan
	2	FC-A2	Second Stage Condenser Fan
30RAN032-040 	1	FC-A1	On with Compressor A1 and/or Compressor A2
	2	FC-A2	First Stage Condenser Fan, Circuit A
	3	FC-LS	Low Speed, Fan on w/Compressor B1
	3	FC-HS	Energize Fan at High Speed, Circuit B
30RAN042-055 	1	FC-A1	On with Compressor A1 and/or Compressor A2
	2	FC-A2	First Stage Condenser Fan, Circuit A
	3	FC-B1	On with Compressor B1 and/or Compressor B2
	4	FC-B2	First Stage Condenser Fan, Circuit B

Fig. 14 — 30RA Condenser Fan Sequence

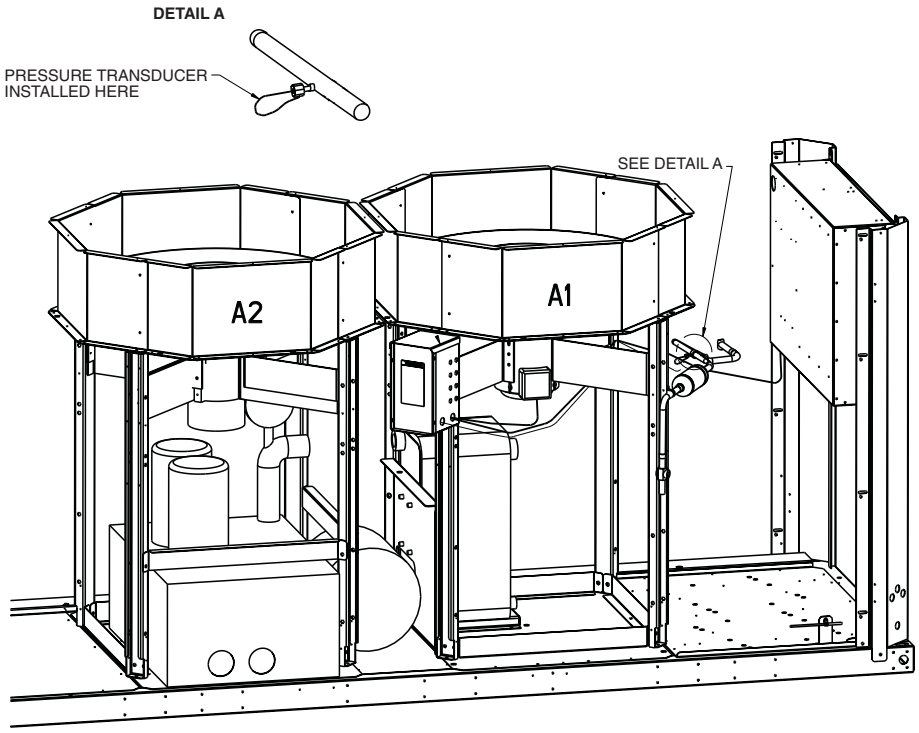


Fig. 15 — Typical Motormaster® V Controller and Pressure Transducer Location (Sizes 022-030 Shown)

Operation of Machine Based on Control Method and Cooling Set Point Selection Settings — Machine On/Off control is determined by the configuration of the control method (CTRL) [Configuration, OPT2] and cooling set point select (CLSP) [Configuration, SLCT] variables. All models are factory configured with cooling set point select set to 1 (single set point, CSP1). With the control method set to 0, simply switching the Enable/Off/Remote Contact switch to the Enable or Remote Contact position (external contacts closed) will put the chiller in an occupied state. The control mode [Operating Modes, MODE] will be 1 (OFF LOCAL) when the switch is Off and will be 5 (ON LOCAL) when in the Enable position or Remote Contact position with external contacts closed.

Two other control methods are available for Machine On/Off control:

OCCUPANCY SCHEDULE (CTRL=2) — The Main Base Board will use the operating schedules as defined under the Time Clock mode in the Marquee display. These schedules are identical. The schedule number must be set to 1 for local schedule.

