Controls, Start-Up, Operation, Service and Troubleshooting

CONTENTS

CONTENTS (cont)

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment. Untrained personnel can perform the basic maintenance functions of replacing filters. Trained service personnel should perform all other operations.

When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguishers available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operation on unit turn off and lock off main power switch to unit. Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation and service. The unit may have an internal non-fused disconnect or a field-installed disconnect. **Note that the unit may also be equipped with a convenience outlet, that this outlet is wired to the line side of the unit-mounted disconnect and will remain hot when the disconnect in the unit is off. There is a separate fuse/disconnect for the convenience outlet.**

⚠ CAUTION

This unit uses a microprocessor-based electronic control system. *Do not* use jumpers or other tools to short out components or to bypass or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.

⚠ WARNING

1. Improper Installation, adjustment, alteration, service, or maintenance can cause property damage, personal injury, or loss of life. Refer to the User's Information Manual provided with this unit for more details.
2. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

What to do if you smell gas:

1. DO NOT try to light any appliance.
2. DO NOT touch any electrical switch, or use any phone in your building.
3. IMMEDIATELY call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
4. If you cannot reach your gas supplier call the fire department.

GENERAL

This book contains Start-Up, Controls Operation, Troubleshooting and Service information for the 48/50A series rooftop units. See Table 1. These units are equipped with *Comfort*Link™ controls.

Use this guide in conjunction with the separate installation instructions packaged with the unit. Refer to the Wiring Diagrams literature for more detailed wiring information.

Table 1 — A Series Product Line

UNIT	APPLICATION
48AJ	CV Unit with Gas Heat, Vertical Supply
48AK	VAV Units with Gas Heat, Horizontal Supply
48AW	CV Unit with Gas Heat, Vertical Supply
48AY	VAV Unit with Gas Heat, Horizontal Supply
50AJ	CV Unit with Optional Electric Heat, Vertical Supply
50AK	VAV Units with Optional Electric Heat, Horizontal Supply
50AW	CV Unit with Optional Electric Heat, Vertical Supply
50AY	VAV Unit with Optional Electric Heat, Horizontal Supply

LEGEND

CV — Constant Volume
VAV — Variable Air Volume

The A series units provide ventilation, cooling, and heating (when equipped) in variable air volume (VAV), variable volume and temperature (VVT®), and constant volume (CV) applications. The 48AJ,AK,AW,AY and 50AJ,AK,AW,AY units contain the factory-installed *Comfort*Link™ control system which provides full system management. The main base board (MBB) stores hundreds of unit configuration settings and 8 time of day schedules. The MBB also performs self diagnostic tests at unit start-up, monitors the operation of the unit, and provides alarms and alert information. The system also contains other optional boards that are connected to the MBB through the Local Equipment Network (LEN). Information on system operation and status are sent to the MBB processor by various sensors and optional boards that are located at the unit. Access to the unit controls for configuration, set point selection, schedule creation, and service can be done through a unit-mounted Scrolling Marquee. Access can also be done through the Carrier Comfort Network using the ComfortVIEW™ software or the accessory Navigator™ hand-held display.

The *Comfort*Link system controls all aspects of the rooftop. It controls the supply-fan motor, compressors, and economizers to maintain the proper temperature conditions. The controls also cycle condenser fans to maintain suitable head pressure. All VAV units are equipped with a standard VFD (variable frequency drive) for supply fan speed control and supply duct pressure control. The *Comfort*Link control directly controls the speed of the VFD based on a static pressure sensor input. In addition, the *Comfort*Link control can control the building pressure using multiple power exhaust fans controlled from damper position or from a building pressure sensor. The control safeties are continuously monitored to prevent the unit from operating under abnormal conditions. Sensors include suction pressure transducers and saturated condensing temperature sensors which allow for display of operational pressures and saturation temperatures.

A scheduling function, programmed by the user, controls the unit occupied/unoccupied schedule. Up to 8 different schedules can be programmed.

The controls also allow the service person to operate a quick test so that all the controlled components can be checked for proper operation.

BASIC CONTROL USAGE

***Comfort*Link Control —** The *Comfort*Link control is a comprehensive unit-management system. The control system is easy to access, configure, diagnose and troubleshoot.

The control is flexible, providing two types of constant volume cooling control sequences, two variable air volume cooling control sequences, and heating control sequences for two-stage electric and gas systems, and for multiple-stage gas heating, in both Occupied and Unoccupied schedule modes. This control also manages:

- VAV duct pressure (through optional VFD), with reset
- Building pressure through two different power exhaust systems
- Condenser fan cycling for mild ambient head pressure control
- Space ventilation control, in Occupied and Unoccupied periods, using CO_2 sensors or external signals, with ventilation defined by damper position or ventilation airflow measurement
- Smoke control functions
- Occupancy schedules
- Occupancy or start/stop sequences based on third party signals
- Alarm status and history and run time data
- Management of a complete unit service test sequence

System diagnostics are enhanced by the use of multiple external sensors for air temperatures, air pressures and refrigerant pressures. Unit-mounted actuators provide digital feedback data to the unit control.

The *Comfort*Link control is fully communicating and cable-ready for connection to the Carrier Comfort Network (CCN) building management system. The control provides high-speed communications for remote monitoring via the Internet. Multiple units can be linked together (and to other *Comfort*Link control equipped units) using a 3-wire communication bus.

The *Comfort*Link control system is easy to access through the use of a unit-mounted display module. There is no need to bring a separate computer to this unit for start-up. Access to control menus is simplified by the ability to quickly select from 11 menus. A scrolling readout provides detailed explanations of control information. Only four, large, easy-to-use buttons are required to maneuver through the entire controls menu. The display readout is designed to be visible even in bright sunlight.

For added service flexibility, an accessory hand-held Navigator module is also available. This portable device has an extended communication cable that can be plugged into the unit's communication network either at the main control box or at the opposite end of the unit, at a remote modular plug. The Navigator display provides the same menu structure, control access and display data as is available at the unit-mounted Scrolling Marquee display.

Scrolling Marquee — This device is the keypad interface used to access the control information, read sensor values, and test the unit. The Scrolling Marquee is located in the main control box and is standard on all units. The Scrolling Marquee display is a 4-key, 4-character, 16-segment LED display module. The display also contains an Alarm Status LED (light-emitting diode). See Fig. 1. The display is easy to operate using 4 buttons and a group of 11 LEDs that indicate the following menu structures (see Appendix A):

- Run Status
- Service Test
- Temperatures
- Pressures
- Set points
- Inputs
- Outputs
- Configuration
- Timeclock
- Operating Modes
- Alarms

Through the Scrolling Marquee, the user can access all of the inputs and outputs to check on their values and status, configure operating parameters plus evaluate the current decision status for operating modes. Because the A-Series units are equipped with suction pressure and saturated temperature thermistors, the Scrolling Marquee can also display refrigerant circuit pressures typically obtained from service gages. The control also includes an alarm history which can be accessed from the display. In addition, through the Scrolling Marquee, the user can access a built-in test routine that can be used at start-up commissioning and to diagnose operational problems with the unit.
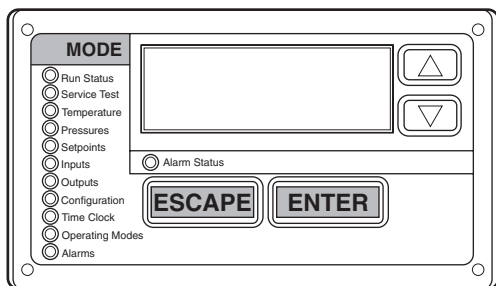
Fig. 1 — Scrolling Marquee

Accessory Navigator™ Display — The accessory hand-held Navigator display can be used with the 48/50A units. See Fig. 2. The Navigator display operates the same way as the Scrolling Marquee device. The Navigator display is plugged into the RJ-11 jack in the main control box on the COMM board. The Navigator display can also be plugged into the RJ-11 jack located on the unit corner post located in the auxiliary control box.

Operation — All units are shipped from the factory with the Scrolling Marquee display, which is located in the main control box. See Fig. 1. In addition, the *Comfort*Link™ control also supports the use of the handheld Navigator display.

Both displays provide the user with an interface to the *Comfort*Link control system. The displays have ▲ and ▼ arrow keys, an ESCAPE key and an ENTER key. These keys are used to navigate through the different levels of the display structure. The Navigator and the Scrolling Marquee operate in the same manner, except that the Navigator display has multiple lines of display and the Scrolling Marquee has a single line. All further discussions and examples in this document will be based on the Scrolling Marquee display. See Table 2 for the menu structure.

The four keys are used to navigate through the display structure, which is organized in a tiered mode structure. If the buttons have not been used for a period, the display will default to the AUTO VIEW display category as shown under the RUN STATUS category. To show the top-level display, press the ESCAPE key until a blank display is shown. Then use the ▲ and ▼ arrow keys to scroll through the top-level categories. These are listed in Appendix A and will be indicated on the Scrolling Marquee by the LED next to each mode listed on the face of the display.

When a specific mode or sub-mode is located, push the ENTER key to enter the mode. Depending on the mode, there may be additional tiers. Continue to use the ▲ and ▼ keys and the ENTER keys until the desired display item is found. At any time, the user can move back a mode level by pressing the ESCAPE key. Once an item has been selected the display will flash showing the item, followed by the item value and then followed by the item units (if any).

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 four digits of the password. The default password is 1111.
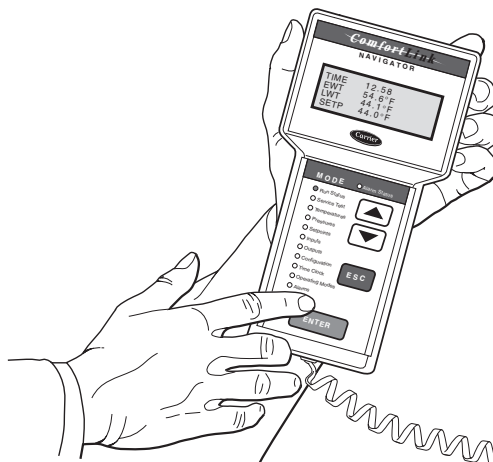
Fig. 2 — Accessory Navigator Display

Pressing the ESCAPE and ENTER keys simultaneously will scroll an expanded text description across the display indicating the full meaning of each display point. Pressing the ESCAPE and ENTER keys when the display is blank (MODE LED level) will return the display to its default menu of rotating AUTO VIEW display items. In addition, the password will need to be entered again before changes can be made.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. If the display is in rotating auto-view, press the ENTER key to stop the display at the desired item. Press the ENTER key again so that the item value flashes. Use the arrow keys to change the value of 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.

If the user needs to force a variable, follow the same process as when editing a configuration parameter. A forced variable will be displayed with a blinking "f" following its value. For example, if supply fan requested (*FAN.F*) is forced, the display shows "YESf", where the "f" is blinking to signify a force on the point. Remove the force by selecting the point that is forced with the ENTER key and then pressing the ▲ and ▼ arrow keys simultaneously.

Depending on the unit model, factory-installed options and field-installed accessories, some of the items in the various Mode categories may not apply.

System Pilot — The System Pilot (33PILOT-01) is a component of Carrier's 3V™ system and serves as a user-interface and configuration tool for all Carrier communicating devices. The System Pilot can be used to install and commission a 3V zoning system, linkage compatible air source, universal controller, and all other devices operating on the Carrier communicating network.

Additionally, the System Pilot can serve as a wall-mounted temperature sensor for space temperature measurement. The occupant can use the System Pilot to change set points. A security feature is provided to limit access of features for unauthorized users. See Fig. 3 for System Pilot details.
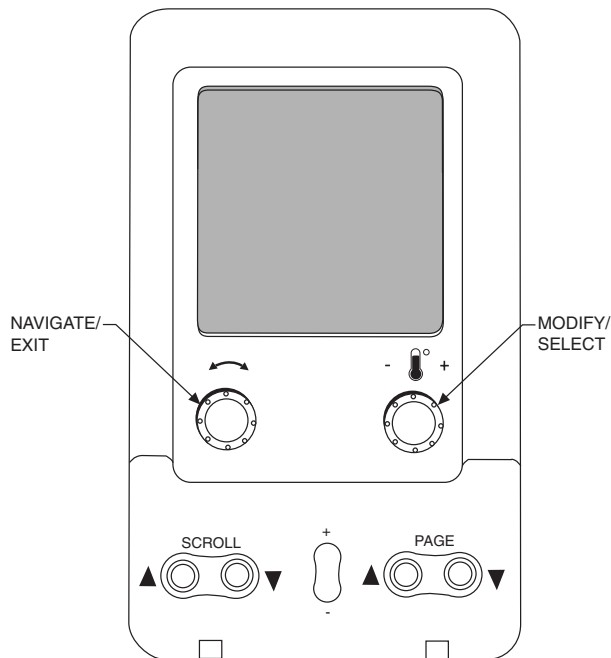
Fig. 3 — System Pilot User Interface

CCN Tables and Display — In addition to the unit-mounted Scrolling Marquee display, the user can also access the same information through the CCN tables by using the Service tool or other CCN programs. Details on the CCN tables are summarized in Appendix B. The variable names used for the CCN tables and the Scrolling Marquee tables may be different and more items are displayed in the CCN tables. As a reference, the CCN variable names are included in the Scrolling Marquee tables and the Scrolling Marquee names are included in the local display tables in Appendix B.

GENERIC STATUS DISPLAY TABLE — The GENERICS points table allows the service/installer the ability to create a custom table in which up to 20 points from the 5 CCN categories (Points, Config, Service-Config, Set Point, and Maintenance) may be collected and displayed.

In the Service-Config table section, there is a table named "generics". This table contains placeholders for up to 20 CCN point names and allows the user to decide which points are displayed in the GENERIC points table under the local display. Each one of these placeholders allows the input of an 8-character ASCII string. Using a CCN interface, enter the Edit mode for the Service-Config table "generics" and enter the CCN name for each point to be displayed in the custom points table in the order they will be displayed. When done entering point names, download the table to the rooftop unit control.

IMPORTANT: The computer system software (ComfortVIEW™, Service Tool, etc.) that is used to interact with CCN controls always saves a template of items it considers as static (e.g., limits, units, forcibility, 24-character text strings, and point names) after the software uploads the tables from a control. Thereafter, the software is only concerned with run time data like value and hardware/force status. With this in mind, it is important that anytime a change is made to the Service-Config table "generics" (which in turn changes the points contained in the GENERIC point table), that a complete new upload be performed. **This requires that any previous table database be completely removed first.** Failure to do this will not allow the user to display the new points that have been created and the CCN interface will have a different table database than the unit control.

Conventions Used in This Manual — The following conventions for discussing configuration points for the local display (Scrolling Marquee or Navigator™ accessory) will be used in this manual.

Point names will be written with the Mode name first, then any sub-modes, then the point name, each separated by an arrow symbol ($\rightarrow$). Names will also be shown in bold and italics. As an example, the IAQ Economizer Override Position which is located in the Configuration mode, Indoor Air Quality Configuration sub-mode, and the Air Quality Set Points sub-sub-mode, would be written as ***Configuration→IAQ→IAQ.SP→IQ.O.P.***

This path name will show the user how to navigate through the local display to reach the desired configuration. The user would scroll through the modes and submodes using the ▲ and ▼ keys. The arrow symbol in the path name represents pressing ENTER to move into the next level of the menu structure.

When a value is included as part of the path name, it will be shown at the end of the path name after an equals sign. If the value represents a configuration setting, an explanation will be shown in parenthesis after the value. As an example, ***Configuration→IAQ→AQ.CF→IQ.AC = 1*** (IAQ Analog Input).

Pressing the ESCAPE and ENTER keys simultaneously will scroll an expanded text description of the point name across the display. The expanded description is shown in the local display tables but will not be shown with the path names in text.

The CCN point names are also referenced in the local display tables for users configuring the unit with CCN software instead of the local display. The CCN tables are located in Appendix B of this manual.

Table 2 — Scrolling Marquee Menu Display Structure

RUN STATUS	SERVICE TEST	TEMPERATURES	PRESSURES	SETPOINTS	INPUTS	OUTPUTS	CONFIGURATION	TIME CLOCK	OPERATING MODES	ALARMS
Auto View of Run Status (VIEW) ↓	Service Test Mode (TEST) ↓	Air Temperatures (AIR.T) ↓	Air Pressures (AIR.P) ↓	Occupied Heat Setpoint (OHSP) ↓	General Inputs (GEN.I) ↓	Fans (FANS) ↓	Unit Configuration (UNIT) ↓	Time of Day (TIME) ↓	System Mode (SYS.M) ↓	Currently Active Alarms (CURR) ↓
Econ Run Status (ECON) ↓	Software Command Disable (STOP) ↓	Refrigerant Temperatures (REF.T)	Refrigerant Pressures (REF.P)	Occupied Cool Setpoint (OCSP) ↓	Compressor Feedback (FD.BK) ↓	Cooling (COOL) ↓	Cooling Configuration (COOL) ↓	Month, Date, Day and Year (DATE) ↓	HVAC Mode (HVAC) ↓	Reset All Current Alarms (R.CUR) ↓
Cooling Information (COOL) ↓	Soft Stop Request (S.STP) ↓			Unoccupied Heat Setpoint (UHSP) ↓	Thermostat Inputs (STAT) ↓	Heating (HEAT) ↓	Evap/Discharge Temp. Reset (EDT.R) ↓	Local Time Schedule (SCH.L) ↓	Control Type (CTRL) ↓	Alarm History (HIST) ↓
Mode Trip Helper (TRIP) ↓	Supply Fan Request (FAN.F) ↓			Unoccupied Cool Setpoint (UCSP) ↓	Fire-Smoke Modes (FIRE) ↓	Economizer (ECON) ↓	Heating Configuration (HEAT) ↓	Local Holiday Schedules (HOL.L) ↓	Mode Controlling Unit (MODE)	Reset Alarm History (R.HIS)
CCN Linkage (LINK) ↓	4 in. Filter Change Mode (F.4.CH) ↓			Heat - Cool Setpoint Gap (GAP) ↓	Relative Humidity (REL.H) ↓	General Outputs (GEN.O)	Supply Static Press. Config. (SP) ↓	Daylight Savings Time (DAY.S)		
Compressor Run Hours (HRS) ↓	Test Independent Outputs (INDP) ↓			VAV Occ Cool On (V.C.ON) ↓	Air Quality Sensors (AIR.Q) ↓		Economizer Configuration (ECON) ↓			
Compressor Starts (STRT) ↓	Test Fans (FANS) ↓			VAV Occ Cool Off (V.C.OF) ↓	CFM Sensors (CFM) ↓		Building Press. Configs (BP) ↓			
Timeguards (TMGD) ↓	Test Cooling (COOL) ↓			Supply Air Setpoint (SASP) ↓	Reset Inputs (RSET) ↓		Cool/Heat Setpt. Offsets (D.L.V.T) ↓			
Software Version Numbers (VERS)	Test Heating (HEAT)			Supply Air Setpoint Hi (SA.HI) ↓	4-20 Milliamp Inputs (4-20)		Demand Limit Config. (DMD.L) ↓			
				Supply Air Setpoint Lo (SA.LO) ↓			Indoor Air Quality Cfg. (IAQ) ↓			
				Heating Supply Air Setpoint (SA.HT) ↓			CCN Configuration (CCN) ↓			
				Tempering Purge SASP (T.PRG) ↓			Alert Limit Config. (ALLM) ↓			
				Tempering in Cool SASP (T.CL) ↓			Sensor Trim Config. (TRIM) ↓			
				Tempering in Vent Occ SASP (T.V.OC) ↓			Switch Logic (SW.LG) ↓			
				Tempering in Vent Unocc. SASP (T.V.UN)			Display Configuration (DISP)			

START-UP

> IMPORTANT: Do not attempt to start unit, even momentarily, until all items on the Start-Up Checklist (in installation instructions) and the following steps have been completed.

Unit Preparation — Check that unit has been installed in accordance with the installation instructions and applicable codes.

Unit Setup — Make sure that the economizer hoods have been installed and that the outdoor filters are properly installed.

Internal Wiring — Ensure that all electrical connections in the control box are tightened as required. If the unit has staged gas heat make sure that the leaving air temperature (LAT) sensors have been routed to the supply ducts as required.

Accessory Installation — Check to make sure that all accessories including space thermostats and sensors have been installed and wired as required by the instructions and unit wiring diagrams.

Crankcase Heaters — Crankcase heaters are energized as long as there is power to the unit, except when the compressors are running.

> IMPORTANT: Unit power must be on for 24 hrs prior to start-up of compressors. Otherwise damage to compressors may result.

Evaporator Fan — Fan belt and fixed pulleys are factory-installed. See Tables 3-26 for fan performance and motor limitations data. Remove tape from fan pulley, and be sure that fans rotate in the proper direction. See Table 27 for motor limitations. See Tables 28A and 28B for air quantity limits. Static pressure drop for power exhaust is negligible. To alter fan performance, see Evaporator Fan Performance Adjustment section on page 110.

Controls — Use the following steps for the controls:

NOTE: The unit is shipped with the unit control disabled. To enable the control, set Local Machine Disable (*Service Test→STOP*) to No.

1. Set any control configurations that are required (field-installed accessories, etc.). The unit is factory configured for all appropriate factory-installed options.

2. Enter unit set points. The unit is shipped with the set point default values. If a different set point is required use the Scroll Marquee, Navigator™ accessory or Service Tool software to change the configuration valves.

3. If the internal unit schedules are going to be used configure the Occupancy schedule.

4. Verify that the control time periods programmed meet current requirements.

5. Using Service Test mode, verify operation of all major components.

6. If the unit is a VAV unit make sure to configure the VFD static pressure set point using the display. To checkout the VFD use the VFD instructions shipped with the unit.

Gas Heat — Verify gas pressure before turning on gas heat as follows:

1. Turn off field-supplied manual gas stop, located external to the unit.

2. Connect pressure gages to supply gas tap, located at field-supplied manual shutoff valves.

3. Connect pressure gages to manifold pressure tap on unit gas valve.

4. Supply gas pressure must not exceed 13.5 in. wg. Check pressure at field-supplied shut-off valve.

5. Turn on manual gas stop and initiate a heating demand. Jumper R to W1 in the control box to initiate heat.

6. Use the Service Test procedure to verify heat operation.

7. After the unit has run for several minutes, verify that incoming pressure is 6.0 in. wg or greater and that the manifold pressure is 3.5 in wg. If manifold pressure must be adjusted refer to Gas Valve Adjustment section.

Table 3 — Fan Performance — 48AJ,AK020,025 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	413	1.15	478	1.51	536	1.89	588	2.29	635	2.69	679	3.11	720	3.53	758	3.96	794	4.39
5,000	388	1.26	448	1.58	509	1.96	563	2.36	613	2.77	659	3.20	702	3.63	742	4.08	780	4.53	816	4.99
6,000	427	1.76	489	2.15	544	2.54	595	2.96	642	3.38	686	3.83	727	4.28	766	4.74	804	5.21	839	5.69
7,000	476	2.44	534	2.86	584	3.28	631	3.70	675	4.15	717	4.60	756	5.07	794	5.54	830	6.03	865	6.53
7,500	502	2.83	557	3.27	606	3.70	651	4.14	694	4.59	734	5.05	772	5.52	809	6.01	845	6.50	878	7.00
8,000	527	3.26	580	3.72	628	4.16	671	4.61	713	5.07	752	5.54	789	6.02	825	6.51	860	7.01	893	7.51
9,000	580	4.25	629	4.74	674	5.21	715	5.68	753	6.16	790	6.65	826	7.14	860	7.65	893	8.16	925	8.67
10,000	633	5.40	679	5.93	721	6.43	760	6.93	796	7.43	831	7.94	865	8.45	897	8.96	929	9.49	959	10.02
11,000	687	6.74	731	7.30	770	7.84	807	8.36	842	8.89	875	9.41	907	9.94	937	10.47	967	11.01	997	11.55
12,000	741	8.26	783	8.86	820	9.43	855	9.98	888	10.53	920	11.08	950	11.62	980	12.18	1008	12.73	1036	13.29
12,500	768	9.10	809	9.71	846	10.30	880	10.87	912	11.43	943	11.99	973	12.54	1002	13.10	1030	13.67	1057	14.23
13,000	796	9.98	835	10.62	871	11.22	905	11.80	936	12.38	966	12.95	996	13.51	1024	14.08	1051	14.65	1078	15.23

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	828	4.83	861	5.27	892	5.72	922	6.17	951	6.62	979	7.08	1006	7.54	1032	8.00	1058	8.47	1082	8.93
5,000	850	5.46	883	5.93	915	6.40	945	6.88	974	7.36	1002	7.85	1030	8.34	1056	8.83	1082	9.33	1107	9.82
6,000	873	6.18	906	6.67	937	7.17	967	7.67	997	8.18	1025	8.69	1052	9.20	1079	9.72	1105	10.24	1130	10.77
7,000	898	7.03	930	7.54	961	8.05	991	8.57	1020	9.10	1048	9.63	1075	10.16	1101	10.70	1127	11.25	1153	11.79
7,500	911	7.51	943	8.02	973	8.55	1003	9.08	1032	9.61	1060	10.15	1087	10.69	1113	11.24	1139	11.79	1164	12.35
8,000	925	8.03	956	8.55	986	9.08	1016	9.62	1044	10.16	1072	10.70	1099	11.26	1125	11.81	1150	12.37	1175	12.94
9,000	956	9.20	986	9.74	1015	10.28	1043	10.83	1071	11.38	1098	11.94	1124	12.50	1150	13.08	1175	13.65	1200	14.23
10,000	989	10.56	1018	11.10	1046	11.66	1073	12.21	1100	12.78	1126	13.35	1152	13.93	1177	14.51	—	—	—	—
11,000	1025	12.10	1053	12.66	1080	13.23	1106	13.80	1132	14.37	1158	14.95	1182	15.54	—	—	—	—	—	—
12,000	1063	13.85	1090	14.42	1116	15.00	1142	15.58	1166	16.17	1191	16.76	—	—	—	—	—	—	—	—
12,500	1083	14.80	1109	15.38	1135	15.96	1160	16.55	1185	17.14	—	—	—	—	—	—	—	—	—	—
13,000	1104	15.81	1129	16.39	1155	16.98	1179	17.57	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

Table 4 — Fan Performance — 48AJ,AK027,030 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	408	1.50	473	1.88	530	2.27	582	2.67	631	3.10	675	3.53	717	3.98	757	4.43	795	4.89	830	5.36
6,000	433	1.80	495	2.18	549	2.58	600	3.00	646	3.43	690	3.87	731	4.32	770	4.79	807	5.26	843	5.74
7,000	484	2.49	540	2.91	591	3.33	637	3.76	681	4.21	722	4.66	761	5.13	799	5.61	835	6.09	869	6.59
8,000	537	3.34	589	3.79	635	4.23	678	4.69	719	5.15	758	5.62	795	6.10	831	6.59	865	7.09	898	7.60
8,250	550	3.57	601	4.03	647	4.49	689	4.94	729	5.41	768	5.88	804	6.37	840	6.86	874	7.37	906	7.88
9,000	590	4.35	638	4.83	682	5.31	723	5.78	761	6.26	798	6.75	833	7.24	867	7.75	899	8.26	931	8.78
10,000	645	5.53	690	6.05	731	6.56	769	7.05	805	7.55	840	8.06	873	8.57	905	9.09	936	9.61	967	10.15
11,000	700	6.90	742	7.46	781	7.99	817	8.51	851	9.04	884	9.56	916	10.09	946	10.62	976	11.16	1005	11.71
12,000	755	8.46	795	9.05	832	9.61	866	10.17	899	10.71	930	11.26	960	11.81	989	12.36	1018	12.91	1045	13.47
13,000	811	10.23	849	10.85	884	11.44	917	12.02	948	12.59	978	13.16	1006	13.73	1034	14.30	1061	14.87	1088	15.45
13,750	854	11.69	890	12.33	924	12.95	955	13.55	985	14.14	1014	14.72	1042	15.29	1069	15.89	1095	16.48	1121	17.07
14,000	868	12.20	904	12.86	937	13.48	968	14.08	998	14.68	1026	15.27	1054	15.86	1081	16.45	1107	17.05	1132	17.64
15,000	924	14.40	959	15.08	990	15.73	1020	16.37	1049	16.99	1076	17.61	1103	18.22	1128	18.83	1153	19.44	1178	20.05

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	864	5.84	897	6.32	928	6.81	959	7.30	988	7.80	1016	8.30	1043	8.80	1070	9.31	1096	9.82	1121	10.33
6,000	876	6.23	909	6.72	940	7.22	970	7.72	999	8.23	1028	8.74	1055	9.25	1081	9.77	1107	10.29	1132	10.82
7,000	902	7.09	934	7.60	965	8.12	994	8.64	1023	9.17	1051	9.70	1078	10.23	1105	10.77	1131	11.32	1156	11.86
8,000	930	8.12	961	8.64	991	9.17	1020	9.71	1049	10.25	1076	10.80	1103	11.35	1129	11.90	1155	12.47	1180	13.03
8,250	938	8.40	969	8.92	998	9.46	1027	10.00	1055	10.54	1083	11.09	1109	11.65	1135	12.21	1161	12.78	1186	13.34
9,000	962	9.31	992	9.84	1021	10.39	1049	10.94	1076	11.49	1103	12.05	1130	12.62	1155	13.19	1180	13.76	—	—
10,000	996	10.69	1025	11.24	1053	11.79	1080	12.35	1107	12.92	1133	13.49	1158	14.07	1183	14.65	—	—	—	—
11,000	1033	12.26	1060	12.82	1087	13.39	1114	13.96	1139	14.54	1165	15.12	1189	15.71	—	—	—	—	—	—
12,000	1072	14.04	1099	14.61	1125	15.19	1150	15.77	1175	16.36	1199	16.96	—	—	—	—	—	—	—	—
13,000	1114	16.03	1139	16.62	1164	17.21	1188	17.80	—	—	—	—	—	—	—	—	—	—	—	—
13,750	1146	17.66	1171	18.26	1195	18.86	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14,000	1157	18.23	1181	18.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