The schedule number can be set anywhere from 65 to 99 for operation under a CCN global schedule. The Enable/Off/Remote Contact must be in the Enable or Remote Contact position. The control mode [Operating Modes, MODE] will be 1 when the switch is Off. The control mode will be 3 when the Enable/Off/Remote Contact switch input is On and the time of day is during an unoccupied period. Similarly, the control mode will be 7 when the time of day is during an occupied period.

CCN SCHEDULE (CTRL=3) — An external CCN device such as Flotronic™ System Manager controls the On/Off state of the machine. This CCN device forces the variable 'CHIL_S_S' between Start/Stop to control the chiller. The control mode [Operating Modes, MODE] will be 1 when the switch is Off. The control mode will be 2 when the Enable/Off/Remote Contact switch input is On and the CHIL_S_S variable is 'Stop.' Similarly, the control mode will be 6 when the CHIL_S_S variable is 'Start.'

Table 8 illustrates how the control method and cooling set point select variables direct the operation of the chiller and the set point to which it controls. The illustration also shows the ON/OFF state of the machine for the given combinations.

Cooling Set Point Select

SINGLE — Unit operation is based on Cooling Set Point 1 (CSP1) [Set Point, COOL].

DUAL SWITCH — Unit operation is based on Cooling Set Point 1 (CSP1) [Set Point, COOL] when the Dual Set Point switch contacts are open and Cooling Set Point 2 (CSP2) [Set Point, COOL] when they are closed.

DUAL CCN OCCUPIED — Unit operation is based on Cooling Set Point 1 (CSP1) [Set Point, COOL] during the Occupied mode and Cooling Set Point 2 (CSP2) [Set Point, COOL] during the Unoccupied mode as configured under the local occupancy schedule accessible only from CCN. Schedule Number in Table SCHEDOVR (See Appendix A) must be configured to 1. If the Schedule Number is set to 0, the unit will operate in a continuous 24-hr Occupied mode. Control method must be configured to 0 (switch). See Table 8.

4 TO 20 mA INPUT — Unit operation is based on an external 4 to 20 mA signal input to the Energy Management Module (EMM).

LOW SOUND MODE OPERATION — All models are factory configured with the Low Sound Mode disabled. In the Configuration mode under sub-mode OPT2, items for low sound mode select (LS.MD), low sound start time (LS.ST), low sound end time (LS.ND) and low sound capacity limit (LS.LT) are factory configured so that the chiller always runs as quietly as possible. This results in operation at increased saturated condensing temperature. As a result, some models may not be able to achieve rated efficiency. For chiller operation at rated efficiency, disable the low sound mode or adjust the low sound mode start and stop times accordingly or set both times to 00:00 for rated efficiency operation 24 hours per day. In addition, the low sound capacity limit can be used to reduce overall chiller capacity, if required, by limiting the maximum to a user-configured percentage.

Table 8 — Control Methods and Cooling Set Points

CONTROL TYPE (CTRL)	OCCUPANCY STATE	COOLING SET POINT SELECT (CLSP)			
		0 (single)	1 (dual, switch)	2 (dual, occ)	3 (4 to 20 mA)
0 (switch)	Occupied	ON,CSP1	ON*	ON,CSP1	ON†
	Unoccupied	ON,CSP1	ON*	ON,CSP2	ON
2 (Occupancy)	Occupied	ON,CSP1	ON*	Illegal	ON†
	Unoccupied	OFF	OFF	Illegal	OFF
3 (CCN)	Occupied	ON,CSP1	ON*	ON,CSP1	ON†
	Unoccupied	ON,CSP1	ON*	ON,CSP2	ON†

*Dual set point switch input used. CSP1 used when switch input is open. CSP2 used when switch input is closed.
†Cooling set point determined from 4 to 20 mA input to Energy Management Module (EMM) to terminals TB6-3,5.