Table 5 — Fan Performance — 48AJ,AK035 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	549	2.97	598	3.40	644	3.83	687	4.28	728	4.73	767	5.20	805	5.68	840	6.17	874	6.67	907	7.17
8,000	606	3.95	651	4.40	694	4.85	734	5.32	772	5.79	808	6.28	844	6.77	878	7.27	910	7.79	942	8.31
9,000	664	5.11	706	5.58	745	6.06	783	6.55	818	7.04	853	7.54	886	8.05	918	8.56	949	9.09	979	9.62
10,000	723	6.46	762	6.96	799	7.46	833	7.97	867	8.48	899	8.99	931	9.52	961	10.05	991	10.59	1019	11.13
10,500	753	7.22	790	7.73	826	8.24	859	8.75	892	9.27	923	9.80	954	10.33	983	10.87	1012	11.42	1040	11.97
11,000	783	8.02	819	8.55	853	9.07	886	9.59	917	10.12	948	10.66	978	11.20	1006	11.74	1035	12.30	1062	12.86
12,000	843	9.79	877	10.34	909	10.88	940	11.43	969	11.98	998	12.53	1026	13.09	1054	13.65	1081	14.22	1107	14.79
13,000	903	11.78	935	12.35	965	12.92	994	13.49	1023	14.06	1050	14.63	1077	15.21	1103	15.79	1128	16.37	1154	16.96
14,000	964	14.00	994	14.60	1022	15.19	1050	15.78	1077	16.37	1103	16.96	1129	17.56	1153	18.15	1178	18.75	1202	19.35
15,000	1025	16.46	1053	17.08	1080	17.70	1106	18.31	1132	18.92	1157	19.53	1181	20.14	1205	20.76	1229	21.37	1251	21.99
16,000	1086	19.17	1112	19.81	1138	20.45	1163	21.08	1188	21.71	1212	22.35	1235	22.98	1258	23.61	1280	24.24	—	—
17,000	1147	22.13	1172	22.80	1197	23.45	1221	24.11	1244	24.76	1267	25.41	1290	26.06	—	—	—	—	—	—
17,500	1177	23.71	1202	24.39	1226	25.06	1250	25.72	1273	26.39	1295	27.04	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	939	7.68	969	8.20	999	8.72	1028	9.25	1056	9.78	1083	10.32	1109	10.86	1135	11.40	1160	11.95	1184	12.50
8,000	972	8.83	1002	9.36	1031	9.90	1059	10.45	1086	11.00	1113	11.55	1139	12.11	1164	12.67	1188	13.24	1213	13.81
9,000	1009	10.16	1037	10.71	1065	11.26	1092	11.82	1119	12.38	1145	12.95	1170	13.53	1195	14.11	1219	14.69	1243	15.27
10,000	1048	11.69	1075	12.25	1102	12.81	1128	13.38	1154	13.96	1179	14.54	1203	15.13	1227	15.72	1251	16.32	1274	16.92
10,500	1068	12.53	1095	13.09	1121	13.66	1147	14.24	1172	14.83	1197	15.41	1221	16.01	1245	16.61	1268	17.21	1291	17.82
11,000	1089	13.42	1115	13.99	1141	14.57	1166	15.15	1191	15.74	1215	16.34	1239	16.94	1262	17.54	1285	18.15	—	—
12,000	1133	15.37	1158	15.96	1182	16.55	1207	17.14	1230	17.75	1254	18.35	1277	18.96	1299	19.58	—	—	—	—
13,000	1178	17.55	1202	18.15	1226	18.75	1249	19.36	1272	19.97	1295	20.59	—	—	—	—	—	—	—	—
14,000	1225	19.96	1248	20.57	1271	21.19	1294	21.81	—	—	—	—	—	—	—	—	—	—	—	—
15,000	1274	22.61	1296	23.24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

Table 6 — Fan Performance — 48AJ,AK040 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	502	2.90	550	3.30	596	3.71	639	4.12	680	4.54	720	4.97	759	5.40	796	5.85	832	6.31	867	6.77
9,000	552	3.81	595	4.24	637	4.67	677	5.11	715	5.55	752	6.00	788	6.45	823	6.92	857	7.39	890	7.87
10,000	602	4.89	642	5.34	680	5.80	717	6.26	752	6.73	787	7.20	821	7.67	854	8.16	886	8.64	917	9.14
11,000	653	6.15	689	6.62	725	7.11	759	7.59	792	8.08	825	8.58	856	9.07	887	9.57	918	10.08	947	10.59
12,000	704	7.60	738	8.09	771	8.60	803	9.11	834	9.63	865	10.14	895	10.66	924	11.18	952	11.71	980	12.24
13,000	756	9.24	788	9.76	818	10.29	848	10.83	878	11.36	906	11.90	935	12.44	962	12.99	989	13.53	1016	14.08
14,000	808	11.10	838	11.64	867	12.19	895	12.74	922	13.30	950	13.87	976	14.43	1002	15.00	1028	15.57	1053	16.14
15,000	861	13.18	888	13.74	915	14.31	942	14.88	968	15.46	994	16.05	1019	16.63	1044	17.22	1068	17.81	1093	18.40
16,000	914	15.49	940	16.06	965	16.65	990	17.24	1015	17.85	1039	18.45	1063	19.06	1087	19.67	1110	20.28	1133	20.89
17,000	967	18.03	991	18.62	1015	19.23	1039	19.85	1062	20.47	1086	21.09	1109	21.72	1131	22.35	1153	22.98	1175	23.61
18,000	1020	20.82	1043	21.43	1066	22.06	1088	22.69	1111	23.33	1133	23.97	1155	24.62	1176	25.27	1197	25.92	1219	26.58
19,000	1073	23.87	1095	24.50	1117	25.14	1138	25.79	1159	26.44	1180	27.11	1201	27.77	1222	28.45	1242	29.12	—	—
20,000	1127	27.18	1147	27.82	1168	28.48	1188	29.15	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	901	7.24	933	7.72	965	8.20	995	8.69	1024	9.19	1053	9.69	1081	10.19	1108	10.70	1134	11.21	1159	11.73
9,000	923	8.35	954	8.85	985	9.35	1014	9.86	1043	10.37	1072	10.89	1099	11.41	1126	11.94	1152	12.47	1177	13.00
10,000	948	9.64	978	10.15	1007	10.66	1036	11.19	1064	11.71	1092	12.25	1119	12.78	1145	13.33	1171	13.88	1196	14.43
11,000	976	11.11	1005	11.63	1033	12.16	1061	12.70	1088	13.24	1114	13.79	1140	14.34	1166	14.90	1191	15.46	1216	16.03
12,000	1008	12.77	1035	13.31	1062	13.86	1088	14.41	1114	14.97	1139	15.53	1164	16.09	1189	16.67	1213	17.24	1237	17.83
13,000	1042	14.64	1068	15.19	1093	15.76	1118	16.32	1143	16.89	1167	17.47	1191	18.05	1215	18.64	1238	19.23	1262	19.82
14,000	1078	16.71	1103	17.28	1127	17.86	1151	18.45	1174	19.03	1198	19.63	1221	20.22	1244	20.82	1266	21.43	1288	22.04
15,000	1116	19.00	1140	19.59	1163	20.19	1186	20.79	1208	21.40	1230	22.00	1253	22.62	1274	23.23	1296	23.85	—	—
16,000	1156	21.51	1178	22.12	1200	22.74	1222	23.36	1244	23.98	1265	24.61	1286	25.24	—	—	—	—	—	—
17,000	1197	24.25	1218	24.89	1240	25.52	1261	26.17	1281	26.81	—	—	—	—	—	—	—	—	—	—
18,000	1239	27.24	1260	27.89	1280	28.55	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

Table 7 — Fan Performance — 48AJ,AK050 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	512	2.98	560	3.38	604	3.79	647	4.20	688	4.62	728	5.05	766	5.49	803	5.94	839	6.40	874	6.86
9,000	561	3.90	604	4.33	645	4.77	685	5.20	723	5.65	760	6.10	796	6.55	831	7.02	864	7.49	897	7.97
10,000	611	5.00	651	5.45	689	5.91	725	6.37	761	6.84	795	7.31	829	7.79	861	8.27	893	8.76	925	9.26
11,000	662	6.27	699	6.75	734	7.23	768	7.72	801	8.21	833	8.71	865	9.20	895	9.71	925	10.21	955	10.73
12,000	714	7.74	748	8.24	780	8.75	812	9.26	843	9.77	873	10.29	903	10.81	932	11.33	960	11.86	988	12.39
13,000	766	9.41	798	9.93	828	10.46	858	11.00	887	11.54	916	12.08	944	12.62	971	13.16	998	13.71	1024	14.26
14,000	819	11.29	848	11.84	877	12.39	905	12.95	932	13.51	959	14.07	985	14.63	1012	15.20	1037	15.77	1062	16.34
15,000	872	13.40	899	13.96	926	14.54	953	15.11	979	15.70	1004	16.28	1029	16.87	1054	17.46	1078	18.05	1102	18.64
16,000	925	15.74	951	16.32	976	16.91	1001	17.51	1026	18.12	1050	18.72	1074	19.33	1097	19.94	1121	20.55	1143	21.17
17,000	979	18.32	1003	18.92	1027	19.53	1051	20.15	1074	20.77	1097	21.40	1120	22.03	1142	22.66	1164	23.29	1186	23.93
18,000	1032	21.15	1055	21.77	1078	22.40	1100	23.04	1123	23.68	1145	24.33	1166	24.98	1188	25.63	1209	26.28	1230	26.93
19,000	1086	24.24	1108	24.88	1129	25.52	1151	26.18	1172	26.84	1193	27.51	1214	28.18	1234	28.85	1255	29.52	1275	30.19
20,000	1140	27.60	1161	28.25	1181	28.92	1202	29.59	1222	30.27	1242	30.95	1262	31.64	1281	32.33	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	907	7.34	940	7.81	971	8.30	1001	8.79	1030	9.29	1059	9.79	1086	10.29	1113	10.80	1139	11.31	1164	11.83
9,000	930	8.46	961	8.95	991	9.46	1021	9.97	1050	10.48	1078	11.00	1105	11.52	1131	12.05	1157	12.58	1183	13.12
10,000	955	9.76	985	10.27	1014	10.79	1043	11.31	1071	11.84	1098	12.37	1125	12.91	1151	13.46	1177	14.01	1202	14.56
11,000	984	11.25	1012	11.77	1040	12.30	1068	12.84	1095	13.38	1121	13.93	1147	14.49	1172	15.05	1197	15.61	1222	16.18
12,000	1016	12.93	1043	13.47	1069	14.02	1095	14.57	1121	15.13	1147	15.69	1172	16.26	1196	16.83	1220	17.41	1244	18.00
13,000	1050	14.82	1076	15.38	1101	15.94	1126	16.51	1151	17.08	1175	17.66	1199	18.24	1223	18.83	1246	19.42	1269	20.02
14,000	1087	16.92	1111	17.49	1136	18.07	1159	18.66	1183	19.25	1206	19.84	1229	20.44	1252	21.04	1274	21.64	1296	22.25
15,000	1126	19.23	1149	19.83	1172	20.43	1195	21.03	1217	21.64	1239	22.25	1261	22.86	1283	23.48	—	—	—	—
16,000	1166	21.78	1188	22.40	1210	23.01	1232	23.64	1253	24.26	1275	24.89	1296	25.52	—	—	—	—	—	—
17,000	1208	24.56	1229	25.20	1250	25.84	1271	26.48	1291	27.12	—	—	—	—	—	—	—	—	—	—
18,000	1250	27.59	1271	28.25	1291	28.91	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	1294	30.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 8 — Fan Performance — 48AJ,AK060 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	476	4.33	534	5.04	585	5.78	632	6.56	674	7.39	714	8.24	751	9.12	786	10.02	819	10.93	851	11.85
14,000	536	6.19	588	6.96	636	7.74	680	8.56	720	9.41	758	10.30	793	11.21	827	12.15	859	13.11	890	14.08
15,000	566	7.28	617	8.09	662	8.90	704	9.73	744	10.59	781	11.50	816	12.42	849	13.38	881	14.36	911	15.35
16,000	597	8.48	645	9.34	689	10.17	730	11.02	768	11.90	804	12.82	839	13.76	871	14.73	902	15.72	932	16.73
17,000	628	9.80	674	10.71	717	11.58	756	12.45	793	13.34	829	14.27	862	15.21	894	16.21	925	17.21	954	18.24
18,000	659	11.25	704	12.21	745	13.11	783	14.00	819	14.91	853	15.85	886	16.82	918	17.82	948	18.84	977	19.88
19,000	691	12.82	734	13.84	773	14.77	810	15.69	845	16.62	879	17.58	911	18.56	942	19.57	971	20.60	1000	21.65
20,000	723	14.53	764	15.60	802	16.57	838	17.52	872	18.47	905	19.44	936	20.44	966	21.45	995	22.50	1023	23.57
21,000	755	16.37	794	17.49	831	18.51	866	19.49	899	20.47	931	21.46	961	22.47	991	23.50	1019	24.55	1047	25.63
22,000	787	18.35	825	19.53	861	20.59	894	21.60	927	22.61	958	23.62	987	24.64	1016	25.69	1044	26.76	1071	27.84
23,000	819	20.48	856	21.71	890	22.81	923	23.87	954	24.90	985	25.93	1014	26.97	1042	28.03	1069	29.11	1096	30.21
24,000	851	22.75	887	24.04	920	25.19	952	26.28	983	27.34	1012	28.40	1041	29.46	1068	30.54	1095	31.63	1121	32.74
25,000	883	25.17	918	26.52	951	27.72	982	28.84	1011	29.94	1040	31.02	1068	32.11	1095	33.21	1121	34.31	1147	35.44
26,000	916	27.76	950	29.15	981	30.40	1011	31.57	1040	32.70	1068	33.81	1095	34.92	1122	36.04	1147	37.16	1172	38.30
27,000	948	30.49	981	31.95	1012	33.24	1041	34.46	1070	35.62	1097	36.76	1123	37.90	1149	39.04	1174	40.18	1199	41.34

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	881	12.78	911	13.72	939	14.67	967	15.62	993	16.58	1019	17.54	1045	18.51	1069	19.48	1093	20.45	1117	21.43
14,000	920	15.06	948	16.06	976	17.07	1003	18.08	1029	19.11	1054	20.13	1079	21.17	1103	22.21	1126	23.26	1149	24.31
15,000	940	16.36	968	17.38	996	18.41	1022	19.45	1047	20.50	1073	21.56	1097	22.63	1121	23.70	1144	24.78	1167	25.86
16,000	961	17.76	989	18.80	1016	19.86	1042	20.92	1067	22.00	1092	23.08	1116	24.17	1140	25.28	1162	26.38	1185	27.49
17,000	983	19.28	1010	20.34	1036	21.42	1062	22.51	1087	23.60	1112	24.71	1135	25.83	1159	26.95	1181	28.09	—	—
18,000	1005	20.94	1032	22.01	1058	23.11	1083	24.21	1108	25.33	1132	26.46	1156	27.60	1178	28.74	—	—	—	—
19,000	1027	22.72	1054	23.81	1080	24.92	1105	26.04	1129	27.18	1153	28.33	1176	29.48	1199	30.65	—	—	—	—
20,000	1050	24.65	1076	25.76	1102	26.88	1126	28.01	1151	29.17	1174	30.33	1197	31.50	—	—	—	—	—	—
21,000	1073	26.73	1099	27.84	1124	28.97	1149	30.13	1173	31.29	1196	32.47	—	—	—	—	—	—	—	—
22,000	1097	28.95	1123	30.08	1147	31.22	1172	32.39	1195	33.56	—	—	—	—	—	—	—	—	—	—
23,000	1122	31.33	1147	32.47	1171	33.63	1195	34.80	—	—	—	—	—	—	—	—	—	—	—	—
24,000	1146	33.87	1171	35.02	1195	36.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	1171	36.58	1196	37.74	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	1197	39.46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND AND NOTES FOR TABLES 3-26.

LEGEND

Bhp — Brake Horsepower

NOTES:
1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.

2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp} \times 746}{\text{Motor efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb and ewb conditions.

Table 9 — Fan Performance — 50AJ,AK020,025 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	398	1.08	464	1.42	523	1.77	575	2.13	622	2.50	666	2.87	707	3.24	745	3.62	781	4.01
5,000	388	1.26	428	1.47	489	1.83	545	2.21	595	2.60	642	2.99	685	3.39	726	3.79	764	4.20	800	4.61
6,000	398	1.59	463	1.97	520	2.36	572	2.76	620	3.17	664	3.59	706	4.01	746	4.44	783	4.87	819	5.31
7,000	441	2.18	501	2.60	554	3.02	602	3.44	647	3.87	690	4.31	730	4.75	769	5.20	805	5.66	840	6.12
7,500	463	2.52	521	2.96	572	3.39	619	3.83	663	4.27	704	4.72	744	5.17	781	5.63	817	6.10	852	6.56
8,000	486	2.90	542	3.36	591	3.80	637	4.25	679	4.70	720	5.16	758	5.62	795	6.09	830	6.57	864	7.05
9,000	532	3.76	585	4.26	631	4.73	674	5.20	714	5.68	752	6.16	789	6.64	824	7.13	858	7.62	890	8.12
10,000	579	4.76	629	5.30	673	5.81	713	6.31	751	6.81	788	7.31	822	7.81	856	8.32	888	8.83	919	9.34
11,000	627	5.91	674	6.50	716	7.04	754	7.57	791	8.09	825	8.62	858	9.14	890	9.66	921	10.20	951	10.73
12,000	675	7.23	720	7.86	760	8.44	797	9.00	831	9.55	864	10.09	896	10.64	926	11.18	956	11.73	985	12.28
12,500	699	7.96	743	8.60	782	9.20	818	9.78	852	10.34	884	10.90	915	11.45	945	12.01	974	12.57	1003	13.13
13,000	724	8.72	767	9.39	805	10.00	840	10.60	873	11.17	905	11.74	935	12.31	965	12.88	993	13.45	1021	14.01

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	815	4.40	847	4.79	879	5.19	909	5.59	938	6.00	965	6.40	992	6.81	1019	7.23	1044	7.65	1069	8.07
5,000	834	5.03	867	5.45	898	5.87	929	6.30	958	6.73	986	7.16	1013	7.60	1040	8.04	1065	8.48	1090	8.92
6,000	853	5.75	886	6.20	918	6.64	948	7.10	977	7.55	1005	8.01	1033	8.47	1059	8.93	1085	9.39	1110	9.86
7,000	874	6.58	906	7.05	937	7.52	967	7.99	996	8.47	1025	8.95	1052	9.43	1079	9.92	1104	10.41	1130	10.90
7,500	885	7.04	917	7.52	948	8.00	978	8.48	1006	8.97	1035	9.46	1062	9.96	1088	10.45	1114	10.95	1139	11.45
8,000	897	7.53	928	8.02	959	8.51	988	9.01	1017	9.50	1045	10.01	1072	10.51	1098	11.02	1124	11.53	1149	12.04
9,000	922	8.62	952	9.13	982	9.64	1011	10.15	1039	10.67	1066	11.19	1093	11.72	1119	12.24	1145	12.77	1169	13.30
10,000	950	9.86	979	10.39	1008	10.92	1036	11.45	1063	11.98	1090	12.52	1116	13.06	1142	13.61	1167	14.15	1191	14.71
11,000	980	11.26	1009	11.81	1037	12.35	1064	12.90	1090	13.45	1116	14.01	1141	14.56	1166	15.13	1191	15.69	—	—
12,000	1013	12.84	1040	13.40	1067	13.96	1093	14.52	1119	15.09	1144	15.66	1169	16.23	1193	16.81	—	—	—	—
12,500	1030	13.69	1057	14.26	1083	14.83	1109	15.40	1134	15.97	1159	16.55	1183	17.14	—	—	—	—	—	—
13,000	1048	14.59	1074	15.16	1100	15.74	1125	16.32	1150	16.90	1174	17.49	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

Table 10 — Fan Performance — 50AJ,AK027,030 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	394	1.42	450	1.74	508	2.11	562	2.50	611	2.90	656	3.31	699	3.72	739	4.14	776	4.56	812	4.98
6,000	404	1.62	468	2.01	525	2.40	576	2.80	624	3.21	668	3.63	710	4.05	750	4.48	787	4.91	823	5.35
7,000	449	2.23	508	2.65	560	3.07	608	3.49	653	3.92	695	4.36	736	4.81	774	5.26	810	5.72	845	6.18
8,000	496	2.98	550	3.43	599	3.88	644	4.32	686	4.78	726	5.24	764	5.70	801	6.17	836	6.65	869	7.13
8,250	508	3.18	561	3.65	609	4.10	653	4.55	695	5.01	734	5.47	772	5.95	808	6.42	843	6.90	876	7.38
9,000	544	3.86	595	4.35	640	4.83	682	5.30	722	5.77	760	6.25	796	6.74	831	7.23	864	7.72	897	8.22
10,000	592	4.90	640	5.43	683	5.93	723	6.43	760	6.93	796	7.43	830	7.93	864	8.44	896	8.95	927	9.47
11,000	641	6.09	687	6.66	727	7.19	765	7.72	801	8.24	835	8.76	867	9.29	899	9.82	930	10.35	959	10.88
12,000	691	7.45	734	8.06	772	8.62	808	9.18	842	9.73	875	10.27	906	10.82	936	11.36	966	11.91	994	12.47
13,000	741	8.98	782	9.63	819	10.23	853	10.81	886	11.39	917	11.96	947	12.52	976	13.09	1004	13.66	1031	14.23
13,750	779	10.25	818	10.92	854	11.55	887	12.16	919	12.75	949	13.34	978	13.93	1006	14.51	1033	15.09	1060	15.68
14,000	791	10.70	830	11.38	866	12.02	898	12.63	930	13.23	960	13.83	988	14.42	1016	15.01	1043	15.59	1070	16.18
15,000	842	12.60	879	13.32	913	13.99	945	14.63	975	15.26	1003	15.88	1031	16.50	1058	17.11	1084	17.72	1109	18.33

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	846	5.41	879	5.85	910	6.28	941	6.72	970	7.16	998	7.61	1025	8.06	1052	8.51	1078	8.96	1103	9.42
6,000	857	5.79	889	6.24	921	6.69	951	7.14	980	7.59	1008	8.05	1035	8.51	1062	8.97	1088	9.44	1113	9.91
7,000	878	6.64	910	7.11	941	7.58	971	8.05	1000	8.53	1028	9.01	1055	9.50	1082	9.98	1108	10.47	1133	10.96
8,000	902	7.61	933	8.10	964	8.59	993	9.09	1022	9.59	1049	10.09	1076	10.59	1102	11.10	1128	11.61	1153	12.12
8,250	908	7.88	939	8.37	969	8.87	999	9.37	1027	9.87	1055	10.38	1082	10.89	1108	11.40	1133	11.91	1158	12.43
9,000	928	8.72	959	9.23	988	9.74	1017	10.26	1045	10.78	1072	11.30	1098	11.82	1124	12.35	1150	12.88	1174	13.41
10,000	957	9.99	986	10.52	1015	11.04	1043	11.58	1070	12.11	1097	12.65	1122	13.19	1148	13.74	1173	14.29	1197	14.84
11,000	988	11.42	1017	11.96	1044	12.51	1071	13.06	1098	13.61	1123	14.17	1149	14.73	1173	15.29	1198	15.85	—	—
12,000	1022	13.02	1049	13.58	1076	14.14	1102	14.71	1127	15.28	1152	15.85	1177	16.42	—	—	—	—	—	—
13,000	1058	14.80	1084	15.38	1110	15.96	1135	16.54	1159	17.13	1184	17.71	—	—	—	—	—	—	—	—
13,750	1086	16.26	1111	16.85	1136	17.44	1161	18.04	1185	18.63	—	—	—	—	—	—	—	—	—	—
14,000	1095	16.77	1120	17.37	1145	17.96	1169	18.56	1193	19.16	—	—	—	—	—	—	—	—	—	—
15,000	1134	18.94	1158	19.55	1182	20.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 10.

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Table 11 — Fan Performance — 50AJ,AK035 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	517	2.72	568	3.14	616	3.56	660	3.99	702	4.43	742	4.88	779	5.33	815	5.79	850	6.25	883	6.71
8,000	569	3.59	616	4.04	660	4.49	701	4.94	740	5.40	778	5.87	814	6.34	848	6.82	881	7.30	913	7.79
9,000	622	4.63	665	5.10	706	5.58	744	6.05	781	6.54	816	7.02	851	7.52	883	8.01	915	8.51	946	9.02
10,000	675	5.84	716	6.34	754	6.84	790	7.34	824	7.84	858	8.35	890	8.86	921	9.37	952	9.89	981	10.42
10,500	702	6.51	741	7.02	778	7.53	813	8.04	847	8.56	879	9.07	910	9.59	941	10.12	971	10.65	999	11.18
11,000	729	7.23	767	7.75	803	8.27	837	8.80	869	9.32	901	9.85	931	10.38	961	10.91	990	11.45	1018	11.99
12,000	784	8.80	819	9.35	853	9.90	885	10.44	916	10.99	946	11.54	975	12.09	1003	12.64	1031	13.20	1058	13.76
13,000	839	10.57	872	11.15	904	11.72	934	12.29	964	12.86	992	13.42	1020	13.99	1047	14.56	1073	15.14	1099	15.72
14,000	894	12.54	925	13.15	955	13.74	984	14.33	1012	14.92	1039	15.51	1066	16.10	1092	16.69	1117	17.28	1142	17.88
15,000	949	14.73	979	15.36	1008	15.98	1035	16.59	1062	17.20	1088	17.81	1113	18.42	1138	19.03	1162	19.64	1186	20.25
16,000	1005	17.13	1033	17.78	1060	18.43	1087	19.06	1112	19.69	1137	20.32	1161	20.95	1185	21.58	1208	22.21	1231	22.84
17,000	1061	19.76	1088	20.43	1114	21.10	1139	21.76	1163	22.41	1187	23.06	1210	23.71	1233	24.36	1256	25.01	1277	25.66
17,500	1088	21.16	1115	21.84	1140	22.52	1165	23.19	1189	23.85	1212	24.52	1235	25.17	1257	25.83	1279	26.49	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	915	7.18	946	7.65	976	8.13	1005	8.61	1033	9.09	1060	9.57	1086	10.06	1112	10.54	1137	11.04	1161	11.53
8,000	944	8.28	974	8.77	1003	9.27	1032	9.77	1059	10.27	1086	10.78	1112	11.29	1137	11.80	1162	12.31	1186	12.82
9,000	976	9.53	1005	10.04	1033	10.56	1061	11.08	1088	11.61	1114	12.13	1139	12.66	1164	13.19	1189	13.72	1212	14.26
10,000	1010	10.95	1038	11.48	1065	12.02	1092	12.55	1118	13.09	1143	13.64	1168	14.19	1193	14.74	1216	15.29	1240	15.84
10,500	1028	11.72	1055	12.26	1082	12.81	1108	13.35	1134	13.90	1159	14.46	1183	15.02	1207	15.57	1231	16.14	1254	16.70
11,000	1046	12.54	1073	13.09	1099	13.64	1125	14.20	1150	14.76	1175	15.32	1199	15.89	1223	16.45	1246	17.03	1269	17.60
12,000	1084	14.32	1110	14.89	1135	15.46	1160	16.03	1185	16.61	1208	17.19	1232	17.77	1255	18.35	1278	18.94	1300	19.53
13,000	1124	16.30	1149	16.88	1173	17.47	1197	18.06	1221	18.65	1244	19.24	1267	19.84	1289	20.44	—	—	—	—
14,000	1166	18.48	1190	19.08	1213	19.68	1236	20.29	1259	20.89	1281	21.50	—	—	—	—	—	—	—	—
15,000	1209	20.87	1232	21.48	1255	22.10	1277	22.72	1299	23.35	—	—	—	—	—	—	—	—	—	—
16,000	1254	23.48	1276	24.11	1297	24.75	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	1299	26.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 13.

Table 12 — Fan Performance — 50AJ,AK020,025 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	475	2.69	523	3.08	569	3.47	612	3.86	653	4.26	692	4.66	730	5.07	767	5.49	802	5.92	836	6.36
9,000	521	3.53	565	3.94	606	4.36	646	4.78	684	5.20	721	5.63	757	6.06	791	6.49	825	6.94	857	7.39
10,000	568	4.52	608	4.96	646	5.40	683	5.84	719	6.29	753	6.74	787	7.20	819	7.65	851	8.11	882	8.58
11,000	615	5.68	652	6.14	687	6.60	722	7.07	755	7.55	788	8.02	819	8.50	850	8.97	880	9.46	909	9.94
12,000	663	7.01	697	7.49	730	7.98	762	8.47	794	8.97	824	9.47	854	9.96	883	10.47	912	10.97	939	11.48
13,000	712	8.53	743	9.03	774	9.54	804	10.05	834	10.57	862	11.09	891	11.61	918	12.13	945	12.66	972	13.19
14,000	760	10.24	790	10.76	819	11.29	847	11.82	875	12.36	902	12.90	929	13.45	955	13.99	981	14.54	1006	15.09
15,000	809	12.15	837	12.69	864	13.24	891	13.79	917	14.35	943	14.91	968	15.48	993	16.04	1018	16.62	1042	17.18
16,000	859	14.27	885	14.83	910	15.40	936	15.97	960	16.55	985	17.13	1009	17.71	1033	18.30	1056	18.89	1079	19.48
17,000	908	16.61	933	17.19	957	17.77	981	18.36	1004	18.96	1028	19.56	1051	20.16	1073	20.77	1096	21.38	1118	21.99
18,000	958	19.18	981	19.77	1004	20.37	1027	20.98	1049	21.60	1071	22.22	1093	22.84	1115	23.46	1136	24.09	1157	24.72
19,000	1007	21.98	1030	22.59	1052	23.21	1073	23.84	1095	24.47	1116	25.10	1137	25.74	1157	26.39	1178	27.04	1198	27.68
20,000	1057	25.02	1079	25.65	1099	26.29	1120	26.93	1140	27.58	1161	28.23	1181	28.89	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	870	6.81	902	7.26	933	7.73	964	8.20	993	8.67	1022	9.16	1050	9.65	1077	10.14	1104	10.64	1129	11.15
9,000	889	7.85	920	8.31	950	8.79	979	9.27	1008	9.75	1036	10.25	1064	10.75	1090	11.26	1117	11.77	1142	12.29
10,000	912	9.05	941	9.53	970	10.02	998	10.51	1026	11.00	1053	11.51	1080	12.02	1106	12.54	1131	13.06	1157	13.59
11,000	938	10.43	966	10.92	993	11.42	1020	11.93	1047	12.44	1073	12.95	1099	13.47	1124	14.00	1149	14.53	1173	15.07
12,000	967	11.98	993	12.49	1020	13.01	1046	13.53	1071	14.05	1096	14.58	1121	15.11	1145	15.65	1169	16.19	1192	16.74
13,000	998	13.72	1023	14.25	1049	14.78	1073	15.32	1098	15.86	1121	16.40	1145	16.95	1168	17.50	1191	18.06	1214	18.62
14,000	1031	15.64	1055	16.19	1079	16.75	1103	17.30	1126	17.86	1149	18.42	1172	18.98	1195	19.55	1217	20.12	1239	20.69
15,000	1066	17.76	1089	18.33	1112	18.90	1135	19.48	1157	20.06	1179	20.63	1201	21.21	1223	21.80	1244	22.38	1265	22.97
16,000	1102	20.08	1124	20.67	1147	21.26	1168	21.86	1190	22.46	1211	23.06	1232	23.66	1253	24.26	1274	24.86	1294	25.46
17,000	1140	22.61	1161	23.22	1182	23.84	1203	24.45	1224	25.07	1245	25.69	1265	26.31	1285	26.93	—	—	—	—
18,000	1178	25.36	1199	25.99	1219	26.63	1240	27.26	1260	27.90	1279	28.54	1299	29.18	—	—	—	—	—	—
19,000	1218	28.34	1238	28.99	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 13.