HEATING OPERATION — The chiller can be used for pump outputs or optional factory-installed hydronic system operation can be utilized for heating applications. The heating mode is activated when the control sees a field-supplied closed switch input to terminal block TB5-7,8. The control locks out cooling when the heat relay input is seen. A field-supplied boiler relay connection is made using heat relay and alarm relay contacts. Factory-installed 'BOILER' connections exist in the control panel near TB5 for these applications. Alarms and alerts A189 through A202 are active during heating operation.

Marquee Display Usage (See Fig. 16 and Tables 8-27) — The Marquee display module provides the user interface to the *Comfort*Link™ control system. The display has up and down arrow keys, an ESCAPE key, and an ENTER key. These keys are used to navigate through the different levels of the display structure. See Table 9. Press the ESCAPE key until the display is blank to move through the top 11 mode levels indicated by LEDs on the left side of the display.

Pressing the ESCAPE and ENTER keys simultaneously will scroll a clear language text description across the display indicating the full meaning of each display acronym. Pressing the ESCAPE and ENTER keys when the display is blank (Mode LED level) will return the Marquee display to its default menu of rotating display items. In addition, the password will be disabled requiring that it be entered again before changes can be made to password protected items.

Clear language descriptions in English, Spanish, French, or Portuguese can be displayed when properly configuring the LANG Item in the Configuration Mode, under the Display (DISP) submode. See Table 17. Throughout this text, the location of items in the menu structure will be described in the following format:

Item Expansion (ITEM) [Mode Name, Sub-mode Name]

For example, using the language selection item:

Language Selection (LANG) [Configuration, DISP]

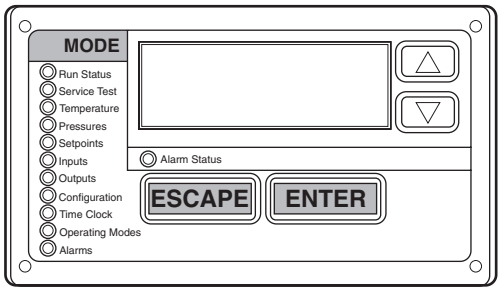


Fig. 16 — Scrolling Marquee Display

NOTE: When the LANG variable is changed to 1, 2, or 3, all appropriate display expansions will immediately change to the new language. No power-off or control reset is required when reconfiguring languages.

When a specific item is located, the display will flash showing the operator, the item, followed by the item value and then followed by the item units (if any). Press the ENTER key to stop the display at the item value. Items in the Configuration and Service Test modes are password protected. The display will flash PASS and WORD when required. Use the ENTER and arrow keys to enter the 4 digits of the password. The default password is 1111.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. Press ENTER to stop the display at the item value. Press the ENTER key again so that the item value flashes. Use the arrow keys to change the value or state of an item and press the ENTER key to accept it. Press the ESCAPE key and the item, value, or units display will resume. Repeat the process as required for other items.

See Tables 8-27 for further details.

Service Test (See Table 11) — *Both main power and control circuit power must be on.*

The Service Test function should be used to verify proper operation of condenser fan(s), compressors, minimum load valve solenoid (if installed), cooler pump(s) and remote alarm relay. To use the Service Test mode, the Enable/Off/Remote Contact switch must be in the OFF position. Use the display keys and Table 11 to enter the mode and display TEST. Press ENTER twice so that OFF flashes. Enter the password if required. Use either arrow key to change the TEST value to the ON position and press ENTER. Press ESCAPE and the ▼ button to enter the OUTS or COMP sub-mode.

Test the condenser fans, cooler pump(s) and alarm relay by changing the item values from OFF to ON. These discrete outputs are then turned off if there is no keypad activity for 10 minutes. Test the compressor and minimum load valve solenoid (if installed) outputs in a similar manner. The minimum load valve solenoids will be turned off if there is no keypad activity for 10 minutes. Compressors will stay on until they are turned off by the operator. The Service Test mode will remain enabled for as long as there is one or more compressors running. All safeties are monitored during this test and will turn a compressor, circuit or the machine off if required. Any other mode or sub-mode can be accessed, viewed, or changed during the TEST mode. The STAT item [Run/Status, VIEW] will display "0" as long as the Service mode is enabled. The TEST sub-mode value must be changed back to OFF before the chiller can be switched to Enable or Remote contact for normal operation.