Table 13 — Fan Performance — 50AJ,AK050 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	485	2.76	532	3.15	577	3.54	620	3.94	661	4.34	700	4.74	737	5.16	774	5.58	809	6.01	843	6.45
9,000	530	3.62	574	4.03	615	4.45	655	4.87	692	5.29	729	5.72	764	6.15	798	6.59	832	7.03	864	7.49
10,000	577	4.62	617	5.06	655	5.50	692	5.95	727	6.40	761	6.85	794	7.30	827	7.76	858	8.22	889	8.69
11,000	625	5.80	661	6.26	697	6.73	731	7.20	764	7.67	796	8.14	827	8.62	858	9.10	888	9.58	917	10.07
12,000	673	7.15	707	7.63	740	8.12	772	8.62	803	9.11	833	9.61	863	10.11	891	10.61	920	11.12	947	11.62
13,000	722	8.69	753	9.19	784	9.70	814	10.22	843	10.74	872	11.26	900	11.78	927	12.31	954	12.83	980	13.36
14,000	771	10.43	800	10.95	829	11.48	857	12.01	885	12.55	912	13.10	938	13.64	964	14.19	990	14.74	1015	15.29
15,000	821	12.37	848	12.91	875	13.46	901	14.01	928	14.57	953	15.14	978	15.70	1003	16.27	1028	16.84	1052	17.41
16,000	870	14.52	896	15.08	922	15.65	947	16.22	971	16.80	996	17.39	1020	17.97	1043	18.56	1066	19.15	1089	19.75
17,000	920	16.89	945	17.48	969	18.06	993	18.65	1016	19.25	1039	19.86	1062	20.46	1084	21.07	1107	21.68	1129	22.30
18,000	971	19.50	994	20.10	1017	20.71	1039	21.32	1061	21.93	1083	22.55	1105	23.18	1126	23.80	1148	24.44	1169	25.07
19,000	1021	22.35	1043	22.96	1065	23.59	1086	24.21	1107	24.85	1128	25.49	1149	26.13	1170	26.78	1190	27.42	1210	28.08
20,000	1071	25.43	1092	26.07	1113	26.71	1133	27.36	1154	28.01	1174	28.66	1194	29.33	1213	29.99	1233	30.65	1252	31.33

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	876	6.90	908	7.35	939	7.82	970	8.29	999	8.77	1027	9.25	1055	9.74	1082	10.24	1109	10.74	1134	11.25
9,000	896	7.95	926	8.41	956	8.89	986	9.37	1014	9.86	1042	10.36	1069	10.86	1096	11.37	1122	11.88	1148	12.40
10,000	919	9.17	948	9.64	977	10.13	1005	10.62	1032	11.12	1059	11.63	1086	12.14	1112	12.66	1137	13.18	1162	13.71
11,000	945	10.56	973	11.05	1001	11.55	1027	12.06	1054	12.57	1080	13.09	1105	13.61	1130	14.14	1155	14.67	1179	15.21
12,000	975	12.13	1001	12.64	1027	13.16	1053	13.68	1078	14.21	1103	14.74	1128	15.27	1152	15.81	1176	16.35	1199	16.90
13,000	1006	13.89	1032	14.42	1057	14.96	1081	15.49	1105	16.03	1129	16.58	1153	17.12	1176	17.68	1199	18.23	1221	18.80
14,000	1040	15.84	1064	16.39	1088	16.94	1112	17.50	1135	18.06	1158	18.62	1180	19.18	1203	19.75	1225	20.32	1246	20.90
15,000	1075	17.99	1098	18.56	1121	19.13	1144	19.71	1166	20.29	1188	20.86	1210	21.45	1231	22.03	1253	22.62	1274	23.21
16,000	1112	20.34	1134	20.93	1156	21.53	1178	22.12	1199	22.72	1221	23.32	1241	23.92	1262	24.52	1283	25.13	—	—
17,000	1150	22.91	1172	23.52	1193	24.14	1214	24.76	1234	25.37	1255	25.99	1275	26.61	1295	27.23	—	—	—	—
18,000	1190	25.70	1210	26.34	1230	26.97	1250	27.61	1270	28.25	1290	28.89	—	—	—	—	—	—	—	—
19,000	1230	28.73	1250	29.38	1269	30.04	1289	30.70	—	—	—	—	—	—	—	—	—	—	—	—
20,000	1271	31.99	1290	32.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 14 — Fan Performance — 50AJ,AK060 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	450	4.02	509	4.71	560	5.41	605	6.12	647	6.86	686	7.62	723	8.40	757	9.21	790	10.04	821	10.89
14,000	505	5.74	558	6.49	606	7.24	649	8.01	689	8.79	727	9.59	762	10.40	795	11.24	827	12.09	857	12.96
15,000	533	6.75	584	7.53	630	8.32	672	9.11	711	9.91	748	10.73	782	11.56	815	12.41	846	13.28	876	14.17
16,000	561	7.88	610	8.68	655	9.50	696	10.32	734	11.14	770	11.98	803	12.84	836	13.71	866	14.59	896	15.49
17,000	590	9.12	637	9.95	680	10.79	720	11.64	757	12.49	792	13.35	825	14.23	857	15.12	887	16.02	916	16.94
18,000	619	10.48	664	11.33	706	12.20	744	13.07	781	13.96	815	14.84	847	15.74	878	16.65	908	17.57	937	18.50
19,000	648	11.96	692	12.84	732	13.74	769	14.64	805	15.54	838	16.45	870	17.37	900	18.30	930	19.24	958	20.19
20,000	678	13.57	719	14.47	758	15.40	795	16.32	829	17.25	862	18.19	893	19.13	923	20.08	952	21.04	979	22.01
21,000	707	15.30	748	16.24	785	17.19	821	18.14	854	19.09	886	20.05	917	21.02	946	22.00	974	22.98	1001	23.97
22,000	737	17.18	776	18.14	812	19.11	847	20.09	879	21.07	911	22.06	940	23.05	969	24.04	997	25.05	1024	26.06
23,000	767	19.20	804	20.18	840	21.17	873	22.17	905	23.18	935	24.19	965	25.21	993	26.23	1020	27.25	1046	28.28
24,000	797	21.35	833	22.36	867	23.38	900	24.40	931	25.43	961	26.47	989	27.51	1017	28.55	1044	29.60	1070	30.65
25,000	827	23.66	862	24.68	895	25.72	927	26.78	957	27.83	986	28.89	1014	29.95	1041	31.02	1068	32.09	1093	33.17
26,000	857	26.11	891	27.16	923	28.23	954	29.30	984	30.38	1012	31.46	1040	32.55	1066	33.64	1092	34.73	1117	35.83
27,000	888	28.72	920	29.79	952	30.88	982	31.97	1011	33.08	1038	34.19	1065	35.29	1091	36.40	1117	37.52	1141	38.64

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	851	11.75	880	12.63	907	13.53	934	14.45	960	15.38	985	16.32	1010	17.28	1033	18.24	1057	19.22	1079	20.22
14,000	886	13.85	915	14.76	942	15.68	968	16.62	993	17.57	1018	18.54	1042	19.52	1066	20.51	1088	21.52	1111	22.53
15,000	905	15.07	933	15.99	960	16.92	986	17.87	1011	18.83	1035	19.81	1059	20.81	1082	21.81	1105	22.82	1127	23.85
16,000	924	16.41	952	17.34	978	18.28	1004	19.25	1029	20.22	1053	21.21	1077	22.21	1100	23.22	1122	24.25	1144	25.29
17,000	944	17.86	971	18.81	997	19.77	1023	20.74	1047	21.73	1071	22.73	1095	23.74	1117	24.76	1140	25.80	1161	26.85
18,000	964	19.45	991	20.41	1017	21.38	1042	22.36	1066	23.36	1090	24.37	1113	25.40	1136	26.43	1158	27.48	1179	28.54
19,000	985	21.15	1011	22.13	1037	23.12	1061	24.11	1085	25.13	1109	26.15	1132	27.19	1154	28.24	1176	29.29	1197	30.36
20,000	1006	22.99	1032	23.98	1057	24.99	1081	26.00	1105	27.03	1128	28.06	1151	29.11	1173	30.17	1195	31.24	—	—
21,000	1028	24.97	1053	25.97	1078	26.99	1102	28.02	1126	29.06	1148	30.11	1171	31.17	1193	32.25	—	—	—	—
22,000	1050	27.08	1075	28.10	1099	29.14	1123	30.18	1146	31.24	1169	32.30	1191	33.38	—	—	—	—	—	—
23,000	1072	29.32	1097	30.37	1121	31.42	1144	32.48	1167	33.55	1190	34.64	—	—	—	—	—	—	—	—
24,000	1095	31.71	1119	32.78	1143	33.85	1166	34.93	1189	36.02	—	—	—	—	—	—	—	—	—	—
25,000	1118	34.25	1142	35.33	1165	36.42	1188	37.52	—	—	—	—	—	—	—	—	—	—	—	—
26,000	1141	36.93	1165	38.04	1188	39.15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	1165	39.76	1188	40.89	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND AND NOTES FOR TABLES 3-26.

LEGEND

Bhp — Brake Horsepower

NOTES:
1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.

2. Conversion — Bhp to watts:

$$Watts = \frac{Bhp \times 746}{Motor\ efficiency}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb and ewb conditions.

Table 15 — Fan Performance — 48AW,AY020,025 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	422	1.20	486	1.56	542	1.94	594	2.34	640	2.74	683	3.15	724	3.57	762	4.00	797	4.42
5,000	394	1.29	461	1.66	520	2.04	573	2.44	622	2.85	667	3.28	709	3.72	749	4.16	786	4.61	822	5.07
6,000	445	1.87	505	2.26	559	2.66	609	3.08	655	3.51	698	3.95	738	4.41	777	4.87	813	5.35	848	5.82
7,000	498	2.59	553	3.01	603	3.44	649	3.87	692	4.32	732	4.78	771	5.25	808	5.73	843	6.22	877	6.72
7,500	526	3.02	578	3.45	626	3.89	670	4.33	712	4.79	751	5.26	789	5.74	825	6.22	859	6.72	893	7.22
8,000	554	3.48	604	3.93	650	4.38	692	4.84	733	5.30	771	5.78	808	6.26	843	6.76	877	7.26	909	7.77
9,000	610	4.55	657	5.03	699	5.51	739	5.98	777	6.47	813	6.96	848	7.46	881	7.97	913	8.48	944	9.01
10,000	668	5.80	711	6.31	751	6.82	788	7.32	824	7.82	858	8.33	891	8.85	922	9.37	953	9.90	983	10.44
11,000	727	7.25	766	7.79	804	8.32	839	8.85	872	9.37	905	9.90	936	10.44	966	10.98	995	11.52	1024	12.07
12,000	786	8.90	823	9.48	858	10.03	891	10.59	923	11.13	953	11.68	983	12.24	1012	12.79	1040	13.35	1067	13.92
12,500	816	9.81	852	10.40	885	10.97	918	11.53	949	12.09	978	12.66	1007	13.22	1035	13.78	1063	14.35	1089	14.93
13,000	846	10.77	880	11.38	913	11.96	944	12.54	975	13.11	1004	13.68	1032	14.25	1059	14.83	1086	15.41	1112	15.99

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	832	4.86	864	5.29	895	5.74	925	6.18	954	6.63	982	7.08	1009	7.53	1035	7.99	1060	8.45	1085	8.91
5,000	856	5.53	889	6.00	920	6.47	950	6.95	979	7.42	1007	7.91	1034	8.39	1061	8.88	1086	9.37	1111	9.86
6,000	882	6.31	914	6.80	945	7.30	975	7.80	1004	8.30	1032	8.81	1059	9.32	1085	9.84	1111	10.35	1136	10.87
7,000	910	7.22	941	7.73	971	8.25	1001	8.77	1029	9.29	1057	9.82	1084	10.36	1110	10.89	1136	11.43	1161	11.98
7,500	925	7.73	956	8.25	986	8.78	1015	9.31	1043	9.84	1071	10.38	1097	10.92	1123	11.47	1149	12.02	1173	12.57
8,000	941	8.29	971	8.82	1001	9.35	1029	9.89	1057	10.43	1084	10.98	1111	11.53	1137	12.08	1162	12.64	1187	13.21
9,000	975	9.54	1004	10.08	1033	10.62	1061	11.18	1088	11.73	1114	12.30	1140	12.86	1165	13.44	1190	14.01	—	—
10,000	1012	10.98	1040	11.54	1068	12.09	1094	12.66	1121	13.23	1146	13.80	1171	14.38	1196	14.97	—	—	—	—
11,000	1052	12.63	1079	13.20	1105	13.76	1131	14.34	1156	14.92	1181	15.51	—	—	—	—	—	—	—	—
12,000	1094	14.49	1120	15.07	1145	15.65	1170	16.24	1194	16.83	—	—	—	—	—	—	—	—	—	—
12,500	1115	15.51	1141	16.09	1166	16.68	1190	17.27	—	—	—	—	—	—	—	—	—	—	—	—
13,000	1138	16.58	1163	17.16	1187	17.76	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 16 — Fan Performance — 48AW,AY027,030 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	424	1.59	487	1.97	543	2.36	594	2.77	641	3.20	685	3.63	726	4.08	765	4.54	802	5.00	838	5.47
6,000	451	1.90	511	2.29	564	2.70	613	3.12	659	3.55	702	4.00	742	4.45	780	4.92	817	5.39	851	5.87
7,000	506	2.65	560	3.07	609	3.49	654	3.93	697	4.38	737	4.84	776	5.31	813	5.79	848	6.28	881	6.78
8,000	562	3.56	612	4.01	657	4.46	699	4.91	739	5.38	777	5.86	814	6.34	848	6.84	882	7.35	914	7.86
8,250	577	3.81	625	4.27	669	4.73	711	5.19	750	5.66	788	6.14	824	6.63	858	7.13	892	7.64	923	8.15
9,000	620	4.65	666	5.13	707	5.60	747	6.08	784	6.57	820	7.06	855	7.56	888	8.07	920	8.59	951	9.12
10,000	679	5.93	721	6.44	760	6.94	797	7.44	832	7.94	866	8.45	898	8.97	930	9.50	960	10.03	990	10.57
11,000	738	7.40	777	7.94	814	8.47	849	9.00	882	9.52	914	10.05	945	10.58	974	11.13	1003	11.68	1032	12.23
12,000	798	9.09	835	9.66	869	10.22	902	10.77	933	11.32	963	11.86	993	12.42	1021	12.98	1049	13.54	1076	14.11
13,000	859	11.01	893	11.60	925	12.18	956	12.75	986	13.33	1015	13.90	1042	14.47	1070	15.04	1096	15.63	1122	16.21
13,750	905	12.59	937	13.20	968	13.80	997	14.39	1026	14.98	1054	15.57	1081	16.16	1107	16.75	1133	17.34	1158	17.94
14,000	920	13.14	952	13.76	982	14.37	1011	14.97	1040	15.56	1067	16.16	1094	16.75	1120	17.34	1145	17.94	1170	18.54
15,000	981	15.52	1011	16.17	1040	16.80	1068	17.42	1095	18.04	1121	18.65	1146	19.27	1171	19.88	1195	20.50	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	871	5.94	904	6.42	935	6.91	965	7.40	994	7.89	1022	8.39	1049	8.88	1075	9.39	1101	9.89	1126	10.40
6,000	885	6.36	917	6.85	948	7.34	978	7.85	1006	8.35	1034	8.86	1061	9.37	1088	9.88	1113	10.40	1138	10.92
7,000	914	7.29	945	7.80	975	8.31	1005	8.84	1033	9.36	1061	9.89	1087	10.42	1114	10.96	1139	11.50	1164	12.05
8,000	946	8.38	976	8.90	1005	9.44	1034	9.98	1062	10.52	1089	11.07	1115	11.62	1141	12.18	1166	12.74	1191	13.30
8,250	954	8.68	984	9.21	1013	9.74	1042	10.29	1069	10.83	1096	11.39	1122	11.94	1148	12.50	1173	13.07	1197	13.64
9,000	981	9.65	1010	10.19	1038	10.74	1066	11.29	1093	11.85	1119	12.41	1145	12.98	1170	13.55	1195	14.13	—	—
10,000	1019	11.12	1047	11.67	1074	12.23	1101	12.79	1127	13.37	1152	13.94	1177	14.52	—	—	—	—	—	—
11,000	1059	12.79	1086	13.36	1113	13.93	1138	14.51	1163	15.09	1188	15.68	—	—	—	—	—	—	—	—
12,000	1102	14.68	1128	15.26	1153	15.85	1178	16.43	—	—	—	—	—	—	—	—	—	—	—	—
13,000	1147	16.80	1172	17.39	1196	17.99	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13,750	1182	18.54	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14,000	1194	19.15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 17 — Fan Performance — 48AW,AY035 Units)

AIRFLOW (Cfm)	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	568	3.13	616	3.56	661	4.00	704	4.45	744	4.91	782	5.39	818	5.87	853	6.36	886	6.86	919	7.37
8,000	629	4.17	673	4.62	714	5.08	753	5.55	791	6.03	826	6.52	861	7.02	894	7.53	926	8.05	957	8.57
9,000	690	5.40	731	5.88	769	6.36	805	6.85	840	7.35	874	7.86	907	8.37	938	8.90	968	9.43	998	9.96
10,000	753	6.85	790	7.35	826	7.85	860	8.36	892	8.88	924	9.40	955	9.93	985	10.47	1013	11.02	1042	11.57
10,500	784	7.65	820	8.16	855	8.68	887	9.20	919	9.72	950	10.25	980	10.79	1009	11.34	1037	11.89	1064	12.45
11,000	816	8.50	851	9.03	884	9.56	916	10.09	946	10.62	976	11.16	1005	11.71	1033	12.27	1061	12.82	1088	13.39
12,000	879	10.39	912	10.94	943	11.49	973	12.04	1002	12.60	1030	13.15	1057	13.72	1084	14.29	1110	14.86	1136	15.44
13,000	943	12.51	973	13.09	1003	13.66	1031	14.23	1058	14.81	1085	15.38	1111	15.96	1137	16.55	1162	17.14	1186	17.74
14,000	1007	14.89	1036	15.48	1063	16.07	1090	16.67	1116	17.26	1141	17.86	1166	18.46	1191	19.06	1214	19.67	1238	20.28
15,000	1072	17.52	1098	18.13	1125	18.75	1150	19.36	1175	19.97	1199	20.59	1222	21.21	1246	21.83	1268	22.45	1291	23.08
16,000	1136	20.41	1162	21.05	1186	21.68	1210	22.32	1234	22.95	1257	23.58	1280	24.22	—	—	—	—	—	—
17,000	1201	23.58	1225	24.24	1248	24.89	1271	25.55	1294	26.20	—	—	—	—	—	—	—	—	—	—
17,500	1233	25.27	1257	25.94	1280	26.60	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	950	7.88	980	8.39	1009	8.92	1037	9.44	1065	9.97	1092	10.51	1118	11.05	1143	11.59	1168	12.13	1192	12.68
8,000	987	9.10	1016	9.63	1044	10.17	1072	10.72	1099	11.27	1125	11.82	1150	12.38	1175	12.94	1199	13.51	1223	14.08
9,000	1027	10.51	1055	11.06	1082	11.62	1109	12.18	1135	12.74	1160	13.31	1185	13.89	1209	14.47	1233	15.05	1256	15.64
10,000	1069	12.13	1096	12.69	1122	13.26	1148	13.84	1173	14.42	1198	15.00	1222	15.59	1245	16.19	1268	16.79	1291	17.39
10,500	1091	13.02	1118	13.59	1143	14.16	1168	14.75	1193	15.33	1217	15.93	1241	16.53	1264	17.13	1287	17.73	—	—
11,000	1114	13.96	1140	14.54	1165	15.13	1190	15.72	1214	16.31	1238	16.91	1261	17.51	1284	18.12	—	—	—	—
12,000	1161	16.03	1186	16.62	1210	17.22	1234	17.82	1257	18.43	1280	19.04	—	—	—	—	—	—	—	—
13,000	1210	18.34	1234	18.94	1257	19.56	1280	20.17	—	—	—	—	—	—	—	—	—	—	—	—
14,000	1261	20.90	1283	21.52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 18 — Fan Performance — 48AW,AY040 Units

AIRFLOW (Cfm)	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	526	3.10	573	3.50	617	3.91	660	4.33	700	4.75	740	5.18	778	5.62	814	6.07	850	6.53	884	7.00
9,000	579	4.08	621	4.51	662	4.95	701	5.39	738	5.83	775	6.28	810	6.74	845	7.21	878	7.69	911	8.17
10,000	633	5.24	671	5.70	709	6.16	744	6.62	779	7.09	813	7.57	846	8.05	879	8.53	910	9.03	941	9.53
11,000	687	6.59	723	7.07	757	7.56	790	8.05	823	8.54	854	9.04	885	9.54	916	10.05	945	10.56	974	11.08
12,000	742	8.15	775	8.65	807	9.17	838	9.68	868	10.20	898	10.72	927	11.24	955	11.77	983	12.30	1011	12.84
13,000	797	9.92	827	10.45	857	10.98	887	11.52	915	12.07	943	12.61	970	13.15	997	13.70	1024	14.25	1050	14.81
14,000	852	11.92	881	12.47	909	13.03	936	13.59	963	14.15	990	14.72	1016	15.29	1041	15.86	1066	16.43	1091	17.01
15,000	908	14.15	935	14.72	961	15.31	987	15.89	1013	16.48	1038	17.06	1062	17.65	1086	18.25	1110	18.84	1134	19.44
16,000	964	16.63	989	17.23	1014	17.83	1039	18.43	1063	19.04	1086	19.65	1110	20.26	1133	20.88	1156	21.49	1178	22.11
17,000	1021	19.37	1044	19.98	1068	20.60	1091	21.23	1114	21.86	1136	22.49	1158	23.12	1180	23.76	1202	24.39	1223	25.03
18,000	1077	22.37	1099	23.01	1122	23.64	1144	24.29	1165	24.94	1187	25.59	1208	26.25	1229	26.90	1250	27.56	1270	28.22
19,000	1133	25.65	1155	26.30	1176	26.96	1197	27.62	1217	28.29	1238	28.96	—	—	—	—	—	—	—	—
20,000	1190	29.21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	917	7.48	949	7.96	980	8.44	1010	8.94	1039	9.43	1067	9.93	1094	10.44	1121	10.95	1147	11.46	1172	11.98
9,000	942	8.66	973	9.16	1003	9.66	1033	10.17	1061	10.69	1089	11.21	1116	11.73	1142	12.26	1168	12.80	1193	13.33
10,000	971	10.03	1001	10.55	1030	11.06	1058	11.59	1086	12.12	1113	12.66	1139	13.20	1165	13.75	1190	14.30	1215	14.86
11,000	1003	11.60	1031	12.13	1059	12.67	1086	13.21	1112	13.75	1139	14.31	1164	14.86	1189	15.43	1214	15.99	1238	16.56
12,000	1038	13.38	1065	13.92	1091	14.47	1117	15.03	1142	15.59	1167	16.16	1192	16.73	1216	17.31	1240	17.89	1264	18.48
13,000	1075	15.37	1101	15.93	1126	16.50	1150	17.07	1175	17.65	1199	18.23	1222	18.82	1246	19.41	1269	20.00	1291	20.61
14,000	1115	17.59	1139	18.17	1163	18.75	1186	19.34	1210	19.94	1232	20.53	1255	21.14	1277	21.74	1300	22.35	—	—
15,000	1157	20.04	1180	20.64	1202	21.24	1225	21.85	1247	22.46	1269	23.07	1290	23.69	—	—	—	—	—	—
16,000	1200	22.73	1222	23.35	1243	23.97	1265	24.60	1286	25.23	—	—	—	—	—	—	—	—	—	—
17,000	1245	25.67	1266	26.32	1286	26.96	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	1290	28.88	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 19 — Fan Performance — 48AW,AY050 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	536	3.18	582	3.58	626	3.99	668	4.41	708	4.83	747	5.27	785	5.71	821	6.16	857	6.63	891	7.09
9,000	588	4.17	630	4.60	670	5.04	709	5.48	746	5.93	782	6.38	818	6.84	852	7.31	885	7.79	918	8.28
10,000	642	5.35	680	5.80	717	6.27	753	6.73	787	7.20	821	7.68	854	8.16	886	8.65	917	9.14	948	9.65
11,000	696	6.72	732	7.20	766	7.69	799	8.18	831	8.67	863	9.17	893	9.68	923	10.18	953	10.70	982	11.21
12,000	751	8.29	784	8.80	816	9.32	847	9.83	877	10.35	906	10.87	935	11.40	964	11.92	991	12.46	1019	12.99
13,000	807	10.09	837	10.62	867	11.16	896	11.70	924	12.24	952	12.78	979	13.33	1006	13.88	1032	14.43	1058	14.99
14,000	863	12.12	891	12.67	919	13.23	946	13.79	973	14.36	999	14.92	1025	15.49	1050	16.06	1075	16.64	1100	17.21
15,000	919	14.38	946	14.96	972	15.54	997	16.12	1023	16.71	1047	17.30	1072	17.89	1096	18.48	1120	19.08	1143	19.68
16,000	975	16.90	1000	17.49	1025	18.09	1049	18.70	1073	19.31	1097	19.92	1120	20.53	1143	21.15	1165	21.76	1188	22.38
17,000	1032	19.67	1056	20.29	1079	20.91	1102	21.54	1125	22.17	1147	22.80	1169	23.44	1191	24.07	1213	24.71	1234	25.35
18,000	1089	22.71	1111	23.35	1134	23.99	1155	24.64	1177	25.29	1198	25.95	1219	26.60	1240	27.26	1261	27.92	1281	28.58
19,000	1146	26.04	1167	26.69	1188	27.35	1209	28.02	1230	28.69	1250	29.37	1270	30.04	1290	30.72	—	—	—	—
20,000	1203	29.65	1224	30.32	1244	31.00	1263	31.69	1283	32.38	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	923	7.57	955	8.05	986	8.54	1016	9.03	1045	9.53	1073	10.03	1100	10.54	1126	11.05	1152	11.56	1177	12.08
9,000	949	8.77	980	9.27	1010	9.77	1039	10.28	1067	10.80	1095	11.32	1122	11.85	1148	12.38	1174	12.91	1199	13.45
10,000	978	10.15	1008	10.67	1036	11.19	1064	11.72	1092	12.25	1119	12.79	1145	13.33	1171	13.88	1196	14.43	1221	14.99
11,000	1010	11.74	1038	12.27	1066	12.81	1093	13.35	1119	13.90	1145	14.45	1171	15.01	1196	15.57	1220	16.14	1245	16.72
12,000	1046	13.53	1072	14.08	1098	14.63	1124	15.19	1149	15.76	1174	16.32	1199	16.90	1223	17.48	1247	18.06	1270	18.65
13,000	1084	15.55	1109	16.11	1134	16.68	1158	17.26	1182	17.84	1206	18.42	1230	19.01	1253	19.60	1276	20.20	1299	20.80
14,000	1124	17.79	1148	18.38	1171	18.97	1195	19.55	1218	20.15	1241	20.75	1263	21.35	1285	21.96	—	—	—	—
15,000	1166	20.27	1189	20.88	1211	21.49	1234	22.09	1256	22.71	1277	23.32	1299	23.94	—	—	—	—	—	—
16,000	1210	23.00	1231	23.62	1253	24.25	1274	24.88	1295	25.51	—	—	—	—	—	—	—	—	—	—
17,000	1255	25.99	1276	26.63	1296	27.27	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 20 — Fan Performance — 48AW,AY060 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	516	4.81	569	5.54	617	6.30	660	7.10	701	7.93	739	8.79	774	9.68	808	10.59	841	11.52	872	12.46
14,000	584	6.90	632	7.69	676	8.50	716	9.33	754	10.20	790	11.10	824	12.02	857	12.97	888	13.94	917	14.92
15,000	619	8.13	664	8.96	706	9.79	745	10.65	782	11.53	817	12.44	850	13.38	882	14.35	912	15.33	941	16.34
16,000	654	9.49	697	10.36	737	11.22	775	12.10	811	13.00	845	13.93	877	14.88	908	15.86	938	16.86	966	17.88
17,000	689	10.99	730	11.90	769	12.79	806	13.69	840	14.61	873	15.56	904	16.53	935	17.52	964	18.54	992	19.58
18,000	725	12.64	764	13.58	801	14.51	837	15.43	870	16.38	902	17.34	933	18.32	962	19.33	990	20.36	1018	21.41
19,000	760	14.43	798	15.41	834	16.37	868	17.32	900	18.29	932	19.27	961	20.27	990	21.29	1018	22.34	1045	23.40
20,000	796	16.37	833	17.39	867	18.39	900	19.37	931	20.36	962	21.36	991	22.38	1019	23.42	1046	24.48	1072	25.56
21,000	832	18.47	867	19.54	901	20.56	932	21.57	963	22.59	992	23.61	1020	24.65	1048	25.71	1074	26.78	1100	27.87
22,000	869	20.74	902	21.84	934	22.90	965	23.94	995	24.98	1023	26.03	1051	27.09	1077	28.17	1103	29.26	1129	30.36
23,000	905	23.17	937	24.31	968	25.40	998	26.48	1027	27.55	1055	28.62	1081	29.70	1107	30.79	1133	31.90	1157	33.02
24,000	942	25.78	973	26.95	1003	28.08	1032	29.18	1059	30.28	1086	31.38	1113	32.48	1138	33.59	1163	34.72	1187	35.86
25,000	978	28.56	1008	29.77	1037	30.93	1065	32.07	1092	33.20	1119	34.32	1144	35.44	1169	36.58	1193	37.72	—	—
26,000	1015	31.52	1044	32.76	1072	33.96	1099	35.13	1125	36.29	1151	37.44	1176	38.59	—	—	—	—	—	—
27,000	1052	34.66	1080	35.94	1107	37.18	1133	38.38	1159	39.57	1184	40.75	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	901	13.42	930	14.38	958	15.36	985	16.34	1011	17.33	1036	18.33	1061	19.33	1085	20.34	1108	21.35	1131	22.36
14,000	946	15.92	974	16.94	1001	17.97	1027	19.01	1052	20.06	1077	21.12	1101	22.18	1125	23.25	1148	24.33	1170	25.42
15,000	970	17.36	997	18.40	1024	19.45	1049	20.51	1074	21.58	1099	22.67	1122	23.76	1146	24.86	1168	25.97	1191	27.08
16,000	994	18.93	1021	19.98	1047	21.05	1072	22.14	1097	23.23	1121	24.34	1144	25.45	1167	26.58	1190	27.71	—	—
17,000	1019	20.63	1045	21.70	1071	22.79	1096	23.89	1120	25.01	1144	26.13	1167	27.27	1190	28.42	—	—	—	—
18,000	1045	22.48	1070	23.57	1096	24.67	1120	25.79	1144	26.93	1169	28.07	1190	29.23	—	—	—	—	—	—
19,000	1071	24.49	1096	25.59	1121	26.71	1145	27.84	1169	28.99	1192	30.16	—	—	—	—	—	—	—	—
20,000	1098	26.66	1123	27.77	1147	28.90	1171	30.05	1194	31.21	—	—	—	—	—	—	—	—	—	—
21,000	1125	28.99	1150	30.12	1173	31.26	1197	32.42	—	—	—	—	—	—	—	—	—	—	—	—
22,000	1153	31.49	1177	32.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23,000	1181	34.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND AND NOTES FOR TABLES 3-26.

LEGEND
Bhp — Brake Horsepower

NOTES:
1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.

2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp} \times 746}{\text{Motor efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb and ewb conditions.

Table 21 — Fan Performance — 50AW,AY020,025 Units

AIRFLOW (Cfm)	\- AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	394	1.06	409	1.13	473	1.47	530	1.82	581	2.18	629	2.55	673	2.93	714	3.31	752	3.70	789	4.10
5,000	388	1.26	445	1.57	504	1.93	557	2.30	606	2.68	651	3.07	694	3.47	734	3.88	772	4.29	808	4.71
6,000	421	1.72	485	2.12	540	2.52	590	2.92	636	3.32	679	3.73	719	4.15	757	4.57	794	5.00	829	5.44
7,000	471	2.38	528	2.80	580	3.24	627	3.67	670	4.10	711	4.53	749	4.97	786	5.41	821	5.86	855	6.31
8,000	522	3.19	573	3.64	621	4.10	666	4.56	707	5.02	746	5.48	783	5.94	818	6.40	852	6.87	884	7.34
9,000	575	4.16	621	4.63	666	5.11	708	5.60	747	6.09	784	6.58	820	7.07	853	7.56	886	8.05	917	8.54
10,000	629	5.30	671	5.79	712	6.30	751	6.81	789	7.32	824	7.84	858	8.35	891	8.87	922	9.38	952	9.90
11,000	683	6.62	723	7.14	761	7.66	797	8.19	832	8.73	866	9.27	899	9.81	930	10.35	960	10.89	989	11.43
12,000	739	8.12	776	8.67	811	9.21	845	9.76	878	10.32	910	10.88	941	11.45	971	12.01	1000	12.58	1028	13.14
13,000	794	9.82	829	10.40	862	10.97	893	11.53	925	12.11	955	12.69	985	13.28	1013	13.86	1041	14.45	1069	15.04
14,000	850	11.73	883	12.34	914	12.92	944	13.51	973	14.10	1002	14.70	1030	15.30	1057	15.91	1084	16.52	1111	17.13
15,000	906	13.85	938	14.48	967	15.09	995	15.70	1023	16.31	1050	16.92	1077	17.54	—	—	—	—	—	—

AIRFLOW (Cfm)	\- AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4,000	823	4.50	856	4.90	887	5.30	917	5.71	946	6.12	974	6.53	1001	6.95	1027	7.36	1052	7.78	1076	8.21
5,000	843	5.14	876	5.57	908	6.00	938	6.44	968	6.88	996	7.32	1024	7.77	1050	8.22	1076	8.67	1101	9.12
6,000	863	5.88	896	6.34	927	6.79	958	7.25	987	7.71	1016	8.18	1043	8.65	1070	9.13	1096	9.60	1122	10.08
7,000	887	6.77	919	7.24	949	7.71	979	8.18	1008	8.66	1036	9.15	1063	9.64	1090	10.13	1116	10.63	1141	11.13
8,000	915	7.82	946	8.30	975	8.78	1004	9.27	1032	9.77	1059	10.27	1086	10.77	1112	11.28	1137	11.80	1162	12.31
9,000	947	9.03	976	9.53	1004	10.03	1032	10.54	1059	11.05	1085	11.56	1111	12.08	1136	12.60	1161	13.13	1186	13.66
10,000	981	10.42	1009	10.93	1037	11.45	1063	11.98	1089	12.50	1115	13.03	1140	13.56	1164	14.10	1188	14.64	—	—
11,000	1017	11.97	1045	12.51	1071	13.05	1097	13.60	1122	14.14	1147	14.69	1171	15.24	1195	15.79	—	—	—	—
12,000	1055	13.71	1082	14.27	1108	14.84	1133	15.40	1157	15.96	1181	16.53	—	—	—	—	—	—	—	—
13,000	1095	15.63	1121	16.22	1146	16.80	1170	17.39	1194	17.98	—	—	—	—	—	—	—	—	—	—
14,000	1136	17.74	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 22 — Fan Performance — 50AW,AY027,030 Units

AIRFLOW (Cfm)	\- AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	398	1.45	465	1.83	522	2.21	573	2.60	620	2.99	664	3.39	706	3.79	745	4.21	783	4.63	819	5.06
6,000	422	1.72	485	2.12	541	2.52	590	2.92	636	3.32	679	3.73	719	4.15	758	4.57	794	5.01	830	5.44
7,000	471	2.38	528	2.81	580	3.24	627	3.67	671	4.10	711	4.53	750	4.97	786	5.41	821	5.86	855	6.32
8,000	522	3.19	574	3.64	622	4.10	666	4.56	708	5.02	747	5.48	783	5.94	818	6.41	852	6.87	884	7.35
8,250	536	3.42	585	3.87	633	4.34	676	4.81	717	5.27	756	5.74	792	6.21	827	6.68	860	7.15	892	7.63
9,000	575	4.16	622	4.63	666	5.11	708	5.60	747	6.09	784	6.58	820	7.07	853	7.56	886	8.05	917	8.54
10,000	629	5.30	671	5.79	712	6.30	751	6.81	789	7.32	824	7.84	858	8.35	891	8.87	922	9.38	952	9.90
11,000	683	6.61	723	7.13	760	7.66	797	8.19	832	8.72	866	9.26	898	9.81	930	10.35	960	10.89	989	11.43
12,000	738	8.11	775	8.66	810	9.20	844	9.75	877	10.31	909	10.87	940	11.44	970	12.00	999	12.57	1028	13.13
13,000	793	9.80	828	10.38	861	10.95	892	11.51	924	12.09	954	12.67	984	13.26	1012	13.84	1040	14.43	1068	15.02
13,750	834	11.21	868	11.81	899	12.39	930	12.97	959	13.56	989	14.15	1017	14.75	1045	15.35	1072	15.96	1099	16.56
14,000	848	11.70	881	12.31	912	12.89	942	13.48	972	14.07	1000	14.67	1029	15.27	1056	15.88	1083	16.49	1109	17.10
15,000	904	13.80	936	14.44	965	15.05	993	15.66	1021	16.27	1048	16.88	1075	17.50	1101	18.13	1127	18.76	1152	19.38

AIRFLOW (Cfm)	\- AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
5,500	853	5.50	886	5.94	918	6.39	948	6.83	978	7.29	1006	7.74	1034	8.20	1061	8.66	1087	9.13	1112	9.59
6,000	864	5.89	896	6.34	928	6.79	958	7.25	988	7.72	1016	8.19	1044	8.66	1071	9.13	1097	9.61	1122	10.09
7,000	888	6.78	919	7.24	950	7.71	979	8.19	1008	8.67	1036	9.16	1064	9.65	1090	10.14	1116	10.64	1142	11.14
8,000	915	7.82	946	8.30	975	8.79	1004	9.28	1032	9.77	1059	10.27	1086	10.78	1112	11.29	1137	11.80	1162	12.32
8,250	923	8.11	953	8.59	982	9.08	1011	9.58	1038	10.08	1065	10.58	1092	11.09	1118	11.60	1143	12.12	1168	12.64
9,000	947	9.03	976	9.53	1004	10.03	1032	10.54	1059	11.05	1085	11.56	1111	12.08	1137	12.60	1161	13.13	1186	13.66
10,000	981	10.42	1009	10.93	1036	11.45	1063	11.98	1089	12.50	1115	13.03	1140	13.56	1164	14.10	1188	14.64	—	—
11,000	1017	11.97	1044	12.51	1071	13.05	1097	13.59	1122	14.14	1147	14.68	1171	15.23	1195	15.78	—	—	—	—
12,000	1055	13.70	1081	14.26	1107	14.83	1132	15.39	1157	15.95	1181	16.52	—	—	—	—	—	—	—	—
13,000	1094	15.61	1120	16.20	1145	16.78	1170	17.37	1193	17.96	—	—	—	—	—	—	—	—	—	—
13,750	1125	17.17	1150	17.77	1174	18.38	1198	18.98	—	—	—	—	—	—	—	—	—	—	—	—
14,000	1135	17.71	1160	18.32	1184	18.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	1177	20.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 16.

Table 23 — Fan Performance — 50AW,AY035 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	537	2.87	588	3.31	634	3.74	677	4.17	717	4.60	755	5.04	792	5.48	827	5.93	860	6.39	893	6.85
8,000	592	3.81	638	4.27	682	4.73	722	5.19	760	5.65	796	6.11	831	6.58	864	7.05	896	7.52	927	8.00
9,000	648	4.91	691	5.40	731	5.89	769	6.38	805	6.87	840	7.36	872	7.84	904	8.34	934	8.83	964	9.33
10,000	705	6.20	744	6.71	782	7.23	818	7.74	852	8.26	885	8.77	916	9.29	946	9.80	976	10.32	1004	10.84
10,500	734	6.92	771	7.44	808	7.97	843	8.50	876	9.03	908	9.55	939	10.08	968	10.61	997	11.14	1025	11.66
11,000	762	7.69	799	8.22	834	8.76	868	9.30	900	9.84	932	10.38	962	10.92	991	11.46	1019	12.00	1046	12.54
12,000	821	9.38	854	9.93	887	10.49	919	11.05	950	11.61	980	12.18	1008	12.75	1036	13.31	1063	13.87	1090	14.44
13,000	879	11.28	911	11.85	941	12.43	971	13.01	1001	13.60	1029	14.18	1056	14.77	1083	15.36	1109	15.95	1135	16.54
14,000	938	13.40	968	13.99	996	14.59	1025	15.19	1052	15.80	1079	16.40	1106	17.02	1131	17.63	1156	18.24	1181	18.85
15,000	997	15.75	1025	16.36	1052	16.98	1079	17.59	1105	18.22	1131	18.85	1156	19.48	1180	20.11	1205	20.74	1228	21.38
16,000	1057	18.34	1083	18.97	1108	19.60	1134	20.24	1159	20.88	1183	21.53	1207	22.17	1231	22.83	1254	23.48	1277	24.13
17,000	1116	21.17	1141	21.82	1165	22.47	1189	23.12	1213	23.78	1236	24.44	1259	25.11	1282	25.78	—	—	—	—
17,500	1146	22.68	1170	23.34	1194	24.00	1217	24.66	1240	25.33	1263	26.00	1285	26.67	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
7,000	924	7.31	954	7.79	984	8.26	1013	8.75	1041	9.23	1068	9.72	1094	10.22	1120	10.71	1146	11.21	1170	11.72
8,000	957	8.48	986	8.97	1014	9.46	1042	9.96	1069	10.46	1095	10.96	1121	11.48	1147	11.99	1171	12.51	1196	13.03
9,000	993	9.83	1021	10.33	1048	10.84	1075	11.35	1101	11.86	1126	12.38	1151	12.91	1176	13.44	1200	13.97	1223	14.51
10,000	1032	11.36	1058	11.88	1085	12.41	1110	12.93	1135	13.46	1160	14.00	1184	14.54	1207	15.08	1231	15.63	1254	16.18
10,500	1052	12.20	1078	12.73	1104	13.26	1129	13.80	1153	14.34	1178	14.88	1201	15.43	1225	15.98	1247	16.53	1270	17.09
11,000	1072	13.08	1098	13.62	1124	14.17	1148	14.72	1172	15.26	1196	15.82	1219	16.37	1242	16.93	1265	17.49	1287	18.05
12,000	1115	15.00	1140	15.57	1165	16.13	1188	16.70	1212	17.27	1235	17.84	1257	18.41	1279	18.98	—	—	—	—
13,000	1159	17.12	1183	17.71	1207	18.30	1230	18.89	1253	19.47	1275	20.06	1297	20.65	—	—	—	—	—	—
14,000	1205	19.46	1228	20.07	1251	20.68	1273	21.28	1295	21.90	—	—	—	—	—	—	—	—	—	—
15,000	1251	22.01	1274	22.64	1296	23.27	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	1299	24.79	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 19.

Table 24 — Fan Performance — 50AW,AY040 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	499	2.88	546	3.27	590	3.66	632	4.06	672	4.46	711	4.87	748	5.28	784	5.70	819	6.14	853	6.58
9,000	548	3.78	591	4.20	631	4.62	670	5.04	708	5.47	744	5.90	778	6.33	812	6.77	845	7.22	877	7.67
10,000	599	4.86	637	5.30	675	5.74	711	6.19	746	6.64	779	7.09	812	7.55	844	8.01	875	8.47	905	8.94
11,000	649	6.11	685	6.57	720	7.04	753	7.51	786	7.99	817	8.47	848	8.94	878	9.43	907	9.91	936	10.40
12,000	701	7.54	734	8.03	766	8.52	797	9.02	828	9.52	857	10.02	886	10.52	915	11.03	943	11.53	970	12.04
13,000	753	9.18	783	9.69	813	10.21	842	10.72	871	11.25	899	11.77	927	12.30	953	12.82	980	13.35	1006	13.88
14,000	805	11.03	833	11.56	861	12.09	889	12.63	916	13.18	942	13.73	968	14.27	994	14.82	1019	15.37	1044	15.92
15,000	857	13.09	884	13.64	910	14.20	936	14.76	962	15.32	987	15.89	1011	16.46	1036	17.03	1060	17.61	1083	18.18
16,000	910	15.38	935	15.95	960	16.53	984	17.11	1008	17.69	1032	18.28	1056	18.87	1079	19.47	1101	20.06	1124	20.66
17,000	963	17.91	986	18.50	1010	19.09	1033	19.69	1056	20.30	1078	20.91	1101	21.52	1123	22.13	1145	22.75	1166	23.36
18,000	1016	20.68	1038	21.29	1060	21.90	1082	22.52	1104	23.15	1126	23.77	1147	24.41	1168	25.04	1189	25.67	1209	26.31
19,000	1069	23.71	1090	24.33	1111	24.96	1132	25.60	1153	26.25	1173	26.89	1194	27.54	1214	28.19	1234	28.85	—	—
20,000	1122	26.99	1142	27.64	1162	28.29	1182	28.95	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	885	7.03	917	7.48	948	7.95	978	8.42	1007	8.90	1036	9.39	1063	9.88	1090	10.38	1116	10.88	1142	11.39
9,000	908	8.13	939	8.60	968	9.08	997	9.56	1026	10.05	1053	10.55	1080	11.05	1107	11.56	1133	12.08	1158	12.60
10,000	934	9.42	963	9.90	992	10.39	1020	10.89	1047	11.39	1073	11.89	1100	12.41	1125	12.93	1151	13.45	1175	13.99
11,000	964	10.89	992	11.39	1019	11.89	1045	12.40	1071	12.91	1097	13.43	1122	13.96	1147	14.49	1171	15.02	1195	15.56
12,000	996	12.55	1023	13.07	1048	13.59	1074	14.11	1099	14.64	1123	15.17	1147	15.71	1171	16.25	1195	16.80	1218	17.35
13,000	1031	14.41	1056	14.95	1081	15.48	1105	16.03	1129	16.57	1152	17.12	1175	17.67	1198	18.22	1221	18.78	1243	19.35
14,000	1068	16.48	1092	17.03	1115	17.59	1138	18.15	1161	18.71	1184	19.27	1206	19.84	1228	20.41	1250	20.99	1271	21.56
15,000	1106	18.75	1129	19.33	1151	19.91	1174	20.48	1196	21.07	1217	21.65	1239	22.23	1260	22.82	1280	23.41	—	—
16,000	1146	21.25	1168	21.85	1189	22.45	1211	23.04	1232	23.64	1253	24.25	1273	24.85	1293	25.45	—	—	—	—
17,000	1187	23.98	1208	24.60	1229	25.21	1249	25.83	1270	26.46	1289	27.07	—	—	—	—	—	—	—	—
18,000	1230	26.95	1250	27.58	1269	28.22	1289	28.86	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Legend and Notes on page 19.

Table 25 — Fan Performance — 50AW,AY050 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	509	2.95	555	3.35	599	3.74	640	4.14	680	4.54	718	4.95	755	5.36	791	5.79	826	6.22	859	6.66
9,000	558	3.87	600	4.29	640	4.71	678	5.13	715	5.56	751	5.99	786	6.42	819	6.87	852	7.31	884	7.77
10,000	608	4.96	646	5.40	683	5.85	719	6.30	754	6.75	787	7.20	819	7.66	851	8.12	882	8.58	912	9.06
11,000	659	6.23	694	6.69	728	7.16	762	7.64	794	8.11	825	8.59	856	9.07	886	9.55	915	10.04	943	10.53
12,000	710	7.68	743	8.17	775	8.67	806	9.17	836	9.67	866	10.17	895	10.67	923	11.17	950	11.68	978	12.19
13,000	763	9.35	793	9.86	823	10.37	852	10.89	880	11.42	908	11.94	935	12.47	962	12.99	988	13.52	1014	14.05
14,000	815	11.22	843	11.75	871	12.29	899	12.83	925	13.38	952	13.92	978	14.47	1003	15.02	1028	15.57	1052	16.12
15,000	868	13.31	895	13.86	921	14.42	946	14.98	972	15.55	997	16.12	1021	16.69	1045	17.26	1069	17.83	1092	18.41
16,000	921	15.64	946	16.21	971	16.78	995	17.37	1019	17.96	1043	18.54	1066	19.14	1089	19.73	1111	20.32	1134	20.92
17,000	974	18.20	998	18.79	1021	19.39	1044	19.99	1067	20.60	1089	21.21	1112	21.82	1134	22.43	1155	23.05	1176	23.66
18,000	1028	21.01	1050	21.62	1072	22.24	1094	22.86	1116	23.49	1137	24.12	1158	24.75	1179	25.38	1200	26.02	1220	26.65
19,000	1081	24.08	1103	24.71	1124	25.35	1145	25.99	1165	26.63	1185	27.28	1206	27.93	1226	28.58	1245	29.24	1265	29.90
20,000	1135	27.42	1155	28.06	1175	28.72	1195	29.38	1215	30.04	1234	30.71	1254	31.38	1273	32.05	1292	32.72	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
8,000	892	7.12	923	7.57	954	8.04	984	8.52	1013	9.00	1041	9.49	1069	9.98	1095	10.48	1121	10.98	1147	11.49
9,000	915	8.23	945	8.70	975	9.18	1003	9.67	1032	10.16	1059	10.66	1086	11.16	1112	11.67	1138	12.19	1163	12.71
10,000	941	9.53	970	10.02	998	10.51	1026	11.00	1053	11.51	1080	12.01	1106	12.53	1131	13.05	1156	13.58	1181	14.11
11,000	971	11.02	999	11.52	1026	12.02	1052	12.53	1078	13.05	1103	13.57	1128	14.09	1153	14.63	1177	15.16	1201	15.71
12,000	1004	12.70	1030	13.22	1056	13.74	1081	14.26	1106	14.79	1130	15.33	1154	15.86	1178	16.41	1201	16.96	1224	17.51
13,000	1039	14.59	1064	15.12	1088	15.66	1113	16.20	1136	16.74	1160	17.29	1183	17.85	1206	18.40	1228	18.96	1250	19.53
14,000	1076	16.68	1100	17.23	1123	17.79	1147	18.35	1169	18.91	1192	19.48	1214	20.04	1236	20.62	1257	21.19	1279	21.77
15,000	1115	18.98	1138	19.56	1160	20.14	1182	20.72	1204	21.30	1226	21.88	1247	22.47	1268	23.05	1289	23.65	—	—
16,000	1156	21.52	1178	22.11	1199	22.71	1220	23.31	1241	23.91	1262	24.51	1282	25.12	—	—	—	—	—	—
17,000	1198	24.28	1218	24.90	1239	25.52	1259	26.14	1279	26.76	1299	27.38	—	—	—	—	—	—	—	—
18,000	1240	27.29	1260	27.93	1280	28.57	1300	29.21	—	—	—	—	—	—	—	—	—	—	—	—
19,000	1284	30.55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 26 — Fan Performance — 50AW,AY060 Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	490	4.48	543	5.17	591	5.88	634	6.61	674	7.37	711	8.14	746	8.94	779	9.76	811	10.60	841	11.45
14,000	554	6.41	602	7.17	645	7.94	686	8.72	723	9.51	759	10.33	792	11.16	824	12.01	855	12.88	884	13.76
15,000	586	7.56	632	8.34	674	9.14	713	9.94	749	10.77	784	11.60	816	12.45	848	13.32	878	14.21	906	15.11
16,000	619	8.83	663	9.64	703	10.46	741	11.30	776	12.14	810	13.00	841	13.87	872	14.76	901	15.66	929	16.58
17,000	652	10.23	694	11.07	733	11.92	769	12.78	803	13.65	836	14.53	867	15.42	897	16.33	926	17.25	953	18.19
18,000	685	11.76	725	12.63	763	13.51	798	14.39	831	15.29	863	16.20	893	17.11	922	18.04	950	18.98	978	19.93
19,000	719	13.44	757	14.33	793	15.23	827	16.14	860	17.07	890	18.00	920	18.94	949	19.88	976	20.84	1003	21.81
20,000	753	15.26	789	16.18	824	17.10	857	18.04	888	18.99	918	19.94	947	20.90	975	21.87	1002	22.85	1028	23.84
21,000	787	17.23	822	18.17	855	19.12	887	20.08	918	21.05	947	22.03	975	23.02	1002	24.01	1029	25.01	1054	26.02
22,000	821	19.35	855	20.32	887	21.29	918	22.28	947	23.28	976	24.28	1003	25.28	1030	26.30	1056	27.32	1081	28.35
23,000	855	21.63	888	22.62	919	23.62	949	24.63	977	25.65	1005	26.68	1032	27.71	1058	28.75	1083	29.79	1108	30.85
24,000	889	24.07	921	25.08	951	26.11	980	27.14	1008	28.19	1035	29.24	1061	30.29	1086	31.35	1111	32.42	1135	33.49
25,000	924	26.67	954	27.71	983	28.76	1011	29.82	1038	30.89	1065	31.96	1090	33.04	1115	34.12	1139	35.21	1163	36.31
26,000	958	29.45	987	30.51	1016	31.59	1043	32.67	1069	33.76	1095	34.85	1120	35.95	1144	37.06	1168	38.17	1191	39.29
27,000	993	32.40	1021	33.49	1048	34.58	1075	35.69	1101	36.80	1126	37.92	1150	39.04	1174	40.17	1197	41.30	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	2.2		2.4		2.6		2.8		3.0		3.2		3.4		3.6		3.8		4.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
12,000	870	12.33	898	13.22	925	14.13	951	15.06	977	16.00	1002	16.96	1026	17.92	1049	18.90	1072	19.89	1094	20.89
14,000	912	14.67	939	15.59	965	16.52	991	17.47	1016	18.44	1040	19.42	1063	20.41	1086	21.41	1109	22.43	1131	23.46
15,000	934	16.02	961	16.96	987	17.90	1012	18.87	1036	19.84	1060	20.83	1083	21.84	1106	22.85	1128	23.88	1150	24.92
16,000	957	17.51	983	18.46	1008	19.42	1033	20.39	1057	21.38	1081	22.39	1104	23.40	1126	24.43	1148	25.47	1170	26.52
17,000	980	19.13	1006	20.10	1031	21.07	1055	22.06	1079	23.06	1102	24.07	1125	25.10	1147	26.14	1169	27.19	1190	28.26
18,000	1004	20.89	1029	21.87	1054	22.86	1078	23.86	1101	24.88	1124	25.91	1147	26.94	1169	28.00	1190	29.06	—	—
19,000	1028	22.80	1053	23.79	1078	24.80	1101	25.81	1124	26.84	1147	27.89	1169	28.94	1190	30.00	—	—	—	—
20,000	1053	24.85	1078	25.86	1102	26.88	1125	27.91	1148	28.96	1170	30.01	1192	31.08	—	—	—	—	—	—
21,000	1079	27.04	1103	28.07	1128	29.11	1149	30.16	1172	31.22	1194	32.30	—	—	—	—	—	—	—	—
22,000	1105	29.39	1129	30.44	1152	31.50	1174	32.57	1196	33.65	—	—	—	—	—	—	—	—	—	—
23,000	1131	31.90	1155	32.97	1177	34.05	1199	35.13	—	—	—	—	—	—	—	—	—	—	—	—
24,000	1158	34.57	1181	35.66	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	1186	37.41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

LEGEND AND NOTES FOR TABLES 3-26.

LEGEND
Bhp — Brake Horsepower

NOTES:
1. Fan performance is based on wet coils, economizer, roof curb, cabinet losses, and clean 2-in. filters.

2. Conversion — Bhp to watts:

$$\text{Watts} = \frac{\text{Bhp x 746}}{\text{Motor efficiency}}$$

3. Variable Air Volume units will operate down to 70 cfm/ton. Performance at 70 cfm/ton is limited to unloaded operation and may be additionally limited by edb and ewb conditions.

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Table 27 — Motor Limitations

HIGH-EFFICIENCY MOTORS

Nominal		Maximum		Maximum Amps			Maximum Watts	Maximum Efficiency
Bhp	BkW	Bhp	BkW	230 v	460 v	575 v		
5	3.73	5.9	4.40	14.6	7.9	6.0	5,030	87.5
7.5	5.6	8.7	6.49	22	—	—	7,717	84.1
		9.5	7.09	—	12.0	10.0	8,008	88.5
10	7.46	10.2	7.61	28	—	—	9,502	89.5
		11.8	8.80	—	14.6	12.0	9,836	89.5
15	11.19	15.3	11.41	43.8	—	—	12,543	91.0
		18.0	13.43	—	21.9	19.0	14,756	91.0
20	14.92	22.4	16.71	62	—	—	18,363	91.0
		23.4	17.46	—	28.7	23.0	19,183	91.0
25	18.65	28.9	21.56	72	—	—	23,511	91.7
		29.4	21.93	—	37.4	31.0	23,918	91.7
30	22.38	35.6	26.56	95	—	—	28,742	92.4
		34.7	25.89	—	48.0	47.0	28,015	92.4
40	29.84	42.0	31.33	110	55.0	48.8	33,690	93.0

PREMIUM-EFFICIENCY MOTORS

Nominal		Maximum		Maximum Amps		Maximum Watts	Maximum Efficiency
Bhp	BkW	Bhp	BkW	230 v	460 v		
5	3.73	5.9	4.40	15.8	7.9	4,918	89.5
7.5	5.6	8.7	6.49	22	—	7,078	91.7
		9.5	7.09	—	12.0	7,728	91.7
10	7.46	10.2	7.61	28	—	8,298	91.0
		11.8	8.80	—	15.0	9,600	91.7
15	11.19	15.3	11.41	43.8	—	12,273	91.7
		18.0	13.43	—	21.9	14,439	93.0
20	14.92	22.4	16.71	58.2	—	17,853	93.0
		23.4	17.46	—	28.7	18,650	93.6
25	18.65	28.9	21.56	73	—	23,034	93.6
		29.4	21.93	—	36.3	23,432	93.6
30	22.38	35.6	26.56	82.6	—	28,374	93.6
		34.7	25.89	—	41.7	27,656	93.6
40	29.84	42.0	31.33	110.0	55.0	33,156	94.5

LEGEND

Bhp — Brake Horsepower
BkW — Brake Kilowatts

NOTES:
1. Extensive motor and electrical testing on the Carrier units has ensured that the full horsepower range of the motor can be utilized with confidence.

Using the fan motors up to the horsepower ratings shown in the Motor Limitations table will not result in nuisance tripping or premature motor failures. Unit warranty will not be affected.
2. All motors comply with Energy Policy Act (EPACT) Standards effective October 24, 1997.

Table 28A — Air Quantity Limits (48AJ,AK,AW,AY)

UNIT 48AJ,AK,AW,AY	MINIMUM HEATING AIRFLOW CFM (Low Heat)	MINIMUM HEATING AIRFLOW CFM (High Heat)	MINIMUM COOLING AIRFLOW (VAV) CFM AT FULL LOAD	MINIMUM COOLING AIRFLOW CFM (CV)	MAXIMUM AIRFLOW CFM
020	5,900	6,100	4,000	6,000	10,000
025	5,900	6,100	5,000	7,500	12,500
027	5,900	6,100	5,400	8,100	13,500
030	5,900	6,100	6,000	9,000	15,000
035	5,900	6,100	7,000	10,500	17,500
040	7,600	10,100	8,000	12,000	20,000
050	7,600	10,100	10,000	15,000	22,500
060	11,000	10,100	12,000	18,000	27,000

LEGEND

CV — Constant Volume
VAV — Variable Air Volume

NOTE: Variable Air Volume units will operate down to 70 cfm/ton in Cooling Mode. Performance at 70 cfm/ton is limited to unloaded operation and may be also limited by edb (entering dry bulb) and ewb (entering wet bulb) conditions.

Table 28B — Air Quantity Limits (50AJ,AK,AW,AY)

UNIT	COOLING		ELECTRIC HEAT	
	Min CFM	Max CFM*	Min CFM	Max CFM
50AJ,AW020	6,000	10,000	6,000	15,000
50AK,AY020	4,000	10,000		
50AJ,AW025	7,500	12,500		
50AK,AY025	5,000	12,500		
50AJ,AW027	8,100	13,500		
50AK,AY027	5,400	13,500		
50AJ,AW030	9,000	15,000		
50AK,AY030	6,000	15,000		
50AJ,AW035	10,500	17,500		
50AK,AY035	7,000	17,500		
50AJ,AW040	12,000	20,000	10,500	20,000
50AK,AY040	8,000	20,000		
50AJ,AW050	13,500	20,000		
50AK,AY050	10,000	20,000		
50AJ,AW060	18,000	27,000	15,000	27,000
50AK,AY060	12,000	27,000		

*Operation at these levels may be limited by entering evaporator air wet bulb temperatures.

CONTROLS QUICK START

The following section will provide a quick user guide to setting up and configuring the A series units with *Comfort*Link™ controls. See Basic Control Usage section on page 3 for information on operating the control.

Two-Stage Constant Volume Units with Mechanical Thermostat — To configure the unit, perform the following:

1. The unit is shipped with the unit control disabled. Enable the control by setting Local Machine Disable (*Service Test→STOP*) to No.