Optional Factory-Installed Hydronic Package — If the chiller has factory-installed chilled fluid pumps, specific steps should be followed for proper operation.

The pump(s) in the hydronic package come factory pre-wired into the main unit power supply/starter. In order to check proper pump rotation, use the Service Test function to test the condenser fans and observe them for proper rotation (counter clockwise when viewed from the top). If fans turn correctly, the pumps will rotate correctly. Clockwise rotation of the pump motor cooling fans can also be used to determine that pumps are rotating correctly.

⚠ CAUTION

Operation of pump in wrong direction, even for a few seconds, can cause irreversible damage to pump impeller and housing. Always verify correct wiring/pump rotation before operation.

Use Service Test function to test operation of pumps. Verify that the flow switch input is made when the pump is running. For dual pump hydronic systems, the control only uses one pump at a time. Consult the Installation Instructions supplied with this chiller and use the circuit setter balancing valve installed in hydronic package to adjust fluid flow rate.

Cooler Pump Control — The 30RA AquaSnap® machines equipped with a factory installed pump package are configured with the Cooler Pump Control (CPC) [Configuration, OPT1] ON.

Machines not equipped with a pump package are configured with the cooler pump control OFF. It is recommended that the machine control the chilled water pump. If not, a 5-minute time delay is required after the command to shut the machine down is sent before the chilled water pump is turned off. This is required to maintain water flow during the shutdown period of the machine.

With or without this option enabled, the cooler pump relay will be energized when the machine enters an ON status (i.e., On Local, On CCN, On Time). An A207 - Cooler Freeze Protection Alarm, will energize the cooler pump relay also, as an override. The cooler pump relay will remain energized if the machine is in MODE 10 – Minimum Off Time.

Cooler Pump Sequence of Operation — At anytime the unit is in an ON status, as defined by the one of the following conditions, the cooler pump relay will be enabled.

1. The Enable-Off-Remote Switch in ENABLE, (CTRL=0).
2. Enable-Off-Remote Switch in REMOTE with a Start-Stop remote contact closure, (CTRL=0).
3. An Occupied Time Period from an Occupancy Schedule in combination with items 1 or 2, (CTRL=2).
4. A CCN Start-Stop Command to Start in combination with items 1 or 2, (CTRL=3).

As stated before, there are certain alarm conditions and Operating Modes that will turn the cooler pump relay ON. This sequence will describe the normal operation of the pump control algorithm.

When the unit cycles from an “On” state to an “Off” state, the cooler pump output will remain energized for the Cooler Pump Shutdown Delay (PM.DY) [Configuration, OPT1]. This is configurable from 0 to 10 minutes. The factory default is 1 minute. If the pump output was deenergized during the transition period, the pump output will not be energized.

NO INTEGRAL PUMP — SINGLE EXTERNAL PUMP CONTROL — With a single external pump, the following options must be configured:

- Cooler Pump Control (CPC) [Configuration, OPT1] OFF.
- Cooler Pump 1 Enable (PM1E) [Configuration, UNIT] NO.
- Cooler Pump 2 Enable (PM2E) [Configuration, UNIT] NO.

The maximum load allowed for the Chilled Water Pump Starter is 5 VA sealed, 10 VA inrush at 24 volts. The starter coil is powered from the chiller control system. The starter should be wired between TB5-11 and TB5-13. If equipped, the field-installed chilled water pump starter auxiliary contacts should be connected in series with the chilled water flow switch.

The Cooler Pump Relay will be energized when the machine is “On.” The chilled water pump interlock circuit consists of a chilled water flow switch and a field-installed chilled water pump interlock. If the chilled water pump interlock circuit does not close within five (5) minutes of starting, an A200 — Cooler Flow/Interlock failed to close at Start-Up alarm will be generated and chiller will not be allowed to start.