2. The type of control is configured under *Configuration →UNIT→C.TYP*. Set *C.TYP* to 4 (TSTAT 2 STG).

3. Remove jumpers from R-W2 and W2-W1 on TB4 in the control box.

4. See Economizer Options section on page 22 for additional economizer option configurations.

5. See Exhaust Options section on page 22 for additional exhaust option configurations.

Two-Stage Constant Volume Units with Space Sensor — To configure the unit, perform the following:

1. The unit is shipped with the unit control disabled. Enable the control by setting Local Machine Disable (*Service Test→STOP*) to No.

2. The type of control is configured under *Configuration →UNIT→C.TYP.* Set *C.TYP* to 6 (SPT 2 STG).

3. Under *Configuration→SENS→SPT.S*, enable the space sensor by setting *SPT.S* to ENBL (enable).

4. Install jumpers between R-W2 and W2-W1 on TB4 in the control box.

5. The space temperature set points are configured under the *Setpoints* menu. The heating and cooling set points must be configured. See the Heating Control and Cooling Control sections on pages 41 and 30 for further description on these configurations. Configure the following set points:

OHSP	Occupied Heat Setpoint
OCSP	Occupied Cool Setpoint
UHSP	Unoccupied Heat Setpoint
UCSP	Unoccupied Cool Setpoint
GAP	Heat-Cool Setpoint Gap

6. The degrees of demand from the space temperature set points are configured under the *Configuration→D.LV.T* submenu. See the Heating Control and Cooling Control sections for further description on these configurations. Configure the following set points:

L.H.ON	Demand Level Lo Heat On
H.H.ON	Demand Level Hi Heat On
L.H.OF	Demand Level Lo Heat Off
L.C.ON	Demand Level Lo Cool On
H.C.ON	Demand Level Hi Cool On
L.C.OF	Demand Level Lo Cool Off

7. Under *Configuration→UNIT→CV.FN*, set *CV.FN* to 1 for continuous fan or 0 for automatic fan.

8. To program time schedules, set *SCH.N*=1 under *Configuration→CCN→SC.OV→SCH.N* to configure the control to use local schedules.

9. Under the *Timeclock→SCH.L* submenu, enter the desired schedule. See Time Clock section for further descriptions of these configurations.

10. Under the *Configuration→CCN→SC.OV* submenu, the following schedules and overrides should be configured:

O.T.L.	Override time limit
SPT.O	SPT override enabled?
T58.O	T58 override enabled?

11. See Economizer Options section on page 22 for additional economizer option configurations.

12. See Exhaust Options section on page 22 for additional exhaust option configurations.

Variable Air Volume Units Using Return Air Sensor or Space Temperature Sensor — To configure the unit, perform the following:

1. The unit is shipped with the unit control disabled. Enable the control by setting Local Machine Disable (*Service Test→STOP*) to No.

2. The type of control is configured under *Configuration →UNIT→C.TYP.* Set *C.TYP* to 1 (VAV-RAT) for return air sensor. Set *C.TYP* to 2 (VAV-SPT) for space temperature sensor.

   NOTE: For VAV with a space sensor (VAV-SPT), under *Configuration→UNIT→SENS→SPT.S*, enable the space sensor by setting *SPT.S* to ENBL.

3. Install jumpers between R-W2 and W2-W1 on TB4 in the control box.

4. The space temperature set points and the supply air set points are configured under the Setpoints menu. The heating and cooling set points must be configured. See the Heating Control and Cooling Control sections for further description on these configurations. Configure the following set points:

OHSP	Occupied Heat Set point
OCSP	Occupied Cool Set point
UHSP	Unoccupied Heat Set point
V.C.ON	VAV Occupied Cool On Delta
V.C.OF	VAV Occupied Cool Off Delta
SASP	Supply Air Set Point

5. To program time schedules, make sure *SCH.N*=1 under *Configuration→CCN→SC.OV→SCH.N* to configure the control to use local schedules.

6. Under the *Timeclock→SCH.L* submenu, enter the desired schedule. See Time Clock section for further descriptions of these configurations.

7. Under *Configuration→SP→SP.SP*, the Supply Duct Static Pressure set point should be configured.

SP.SP	Static Pressure Set point

8. If Supply air temperature reset is desired, under the *Configuration→EDT.R* submenu, the following set points should be configured:

RS.CF	EDT Reset Configuration
RTIO	Reset Ratio (if *RS.CF* = 1 or 2)
LIMT	Reset Limit (if *RS.CF* = 1 or 2)
RES.S	EDT 4-20 mA Reset Input (if *RS.CF* = 3)

NOTE: Configure either *RTIO* and *LIMT* or *RES.S*. All three are not used.

9. See the Economizer Options section on page 22 for additional economizer option configurations.

10. See the Exhaust Options section on page 22 for addition exhaust option configurations.

Multi-Stage Constant Volume Units with Mechanical Thermostat — To configure the unit, perform the following:

1. The unit is shipped with the unit control disabled. Enable the control by setting Local Machine Disable (**Service Test→STOP**) to No.

2. Under **Configuration→UNIT→C.TYP**, set **C.TYP** to 3 (TSTAT MULTI).

3. Remove jumpers from R-W2 and W2-W1 on TB4 in the control box. Connect thermostat to TB4.

4. Under the **Setpoints** menu, set the following configurations:

   SA.HI   Supply Air Set Point Hi

   SA.LO   Supply Air Set Point Lo

5. See the Economizer Options section on this page for additional economizer option configurations.

6. See the Exhaust Options section on this page for additional exhaust option configurations.

Multi-Stage Constant Volume Units with Space Sensor — To configure the unit, perform the following:

1. The unit is shipped with the unit control disabled. Enable the control by setting Local Machine Disable (**Service Test→STOP**) to No.

2. Under **Configuration→UNIT→C.TYP**, set **C.TYP** to 5 (SPT MULTI).

3. Install jumpers between R-W2 and W2-W1 on TB4 in the control box.

4. Under the **Setpoints** menu, the following configurations should be set:

   OHSP   Occupied Heat Setpoint

   OCSP   Occupied Cool Setpoint

   UHSP   Unoccupied Heat Setpoint

   UCSP   Unoccupied Cool Setpoint

   GAP   Heat-Cool Setpoint Gap

   SA.HI   Supply Air Set Point Hi

   SA.LO   Supply Air Set Point Lo

5. The degrees of demand from the space temperature set points are configured under the **Configuration→D.LV.T** submenu. See the Heating Control and Cooling Control sections for further description on these configurations. Configure the following set points:

   L.H.ON   Demand Level Lo Heat On

   H.H.ON   Demand Level Hi Heat On

   L.H.OF   Demand Level Lo Heat On

   L.C.ON   Demand Level Lo Cool On

   H.C.ON   Demand Level Hi Cool On

   L.C.OF   Demand Level Lo Cool On

6. Under **Configuration→UNIT→SENS→SPT.S**, enable the space sensor by setting **SPT.S** to ENBL.

7. Under **Configuration→UNIT→CV.FN**, set **CV.FN** to 1 for continuous fan or 0 for automatic fan.

8. To program time schedules, set **SCH.N**=1 under **Configuration→CCN→SC.OV→SCH.N** to configure the control to use local schedules.

9. Under the **Timeclock→SCH.L** submenu, enter the desired schedule. See Time Clock section for further descriptions of these configurations.

10. See the Economizer Options section below for addition economizer option configurations.

11. See the Exhaust Options section below for addition exhaust option configurations.

Economizer Options — Under the **Configuration→ECON** submenu, the following set points should be configured:

   EC.EN   Economizer Enabled?

   EC.MN   Economizer Min.Position

   EC.MX   Economizer Maximum Position

   E.TRM   Economizer Trim for SumZ?

   E.SEL   Econ Changeover Select

   OA.E.C   OA Enthalpy Change Over Select

   OA.EN   Outdoor Enthalpy Compare Value

   OAT.L   High OAT Lockout Temp

   O.DEW   OA Dew Point Temp Limit

   ORH.S   Outside Air RH Sensor

Configuration→ECON→EC.MN should always be set for the minimum damper position.

Indoor Air Quality Options

DEMAND CONTROL VENTILATION — Under **Configuration→IAQ→DCV.C**, the following configuration parameters should be set to establish the minimum and maximum points for outdoor air damper position during demand control ventilation (DCV):

   EC.MN   Economizer Min.Position

   IAQ.M   IAQ Demand Vent Min.Pos.

Configuration→IAQ→DCV.C→IAQ.M is used to set the absolute minimum vent position (or maximum reset) under DCV.

Configuration→IAQ→DCV.C→EC.MN is used to set the minimum damper position (or with no DCV reset). This is also referenced in the economizer section.

Exhaust Options — The A series units can be configured with CV 2-stage PE or modulating PE. The following exhaust options should be configured.

Configuration→BP→BF.CF=1 (Two-Stage Exhaust Option) — For two-stage exhaust, under the **Configuration →BP** submenu, configure the following:

   BP.P1   Power Exhaust On Setp.1

   BP.P2   Power Exhaust On Setp.2

Configuration→BP→BF.CF=2 (Modulating Power Exhaust Option) — For modulating exhaust, in the **Configuration→ BP** submenu, configure the following:

   BP.SP   Building Pressure Set point

Set Clock on VFD (If Installed) — The clock set mode is used for setting the date and time for the internal clock of the VFD. In order to use the timer functions of the VFD control, the internal clock must be set. The date is used to determine weekdays and is visible in the fault logs. Refer to the VFD section in Appendix C on page 134 for information on operating the VFD and using the keypad.

To set the clock, perform the following procedure from the VFD keypad:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight CLOCK SET on the display screen and press ENTER (SOFT KEY 2). The clock set parameter list will be displayed.

3. Use the UP or DOWN keys to highlight CLOCK VISI-BILITY and press SEL (SOFT KEY 2). This parameter is used to display or hide the clock on the screen. Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

4. Use the UP or DOWN keys to highlight SET TIME and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the hours and minutes. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

5. Use the UP or DOWN keys to highlight TIME FORMAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

6. Use the UP or DOWN keys to highlight SET DATE and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the day, month, and year. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

7. Use the UP or DOWN keys to highlight DATE FOR-MAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

8. Press EXIT (SOFT KEY 1) twice to return to the main menu.

Programming Operating Schedules —
The *Comfort*Link™ controls will accommodate up to eight different schedules (Periods 1 through 8), and each schedule is assigned to the desired days of the week. Each schedule includes an occupied on and off time. As an example, to set an occupied schedule for 8 AM to 5 PM for Monday through Friday, the user would set days Monday through Friday to ON for Period 1. Then the user would configure the Period 1 Occupied From point to 08:00 and the Period 1 Occupied To point to 17:00. To create a different weekend schedule, the user would use Period 2 and set days Saturday and Sunday to ON with the desired Occupied On and Off times.

NOTE: By default, the time schedule periods are programmed for 24 hours of occupied operation.

To create a schedule, perform the following procedure:

1. Scroll to the Configuration mode, and select CCN CONFIGURATION (*CCN*). Scroll down to the Schedule Number (*Configuration→CCN→SC.OV→SCH.N*). If password protection has been enabled, the user will be prompted to enter the password before any new data is accepted. *SCH.N* has a range of 0 to 99. The default value is 1. A value of 0 is always occupied, and the unit will control to its occupied set points. A value of 1 means the unit will follow a local schedule, and a value of 65 to 99 means it will follow a CCN schedule. Schedules 2-64 are not used as the control only supports one internal/local schedule. If one of the 2-64 schedules is configured, then the control will force the number back to 1. Make sure the value is set to 1 to use a local schedule.

2. Enter the Time Clock mode. Scroll down to the LOCAL TIME SCHEDULE (*SCH.L*) sub-mode, and press ENTER. Period 1 (*PER.1*) will be displayed.

3. Scroll down to the *MON* point. This point indicates if schedule 1 applies to Monday. Use the ENTER command to go into Edit mode, and use the UP or DOWN key to change the display to YES or NO. Scroll down through the rest of the days and apply schedule 1 where desired. The schedule can also be applied to a holiday.

4. Configure the beginning of the occupied time period for Period 1 (*OCC*). Press ENTER to go into Edit mode, and the first two digits of the 00.00 will start flashing. Use the

UP or DOWN key to display the correct value for hours, in 24-hour (military) time. Press ENTER and hour value is saved and the minutes digits will start flashing. Use the same procedure to display and save the desired minutes value.

5. Configure the unoccupied time for period 1 (*UNC*). Press ENTER to go into Edit mode, and the first two digits of the 00.00 will start flashing. Use the UP or DOWN key to display the correct value for hours, in 24-hour (military) time. Press ENTER and hour value is saved and the minutes digits will start flashing. Use the same procedure to display and save the desired minutes value.

6. The first schedule is now complete. If a second schedule is needed, such as for weekends or holidays, scroll down and repeat the entire procedure for period 2 (*PER.2*). If additional schedules are needed, repeat the process for as many as are needed. Eight schedules are provided.

SERVICE TEST

General — The units are equipped with a Service Test feature, which is intended to allow a service person to force the unit into different modes of operation. To use this feature, enter the Service Test category on the local display and place the unit into the test mode by changing *Service Test→TEST* from OFF to ON. The display will prompt for the password before allowing any change. The default password is 1111. Once the unit enters the Service Test mode, the unit will shut down all current modes.

TEST — The *TEST* command turns the unit off (hard stop) and allows the unit to be put in a manual control mode.

STOP — The *STOP* command completely disables the unit (all outputs turn off immediately). Once in this mode, nothing can override the unit to turn it on. The controller will ignore all inputs and commands.

S.STP — Setting Soft Stop to YES turns the unit off in an orderly way, honoring any timeguards currently in effect.

FAN.F — By turning the FAN FORCE on, the supply fan is turned on and will operate as it normally would, controlling duct static pressure on VAV applications or just energizing the fan on CV applications. To remove the force, press ENTER and then press the UP and DOWN arrows simultaneously.

F.4.CH — The 4-Inch Filter Change Mode variable is used to service the unit when 4-in. filters are used. When the filters need to be changed, set *Service Test→F.4.CH = YES*. The unit will be placed in Service Test mode and the economizer will move to the 40% open position to facilitate removal of the 4-in. filters. After the filters have been changed, set *Service Test→F.4.CH = NO* to return the unit to normal operation.

The remaining categories: *INDP, FANS, COOL,* and *HEAT* are sub-menus with separate items and functions. See Table 29.

Service Test Mode Logic — Operation in the Service Test mode is sub-menu specific except for the Independent sub-menu. Leaving the sub-menu while a test is being performed and attempting to start a different test in the new sub-menu will cause the previous test to terminate. When this happens, the new request will be delayed for 5 seconds. For example, if compressors were turned on under the COOL sub-menu, any attempt to turn on heating stages within the HEAT sub-menu would immediately turn off the compressors and 5 seconds later the controller would honor the requested heat stages.

However, it is important to note that the user can leave a Service Test mode to view any of the local display menus (RUN STATUS, TEMPERATURES, PRESSURES, SETPOINTS, INPUTS, OUPTUTS, CONFIGURATION, TIME CLOCK, OPERATING MODES, and ALARMS) and the control will remain in the Service Test mode.

Table 29 — Service Test

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
TEST	Service Test Mode	ON/OFF		MAN_CTRL	
STOP	Local Machine Disable	YES/NO		UNITSTOP	config
S.STP	Soft Stop Request	YES/NO		SOFTSTOP	forcible
FAN.F	Supply Fan Request	YES/NO		SFANFORC	forcible
F.4.CH	4 in. Filter Change Mode	YES/NO		FILT4CHG	
INDP	TEST INDEPENDENT OUTPUTS				
ECN.C	Economizer Act.Cmd.Pos.			ECONCTST	
E.PWR	Economizer Power Test			ECONPTST	
E.CAL	Calibrate the Economizer?			ECON_CAL	
PE.A	Power Exhaust Relay A			PE_A_TST	
PE.B	Power Exhaust Relay B			PE_B_TST	
PE.C	Power Exhaust Relay C			PE_C_TST	
H.I.R	Heat Interlock Relay	ON/OFF		HIR_TST	
ALRM	Remote Alarm Relay	ON/OFF		ALRM_TST	
FANS	TEST FANS				
S.FAN	Supply Fan Relay	ON/OFF		SFAN_TST	
S.VFD	Supply Fan VFD Speed	0-100	%	SGVFDTST	
CD.F.A	Condenser Fan Circuit A	ON/OFF		CNDA_TST	
CD.F.B	Condenser Fan Circuit B	ON/OFF		CNDB_TST	
COOL	TEST COOLING				
A1	Compressor A1 Relay	ON/OFF		CMPA1TST	
A2	Compressor A2 Relay	ON/OFF		CMPA2TST	
MLV	Min. Load Valve (HGBP)	ON/OFF		MLV_TST	
B1	Compressor B1 Relay	ON/OFF		CMPB1TST	
B2	Compressor B2 Relay	ON/OFF		CMPB2TST	
HEAT	TEST HEATING				
HT.1	Heat Relay 1	ON/OFF		HS1_TST	
HT.2	Heat Relay 2	ON/OFF		HS2_TST	
HT.3	Relay 3 W1 Gas Valve 2	ON/OFF		HS3_TST	
HT.4	Relay 4 W2 Gas Valve 2	ON/OFF		HS4_TST	
HT.5	Relay 5 W1 Gas Valve 3	ON/OFF		HS5_TST	
HT.6	Relay 6 W2 Gas Valve 3	ON/OFF		HS6_TST	

Independent Outputs — The Independent sub-menu items can be turned on and off regardless of the other category states. For example, the alarm relay can be forced on in the INDEPENDENT sub-menu and will remain on if compressor relay are requested in the COOL sub-menu.

Fans — Upon entering the Fans sub-menu, the user will be able to turn the supply fan on and off, set the supply fan VFD speed, and turn the condenser fans on and off.

Cooling — The cooling sub-menu offers different cooling service tests.

The user has manual relay control of individual compressors. If the user energizes mechanical cooling, the supply fan and the outdoor fans will be started automatically. During mechanical cooling, the unit will protect itself. Compressor diagnostics are active, monitoring for high discharge pressure, low suction pressure, etc. The user can also turn the hot gas bypass valve on and off.

NOTE: It is crucial that proper compressor rotation be verified during the service test. Each compressor must be tested individually. After starting each compressor, the control will check the suction pressure after 5 seconds of run time. If the control does not see a sufficient decrease in suction pressure after 5 seconds, mechanical cooling will be shut down, and an alarm will be generated (A140). This alarm requires a manual reset. If this alarm occurs, do not attempt a restart of the compressor and do not attempt to start any other compressors until the wiring to the unit has been corrected.

Heating — If unit has a thermostat connected (*C.TYP* = 3 or 4), install the RED jumper wires between TB4, terminals R (1), W2 (3) and W1 (4). Terminal block TB4 is located in the unit control box. Remember to disconnect these jumpers when Test Mode is completed. The Heat Test Mode sub-menu will offer automatic fan start-up if not a gas fired heat unit. On gas heat units, the IGC feedback from the gas control units will bring the fan on as required.

Within this sub-menu, the user has control of heat relays 1 to 6.

NOTE: When service test has been completed, if unit has a thermostat connected (*C.TYP* = 3 or 4), remove the RED jumper wires at TB4, terminals R (1), W2 (3) and W1 (4). Terminal block TB4 is located in the unit control box. Store these jumpers in the unit control box for future use.

THIRD PARTY CONTROL

Thermostat — The method of control would be through the thermostat inputs:

Y1 = first stage cooling
Y1 and Y2 = first and second stage cooling
W1 = first stage heating
W1 and W2 = first and second stage heating
G = supply fan

Alarm Output — The alarm output TB4-7 and 8, will provide relay closure whenever the unit is under an alert or alarm condition.

Remote Switch — The remote switch may be configured for three different functions. Under *Configuration→UNIT,* set *RM.CF* to one of the following:

0 = no remote switch
1 = occupied/unoccupied switch
2 = start/stop switch
3 = occupancy override switch

Under *Configuration→SW.LG, RMI.L,* the remote occupancy switch can be set to either a normally open or normally closed switch input. Normal is defined as either unoccupied, start or "not currently overridden," respective to the *RM.CF* configuration.

With *RM.CF* set to 1, no time schedules are followed and the unit follows the remote switch only in determining the state of occupancy.

With *RM.CF* set to 2, the remote switch can be used to shut down and disable the unit, while still honoring timeguards on compressors. Time schedules, internal or external, may be run simultaneously with this configuration.

With *RM.CF* set to 3, the remote input may override an unoccupied state and force the control to go into occupied mode. As with the start/stop configuration, an internal or external time schedule may continue to control occupancy when the switch is not in effect.

VFD Control — On VFD equipped supply fans, supply duct static pressure control may be left under unit control or be externally controlled. To control a VFD externally with a 4 to 20 mA signal, set **SP.CF** to 0, under the **Configuration→SP** menu. This will disable the *Comfort*Link™ control from varying the VFD speed in response to duct pressure with its 4 to 20 mA output. The signal is connected directly to the VFD.

See Appendix C and the VFD literature supplied with the unit for VFD configurations and field wiring connections to the VFD.

Supply Air Reset — With the installation of the Control Expansion Module (CEM), the *Comfort*Link control is capable of accepting a 4 to 20 mA signal, to reset the supply-air temperature up to a maximum of 20 F.

Under **Configuration→EDT.R** set **RS.CF** to 3 (external 4 to 20 mA supply air reset control). The 4 to 20 mA input to the control system (TB6-1 and 3), will be linearized and range from 0º to 20 F. For example, 4 mA = 0º F reset, 12 mA = 10º F reset and 20 mA = 20º F reset.

Demand Limit Control — The term Demand Limit Control refers to the restriction of the machine's mechanical cooling capacity to control the amount of power that a machine may use.

Demand Limiting using mechanical control is possible via two means:

Two discrete inputs tied to demand limit set point percentages.

OR

A 4 to 20 mA input that can reduce or limit capacity linearly to a set point percentage.

In either case, it will be necessary to install a Controls Expansion Module (CEM).

DEMAND LIMIT DISCRETE INPUTS — First, set **DM.L.S** in **Configuration→DMD.L** to 1 (2 switches).

When **Inputs→GEN.I→DL.S1** (Demand Switch no. 1) is OFF, the control will not set any limit to the capacity, and when ON, the control sets a capacity limit to the **Configuration→DMD.L→D.L.S1** set point.

Likewise, when **Inputs→GEN.I→DL.S2** (Demand Switch no. 2) is OFF, the control will not set any limit to the capacity, and when ON, the control sets a capacity limit to the **Configuration→DMD.L→D.L.S2** set point.

If both switches are ON, **Inputs→GEN.I→DL.S2** is used as the limiter of capacity.

Under **Configuration→SW.LG**, set the logic state appropriately for the action desired. Set the **DL1.L and DL2.L** configurations. They can be set normally open or normally closed. For example, if **DL1.L** is set to OPEN, the user will need to close the switch to cause the control to limit capacity to the demand limit 1 set point. Likewise, if **DL1.L** is set to CLSE (closed), the user will need to open the switch to cause the control to limit capacity to the demand limit 1 set point.

DEMAND LIMIT 4 TO 20 mA INPUT — Under **Configuration→DMD.L,** set configuration **DM.L.S** to 2 (2 = 4 to 20 mA control). Under the same menu, set **D.L.20** to a value from 0 to 100% to set the demand limit range. For example, with **D.L.20** set to 50, a 4 mA signal will result in no limit to the capacity and 20 mA signal will result in a 50% reduction in capacity.

Demand Controlled Ventilation Control — There are multiple methods for externally controlling the economizer damper.

IAQ DISCRETE INPUT CONFIGURATION — The IAQ discrete input configuration requires a CEM module (optional) to be installed and an interface to a switch input at TB5-6 and 7.

The state of the input on the display can be found at **Inputs→AIR.Q→IAQ.I.**

Before configuring the switch functionality, first determine how the switch will be read. A closed switch can indicate either a low IAQ condition or a high IAQ condition. This is set at **Configuration→SW.LG** and **IAQ.L**. The user can set what a low reading would mean based on the type of switch being used. Setting **IAQ.L** to OPEN means that when the switch is open the input will read LOW. When the switch is closed, the input will read HIGH. Setting **IAQ.L** to CLSE (closed) means that when the switch is closed the input will read LOW, and therefore, when the switch is open the switch will read HIGH.

There are two possible configurations for the IAQ discrete input. Select item **Configuration→IAQ→AQ.CF→IQ.I.C** and configure for either 1 (IAQ Discrete) or 2 (IAQ Discrete Override).

IQ.I.C = 1 (IAQ Discrete) — If the user sets **IQ.I.C** to 1 (IAQ Discrete), and the switch logic (**Configuration→SW.LG→IAQ.L**) is set to OPEN, then an open switch reads low and a closed switch reads high.

If the switch is open, the economizer will be commanded to the IAQ Demand Vent Minimum Position.

These settings may be adjusted and are located at **Configuration→IAQ→DCV.C→IAQ.M**.

If the switch is closed, the IAQ reading will be high and the economizer will be commanded to the Economizer Minimum Position.

These settings may be adjusted and are located at **Configuration→IAQ→DCV.C→EC.MN.**

IQ.I.C = 2 (IAQ Discrete Override) — If the user sets **IQ.I.C** to 2 (IAQ Discrete Override), and **Configuration→SW.LG→IAQ.L** is set to OPEN, then an open switch reads low and a closed switch reads high.

If the switch reads low, no action will be taken. If the switch reads high, the economizer will immediately be commanded to the IAQ Economizer Override Position. This can be set from 0 to 100% and can be found at **Configuration→IAQ→AQ.SP→IQ.O.P.**

FAN CONTROL FOR THE IAQ DISCRETE INPUT — Under **Configuration→IAQ→AQ.CF**, the **IQ.I.F** (IAQ Discrete Input Fan Configuration) must also be set. There are three configurations for **IQ.I.F**. Select the configuration which will be used for fan operation. This configuration allows the user to decide (if the supply fan is not already running), whether the IAQ discrete switch will start the fan, and in which state of occupancy the fan will start.

IQ.I.F = 0	Minimum Position Override Switch input will not start fan
IQ.I.F = 1	Minimum Position Override Switch input will start fan in occupied mode only
IQ.I.F = 2	Minimum Position Override Switch input will start fan in both occupied and unoccupied modes

IAQ ANALOG INPUT CONFIGURATION — This input is an analog input located on the main base board (MBB). There are 4 different functions for this input. The location of this configuration is at **Configuration→IAQ→AQ.CF→IQ.A.C.**

The functions possible for **IQ.A.C** are:

- 0 = no IAQ analog input
- 1 = IAQ analog input
- 2 = IAQ analog input used to override to a set position
- 3 = 4 to 20 mA 0 to 100% economizer minimum position control
- 4 = 0 to 10 kohms 0 to 100% economizer minimum position control

Options 2, 3, and 4 are dedicated for third party control.

IQ.A.C* = 2** (IAQ Analog Input Used to Override) — Under ***Configuration→IAQ→AQ.SP, set *IQ.O.P* (IAQ Economizer Override Position). The ***IQ.O.P*** configuration is adjustable from 0 to 100%. These configurations are also used in conjunction with ***Configuration→IAQ→AQ.CF→IQ.A.F*** (IAQ 4 to 20 mA Fan Configuration). There are three configurations for ***IQ.A.F*** and they follow the same logic as for the discrete input. This configuration allows the user to decide (if the supply fan is not already running), if the IAQ Analog Minimum Position Override input will start the fan, and in which state of occupancy the fan will start.

***IQ.A.F* = 0**	IAQ analog sensor input cannot start the supply fan
***IQ.A.F* = 1**	IAQ analog sensor input can start the supply fan in occupied mode only
***IQ.A.F* = 2**	IAQ analog sensor input can start the supply fan in both occupied and unoccupied modes

If ***IQ.A.F*** is configured to request the supply fan, then configurations ***D.F.ON*** and ***D.F.OF*** need to be set. These configuration settings are located under ***Configuration→IAQ→AQ.SP*** and configure the fan override operation based on the differential air quality (DAQ). If DAQ rises above ***D.F.ON***, the control will request the fan on until DAQ falls below ***D.F.OF***.

NOTE: If ***D.F.ON*** is configured below ***DAQ.H***, the unit is in occupied mode, and the fan was off, then DAQ rose above ***D.F.ON*** and the fan came on, the economizer will go to the economizer minimum position (***EC.MN***).

The 4 to 20 mA signal from the sensor wired to TB5-6 and 7 is scaled to an equivalent indoor CO_2 (IAQ) by the parameters ***IQ.R.L*** and ***IQ.R.H*** located under the ***Configuration→IAQ→AQ.SR*** menu. The parameters are defined such that 4 mA = ***IQ.R.L*** and 20 mA = ***IQ.R.H***. When the differential air quality DAQ (IAQ – ***OAQ.U***) exceeds the ***DAQ.H*** set point (***Configuration→IAQ→AQ.SP*** menu) and the supply fan is on, the economizer minimum vent position (***Configuration→IAQ→DCV.C→EC.MN***) is overridden and the damper is moved to the ***IQ.P.O*** configuration. When the DAQ falls below the ***DAQ.L*** set point (***Configuration→IAQ→AQ.SP*** menu), the economizer damper is moved back to the minimum vent position (***EC.MN***).

NOTE: Configuration ***OAQ.U*** is used in the calculation of the trip point for override and can be found under ***Configuration→IAQ→AQ.SP***.

***IQ.A.C* = 3** (4 to 20 mA Damper Control) — This configuration will provide full 4 to 20 mA remotely controlled analog input for economizer minimum damper position. The 4 to 20 mA signal is connected to terminals TB5-6 and 7. The input is processed as 4 mA = 0% and 20 mA = 100%, thereby giving complete range control of the effective minimum position.

The economizer sequences can be disabled by setting ***Configuration→ ECON→E.SEL*** to 0. Complete control of the economizer damper position is then possible by using a 4 to 20 mA economizer minimum position control or a 0 to 10 kohm 0 to 100% economizer minimum position control via configuration decisions at ***Configuration→IAQ→IQ.A.C***.

***IQ.A.C* = 4** (10 Kohm Potentiometer Damper Control) — This configuration will provide input for a 10 kohm linear potentiometer that acts as a remotely controlled analog input for economizer minimum damper position. The input is processed as 0 ohms = 0% and 10,000 ohms = 100%, thereby giving complete range control of the effective minimum position.

CONTROLS OPERATION

Modes — The *Comfort*Link™ controls operate under a hierarchy of command structure as defined by three essential elements: the System mode, the HVAC mode and the Control mode. The System mode is the top level mode that defines three essential states for the control system: OFF, RUN and TEST.

The HVAC mode is the functional level underneath the System mode which further defines the operation of the control.

The Control mode is essentially the control type of the unit (***Configuration→UNIT→C.TYP***). This defines from where the control looks to establish a cooling or heating mode and whether 2 stages or multiple stages of cooling capacity operation are controlled.

Furthermore, there are a number of modes which operate concurrently when the unit is running. The operating modes of the control are located at the local displays under ***Operating Modes***. See Table 30.