If the chilled water pump interlock or chilled water flow switch opens for at least three (3) seconds after initially being closed, an A201 — Cooler Flow/Interlock Contacts Opened During Normal Operation Alarm will be generated and the machine will stop.

NO INTEGRAL PUMP — DUAL EXTERNAL PUMP CONTROL — With two external pumps, the following options must be configured:

- Cooler Pump Control (CPC) [Configuration, OPT1] ON.
- Cooler Pump 1 Enable (PM1E) [Configuration, UNIT] YES.
- Cooler Pump 2 Enable (PM2E) [Configuration, UNIT] YES.

The maximum load allowed for the Chilled Water Pump Starters is 5 VA sealed, 10 VA inrush at 24 volts. The starter coil is powered from the chiller control system. The starter for Chilled Water Pump 1 should be wired between TB5-11 and TB5-13. The starter for Chilled Water Pump 2 should be wired between TB5-15 and TB5-13. A field-installed chilled water pump interlock for each pump must be connected to each pump’s interlock points on the Main Base Board. The Chilled Water Pump 1 Interlock, CWP1, must be connected to MBB-J7-1 and –2. The Chilled Water Pump 2 Interlock, CWP2, must be connected to MBB-J7-3 and –4. The chilled water pump interlock contacts should be rated for dry circuit application capable of handling 5 vdc at 2 mA.

SINGLE INTEGRAL PUMP CONTROL — With a single pump, the following options must be configured:

- Cooler Pump Control (CPC) [Configuration, OPT1] ON.
- Cooler Pump 1 Enable (PM1E) [Configuration, UNIT] YES.
- Cooler Pump 2 Enable (PM2E) [Configuration, UNIT] NO.

With a single integral pump, the Cooler Pump Starter will be energized when the machine is occupied. As part of the factory-installed package, an auxiliary set of contacts is wired to the MBB to serve as Chilled Water Pump Interlock. When the mechanical cooling is called for, the pump interlock and flow switch is checked. If the circuits are closed, the machine starts its capacity routine. If the auxiliary contact interlock does not close within 25 seconds of the ON command, a T190 — Cooler Pump 1 Aux Contacts Failed to Close at Start-Up Alert will be generated and the pump shut down. The unit will not be allowed to start. If the chilled water flow switch does not close within one (1) minute, two alarms will be generated. A T192 — Cooler Pump 1 Failed to Provide Flow at Start-Up Alert and an A200 – Cooler Flow/Interlock failed to close at Start-Up will be generated and chiller will not be allowed to start.

If the chilled water flow switch opens for at least 3 seconds after initially being closed, a T196 — Flow Lost While Pump 1 Running Alert and an A201 — Cooler Flow/Interlock Contacts

Opened During Normal Operation Alarm will be generated and the machine will stop.

If the control detects the chilled water pump interlock open for 25 seconds after initially being closed, a T194 — Cooler Pump 1 Contacts Opened During Normal Operation Alert is generated and the unit is shut down.

If the control detects the chilled water flow switch circuit closed for at least 5 minutes with the pump output OFF, an A202 — Cooler Pump Interlock Closed When Pump is Off Alarm will be generated and the unit will not be allowed to start.

If the control detects that the chilled water pump auxiliary contacts are closed for at least 25 seconds while the pump is OFF, a T198 — Cooler Pump 1 Aux Contacts Closed While Pump Off Alert is generated. The chiller will not be allowed to start.

If the control starts a pump and the wrong interlock circuit closes for at least 20 seconds, an A189 — Cooler Pump and Aux Contact Input Miswire Alarm will be generated. The unit will be prevented from starting.

As part of a pump maintenance routine, the pump can be started to maintain lubrication of the pump seal. To utilize this function, Cooler Pmp Periodic Start (PM.P.S) [Configuration, UNIT] must be set to YES. This option is set to NO as the factory default. With this feature enabled, if the pump is not operating, it will be started and operated for 2 seconds starting at 14:00 hours. If the pump is operating, this routine is skipped. If the pump has failed and an Alarm/Alert condition is active, the pump will not start that day.

DUAL INTEGRAL PUMP CONTROL — With a dual integral pump package, the following options must be configured:

- Cooler Pump Control (CPC) [Configuration, OPT1] ON.
- Cooler Pump 1 Enable (PM1E) [Configuration, UNIT] YES
- Cooler Pump 2 Enable (PM2E) [Configuration, UNIT] YES

Pump Start Selection is a field-configurable choice. Cooler Pump Select (PM.SL) [Configuration, UNIT] is factory defaulted to 0 (Automatic). This value can be changed to 1 (Pump 1 Starts First) or 2 (Pump 2 Starts First). If PM.SL is 0 (Automatic), the pump selection is based on two criteria: the alert status of a pump and the operational hours on the pump. If a pump has an active Alert condition, it will not be considered for the lead pump. The pump with the lowest operational hours will be the lead pump. A pump is selected by the control to start and continues to be the lead pump until the Pump Changeover Hours (PM.DT) [Configuration, UNIT] is reached. The Lead Pump (LD.PM) [Run Status, VIEW] indicates the pump that has been selected as the lead pump: 1 (Pump 1), 2 (Pump 2), 3 (No Pump). The Pump Changeover Hours is factory defaulted to 500 hours. Regardless of the Cooler Pump Selection, any pump that has an active alert will not be allowed to start.

With the dual integral pump package, the Cooler Pump Starter will be energized when the machine is in an occupied period. As part of the factory-installed package, an auxiliary set of contacts is wired to the MBB to serve as Chilled Water Pump Interlock, one set for each pump to individual channels on the MBB. With a call for mechanical cooling, the specific pump interlock and flow switch are checked. If the circuits are closed, the machine starts its capacity routine. If Pump 1 starts and the auxiliary contact interlock does not close within 25 seconds of the ON command, a T190 – Cooler Pump 1 Aux Contacts Failed to Close at Start-Up Alert will be generated and the pump shut down. The unit will not be allowed to start. If the chilled water flow switch does not close within 1 minute, two alarms will be generated. A T192 – Cooler Pump 1 Failed to Provide Flow at Start-Up Alert and an A200 – Cooler Flow/Interlock failed to close at Start-Up will be generated and chiller will not be allowed to start. In either fault case listed above, Pump 2 will be commanded to start once Pump 1 has failed.

If Pump 2 starts and the auxiliary contact interlock does not close within 25 seconds of the ON command, a T191 — Cooler Pump 2 Aux Contacts Failed to Close at Start-Up Alert will be generated and the pump shut down. The unit will not be allowed to start. If the chilled water flow switch does not close within one (1) minute, two alarms will be generated. A T193 — Cooler Pump 2 Failed to Provide Flow at Start-Up Alert and an A200 – Cooler Flow/Interlock failed to close at Start-Up will be generated and chiller will not be allowed to start. In either fault case listed above, Pump 1 will be commanded to start once Pump 2 has failed.

If the chilled water flow switch opens for at least 3 seconds after initially being closed, a T196 — Flow Lost While Pump 1 Running Alert or T197 — Flow Lost While Pump 2 Running Alert for the appropriate pump and an A201 — Cooler Flow/Interlock Contacts Opened During Normal Operation Alarm will be generated and the machine will stop. If available, the other pump will be started. If flow is proven, the machine will be allowed to restart.

If the chilled water pump interlock opens for 25 seconds after initially being closed is detected by the control, the appropriate T194 – Cooler Pump 1 Contacts Opened During Normal Operation Alert or T195 – Cooler Pump 2 Contacts Opened During Normal Operation Alert is generated and the unit is shut down. If available, the other pump will be started. If flow is proven, the machine will be allowed to restart.