Table 30 — Operating Modes Display Table

ITEM	EXPANSION	RANGE	CCN POINT
SYS.M	ascii string		n/a
HVAC	ascii string		n/a
CTRL	ascii string		n/a
MODE	MODES CONTROLLING UNIT		
OCC	Currently Occupied	ON/OFF	MODEOCCP
T.OVR	Timed Override in Effect	ON/OFF	MODETOVR
DCV	DCV Resetting Min Pos	ON/OFF	MODEADCV
SA.R	Supply Air Reset	ON/OFF	MODESARS
DMD.L	Demand Limit in Effect	ON/OFF	MODEDMLT
T.C.ST	Temp.Compensated Start	ON/OFF	MODETCST
IAQ.P	IAQ Pre-Occ Purge Active	ON/OFF	MODEIQPG
LINK	Linkage Active — CCN	ON/OFF	MODELINK
LOCK	Mech.Cooling Locked Out	ON/OFF	MODELOCK

Currently Occupied (***OCC***) — This variable displays the current occupied state of the unit.

Timed Override in Effect (***T.OVR***) — This variable displays if the state of occupancy is currently occupied due to an override.

DCV Resetting Minimum Position (***DCV***) — This variable displays if the economizer position has been lowered from its maximum vent position.

Supply Air Reset (***SA.R***) — This variable displays if the supply air set point that the rooftop is attempting to maintain is currently being reset upwards. This applies to cooling only.

Demand Limit in Effect (***DMD.L***) — This variable displays if the mechanical cooling capacity is currently being limited or reduced by an outside third party.

Temperature Compensated Start (***T.C.ST***) — This variable displays if Heating or Cooling has been initiated before the occupied period to pre-condition the space.

IAQ Pre-Occupancy Purge Active (***IAQ.P***) — This variable displays if the economizer is open and the fan is on to preventilate the building before occupancy.

Linkage Active CCN (***LINK***) — This variable displays if a linkage master in a zoning system has established "linkage" with this air source (rooftop).

Mechanical Cooling Locked Out (***LOCK***) — This variable displays if mechanical cooling is currently being locked due to low outside air temperature.

SYSTEM MODES (***Operating Modes→SYS.M***)

System Mode Off — When the system mode is OFF, all outputs are to be shut down and no machine control is possible. The following list displays the text assigned to the System Mode when in the OFF mode and the conditions that may cause this mode are checked in the following hierarchal order:

1. Wake up timer on a power reset.

    ("Initializing System ...")

2. System in the process of shutting down compressors and waiting for timeguards to expire.

    ("Shutting Down ...")

3. Factory shut down (internal factory control level — SHUTDOWN).

   ("Factory Shut Down")

4. Unit Stop (software application level variable that acts as a hard shut down — *Service Test→STOP*).

   ("Local Machine Stop")

5. Fire Shut Down (traumatic fire shutdown condition based on the Fire Shutdown Input — *Inputs→FIRE→FSD*).

   ("Fire-Shutdown Mode")

6. Emergency Stop, which is forced over the CCN through the Emergency Stop Variable (EMSTOP).

   ("CCN Emergency Stop")

7. Service test ending transition timer.

   ("Service Test Ending")

8. Unexplained internal software failure.

   ("Internal Failure")

System Mode Test — When the system mode is Test, the control is limited to the Test mode and is controllable via the local displays (Scrolling Marquee and Navigator™ display) or through the factory service test control. The System Test modes are Factory Test Enabled and Service Test Enabled. See the Service Test Mode section for details on test control in this mode.

1. Factory Test mode

   ("Factory test enabled")

2. Service Test mode

   ("Service test enabled")

System Mode Run — When the system mode is Run, the software application in the control is free to run the HVAC control routines by which cooling, heating, IAQ, etc., is possible. There are two possible text displays for this mode, one is normal run mode and the other occurs if one of the following fire-smoke modes is present: smoke purge, pressurization or evacuation.

1. Normal run time state

   ("Unit Operation Enabled")

2. Fire-Smoke control mode

   ("Fire-Smoke Control")

HVAC MODES *(Operating Mode→HVAC)* — The HVAC mode is dependant on the system mode to allow it to further determine the operational state of the rooftop unit. The actual determination of an HVAC mode is based on a hierarchal decision making process whereby certain overrides may interfere with normal temperature/humidity control. The decision making process that determines the HVAC mode is shown in Fig. 4 and Appendix D.

Each HVAC Mode is described below.

HVAC Mode — OFF — The unit is off and no operating modes are active.

HVAC Mode — STARTING UP — The unit is transitioning from the OFF mode to a different mode.

HVAC Mode — SHUTTING DOWN — The unit is transitioning from a mode to the OFF mode.

HVAC Mode — DISABLED — The unit is shut down due to a software command disable through the Scrolling Marquee, a CCN emergency stop command, a service test end, or a control-type change delay.

HVAC Mode — SOFTSTOP REQUEST — The unit is off due to a soft stop request from the control.

HVAC Mode — REM SW.DISABLE — The unit is off due to the remote switch.

HVAC Mode — COMP.STUCK ON — The unit is shut down because there is an indication that a compressor is running even though it has been commanded off.

HVAC Mode — TEST — The unit is in the self test mode which is entered through the Service Test menu.

HVAC Mode — VENT — This is a normal operation mode where no heating or cooling is required and outside air is being delivered to the space to control IAQ levels.

HVAC Mode — HIGH COOL — This is a normal cooling mode where a high cooling demand is required.

HVAC Mode — LOW COOL — This is a normal cooling mode where a low cooling demand is required.

HVAC Mode — UNOCC. FREE COOL — In this mode the unit will operate in cooling but will be using the economizer for free cooling. Entering this mode will depend on the status of the outside air. The unit can be configured for outside air changeover, differential dry bulb changeover, outside air enthalpy changeover, differential enthalpy changeover, or a custom arrangement of enthalpy/dewpoint and dry bulb. See the Economizer section for further details.

HVAC Mode — TEMPERING HICOOL — The economizer is at minimum vent position but the combination of the outside-air temperature and the economizer position has dropped the supply-air temperature below the tempering cool set point. Staged gas heat is used to temper the ventilation air.

HVAC Mode — TEMPERING LOCOOL — The economizer is at minimum vent position but the combination of the outside-air temperature and the economizer position has dropped the supply-air temperature below the tempering cool set point. Staged gas heat is used to temper the ventilation air.

HVAC Mode — TEMPERING VENT — The economizer is at minimum vent position but the supply-air temperature has dropped below the tempering vent set point. Staged gas heat is used to temper the ventilation air.

HVAC Mode — LOW HEAT — The unit will be in low heating demand mode using either gas or electric heat.

HVAC Mode — HIGH HEAT — The unit will be in high heating demand mode using either gas or electric heat.

HVAC Mode — FREEZESTAT TRIP — If the Freezestat trips, the unit enters the Freezestat Trip HVAC mode. The supply fan will run, the hydronic heat valve will be wide open, and the economizer damper will be at minimum.

HVAC Mode — STATIC PRESSURE FAIL — The unit is off due to failure of the static pressure sensor.

HVAC Mode — PLENUM PRESSURE SWITCH — The unit is off due to a plenum pressure switch trip.

HVAC Mode — FIRE SHUT DOWN — The unit has been stopped due to a fire shutdown input (FSD) or two or more of the fire control modes, purge, evacuation, or pressurization have been requested simultaneously.

HVAC Mode — PRESSURIZATION — The unit is in the special fire pressurization mode where the supply fan is on, the economizer damper is open and the power exhaust fans are off. This mode is invoked by the Fire Pressurization (*PRES*) input which can be found in the *INPUT→FIRE* sub-menu.

HVAC Mode — EVACUATION — The unit is in the special Fire Evacuation mode where the supply fan is off, the economizer damper is closed and the power exhaust fans are on. This mode is invoked by the Fire Evacuation (*EVAC*) input which can be found in the *INPUT→FIRE* sub-menu.

HVAC Mode — SMOKE PURGE — The unit is in the special Fire Purge mode where the supply fan is on, the economizer damper is open and the power exhaust fans are on. This mode is invoked by the Fire Evacuation (*PURG*) input which can be found in the *INPUT→FIRE* sub-menu.

System Mode

- **System Mode = OFF?**
  - No → (to Fire-Smoke Control)
  - Yes ↓
- **Inputs -> FIRE -> FSD in alarm?**
  - No → **HVAC Mode = OFF (Disabled)**
  - Yes ↓
- **HVAC Mode = OFF (Fire Shutdown)**

Fire-Smoke Control

- **Unit not in factory test AND fire-smoke control mode is alarming?**
  - No → (to Exceptions)
  - Yes ↓
- **Inputs -> FIRE -> PRES in alarm?**
  - No → **Inputs -> FIRE -> EVAC in alarm?**
    - No → **HVAC Mode = OFF (Purge)**
    - Yes ↓ → **HVAC Mode = OFF (Evacuation)**
  - Yes ↓
- **HVAC Mode = OFF (Pressurization)**

Exceptions

- **Config->UNIT-> C.TYP changed while unit running?**
  - No → **System Mode = TEST?**
  - Yes ↓
    - **15-second delay** ↓
    - **HVAC Mode = OFF (Disabled)**
- **System Mode = TEST?**
  - No → **Service Test -> S.STP = YES?**
  - Yes ↓ → **HVAC Mode = TEST**
- **Service Test -> S.STP = YES?**
  - No → **Config->UNIT-> RM.CF =2 AND Inputs->GEN.I-> REMT = ON**
  - Yes ↓ → **HVAC Mode = SoftStop Request**
- **Config->UNIT-> RM.CF =2 AND Inputs->GEN.I-> REMT = ON**
  - No → (continues)
  - Yes ↓ → **HVAC Mode = OFF (Rem. Sw. Disable)**

- **Config->SP-> SP.CF = 1 OR 2 and static pressure sensor has failed**
  - No → **Config->UNIT-> SFS.M=1 OR 2 AND Config->UNIT-> SFS.S=YES? and supply fan has failed**
  - Yes ↓ → **HVAC Mode = OFF (Static Pres. Fail)**
- **Config->UNIT-> SFS.M=1 OR 2 AND Config->UNIT-> SFS.S=YES? and supply fan has failed**
  - No → **Config->BP-> BP.CF=5 AND There is a plenum pressure switch error**
  - Yes ↓ → **HVAC Mode = OFF (Fan Status Fail)**
- **Config->BP-> BP.CF=5 AND There is a plenum pressure switch error**
  - No → **Unit just waking up from power reset?**
  - Yes ↓ → **HVAC Mode = OFF (Plenum Pressure Trip)**
- **Unit just waking up from power reset?**
  - No → **Unit shutting down?**
  - Yes ↓ → **HVAC Mode = OFF (Starting Up)**
- **Unit shutting down?**
  - No → (to Unit control free)
  - Yes ↓ → **HVAC Mode = Shutting Down**

Unit control free to choose HVAC Mode

- **Unit control free to select normal heating/cooling HVAC mode**
  - **HVAC Mode = OFF**
  - **HVAC Mode = Vent**
  - **HVAC Mode = Tempering Vent**
  - **HVAC Mode = Low Cool**
  - **HVAC Mode = Tempering LoCool**
  - **HVAC Mode = High Cool**
  - **HVAC Mode = Tempering HiCool**
  - **HVAC Mode = Low Heat**
  - **HVAC Mode = High Heat**
  - **HVAC Mode = Unocc. Free Cool**

Fig. 4 — Mode Selection

Unit Configuration Submenu — The *UNIT* sub-menu under the Configuration mode of the local display contains general unit configuration items. This section will define all of these configurations here for easy reference. The sub-menu which contains these configurations is located at the local display under *Configuration→UNIT*. See Table 31.

Machine Control Type (*C.TYP*) — This configuration defines the technique and control source responsible for selecting a cooling, heating, or vent mode and in determining the method by which compressors are staged. The control types are:

• *C.TYP* = 1 (VAV-RAT) and *C.TYP* = 2 (VAV-SPT)

Both of these configurations refer to standard VAV operation. If the control is occupied, the supply fan is run continuously and return-air temperature will be used in the determination of the selection of a cooling mode. VAV-SPT differs from VAV-RAT only in that during the unoccupied period, space temperature will be used instead of return-air temperature to start the fan for 10 minutes to establish an accurate return-air temperature before the return-air temperature is allowed to call out any mode.

• *C.TYP* = 3 (TSTAT – MULTI)

This configuration will force the control to monitor the thermostat inputs to make a determination of mode. Unlike traditional 2-stage thermostat control, the unit is allowed to use multiple stages of cooling control and perform VAV-type operation. The control will be able to call out a LOW COOL or a HIGH COOL mode and maintain a low or high cool supply air set point.

• *C.TYP* = 4 (TSTAT- 2 STG)

This configuration will force the control to monitor the thermostat inputs to make a determination of mode and allow only 2 stages of control for both heating and cooling.

• *C.TYP* = 5 (SPT – MULTI)

This configuration will force the control to monitor a space temperature sensor to make a determination of mode. Unlike traditional 2-stage space temperature control, the unit is allowed to use multiple stages of cooling control and perform VAV-type operation. The control will be able to call out a LOW COOL or a HIGH COOL mode and maintain a low or high cool supply air set point.

• *C.TYP* = 6 (SPT- 2 STG)

This configuration will force the control to monitor the space temperature sensor to make a determination of mode and allow 2 stages of control for both heating and cooling.

FAN MODE (*CV.FN*) — The Fan Mode configuration can be used for machine control types (*Configuration→UNIT→C.TYP*) 3, 4, 5, and 6. The Fan Mode variable establishes the operating sequence for the supply fan during occupied periods. When set to 1 (Continuous), the fan will operate continuously during occupied periods. When set to 0 (Automatic), the fan will run only during a heating or cooling mode.

REMOTE SWITCH CONFIG (*RM.CF*) — The remote switch input is connected to TB6 terminals 1 and 3. This switch can be used for several remote control functions. Please refer to the Remote Control Switch Input section for details on its use and operation.

CEM MODEL INSTALLED (*CEM*) — This configuration instructs the control to communicate with the Controls Expansion Module (*CEM*) over the Local Equipment Network (LEN) when set to Yes. When the unit is configured for certain sensors and configurations, this option will be set to Yes automatically.

The sensors and configurations that automatically turn on this board are:

Configuration→UNIT→SFS.M = 1 (Supply Fan Status Switch Monitoring)

Configuration→UNIT→SENS→SP.RS = Enable (Static Pressure Reset Sensor Enable)

Configuration→EDT.R→RES.S = Enable (4 to 20 mA Supply Air Reset Sensor Enable)

Configuration→DMD.L→DM.L.S = 1 (2 SWITCHES) (Demand Limiting using 2 discrete switches)

Configuration→DMD.L→DM.L.S = 2 (4-20 MA CTRL) (Demand Limiting using a 4 to 20 mA sensor)

Configuration→IAQ→AQ.CF→IQ.I.C = 1 (IAQ DISCRETE) (IAQ discrete switch control)

Configuration→IAQ→AQ.CF→IQ.I.C = 2 (IAQ DISC.OVR) (IAQ discrete switch "override" control)

Configuration→IAQ→AQ.CF→OQ.A.C = 1 (OAQ SENS-DAQ) (Outdoor Air Quality Sensor)

Configuration→IAQ→AQ.CF→OQ.A.C = 2 (4-20 NO DAQ) (4 to 20 mA sensor, no DAQ)

Temperature Compensated Start Cooling Factor (*TCS.C*) — This factor is used in the equation of the Temperature Compensated Start Time Bias for cooling. Refer to the Temperature Compensated Start section for more information. A setting of 0 minutes indicates Temperature Compensated Start in Cooling is not permitted.

Temperature Compensated Start Cooling Factor (*TCS.H*) — This factor is used in the equation of the Temperature Compensated Start Time Bias for heating. Refer to the Temperature Compensated Start section for more information. A setting of 0 minutes indicates Temperature Compensated Start in Heating is not permitted.

Fan Fail Shuts Downs Unit (*SFS.S*) — This configuration will determine whether the unit should shut down on a supply fan status fail or simply alert the condition and continue to run. If set to YES, then the control will shut down the unit and send out an alarm if supply fan status monitoring fails. If set to NO, the control will not shut down the unit if supply fan status monitoring fails but the control will send out an alert.

Fan Status Monitoring (*SFS.M*) — This configuration selects the type of fan status monitoring to be performed.

0 - NONE — No switch or monitoring

1 - SWITCH — Use of the fan status switch

2 - SP RISE — Monitoring of the supply duct pressure.

VAV Unoccupied Fan Retry Time (*VAV.S*) — Machine control types 1 and 2 (VAV-RAT,VAV-SPT) include a process for sampling the return-air temperature during unoccupied periods to prove a valid demand for heating or cooling before initiating an unoccupied heating or cooling mode. If the sampling routine runs but concludes a valid demand condition does not exist, the sampling process will not be permitted for the period of time defined by this configuration. Reducing this value allows a more frequent re-sampling process. Setting this value to zero will prevent any sampling sequence.

Unit Size (*SIZE*) — There are several unit sizes (tons) for the A Series control. Make sure this configuration matches the size called out by the model number of the unit. This is important as the cooling stage tables are directly determined based on this configuration.

Table 31 — Unit Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULTS
UNIT	UNIT CONFIGURATION				
C.TYP	Machine Control Type	1 - 6		CTRLTYPE	4
CV.FN	Fan Mode (0=Auto, 1=Cont)	0 - 1		FAN_MODE	1
RM.CF	Remote Switch Config	0 - 3		RMTINCFG	0
CEM	CEM Module Installed	Yes/No		CEM_BRD	No
TCS.C	Temp.Cmp.Strt.Cool Factr	0 - 60	min	TCSTCOOL	0
TCS.H	Temp.Cmp.Strt.Heat Factr	0 - 60	min	TCSTHEAT	0
SFS.S	Fan Fail Shuts Down Unit	Yes/No		SFS_SHUT	No
SFS.M	Fan Stat Monitoring Type	0 - 2		SFS_MON	0
VAV.S	VAV Unocc.Fan Retry Time	0 - 720	min	SAMPMINS	50
SIZE	Unit Size (20-60)	20 - 60		UNITSIZE	20
DP.XR	Discharge Press. Transducers	Yes/No		DP_TRANS	No
MAT.S	MAT Calc Config	0 - 1		MAT_SEL	1
MAT.R	Reset MAT Table Entries?	Yes/No		MATRESET	No
ALTI	Altitude........in feet:	0 - 60000		ALTITUDE	0
SENS	INPUT SENSOR CONFIG				
SPT.S	Space Temp Sensor	Enable/Disable		SPTSENS	Disable
SP.O.S	Space Temp Offset Sensor	Enable/Disable		SPTOSENS	Disable
SP.O.R	Space Temp Offset Range	1 - 10		SPTO_RNG	5
RRH.S	Return Air RH Sensor	Enable/Disable		RARHSENS	Disable
FLT.S	Filter Stat.Sw.Enabled ?	Enable/Disable		FLTS_ENA	Disable
SP.RS	Stat. Pres. Reset Sensor	Enable/Disable		SPRSTSEN	Disable

Discharge Pressure Transducers (**DP.XR**) — This configuration configures the unit for use with discharge pressure transducers.

MAT Calc Config (**MAT.S**) — This configuration gives the user two options in the processing of the mixed-air temperature (MAT) calculation:

• **MAT.S** = 0

The control will not attempt to learn MAT over time. The control will simply calculate MAT based on the position of the economizer, outside and return air temperature, linearly.

• **MAT.S** = 1

The control will attempt to learn MAT over time. Any time the system is in a vent mode and the economizer stays at a particular position for long enough, MAT = EDT. Using this, the control has an internal table whereby it can more closely determine the true MAT value.

Reset MAT Table Entries? (**MAT.R**) — This configuration allows the user to reset the internally stored MAT learned configuration data back to the default values. The defaults are set to a linear relationship between the economizer damper position and OAT and RAT in the calculation of MAT.

Altitude........In Feet: (**ALTI**) — As the control does not include a barometric pressure sensor to define the calculation of enthalpy and cfm, the control does include an altitude parameter which will serve to set up a default barometric pressure for use with calculations. The effect of barometric pressure in these calculations is not great, but could have an effect depending on the installed elevation of the unit. If the rooftop is installed at a particularly high altitude and enthalpy or cfm are being calculated, set this configuration to the current elevation of the installed rooftop.

Space Temp Sensor (**SPT.S**) — If a space temperature sensor is installed (T55/T56), enable this configuration.

Space Temp Offset Sensor (**SP.O.S**) — If a T56 sensor is installed with the space temperature offset slider, enable this configuration.

Space Temp Offset Range (**SP.O.R**) — If a space temperature offset sensor is installed, it is possible to configure the range of the slider by adjusting this range configuration.

Return RH Sensor (**RRH.S**) — If a return air relative humidity sensor is installed, enable this configuration.

Filter Status Switch Enabled? (**FLT.S**) — If a filter status switch is installed, enable this configuration to begin the monitoring of the filter status input (**Inputs→GEN.I→FLT.S**). See the Dirty Filter Switch section for more details on installation and operation.

Static Pressure Reset Sensor (**SP.RS**) — If the outdoor air quality sensor is not configured (**Configuration→IAQ →AQ.CF→OQ.A.C = 0**), then it is possible to use the OAQ sensor's location on the CEM board to control and adjust the set point remotely for the static pressure reset via an external 4 to 20 mA input. Enabling this sensor will give the user the ability to reset the supply static pressure set point (**Configuration→SP→SP.SP**) from 0 to 3 in. wg of static pressure where 4 mA = 0 in. wg and 20 mA = 3 in. wg.

As an example: If the static pressure reset input is measuring 6 mA, then the input is reset 2 mA of its 16 mA (4 to 20 mA) control range. This is 2/16 of 3 in. wg or 0.375 in. wg of reset. If the static pressure set point (**SP.SP**) = 1.5 in. wg, then the static pressure control point for the system will be 1.5 – 0.375 = 1.125 in. wg.

Cooling Control — When mechanical cooling is required, the A Series *Comfort*Link™ control has the capability to control the staging of the compressors in several different ways. Three scroll compressors are used on sizes 020 to 027 and four on sizes 030 to 060. In addition, the *Comfort*Link control supports the use of an optional minimum load hot gas bypass valve (MLV) that is directly controlled by the *Comfort*Link control, and provides an additional stage of capacity as well as low load coil freeze protection. The control also integrates the use of an economizer with the use of mechanical cooling to allow for the greatest use of free cooling. When both mechanical cooling and the economizer are being used, the control will use the economizer to provide better temperature control and limit the cycling of the compressors. The control also checks on various other operation parameters in the units to make sure that safeties are not exceeded and the compressors are reliably operated.

The A Series *Comfort*Link™ control offers two basic control approaches to mechanical cooling. Constant volume for 2 stages of cooling and VAV for multiple stages of cooling. In addition to these methods of control, the A Series *Comfort*Link control offers the ability to run multiple stages of cooling for either a space temperature sensor or thermostat by controlling the unit to either a low or high cool supply air set point. The control type (**Configuration→ UNIT→ C.TYP**) determines the selection of the type of cooling control as well as the technique for selecting a cooling mode.

There are either three or four compressors divided among two refrigeration circuits in the unit. Circuit A always contains two compressors (A1,A2). Circuit B has either one or two compressors (B1,B2). There may be a minimum load valve (MLV), which, if present, is only associated with circuit A. The decision as to which compressor should be turned on or off is decided by the compressor's availability followed by a pre-ferred staging order.

NOTE: Configuring the machine control type (**C.TYP**) has no effect on whether a unit has a VFD or just a supply fan installed for static pressure control. No matter what the control type is, it is possible to run the unit in either CV or VAV mode provided there are enough stages to accommodate lower air volumes for VAV operation. Refer to the section on static pressure control for information on how to set up the unit for the type of supply fan control desired.

SETTING UP THE SYSTEM

Machine Control Type (**Configuration→UNIT→C.TYP**) — The most fundamental cooling control configuration is located under **Configuration→UNIT**.

ITEM	EXPANSION	RANGE	CCN POINT	DEFAULTS
UNIT C.TYP	UNIT CONFIGURATION Machine Control Type	1 - 6	CTRLTYPE	*

*This default is model number dependent.

This configuration defines the technique and control source responsible for selecting a cooling mode and in determining the method by which compressors are staged. The control types are:

- **C.TYP** = 1 (VAV-RAT) and **C.TYP** = 2 (VAV-SPT)

  Both of these configurations refer to standard VAV operation. If the control is occupied, the supply fan is run continuously and return-air temperature will be used for both in the determination of the selection of a cooling mode. VAV-SPT differs from VAV-RAT only in that during the unoccupied period, space temperature will be used instead of return-air temperature to start the fan for ten minutes before the return-air temperature is allowed to call out any mode.

- **C.TYP** = 3 (TSTAT – MULTI)

  This configuration will force the control to monitor the thermostat inputs to make a determination of mode. Unlike traditional 2-stage thermostat control, the unit is allowed to use multiple stages of cooling control and perform VAV style operation. The control will be able to call out a LOW COOL or a HIGH COOL mode and maintain a low or high cool supply air set point.

- **C.TYP** = 4 (TSTAT – 2 STG)

  This configuration will force the control to monitor the thermostat inputs to make a determination of mode.

- **C.TYP = 5** (SPT – MULTI)

  This configuration will force the control to monitor a space temperature sensor to make a determination of mode. Unlike traditional 2 stage space temperature control, the unit is allowed to use multiple stages of cooling control and perform VAV style operation. The control will be able to call out a LOW COOL or a HIGH COOL mode and maintain a low or high cool supply air set point.

- **C.TYP = 6** (SPT – 2 STG)

  This configuration will force the control to monitor the space temperature sensor to make a determination of mode and allow two stages of cooling.

MACHINE DEPENDENT CONFIGURATIONS — Some configurations are linked to the physical unit and must not be changed. The configurations are provided in case a field replacement of a board occurs and the settings are not preserved by the download process of the new software. The following configurations apply to all machine control types (**C.TYP**) except 4 and 6. These configurations are located at the local display under **Configuration→UNIT**. See Table 32.

Table 32 — Machine Dependent Configurations

ITEM	EXPANSION	RANGE	CCN POINT	DEFAULTS
UNIT SIZE	UNIT CONFIGURATION Unit Size (20-60)	20-60	UNITSIZE	*

*Dependent on unit.

Unit Size (**SIZE**) — There are several unit sizes (tons) for the A Series control. Make sure this configuration matches the size called out by the model number of the unit. This is important as the cooling stage tables are directly determined based on this configuration.

SET POINTS — The set points for both cooling and heating are located at the local display under **Setpoints**. See Table 33.

SUPPLY AIR RESET CONFIGURATION — Supply Air Reset can be used to modify the current cooling supply air set point. Supply Air Reset is applicable to control types, **C.TYP** = 1,2,3, and 5. The configurations for reset can be found at the local display under **Configuration→EDT.R.** See Table 34.

EDT Reset Configuration (**RS.CF**) — This configuration applies to several machine control types (**Configuration→UNIT→C.TYP** = 1,2,3, and 5).

- 0 = NO RESET

  No supply air reset is in effect

- 1 = SPT RESET

  Space temperature will be used as the reset control variable along with both **RTIO** and **LIMT** in the calculation of the final amount of reset to be applied (**Inputs→RSET→SA.S.R**).

- 2 = RAT RESET

  Return-air temperature will be used as the reset control variable along with both **RTIO** and **LIMT** in the calculation of the final amount of reset to be applied (**Inputs→RSET→SA.S.R**).

- 3 = 3RD PARTY RESET

  The reset value is determined by a 4 to 20 mA third party input. An input of 4 mA would correspond to 0º F reset. An input of 20 mA would correspond to 20º F reset. Configuring the control for this option will cause **RES.S** to become enabled automatically with the CEM board. To avoid alarms make sure the CEM board and third party input are connected first before enabling this option.

Reset Ratio (**RTIO**) — This configuration is used when **RS.CF** is set to 1 or 2. For every degree that the controlling temperature (space/return) falls below the occupied cooling set point (**OCSP**), the calculated value of the supply air reset will rise by the number of degrees as specified by this parameter.

Reset Limit (**LIMT**) — This configuration is used when **RS.CF** is set to 1 or 2. This configuration places a clamp on the amount of supply air reset that can be applied.

EDT 4-20 mA Reset Input (**RES.S**) — This configuration is automatically enabled when **Configuration→EDT.R→RS.CF** is set to 3 (third party reset).

COOLING CONFIGURATION — Relevant configurations for mechanical cooling are located at the local display under **Configuration→COOL**. See Table 35.

Table 33 — Setpoints

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
OHSP	Occupied Heat Setpoint	55-80	dF	OHSP	68
OCSP	Occupied Cool Setpoint	55-80	dF	OCSP	75
UHSP	Unoccupied Heat Setpoint	40-80	dF	UHSP	55
UCSP	Unoccupied Cool Setpoint	75-95	dF	UCSP	90
GAP	Heat-Cool Setpoint Gap	2-10	deltaF	HCSP_GAP	5
V.C.ON	VAV Occ. Cool On Delta	0-25	deltaF	VAVOCON	3.5
V.C.OF	VAV Occ. Cool Off Delta	1-25	deltaF	VAVOCOFF	2
SASP	Supply Air Setpoint	45-75	dF	SASP	55
SA.HI	Supply Air Setpoint Hi	45-75	dF	SASP_HI	55
SA.LO	Supply Air Setpoint Lo	45-75	dF	SASP_LO	60
SA.HT	Heating Supply Air Setpt	90-145	dF	SASPHEAT	85
T.PRG	Tempering Purge SASP	−20-80	dF	TEMPPURG	50
T.CL	Tempering in Cool SASP	5-75	dF	TEMPCOOL	5
T.V.OC	Tempering Vent Occ SASP	−20-80	dF	TEMPVOCC	65
T.V.UN	Tempering Vent Unocc. SASP	−20-80	dF	TEMPVUNC	50

Table 34 — Supply Air Reset Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULTS
EDT.R	EVAP.DISCHRGE TEMP RESET				
RS.CF	EDT Reset Configuration	0 - 3		EDRSTCFG	2
RTIO	Reset Ratio	0 - 10		RTIO	2
LIMT	Reset Limit	0 - 20	deltaF	LIMT	10
RES.S	EDT 4-20 ma Reset Input	Enable/Disable		EDTRSENS	Disable

Table 35 — Cooling Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULTS
COOL	COOLING CONFIGURATION				
Z.GN	Capacity Threshold Adjst	−10 - 10		Z_GAIN	1
MC.LO	Compressor Lockout Temp	−20 - 55	dF	OATLCOMP	40
C.FOD	Fan-Off Delay, Mech Cool	0-600	sec	COOL_FOD	60
MLV	Min. Load Valve (HGBP)?	Yes/No		MLV_SEL	No
M.M.	Motor Master Control ?	Yes/No		MOTRMAST	No
HPSP	Head Pressure Setpoint	80 - 150	dF	HPSP	113
A1.EN	Enable Compressor A1	Enable/Disable		CMPA1ENA	Enable
A2.EN	Enable Compressor A2	Enable/Disable		CMPA2ENA	Enable
B1.EN	Enable Compressor B1	Enable/Disable		CMPB1ENA	Enable
B2.EN	Enable Compressor B2	Enable/Disable		CMPB2ENA	Enable
CS.A1	CSB A1 Feedback Alarm	Enable/Disable		CSB_A1EN	Enable
CS.A2	CSB A2 Feedback Alarm	Enable/Disable		CSB_A2EN	Enable
CS.B1	CSB B1 Feedback Alarm	Enable/Disable		CSB_B1EN	Enable
CS.B2	CSB B2 Feedback Alarm	Enable/Disable		CSB_B2EN	Enable
REV.R	Rev. Rotation Verified?	Yes/No		REVR_VER	No

Capacity Threshold Adjust (*Z.GN*) — This configuration is used for units using the "SumZ" algorithm for cooling capacity control (*Configuration→UNIT→C.TYP* = 1, 2, 3 or 5). The configuration affects the cycling rate of the cooling stages by raising or lowering the threshold that demand must build to in order to add or subtract a stage of cooling.

Normally this configuration should not require any tuning or adjustment. If there is an application where the unit may be significantly oversized and there are indications of high compressor cycles then the Capacity Threshold Adjust (*Z.GN*) can be used to adjust the overall logic gain. Normally this is set to 1.0, but it can be adjusted from 0.5 to 4.0. As the value of *Z.GN* is increased, the cycling of cooling stages will be slowed.

Compressor Lockout Temperature (*MC.LO*) — This configuration is the outdoor air temperature setting below which mechanical cooling is locked out.

Fan-Off Delay, Mech Cool (*C.FOD*) — After a mechanical cooling cycle has ended, this is the delay in seconds that the supply fan will continue to operate.

Min. Load Valve (HGBP)? (*MLV*) — This configuration instructs the control as to whether a minimum load valve has been installed and will be controlled by the compressor staging routine.

MotorMaster Control? (*M.M.*) — The condenser fan staging control for the unit is managed directly by the *Comfort*Link™ control. There is no physical Motormaster® device in the standard unit. The standard unit is capable of mechanical cooling operation down to 35 F outdoor temperature. With the addition of accessory Motormaster V speed control on the stage 1 condenser fan(s), mechanical cooling operation down to 0° F outdoor temperature is possible. The accessory Motormaster V speed control is a completely self-contained control and is not controlled by the unit's *Comfort*Link control. The Motormaster control configuration (*M.M.*) only applies to the 060 size units. On 060 size units with accessory Motormaster V speed control installed, this configuration must be set to YES. On 060 size units without accessory Motormaster V speed control installed and on all 020-050 size units, this configuration must be set to NO. On 060 size units with this configuration set to NO, the *Comfort*Link control will control 3 stages of condenser fan head pressure control. With this configuration set to YES, the *Comfort*Link control will control 2 stages of condenser fan head pressure control in addition to the Motormaster V speed control accessory. See Head Pressure Control section, page 40, for more information.

Head Pressure Set Point (*HPSP*) — This is the head pressure set point used by the *Comfort*Link control during condenser fan, head pressure control.

Enable Compressor A1 (*A1.EN*) — This configuration is used to disable the A1 compressor in case of failure.

Enable Compressor A2 (*A2.EN*) — This configuration is used to disable the A2 compressor in case of failure.

Enable Compressor B1 (*B1.EN*) — This configuration is used to disable the B1 compressor in case of failure.

Enable Compressor B2 (*B2.EN*) — This configuration is used to disable the B2 compressor in case of failure.

CSB A1 Feedback Alarm (*CS.A1*) — This configuration is used to enable or disable the compressor A1 feedback alarm. This configuration must be enabled at all times.

CSB A2 Feedback Alarm (*CS.A2*) — This configuration is used to enable or disable the compressor A2 feedback alarm. This configuration must be enabled at all times.

CSB B1 Feedback Alarm (*CS.B1*) — This configuration is used to enable or disable the compressor B1 feedback alarm. This configuration must be enabled at all times.

CSB B2 Feedback Alarm (*CS.B2*) — This configuration is used to enable or disable the compressor B2 feedback alarm. This configuration must be enabled at all times.

Reverse Rotation Verified? (**REV.R**) — If this configuration is set to NO, then after a power up, in the normal run mode, the control will check the suction pressure on the first circuit that is energized after 5 seconds of run time. If the control does not see a sufficient decrease in suction pressure over the first 5 seconds, mechanical cooling will be shut down, and an alarm will be generated (A140). This alarm requires a manual reset.

If the unit is in the Service Test mode, the test will be performed any time a compressor is energized.

Once it has been verified that power to the rooftop and compressors has been applied correctly and the compressors start up normally, this configuration can be set to YES in order to prevent the reverse rotation check from occurring.

COMPRESSOR SAFETIES — The 48/50A Series units with the *Comfort*Link™ controls include a compressor protection board (CSB) that protects the operation of each of the compressors. These boards sense the presence or absence of current to each compressor.

If there is a command for a compressor to run and there is no current, then one of the following safeties or conditions have turned the compressor off:

- Compressor overcurrent — Smaller compressors have internal line breaks and larger compressors have a dedicated circuit breaker for over current protection.
- Compressor short circuit — If the compressor circuit breaker that provides short circuit protection has tripped then there will not be current.
- Compressor motor over temperature — If the internal line-break or over temperature switch has opened.
- High-pressure switch trip — High pressure switch has opened.

Alarms will also occur if the current sensor board malfunctions or is not properly connected to its assigned digital input. If the compressor is commanded OFF and the Current Sensor reads ON, an alert is generated. This will indicate that a compressor contactor has failed closed. In this case, a special mode "Compressor Stuck on Control" will be enabled and all other compressors will be turned off and an alarm enabled to indicate that service is required. Any time the alert occurs, a strike is called out on the affected compressor. If three successive strikes occur the compressor will be locked out requiring a manual reset or power reset of the circuit board. The clearing of strikes during compressor operation is a combination of 3 complete cycles or 15 continuous minutes of run time operation. If there are one or two strikes on the compressor and three short cycles (ON-OFF, ON-OFF, ON-OFF) less than 15 minutes each occur, the strikes are reset to zero for the affected compressor. If the compressor turns on and runs for 15 minutes straight with no compressor failure, the compressor strikes are cleared.

COMPRESSOR TIME GUARDS — The control will not allow any output relay to come on within 3 seconds of any other output relay. For outputs connected to the compressors, the control will use a Compressor Minimum OFF Time of 2 minutes, a Compressor Minimum ON Time of 3 minutes and a Minimum Delay before turning on another compressor of 10 seconds.

COOL MODE SELECTION PROCESS — The A Series *Comfort*Link™ control offers three distinct methods by which it may select a cooling mode.

1. Thermostat (**C.TYP**=3 and 4): The thermostat does not depend upon the state of occupancy or temperature and the modes are called out directly by the discrete inputs (**Inputs→STAT→Y1** and **Y2**).

2. Occupied VAV cooling types (**C.TYP**=1 and 2) are called out in the occupied period (*Operating Modes→ MODE→OCC*=ON).

3. Occupied VAV cooling types (**C.TYP**=1 and 2) are called out in the unoccupied period (*Operating Modes→ MODE→OCC*=OFF). They are also used for space

sensor control types (**C.TYP**=5 and 6) in both the occupied and unoccupied periods.

This section is devoted to the process of cooling mode determination for the three types outlined above.

VAV Cool Mode Selection during the Occupied Period (**C.TYP = 1,2** and *Operating Modes→MODE→OCC =ON*) — There is no difference in the selection of a cooling mode for either VAV-RAT or VAV-SPT in the occupied period. The actual selection of a cool mode, for both control types, is based upon the controlling return-air temperature (*Temperatures→AIR.T →CTRL→R.TMP*). Typically this is the same as the return air temperature thermistor (*Temperatures→AIR.T→RAT*) except when under CCN Linkage.

VAV Occupied Cool Mode Evaluation Configuration — There are VAV occupied cooling offsets under **Setpoints**.

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
V.C.ON	VAV Occ. Cool On Delta	0-25	deltaF	VAVOCON	3.5
V.C.OF	VAV Occ. Cool Off Delta	1-25	deltaF	VAVOCOFF	2

Cool Mode Determination — If the machine control type (*Configuration→UNIT→C.TYP*) = 1 (VAV-RAT) or 2 (VAV-SPT) and the control is occupied (*Operating Modes →MODE→OCC*=ON), then the unit will not follow the occupied cooling set point (*OCSP*). Instead, the control will follow two offsets in the determination of an occupied VAV cooling mode (*Setpoints→V.C.ON* and *Setpoints→V.C.OF*), applying them to the low-heat off trip point and comparing the resulting temperature to the return-air temperature.

The *Setpoints→V.C.ON* (VAV cool mode on offset) and *Setpoints→V.C.OF* (VAV cool mode off offset) offsets are used in conjunction with the low heat mode off trip point to determine when to bring cooling on and off and in enforcing a true "vent" mode between heating and cooling. See Fig. 5. The occupied cooling set point is not used in the determination of the cool mode. The occupied cooling set point is used for supply air reset only.

The advantage of this offset technique is that the control can safely enforce a vent mode without worrying about crossing set points. Even more importantly, under CCN linkage, the occupied heating set point may drift up and down and as such this technique of using offsets ensures a guaranteed separation in degrees Fahrenheit between the calling out of a heating or cooling mode at all times.

NOTE: There is a sub-menu at the local display (**Run Status →TRIP**) that allows the user to see the exact trip points for both the heating and cooling modes without having to calculate them. Refer to the Cool Mode Diagnostic Help section on page 37 for more information.

To enter into a VAV Occupied Cool mode, the controlling temperature must rise above *[OHSP* minus **L.H.ON** plus **L.H.OF** plus **V.C.ON]**.

To exit out of a VAV Occupied Cool Mode, the controlling temperature must fall below *[OHSP* minus **L.H.ON** plus **L.H.OF** plus **V.C.ON** minus **V.C.OF]**.

NOTE: With vent mode, it is possible to exit out of a cooling mode during the occupied period if the return-air temperature drops low enough. When supply-air temperature reset is not configured, this capability will work to prevent over-cooling the space during the occupied period.
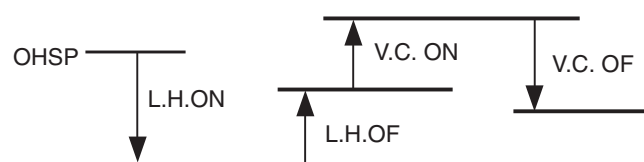
Fig. 5 — VAV Occupied Period Trip Logic

Supply Air Set Point Control and the Staging of Compressors — Once the control has determined that a cooling mode is in effect, the cooling control point (**Run Status→VIEW →CL.C.P**) is calculated and is based upon the supply air set point (**Setpoints→SASP**) plus any supply air reset being applied (**Inputs→RSET→SA.S.R**).

Refer to the SumZ Cooling Algorithm section on page 37 for a discussion of how the A Series *Comfort*Link™ controls manage the staging of compressors to maintain supply-air temperature.

VAV Cool Mode Selection during the Unoccupied Period (**C.TYP = 1,2; *Operating Modes→MODE→OCC*=OFF**) and Space Sensor Cool Mode Selection (**C.TYP=5 and 6**) — The machine control types that utilize this technique of mode selection are:

• **C.TYP** = 1 (VAV-RAT) in the unoccupied period
• **C.TYP** = 2 (VAV-SPT) in the unoccupied period
• **C.TYP** = 5 (SPT-MULTI) in both the occupied and unoccupied period
• **C.TYP** = 6 (SPT- 2 STG) in both the occupied and unoccupied period

These particular control types operate differently than the VAV types in the occupied mode in that there is both a LOW COOL and a HIGH COOL mode. For both of these modes, the control offers two independent set points, **Setpoints→SA.LO** (for LOW COOL mode) and **Setpoints→SA.HI** (for HIGH COOL mode). The occupied and unoccupied cooling set points can be found under **Setpoints**.

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
OCSP	Occupied Cool Setpoint	55-80	dF	OCSP	75
UCSP	Unoccupied Cool Setpoint	75-95	dF	UCSP	90

The heat/cool set point offsets are found under **Configuration→D.LV.T**. See Table 36.

Operating modes are under **Operating Modes→MODE**.

ITEM	EXPANSION	RANGE	CCN POINT
MODE	MODES CONTROLLING UNIT		
OCC	Currently Occupied	ON/OFF	MODEOCCP
T.C.ST	Temp.Compensated Start	ON/OFF	MODETCST

Cool Mode Evaluation Logic — The first thing the control determines is whether the unit is in the occupied mode (**OCC**) or is in the temperature compensated start mode (**T.C.ST**). If the unit is occupied or in temperature compensated start mode, the occupied cooling set point (**OCSP**) is used. For all other modes, the unoccupied cooling set point (**UCSP**) is used. For further discussion and simplification this will be referred to as the "cooling set point." See Fig. 6.

Demand Level Low Cool On Offset (**L.C.ON**) — This is the cooling set point offset added to the cooling set point at which point a Low Cool mode starts.

Demand Level High Cool On Offset (**H.C.ON**) — This is the cooling set point offset added to the "cooling set point plus **L.C.ON**" at which point a High Cool mode begins.

Demand Level Low Cool Off Offset (**L.C.OF**) — This is the cooling set point offset subtracted from "cooling set point plus **L.C.ON**" at which point a Low Cool mode ends.

NOTE: The "high cool end" trip point uses the "low cool off" (**L.C.OF**) offset divided by 2.

To enter into a LOW COOL mode, the controlling temperature must rise above [the cooling set point plus **L.C.ON**.]

To enter into a HIGH COOL mode, the controlling temperature must rise above [the cooling set point plus **L.C.ON** plus **H.C.ON**.]

To exit out of a LOW COOL mode, the controlling temperature must fall below [the cooling set point plus **L.C.ON** minus **L.C.OF**.]

To exit out of a HIGH COOL mode, the controlling temperature must fall below [the cooling set point plus **L.C.ON** minus **L.C.OF**/2.]

Comfort Trending — In addition to the set points and offsets which determine the trip points for bringing on and bringing off cool modes, there are 2 configurations which work to hold off the transitioning from a low cool to a high cool mode if the space is cooling down quickly enough. This technique is referred to as Comfort Trending and the configurations of interest are **C.T.LV** and **C.T.TM**.

Cool Trend Demand Level (**C.T.LV**) — This is the change in demand that must occur within the time period specified by **C.T.TM** in order to hold off a HIGH COOL mode regardless of demand. This is not applicable to VAV control types (**C.TYP**=1 and 2) in the occupied period. As long as a LOW COOL mode is making progress in cooling the space, the control will hold off on the HIGH COOL mode. This is especially true for the space sensor machine control types (**C.TYP**) = 5 and 6, because they may transition into the occupied mode and see an immediate large cooling demand when the set points change.

Cool Trend Time (**C.T.TM**) — This is the time period upon which the cool trend demand level (**C.T.LV**) operates and may hold off staging or a HIGH COOL mode. This is not applicable to VAV control types (**C.TYP**=1 and 2) in the occupied period. See the Cool Trend Demand Level section for more details.

Timeguards — In addition to the set points and offsets which determine the trip points for bringing on and bringing off cool modes there is a timeguard which enforces a time delay between the transitioning from a low cool to a high cool mode. This time delay is 8 minutes. There is a timeguard which enforces a time delay between the transitioning from a heat mode to a cool mode. This time delay is 5 minutes.

Supply Air Set Point Control — Once the control has determined that a cooling mode is in effect, the cooling control point (**Run Status→VIEW→CL.C.P**) is calculated and is based upon either **Setpoints→SA.HI** or **Setpoints→SA.LO**, depending on whether a high or a low cooling mode is in effect, respectively. In addition, if supply air reset is configured, it will also be added to the cooling control point.

Refer to the SumZ Cooling Algorithm section for a discussion of how the A Series *Comfort*Link™ controls manage supply-air temperature and the staging of compressors for these control types.

Table 36 — Cool/Heat Set Point Offsets Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
D.LV.T	COOL/HEAT SETPT. OFFSETS				
L.H.ON	Dmd Level Lo Heat On	-1 - 2	^F	DMDLHON	1.5
H.H.ON	Dmd Level(+) Hi Heat On	0.5 - 2.0	^F	DMDHHON	0.5
L.H.OF	Dmd Level(-) Lo Heat Off	0.5 - 2	^F	DMDLHOFF	1
L.C.ON	Dmd Level Lo Cool On	-1 - 2	^F	DMDLCON	1.5
H.C.ON	Dmd Level(+) Hi Cool On	0.5 - 2	^F	DMDHCON	0.5
L.C.OF	Dmd Level(-) Lo Cool Off	0.5 - 2	^F	DMDLCOFF	1
C.T.LV	Cool Trend Demand Level	0.1 - 5	^F	CTRENDLV	0.1
H.T.LV	Heat Trend Demand Level	0.1 - 5	^F	HTRENDLV	0.1
C.T.TM	Cool Trend Time	30 - 600	sec	CTRENDTM	120
H.T.TM	Heat Trend Time	30 - 600	sec	HTRENDTM	120

Fig. 6 — Cool Mode Evaluation

C.TYP = **3 and 4** (Thermostat Cool Mode Selection) — When a thermostat type is selected, the decision making process involved in determining the mode is straightforward. Upon energizing the Y1 input only, the unit HVAC mode will be LOW COOL. Upon the energizing of both Y1 and Y2 inputs, the unit HVAC mode will be HIGH COOL. If just input G is energized the unit HVAC mode will be VENT and the supply fan will run.

Selecting the _C.TYP_ = 3 (TSTAT – MULTI) control type will cause the control to do the following:

- The control will read the _Configuration→UNIT→SIZE_ configuration parameter to determine the number of cooling stages and the pattern for each stage.
- An HVAC mode equal to LOW COOL will cause the unit to select the _Setpoints→SA.LO_ set point to control to. An HVAC mode equal to HIGH COOL will cause the unit to select the _Setpoints→SA.HI_ set point to control to. Supply air reset (if configured) will be added to either the low or high cool set point.
- The control will utilize the SumZ cooling algorithm and control cooling to a supply air set point. See the section for the SumZ Cooling Algorithm section for information on controlling to a supply air set point and compressor staging.

Selecting the _C.TYP_ = 4 (TSTAT – 2 STG) control type means that only two stages of cooling will be used. On unit sizes 020, 025 and 027 (with three compressors), an HVAC Mode of LOW COOL will energize one compressor in Circuit A; an HVAC Mode of HIGH COOL will energize all three compressors. On unit sizes 030 and larger (with four compressors) an HVAC Mode of LOW COOL will energize both compressors in Circuit A; an HVAC Mode of HIGH COOL will energize all four compressors. Refer to the section on Economizer Integration with Mechanical Cooling for more information.

2-Stage Cooling Control Logic (_C.TYP_ = **4 and 6**) — The logic that stages mechanical cooling for the TSTAT and SPT 2-Stage cooling control types differs from that of the multi-stage control types. This section will explain how compressors are staged and the timing involved for both the Low Cool and High Cool HVAC Modes.

There are either three or four compressors divided among two refrigeration circuits. Circuit A always contains two compressors (_Outputs→COOL→A1_ and _A2_). Circuit B has either one compressor (_Outputs→COOL→B1_) on size 020-027 units or two compressors (_Outputs→COOL→B1_ and _B2_) on size 030-060 units. For 2-stage cooling control, regardless of configuration, there is no minimum load valve (MLV) control. The decision as to which compressor should be turned on or off next is decided by the compressor's availability and the preferred staging order.

The preferred staging order is either A1, A2, B1, B2 (B2 on 030-060 only) or A2, A1, B1, B2 (B2 on 030-060 only). Either A1 or A2 may start first as there is a built-in lead/lag logic on compressors A1 and A2 every time the unit stages to 0 compressors. Also, based on compressor availability, it should be noted that any compressor may come on. For example, on a

3 compressor unit, if no compressors are currently on, compressor A2 is currently under a minimum off compressor timeguard, and 2 compressors are to be turned on, then compressors A1 and B1 will be turned on immediately instead of A1 and A2.

Low Cool Versus High Cool Mechanical Staging — The number of compressors to be requested during a cooling mode are divided into 2 groups by the control, HVAC mode = Lo Cool and HVAC mode = Hi Cool.

If the economizer is not able to provide free cooling (_**Run Status→ECON→ACTV = NO**_) then:
- Lo Cool Mode mechanical stages = 2
- Hi Cool Mode mechanical stages = 3 (for 020 through 027 size units)
- Hi Cool Mode mechanical stages = 4 (for 030 through 060 size units)

If the economizer is able to provide free cooling (_**Run Status→ECON→ACTV = YES**_) then:

If the economizer's current position is less than _**Configuration→ECON→EC.MX**_ – 5 and mechanical cooling has not yet started for the current cool mode session then:
- Lo Cool Mode mechanical stages = 0
- Hi Cool Mode mechanical stages = 0

During the first 2.5 minutes of a low or high cool mode where the economizer position is greater than _**Configuration →ECON→EC.MX**_ – 5% and mechanical cooling has not yet started:
- Lo Cool Mode mechanical stages = 0
- Hi Cool Mode mechanical stages = 0

If the economizer position is greater than _**Configuration →ECON→EC.MX**_ – 5% for more than 2.5 minutes but less than 5.5 minutes and mechanical cooling has not yet started then:
- Lo Cool Mode mechanical stages = 1
- Hi Cool Mode mechanical stages = 1

If the economizer position is greater than _**Configuration →ECON→EC.MX**_ – 5% for more than 5.5 minutes but less than 8 minutes and mechanical cooling has started then:
- Lo Cool Mode mechanical stages = 2
- Hi Cool Mode mechanical stages = 2

If the economizer position is greater than _**Configuration →ECON→EC.MX**_ – 5% for more than 8 minutes but less than 11.5 minutes and mechanical cooling has started then:
- Lo Cool Mode mechanical stages = 2
- Hi Cool Mode mechanical stages = 3

If the economizer position is greater than _**Configuration →ECON→EC.MX**_ – 5% for more than 11.5 minutes and mechanical cooling has started then:
- Lo Cool Mode mechanical stages = 2
- Hi Cool Mode mechanical stages = 3 (for 020 to 027 units only)
- Hi Cool Mode mechanical stages = 4 (for 030 to 060 units only)

NOTE: If some compressors are not available due to being faulted, the Hi Cool Mode number of compressors are affected before the Lo Cool Mode number of compressors. For example, if a 4 compressor unit has one compressor faulted, and the economizer is not active, then an HVAC mode Hi Cool requested number of compressors is changed from 4 to 3. If another compressor faults, then both Lo Cool and Hi Cool requested number of compressors are set to 2. In addition, compressors cannot be brought on faster than one every 30 seconds. If the control needs to bring on 2 compressors at once, the first compressor will come on followed by the second compressor 30 seconds later.

Staging of compressors is shown in Tables 37-42.

EDT Low Override — There is an override if EDT drops too low based on an alert limit that will lock out cooling. If the supply air/evaporator discharge temperature (EDT) falls below the alert limit (*Configuration→ALLM→SA.L.O*) cooling will be inhibited. There is a 20-minute hold off on starting cooling again once the following statement is true: EDT minus (*Run Status→COOL→SUMZ→ADD.R*) has risen above *SA.L.O*.

The variable *ADD.R* is one of the SumZ cooling algorithm control variables dedicated mainly for multi-stage control.

2-Stage Control and the Economizer — The 2 stage logic will first check for the availability of the economizer. If free cooling can be used, then the control will first attempt to use the free cooling.

If no mechanical cooling is active, and the economizer is active, the economizer will first attempt to control to a cooling control point of either the supply air set point high (*SA.HI*) or supply air set point low (*SA.LO*) plus any reset applied, depending on whether high cool or low cool mode is in effect, respectively.

If one stage of mechanical cooling is on, and the economizer is active, then the economizer will attempt to control to 53 F. Also If HVAC mode = LOW COOL, the second stage of mechanical cooling will be locked out.

If the set point cannot be satisfied or the economizer is not active, then cooling will be brought on one stage at a time when the evaporator discharge temperature (EDT) is greater the 1.5° F above the current cooling control point. A start-up time delay of 10 minutes and steady state delay after a compressor is energized of 5 minutes is enforced.

If both circuits of mechanical cooling are running, then the economizer will attempt to control to 48 F. If the economizer is active and the outside air temperature (OAT) is less than the cooling control point + 0.5 F, the compressors will be locked off. When mechanical cooling is on, the control may also use the economizer to trim the leaving-air temperature to prevent unnecessary cycles of the compressor stages.

See the Economizer Integration with Mechanical Cooling section for more information on the holding off of mechanical cooling as well as the economizer control point.

Table 37 — 2-Stage Sequence — 48/50AJ,AW020-027

STAGE	SEQUENCE 1			SEQUENCE 2		
	0	1	2	0	1	2
	Thermostat Inputs			Thermostat Inputs		
Y1	OPEN	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
Y2	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED
COMP	Compressor Status			Compressor Status		
A1	OFF	ON	ON	OFF	OFF	ON
A2	OFF	OFF	ON*	OFF	ON	ON*
B1	OFF	OFF	ON	OFF	OFF	ON
	Unit Capacity			Unit Capacity		
20	0%	67%	100%	0%	67%	100%
25	0%	65%	100%	0%	65%	100%
27	0%	67%	100%	0%	67%	100%

*Compressor start is delay 10 seconds from other compressor.

Table 38 — 2-Stage Sequence — 48/50AJ,AW030-060

STAGE	SEQUENCE 1			SEQUENCE 2		
	0	1	2	0	1	2
	Thermostat Inputs			Thermostat Inputs		
Y1	OPEN	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
Y2	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED
COMP	Compressor Status			Compressor Status		
A1	OFF	ON	ON	OFF	ON*	ON
A2	OFF	ON*	ON	OFF	ON	ON
B1	OFF	OFF	ON	OFF	OFF	ON*
B2	OFF	OFF	ON*	OFF	OFF	ON
	Unit Capacity			Unit Capacity		
30	0%	45%	100%	0%	45%	100%
35	0%	48%	100%	0%	48%	100%
40	0%	43%	100%	0%	43%	100%
50	0%	45%	100%	0%	45%	100%
60	0%	50%	100%	0%	50%	100%

*Compressor start is delay 10 seconds from other compressor.

Table 39 — Staging Sequence Without Hot Gas Bypass — 48/50AK,AY020-027 and Multi-Stage 48/50AJ,AW020-027

STAGE	SEQUENCE 1					SEQUENCE 2				
	0	1	2	3	4	0	1	2	3	4
COMP	Compressor Status					Compressor Status				
A1	OFF	ON	ON	OFF	ON	OFF	OFF	ON	ON	ON
A2	OFF	OFF	ON	ON	ON	OFF	ON	ON	OFF	ON
B1	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON
	Unit Capacity 48/50A					Unit Capacity 48/50A				
20	0%	33%	67%	67%	100%	0%	33%	67%	67%	100%
25	0%	30%	65%	70%	100%	0%	35%	65%	65%	100%
27	0%	33%	67%	67%	100%	0%	33%	67%	67%	100%

Table 40 — Staging Sequence With Hot Gas Bypass — 48/50AK,AY020-027 and Multi-Stage 48/50AJ,AW020-027

STAGE	SEQUENCE 1						SEQUENCE 2					
	0	1	2	3	4	5	0	1	2	3	4	5
COMP	Compressor Status						Compressor Status					
A1	OFF	ON*	ON	ON	OFF	ON	OFF	OFF	OFF	ON	ON	ON
A2	OFF	OFF	OFF	ON	ON	ON	OFF	ON*	ON	ON	OFF	ON
B1	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON
	Unit Capacity 48/50A						Unit Capacity 48/50A					
20	0%	18%	33%	67%	67%	100%	0%	18%	33%	67%	67%	100%
25	0%	17%	30%	65%	70%	100%	0%	22%	35%	65%	65%	100%
27	0%	21%	33%	67%	67%	100%	0%	21%	33%	67%	67%	100%

*With Minimum Load Valve ON.

Table 41 — Staging Sequence Without Hot Gas Bypass —
48/50AK,AY030-060 and Multi-Stage 48/50AJ,AW030-060

STAGE	SEQUENCE 1						SEQUENCE 2					
	0	1	2	3	4	5	0	1	2	3	4	5
COMP	Compressor Status						Compressor Status					
A1	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	ON	ON
A2	OFF	OFF	ON	ON	ON	ON	OFF	ON	ON	OFF	ON	ON
B1	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
B2	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	ON	ON
	Unit Capacity 48/50A						Unit Capacity 48/50A					
30	0%	23%	45%	50%	73%	100%	0%	23%	45%	50%	73%	100%
35	0%	22%	48%	52%	74%	100%	0%	26%	48%	48%	74%	100%
40	0%	21%	43%	50%	71%	100%	0%	21%	43%	50%	72%	100%
50	0%	23%	46%	46%	68%	100%	0%	23%	46%	54%	77%	100%
60	0%	24%	50%	50%	74%	100%	0%	26%	50%	50%	76%	100%

Table 42 — Staging Sequence With Hot Gas Bypass — 48/50AK,AY030-060

STAGE	SEQUENCE 1							SEQUENCE 2						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
COMP	Compressor Status							Compressor Status						
A1	OFF	ON*	ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	ON	ON	ON
A2	OFF	OFF	OFF	ON	ON	ON	ON	OFF	ON*	ON	ON	OFF	ON	ON
B1	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON
B2	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	ON	ON
	Unit Capacity 48/50A							Unit Capacity 48/50A						
30	0%	12%	23%	45%	50%	73%	100%	0%	12%	23%	45%	50%	73%	100%
35	0%	12%	22%	48%	52%	74%	100%	0%	16%	26%	48%	48%	74%	100%
40	0%	13%	21%	43%	50%	71%	100%	0%	13%	21%	43%	50%	72%	100%
50	0%	16%	23%	46%	46%	68%	100%	0%	16%	23%	46%	54%	77%	100%
60	0%	19%	24%	50%	50%	74%	100%	0%	21%	26%	50%	50%	76%	100%

*With minimum load valve ON.

COOLING MODE DIAGNOSTIC HELP — To quickly determine the current trip points for the cooling modes, the Run Status sub-menu at the local display allows the user to view the calculated start and stop points for both the cooling and heating trip points. The following sub-menu can be found at the local display under **Run Status→TRIP**. See Table 43.