If the control detects that the chilled water flow switch circuit is closed for at least 5 minutes with the pump output OFF, an A202 – Cooler Pump Interlock Closed When Pump is Off Alarm will be generated and the unit will not be allowed to start.

If the control detects that the chilled water pump auxiliary contacts are closed for at least 25 seconds while the pump is OFF, the appropriate T198 – Cooler Pump 1 Aux Contacts Closed While Pump Off or Alert T199 – Cooler Pump 2 Aux Contacts Closed While Pump Off Alert is generated. The chiller will not be allowed to start.

If the control starts a pump and the wrong interlock circuit closes for at least 20 seconds, an A189 – Cooler Pump and Aux Contact Input Miswire Alarm will be generated. The unit will be prevented from starting.

The control will allow for pump changeover. Two methods will change the pump sequence. Before the changeover can occur, the unit must be at Capacity Stage 0. During changeover the chilled water flow switch input is ignored for 10 seconds to avoid a nuisance alarm.

With Cooler Pump Select (PM.SL) [Configuration, UNIT] set to 0 (Automatic) and when the differential time limit Pump Changeover Hours (PM.DT) [Configuration, UNIT] is reached, the lead pump will be turned OFF. Approximately one (1) second later, the lag pump will start. Manual changeover can be accomplished by changing Rotate Cooler Pump Now (ROT.P) [Configuration, UNIT] to YES only if the machine is at Capacity Stage 0 and the differential time limit Pump Changeover Hours (PM.DT) [Configuration, UNIT] is reached. If the PM.DT is not satisfied, the changeover will not occur. With the machine at Capacity Stage 0, the pumps would rotate automatically as part of the normal routine.

With Cooler Pump Select (PM.SL) [Configuration, UNIT] set to 1 (Pump 1 Starts First) or 2 (Pump 2 Starts First), a manual changeover can be accomplished by changing PM.SL only. The machine Remote-Off-Enable Switch must be in the OFF position to change this variable. The Rotate Cooler Pump Now (ROT.P) [Configuration, UNIT] feature does not work for these configuration options.

As part of a pump maintenance routine, the pumps can be started to maintain lubrication to the pump seal. To utilize this function, Cooler Pmp Periodic Start (PM.P.S) [Configuration, UNIT] must be set to YES. This option is set to NO as the factory default. If feature is enabled and the pump(s) are not operating, then the pumps will be operated every other day for 2 seconds starting at 14:00 hours. If a pump has failed and has an active Alert condition, it will not be started that day.

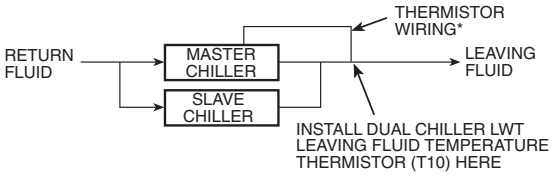
Configuring and Operating Dual Chiller Control — The dual chiller routine is available for the control of two units supplying chilled fluid on a common loop. This control algorithm is designed for parallel fluid flow arrangement only. One chiller must be configured as the master chiller, the other as the slave. An additional leaving fluid temperature thermistor (Dual Chiller LWT) must be installed as shown in Fig. 17 and connected to the master chiller. Refer to Sensors section, page 4, for wiring. The CCN communication bus must be connected between the two chillers. Connections can be made to the CCN screw terminals on TB3. Refer to Carrier Comfort Network Interface section, page 3, for wiring information.

Refer to Table 21 for dual chiller configuration. In this example the master chiller will be configured at address 1 and the slave chiller at address 2. The master and slave chillers must reside on the same CCN bus (CCNB) but cannot have the same CCN address (CCNA) [Configuration, OPT2]. Both master and slave chillers must have Lead/Lag Chiller Enable (LLEN) [Configuration, RSET] configured to ENBL. Master/Slave Select (MSSL) [Configuration, RSET] must be configured to MAST for the master chiller and SLVE for the slave. Also in this example, the master chiller will be configured to use Lead/Lag Balance Select (LLBL) and Lead/Lag Balance Delta (LLBD) [Configuration, RSET] to even out the chiller run-times weekly. The Lag Start Delay (LLDY) [Configuration, RSET] feature will be set to 10 minutes. This will prevent the lag chiller from starting until the lead chiller has been at 100% capacity for the length of the delay time. Parallel configuration (PARA) [Configuration, RSET] can only be configured to YES. The variables LLBL, LLBD and LLDY are not used by the slave chiller.

Dual chiller start/stop control is determined by configuration of Control Method (CTRL) [Configuration, OPT2] of the Master chiller. The Slave chiller should always be configured for CTRL=0, *Switch*. If the chillers are to be controlled by Remote Contacts, both Master and Slave chillers should be enabled together. Two separate relays or one relay with two sets of contacts may control the chillers. The Enable/Off/Remote Contact switch should be in the Remote Contact position on both the Master and Slave chillers. The Enable/Off/Remote Contact switch should be in the Enable position for CTRL=2, *Occupancy* or CTRL=3, *CCN Control*.

Both chillers will stop if the Master chiller Enable/Off/Remote Contact switch is in the Off position. If the Emergency Stop switch is turned off or an alarm is generated on the Master chiller the Slave chiller will operate in a Stand-Alone mode. If the Emergency Stop switch is turned off or an alarm is generated on the Slave chiller the Master chiller will operate in a Stand-Alone mode.

The master chiller controls the slave chiller by changing its Control Mode (STAT) [Run Status, VIEW] and its operating setpoint or Control Point (CTPT) [Run Status, VIEW].



*Depending on piping sizes, use either:
- HH79NZ014 sensor/10HB50106801 well (3-in. sensor/well)
- HH79NZ029 sensor/10HB50106802 well (4-in. sensor/well)

Fig. 17 — Dual Chiller Thermistor Location

Table 9 — Marquee Display Menu Structure*

MODE	RUN STATUS	SERVICE TEST	TEMPERATURES	PRESSURES	SET POINTS	INPUTS	OUTPUTS	CONFIGURATION	TIME CLOCK	OPERATING MODES	ALARMS
SUB-MODE	Auto Display (VIEW)	Manual Mode On/Off (TEST)	Unit Temperatures (UNIT)	Ckt A Pressures (PRC.A)	Cooling (COOL)	Unit Discrete (GEN.I)	Unit Discrete (GEN.O)	Display (DISP)	Unit Time (TIME)	Modes (MODE)	Current (CRNT)
	Machine Hours/Starts (RUN)	Unit Outputs (OUTS)	Ckt A Temperatures (CIR.A)	Ckt B Pressures (PRC.B)	Head Pressure (HEAD)	Ckt A/B (CRCT)	Ckt A (CIR.A)	Machine (UNIT)	Unit Date (DATE)		Reset Alarms (RCRN)
	Compressor Run Hours (HOUR)	Ckt A Comp Tests (CMPA)	Ckt B Temperatures (CIR.B)		Brine Freeze-point (FRZ)	Unit Analog (4-20)	Ckt B (CIR.B)	Options 1 (OPT1)	Daylight Saving Time (DST)		Alarm History (HIST)
	Compressor Starts (STRT)	Ckt B Comp Tests (CMPB)						Options 2 (OPT2)	Schedule Number (SCH.N)		
	Pump Maint. (PM)							Temperature Reset (RSET)	Local Schedule (SCH.L)		
	Software Version (VERS)							Set Point Select (SLCT)	Schedule Override (OVR)		
								Service Configuration (SERV)			
								Broadcast Configuration (BCST)			

LEGEND

Ckt — Circuit

*Throughout this text, the location of items in the menu structure will be described in the following format:

Item Expansion (ITEM) [Mode Name, Sub-mode Name]

For example, using the language selection item:

Language Selection (LANG) [Configuration, DISP]