Table 43 — Run Status Mode Trip Helper

ITEM	EXPANSION	UNITS	CCN POINT
TRIP	MODE TRIP HELPER		
UN.C.S	Unoccup. Cool Mode Start	dF	UCCLSTRT
UN.C.E	Unoccup. Cool Mode End	dF	UCCL_END
OC.C.S	Occupied Cool Mode Start	dF	OCCLSTRT
OC.C.E	Occupied Cool Mode End	dF	OCCL_END
TEMP	Ctl.Temp RAT,SPT or Zone	dF	CTRLTEMP
OC.H.E	Occupied Heat Mode End	dF	OCHT_END
OC.H.S	Occupied Heat Mode Start	dF	OCHTSTRT
UN.H.E	Unoccup. Heat Mode End	dF	UCHT_END
UN.H.S	Unoccup. Heat Mode Start	dF	UCHTSTRT
HVAC	the current HVAC MODE		String

The controlling temperature is "*TEMP*" and is in the middle of the table for easy reference. The HVAC mode can also be viewed at the bottom of the table.

SUMZ COOLING ALGORITHM — The SumZ cooling algorithm is an adaptive PID which is used by the control whenever more than 2 stages of cooling are present (*C.TYP* = 1,2,3, and 5). This section will describe its operation and define the pertinent parameters. It is generally not necessary to modify parameters in this section. The information is presented primarily for reference and may be helpful for troubleshooting complex operational problems.

The only configuration parameter for the SumZ algorithm is located at the local display under **Configuration →COOL→Z.GN**. See Table 35.

Capacity Threshold Adjust (**Z.GN**) — This configuration is used on units using the "SumZ" algorithm for cooling capacity control (**Configuration→UNIT→C.TYP** = 1, 2, 3 and 5). It affects the cycling rate of the cooling stages by raising or lowering the threshold that capacity must build to in order to add or subtract a stage of cooling.

The cooling algorithm's run-time variables are located at the local display under **Run Status→COOL**. See Table 44.

Current Running Capacity (**C.CAP**) — This variable represents the amount of capacity currently running in percent.

Current Cool Stage (**CUR.S**) — This variable represents the cool stage currently running.

Maximum Cool Stages (**MAX.S**) — This variable is the maximum number of cooling stages the control is configured for and capable of controlling.

Active Demand Limit (**DEM.L**) — If demand limit is active, this variable will represent the amount of capacity that the control is currently limited to.

Capacity Load Factor (**SMZ**) — This factor builds up or down over time (–100 to +100) and is used as the means of adding or subtracting a cooling stage during run time. It is a normalized representation of the relationship between "Sum" and "Z".

Next Stage EDT Decrease (**ADD.R**) — This variable represents (if adding a stage of cooling) how much the temperature should drop in degrees depending on the **R.PCT** calculation and exactly how much additional capacity is to be added.

ADD.R = R.PCT * (C.CAP — capacity after adding a cooling stage)

For example: If **R.PCT** = 0.2 and the control would be adding 20% cooling capacity by taking the next step up, 0.2 times 20 = 4 F (**ADD.R**)

Table 44 — Run Status Cool Display

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
COOL	COOLING INFORMATION				
C.CAP	Current Running Capacity		%	CAPTOTAL	
CUR.S	Current Cool Stage			COOL_STG	
MAX.S	Maximum Cool Stages			CLMAXSTG	
DEM.L	Active Demand Limit		%	DEM_LIM	forcible
SUMZ	COOL CAP. STAGE CONTROL				
SMZ	Capacity Load Factor	-100 – +100		SMZ	
ADD.R	Next Stage EDT Decrease		^F	ADDRISE	
SUB.R	Next Stage EDT Increase		^F	SUBRISE	
R.PCT	Rise Per Percent Capacity			RISE_PCT	
Y.MIN	Cap Deadband Subtracting			Y_MINUS	
Y.PLU	Cap Deadband Adding			Y_PLUS	
Z.MIN	Cap Threshold Subtracting			Z_MINUS	
Z.PLU	Cap Threshold Adding			Z_PLUS	
H.TMP	High Temp Cap Override			HI_TEMP	
L.TMP	Low Temp Cap Override			LOW_TEMP	
PULL	Pull Down Cap Override			PULLDOWN	
SLOW	Slow Change Cap Override			SLO_CHNG	

Next Stage EDT Increase (**SUB.R**) — This variable represents (if subtracting a stage of cooling) how much the temperature should rise in degrees depending on the **R.PCT** calculation and exactly how much capacity is to be subtracted.

SUB.R = R.PCT * (**C.CAP** — capacity after subtracting a cooling stage)

For Example: If **R.PCT** = 0.2 and the control would be subtracting 30% capacity by taking the next step down, 0.2 times –30 = –6 F (**SUB.R**)

Rise Per Percent Capacity (**R.PCT**) — This is a real time calculation that represents the amount of degrees of drop/rise across the evaporator coil versus percent of current running capacity.

R.PCT = (*MAT* – *EDT*)/ **C.CAP**

Cap Deadband Subtracting (**Y.MIN**) — This is a control variable used for Low Temp Override (**L.TMP**) and Slow Change Override (**SLOW**).

Y.MIN = -**SUB.R***0.4375

Cap Deadband Adding (**Y.PLU**) — This is a control variable used for High Temp Override (**H.TMP**) and Slow Change Override (**SLOW**).

Y.PLU = -**ADD.R***0.4375

Cap Threshold Subtracting (**Z.MIN**) — This parameter is used in the calculation of SumZ and is calculated as follows:

Z.MIN = Configuration→COOL→Z.GN * (–10 + (4* (**–SUB.R**))) * 0.6

Cap Threshold Adding (**Z.PLU**) — This parameter is used in the calculation of SumZ and is calculated as follows:

Z.PLU = Configuration→COOL→Z.GN * (10 + (4* (**–ADD.R**))) * 0.6

High Temp Cap Override (**H.TMP**) — If stages of mechanical cooling are on and the error is greater than twice **Y.PLU**, and the rate of change of error is greater than 0.5° F per minute, then a stage of mechanical cooling will be added every 30 seconds. This override is intended to react to situations where the load rapidly increases.

Low Temp Cap Override (**L.TMP**) — If the error is less than twice **Y.MIN**, and the rate of change of error is less than –0.5° F per minute, then a mechanical stage will be removed every 30 seconds. This override is intended to quickly react to situations where the load is rapidly reduced.

Pull Down Cap Override (**PULL**) — If the error from set point is above 4° F, and the rate of change is less than –1° F per minute, then pulldown is in effect, and "SUM" is set to 0. This keeps mechanical cooling stages from being added when the error is very large, but there is no load in the space. Pulldown for units is expected to rarely occur, but is included for the rare situation when it is needed. Most likely pulldown will occur when mechanical cooling first becomes available shortly after the control goes into an occupied mode (after a warm unoccupied mode).

Slow Change Cap Override (**SLOW**) — With a rooftop unit, the design rise at 100% total unit capacity is generally around 30° F. For a unit with 4 stages, each stage represents about 7.5° F of change to EDT. If stages could reliably be cycled at very fast rates, the set point could be maintained very precisely. Since it is not desirable to cycle compressors more than 6 cycles per hour, slow change override takes care of keeping the PID under control when "relatively" close to set point.

SumZ Operation — The SumZ algorithm is an adaptive PID style of control. The PID is programmed within the control and the relative speed of staging can only be influenced by the user through the adjustment of the **Z.GN** configuration, described in the reference section. The capacity control algorithm uses a modified PID algorithm, with a self adjusting gain which compensates for varying conditions, including changing flow rates across the evaporator coil.

Previous implementations of SumZ made static assumptions about the actual size of the next capacity jump up or down. This control uses a "rise per percent capacity" technique in the calculation of SumZ, instead of the previous "rise per stage" method. For each jump, up or down in capacity, the control will know beforehand the exact capacity change brought on. Better overall staging control can be realized with this technique.

SUM Calculation — The PID calculation of the "SUM" is evaluated once every 80 seconds.

SUM = Error + "SUM last time through" + (3 * Error Rate)

Where:

SUM = the PID calculation

Error = EDT – Cooling Control Point

Error Rate = Error – "Error last time through"

NOTE: "Error" is clamped between –50 and +50 and "Error rate" is clamped between –20 and +20.

This "SUM" will be compared against the "Z" calculations in determining whether cooling stages should be added or subtracted.

Z Calculation — For the "Z" calculation, the control attempts to determine the entering and the leaving-air temperature of the evaporator coil and based upon the difference between the two during mechanical cooling, determines whether to add or subtract a stage of cooling. This is the adaptive element.

The entering-air temperature is referred to as *MAT* (mixed-air temperature) and the leaving-air temperature of the evaporator coil is referred to as *EDT* (evaporator discharge temperature). They are found at the local display under the ***Temperatures→CTRL*** sub-menu.

The main elements to be calculated and used in the calculation of SumZ are:

1) the rise per percent capacity (*R.PCT*)

2) the amount of expected rise for the next cooling stage addition

3) the amount of expected rise for the next cooling stage subtraction

The calculation of "Z" requires two variables, *Z.PLU* used when adding a stage and *Z.MIN* used when subtracting a stage. They are calculated with the following formulas:

$Z.PLU = Z.GN * (10 + (4*(-ADD.R))) * 0.6$

$Z.MIN = Z.GN * (-10 + (4*(-SUB.R))) * 0.6$

Where:

Z.GN = configuration used to modify the threshold levels used for staging (*Configuration→COOL→Z.GN*)

ADD.R = *R.PCT* * (*C.CAP* – capacity after adding a cooling stage)

SUB.R = *R.PCT* * (*C.CAP* – capacity after subtracting a cooling stage)

Both of these terms, *Z.PLU* and *Z.MIN*, represent a threshold both positive and negative upon which the "SUM" calculation must build up to in order to cause the compressor to stage up or down.

Comparing SUM and Z — The "SUM" calculation is compared against *Z.PLU* and *Z.MIN*.
• If "SUM" rises above *Z.PLU*, a cooling stage is added.
• If "SUM" falls below *Z.MIN*, a cooling stage is subtracted.

There is a variable called *SMZ* which is described in the reference section and which can simplify the task of watching the demand build up or down over time. It is calculated as follows:

If SUM is positive: $SMZ = 100*(SUM/Z.PLU)$

If SUM is negative: $SMZ = -100*(SUM/Z.MIN)$

Mixed Air Temperature Calculation (MAT) — The mixed-air temperature is calculated and is a function of the economizer position. Additionally there are some calculations in the control which can zero in over time on the relationship of return and outside air as a function of economizer position. There are two configurations which relate to the calculation of "MAT". These configurations can be located at the local display under *Configuration→UNIT*.

ITEM	EXPANSION	RANGE	CCN POINT	DEFAULTS
UNIT	UNIT CONFIGURATION			
MAT.S	MAT Calc Config	0 - 1	MAT_SEL	1
MAT.R	Reset MAT Table Entries?	Yes/No	MATRESET	No

MAT Calc Config (*MAT.S*) — This configuration gives the user two options in the processing of the mixed-air temperature (MAT) calculation:
• *MAT.S* = 0

The control will not attempt to learn MAT over time. The control will simply calculate MAT based on the position of the economizer, outside and return air temperature, linearly.

• *MAT.S* = 1

The control will attempt to learn MAT over time. Any time the system is in a vent mode and the economizer stays at a particular position for long enough, MAT = EDT. Using this, the control has an internal table whereby it can more closely determine the true MAT value.

Reset MAT Table Entries? (*MAT.R*) — This configuration allows the user to reset the internally stored MAT learned configuration data back to the default values. The defaults are set to a linear relationship between the economizer damper position and OAT and RAT in the calculation of MAT.

SumZ Overrides — There are a number of overrides to the SumZ algorithm which may add or subtract stages of cooling.
• High Temp Cap Override (*H.TMP*)
• Low Temp Cap Override (*L.TMP*)
• Pull Down Cap Override (*PULL*)
• Slow Change Cap Override (*SLOW*)

Economizer Trim Override — The unit may drop stages of cooling when the economizer is performing free cooling and the configuration *Configuration→ECON→E.TRM* is set to Yes. The economizer controls to the same supply air set point as mechanical cooling does for SumZ when *E.TRM* = Yes. This allows for much tighter temperature control as well as cutting down on the cycling of compressors.

For a long cooling session where the outside-air temperature may drop over time, there may be a point at which the economizer has closed down far enough were the unit could remove a cooling stage and open up the economizer further to make up the difference.

Mechanical Cooling Lockout (*Configuration→COOL→MC.LO*) **—** This configuration allows a configurable outside-air temperature set point below which mechanical cooling will be completely locked out.

DEMAND LIMIT CONTROL — Demand Limit Control may override the cooling algorithm and clamp or shed cooling capacity during run time. The term Demand Limit Control refers to the restriction of the machine capacity to control the amount of power that a machine will use. Demand limit control is intended to interface with an external Loadshed Device either through CCN communications, external switches, or 4 to 20 mA input.

The control has the capability of loadshedding and limiting in 3 ways:
• Two discrete inputs tied to configurable demand limit set point percentages.
• An external 4 to 20 mA input that can reset capacity back linearly to a set point percentage.
• CCN loadshed functionality.

NOTE: It is also possible to force the demand limit variable (*Run Status→COOL→DEM.L*).

To use Demand Limiting, select the type of demand limiting to use. This is done with the Demand Limit Select configuration (*Configuration→DMD.L→DM.L.S*).

To view the current demand limiting currently in effect, look at *Run Status→COOL→DEM.L*.

The configurations associated with demand limiting can be viewed at the local display at *Configuration→DMD.L*. See Table 45.

Demand Limit Select (*DM.L.S*) — This configuration determines the type of demand limiting.

• 0 = NONE — Demand Limiting not configured.
• 1 = 2 SWITCHES — This will enable switch input demand limiting using the switch inputs connected to the CEM board. Connections should be made to TB6-4,5,6.
• 2 = 4 to 20 mA — This will enable the use of a remote 4 to 20 mA demand limit signal. The CEM module must be used. The 4 to 20 mA signal must come from an externally sourced controller and should be connected to TB6-7,8.
• 3 = CCN LOADSHED — This will allow for loadshed and red lining through CCN communications.

Table 45 — Demand Limit Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
DMD.L	DEMAND LIMIT CONFIG.				
DM.L.S	Demand Limit Select	0 - 3		DMD_CTRL	0
D.L.20	Demand Limit at 20 ma	0 - 100	%	DMT20MA	100
SH.NM	Loadshed Group Number	0 - 99		SHED_NUM	0
SH.DL	Loadshed Demand Delta	0 - 60	%	SHED_DEL	0
SH.TM	Maximum Loadshed Time	0 - 120	min	SHED_TIM	60
D.L.S1	Demand Limit Sw.1 Setpt.	0 - 100	%	DLSWSP1	80
D.L.S2	Demand Limit Sw.2 Setpt.	0 - 100	%	DLSWSP2	50

Two-Switch Demand Limiting (*DM.L.S = 1*) — This type of demand limiting utilizes two discrete inputs:

Demand Limit Switch 1 Setpoint (*D.L.S1*) — Dmd Limit Switch Setpoint 1 (0-100% total capacity)

Demand Limit 2 Setpoint (*D.L.S2*) — Dmd Limit Switch Setpoint 2 (0-100% total capacity)

The state of the discrete switch inputs can be found at the local display:

Inputs→GEN.I→DL.S1

Inputs→GEN.I→DL.S2

The following table illustrates the demand limiting (*Run Status→COOL→DEM.L*) that will be in effect based on the logic of the applied switches:

Switch Status	*Run Status→COOL→DEM.L = 1*
Inputs→GEN.I→DL.S1 = OFF *Inputs→GEN.I→DL.S2* = OFF	100%
Inputs→GEN.I→DL.S1 = ON *Inputs→GEN.I→DL.S2* = OFF	*Configuration→DMD.L→D.L.S1*
Inputs→GEN.I→DL.S1 = ON *Inputs→GEN.I→DL.S2* = ON	*Configuration→DMD.L→D.L.S2*
Inputs→GEN.I→DL.S1 = OFF *Inputs→GEN.I→DL.S2* = ON	*Configuration→DMD.L→D.L.S2*

4-20 mA Demand Limiting (*DM.L.S = 2*) — If the unit has been configured for 4 to 20 mA demand limiting, then the *Inputs→4-20→DML.M* value is used to determine the amount of demand limiting in effect (*Run Status→COOL→DEM.L*). The Demand Limit at 20 mA (*D.L.20*) configuration must be set. This is the configured demand limit corresponding to a 20 mA input (0 to 100%).

The value of percentage reset is determined by a linear interpolation from 0% to *"D.L.20"*% based on the *Inputs→4-20→DML.M* input value.

The following examples illustrate the demand limiting (*Run Status→COOL→DEM.L*) that will be in effect based on amount of current seen at the 4 to 20 mA input, *DML.M*.

D.L.20 = 80% *DML.M* = 4mA *DEM.L* = 100%	*D.L.20* = 80% *DML.M* = 12 mA *DEM.L* = 90%	*D.L.20* = 80% *DML.M* = 20mA *DEM.L* = 80%

CCN Loadshed Demand Limiting (*DM.L.S = 3*) — If the unit has been configured for CCN Loadshed Demand Limiting, then the demand limiting variable (*Run Status→COOL→DEM.L*) is controlled via CCN commands.

The relevant configurations for this type of demand limiting are:

Loadshed Group Number (*SH.NM*) — CCN Loadshed Group number

Loadshed Demand Delta (*SH.DL*) — CCN Loadshed Demand Delta

Maximum Loadshed Time (*SH.TM*) — CCN Maximum Loadshed time

The Loadshed Group Number (*SH.NM*) corresponds to the loadshed supervisory device that resides elsewhere on the CCN network and broadcasts loadshed and redline commands to its associated equipment parts. The *SH.NM* variable will default to zero which is an invalid group number. This allows the loadshed function to be disabled until configured.

Upon reception of a redline command, the machine will be prevented from starting if it is not running. If it is running, then *DEM.L* is set equal to the current running cooling capacity (*Run Status→COOL→C.CAP*).

Upon reception of a loadshed command, the *DEM.L* variable is set to the current running cooling capacity (*Run Status→COOL→C.CAP*) minus the configured Loadshed Demand Delta (*SH.DL*).

A redline command or loadshed command will stay in effect until a Cancel redline or Cancel loadshed command is received, or until the configurable Maximum Loadshed time (*SH.TM*) has elapsed.

HEAD PRESSURE CONTROL — Condenser head pressure control for the 48/50A series rooftops is controlled directly by the unit, except when the unit is equipped and configured for Motormaster® V control. See Table 46. If the unit is equipped with the accessory Motormaster V control, the Motormaster Installed configuration (*Configuration→COOL→M.M.*) must be set to YES if the unit size (*Configuration→UNIT→SIZE*) is 60 tons. This is because condenser fan relay A must be energized to enable Motormaster V control. The size 60 unit offers 3 stages of head pressure control and is the one case where condenser fan relay A may be requested off during head pressure control operation. By configuring *M.M.* to YES, the control is instructed not to turn off the relay to attempt 3 stages of head pressure control.

The saturated condensing temperature (SCT) sensors (*Temperatures→REF.T→SCT.A* and *SCT.B*), which are connected to the condenser coils in circuit A and B, are used to measure the saturated condensing temperature and may be used to control head pressure. The equivalent refrigerant pressure values can be viewed under *Pressures→REF.P→DP.A* and *DP.B*.

There are two configurations provided for head pressure control that can be found at the local display:

• *Configuration→COOL→M.M.* – Motormaster Control?
• *Configuration→COOL→HPSP* – Head Pressure Set Point

There are two condenser fan relays used to control head pressure:

• *Outputs→FANS→CD.F.A* - Condenser Fan A
• *Outputs→FANS→CD.F.B* - Condenser Fan B

Head Pressure Control Operation — The following logic describes the head pressure control routine when any compressor has been commanded on.

When the compressor has been commanded on, then condenser fan A will be energized *(CD.F.A = ON)*. If the highest active circuit SCT is above the *HPSP*, then condenser fan B will be energized (*CD.F.B = ON*). If the OAT is above 75 F, then both condenser fans A and B will be energized (*CD.F.A = ON* and *CD.F.B = ON*). The fans will remain on until OAT temperature drops below 73 F or the compressors are turned off. If the SCT on an active circuit drops 40 F below the *HPSP* for 2 minutes, then condenser fan B is turned off (*CD.FB = OFF*).

NOTE: For size 60 units not configured for Motormaster® control, the control stages down differently than the other units. For size 60 units, the unit control will first turn off condenser fan relay A. After 2 minutes, the control will turn off relay B and turn back on relay A.

Failure Mode Operation — If either of the SCT sensors fails, then the control defaults to head pressure control based on the OAT sensor. The control turns on *CD.F.B* when the ambient temperature is above 65 F and turns off *CD.F.B* when the ambient temperature is below 50 F. If the SCT and OAT sensors have both failed, then the control turns on *CD.F.B* when compressors are on.

Table 46 — Condenser Fan Staging

FAN RELAY	48/50A UNIT SIZE		
	020-035	040-050	060
OFC1 (RELAY 6)	OFM1	OFM1, OFM2	OFM1, OFM2
OFC2 (RELAY 5)	OFM2	OFM3, OFM4	OFM3, OFM4, OFM5, OFM6

ECONOMIZER INTEGRATION WITH MECHANICAL COOLING — When the economizer is able to provide free cooling (*Run Status→ECON→ACTV* = YES), mechanical cooling may be delayed or even held off indefinitely.

NOTE: Once mechanical cooling has started, this delay logic is no longer relevant.

Economizer Mechanical Cooling Delay — This type of mechanical cooling delay is relevant to the all machine control types.

If the economizer is able to provide free cooling at the start of a cooling session, the mechanical cooling algorithm checks the economizer's current position (*Run Status→ECON→ECN.P*) and compares it to the economizer's maximum position (*Configuration→ECON→EC.MX*) – 5%. Once the economizer has opened beyond this point a 2.5-minute timer starts. If the economizer stays beyond this point for 2.5 minutes continuously, the mechanical cooling algorithm is allowed to start computing demand and stage compressors.

Economizer Control Point (*Run Status→VIEW→EC.C.P*) — There are 4 different ways to determine the economizer control point when the economizer is able to provide free cooling:

If no mechanical cooling is active and HVAC mode = LOW COOL

EC.C.P = Setpoints→SA.LO + Inputs→RSET→SA.S.R

If no mechanical cooling is active and HVAC mode = HIGH COOL

EC.C.P = Setpoints→SA.HI + Inputs→RSET→SA.S.R

When the first stage of mechanical cooling has started

EC.C.P = 53 F plus any economizer suction pressure reset applied

When the second stage of mechanical cooling has started

EC.C.P = 48 F plus any economizer suction pressure reset applied

Heating Control — The A Series *Comfort*Link™ control offers control for 3 different types of heating systems to satisfy general space heating requirements: 2-Stage Gas Heat, 2-Stage Electric Heat and Multiple-Stage Gas Heat.

Variable Air Volume (VAV) type applications (*C.TYP* = 1, 2, 3, or 5) require that the space terminal positions be commanded to open to Minimum Heating positions when Gas or Electric Heat systems are active, to provide for the unit heating system's Minimum Heating Airflow rate.

For VAV applications, the Heat Interlock Relay (HIR) function provides the switching of a control signal intended for use by the VAV terminals. This signal must be used to command the terminals to open to their Heating Open positions. The HIR is energized whenever the Heating mode is active, an IAQ pre-occupied force is active, or if fire smoke modes, pressurization, or smoke purge modes are active.

SETTING UP THE SYSTEM — The essential heating configurations located at the local display under *Configuration→HEAT*. See Table 47.

Table 47 — Heating Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
HEAT	HEATING CONFIGURATION				
HT.CF	Heating Control Type	0 - 3		HEATTYPE	0*
HT.SP	Heating Supply Air Setpt	80 - 120	dF	SASPHEAT	85
OC.EN	Occupied Heating Enabled	Yes/No		HTOCCENA	No
LAT.M	MBB Sensor Heat Relocate	Yes/No		HTLATMON	No
G.FOD	Fan Off Delay, Gas Heat	45 - 600	sec	GAS_FOD	45
E.FOD	Fan Off Delay, Elec Heat	10 - 600	sec	ELEC_FOD	30
SG.CF	STAGED GAS CONFIGS				
HT.ST	Staged Gas Heat Type	0 - 4		HTSTGTYP	0*
CAP.M	Max Cap Change per Cycle	5 - 45		HTCAPMAX	45*
M.R.DB	S.Gas DB min.dF/PID Rate	0 - 5		HT_MR_DB	0.5
S.G.DB	St.Gas Temp. Dead Band	0 - 5	^F	HT_SG_DB	2
RISE	Heat Rise dF/sec Clamp	0.05 - 0.2		HTSGRISE	0.06
LAT.L	LAT Limit Config	0 - 20	^F	HTLATLIM	10
LIM.M	Limit Switch Monitoring?	Yes/No		HTLIMMON	Yes
SW.H.T	Limit Switch High Temp	110 - 180	dF	HT_LIMHI	170*
SW.L.T	Limit Switch Low Temp	100 - 170	dF	HT_LIMLO	160*
HT.P	Heat Control Prop. Gain	0 - 1.5		HT_PGAIN	1
HT.D	Heat Control Derv. Gain	0 - 1.5		HT_DGAIN	1
HT.TM	Heat PID Rate Config	60 - 300	sec	HTSGPIDR	90

*Some defaults are model number dependent.

Heating Control Type (**HT.CF**) — The heating control types available are selected/configured with this variable.

    0 = No Heat
    1 = Electric Heat
    2 = 2 Stage Gas Heat
    3 = Staged Gas Heat

Heating Supply Air Set Point (**HT.SP**) — In a low heat mode for staged gas heat, this is the supply air set point for heating.

Occupied Heating Enable (**OC.EN**) — This configuration only applies when the unit's control type (**Configuration →UNIT→C.TYP**) is configured for 1 (VAV-RAT) or 2 (VAV-SPT). If the user wants to have the capability of performing heating throughout the entire occupied period, then this configuration needs to be set to "YES". Most installations do not require this capability, and if heating is installed, it is used to heat the building up in the morning. In this case set **OC.EN** to "NO".

NOTE: This unit des not support simultaneous heating and cooling. If significant simultaneous heating and cooling demand is expected, it may be necessary to provide additional heating or cooling equipment and a control system to provide occupants with proper comfort.

MBB Sensor Heat Relocate (**LAT.M**) — This option allows the user additional performance benefit when under CCN Linkage for the 2-stage electric and gas heating types. As two-stage heating types do not "modulate" to a supply air set point, no leaving air thermistor is required and none is provided. The evaporator discharge thermistor, which is initially installed up-stream of the heater, can be repositioned downstream and the control can expect to sense this heat. While the control does not need this to energize stages of heat, the control can wait for a sufficient temperature rise before announcing a heating mode to a CCN Linkage system (ComfortID™).

If the sensor is relocated, the user will now have the capability to view the leaving-air temperature at all times at **Temperatures→AIR.T→CTRL→LAT**.

NOTE: If the user does not relocate this sensor for the 2-stage electric or gas heating types and is under CCN Linkage, then the control will send a heating mode (if present) uncondition-ally to the linkage coordinator in the CCN zoning system regardless of the leaving-air temperature.

Fan-Off Delay, Gas Heat (**G.FOD**) — This configuration is the delay in seconds, after a gas heat mode has ended (**HT.CF=2,3**) that the control will continue to energize the supply fun.

Fan-Off Delay, Elec Heat (**E.FOD**) — This configuration is the delay in seconds, after an electric heat mode has ended (**HT.CF=1**) that the control will continue to energize the supply fun.

HEAT MODE SELECTION PROCESS — There are two possible heat modes that the control will call out for heating control: HVAC Mode = LOW HEAT and HVAC Mode = HIGH HEAT. These modes will be called out based on control type (**C.TYP**).

VAV-RAT (**C.TYP = 1**) and VAV-SPT (**C.TYP = 2**) — There is no difference in the selection of a heating mode for either VAV-RAT or VAV-SPT, except that for VAV-SPT, space tem-perature is used in the unoccupied period to turn on the supply fan for 10 minutes before checking return-air temperature. The actual selection of a heat mode, LOW or HIGH for both control types, will be based upon the controlling return-air temperature.

With sufficient heating demand, there are still conditions that will prevent the unit from selecting a heat mode. First, the unit must be configured for a heat type (**Configuration→ HEAT→HT.CF** not equal to "NONE"). Second, the unit has a configuration which can enable or disable heating in the occupied period except for a standard morning warmup cycle

(**Configuration→HEAT→OC.EN**). See descriptions above in the Setting Up the System section for more information.

If the unit is allowed to select a heat mode, then the next step is an evaluation of demand versus set point. At this point, the logic is the same as for control types SPT Multi-Stage and SPT-2 Stage, (**C.TYP** = 5,6) except for the actual temperature compared against set point. See Temperature Driven Heat Mode Evaluation section.

Tstat-Multi-Stage (**C.TYP = 3**) and Tstat-2 Stage (**C.TYP = 4**) — There is no difference to consider for selecting a heat mode whether the control type is for TSTAT 2-stage or TSTAT multi-stage as this only refers to how cooling will be handled. With thermostat control the W1 and W2 inputs determine whether the HVAC Mode is LOW or HIGH HEAT.

W1 = ON, W2 = OFF: HVAC MODE = LOW HEAT*
W2 = ON, W2 = ON: HVAC MODE = HIGH HEAT

*If the heating type is either 2-stage electric or 2-stage gas, the unit may promote a low heat mode to a high heat mode.

NOTE: If W2 = ON and W1 is OFF, a "HIGH HEAT" HVAC Mode will be called out but an alert (T422) will be generated. See Alarms and Alerts section on page 78.

SPT Multi-Stage (**C.TYP = 5**) and SPT 2 Stage (**C.TYP = 6**) — There is no difference to consider for selecting a heat mode whether the control type is for SPT 2-stage or SPT multi-stage as this only refers to how cooling will be handled. So, for a valid heating type selected (**HT.CF** not equal to zero) the unit is free to select a heating mode based on space temperature (SPT).

If the unit is allowed to select a heat mode, then the next step is an evaluation of demand versus set point. At this point, the logic is the same as for control types VAV-RAT and VAV-SPT, (**C.TYP** = 1,2) except for the actual temperature compared against set point. See Temperature Driven Heat Mode Evaluation section below.

TEMPERATURE DRIVEN HEAT MODE EVALUATION — This section discusses the technique for selecting a heating mode based on temperature. Regardless of whether the unit is configured for return air or space temperature the logic is ex-actly the same. For the rest of this discussion, the temperature in question will be referred to as the "controlling temperature."

First, the occupied and unoccupied heating set points under **Setpoints** must be configured.

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
OHSP	Occupied Heat Setpoint	55-80	dF	OHSP	68
UHSP	Unoccupied Heat Setpoint	40-80	dF	UHSP	55

Then, the heat/cool set point offsets under **Configuration→ D.LV.T** should be set. See Table 48.

Related operating modes are under **Operating Modes→ MODE**.

ITEM	EXPANSION	RANGE	CCN POINT
MODE	MODES CONTROLLING UNIT		
OCC	Currently Occupied	ON/OFF	MODEOCCP
T.C.ST	Temp.Compensated Start	ON/OFF	MODETCST

The first thing the control determines is whether the unit is in the occupied mode (**OCC**) or in the temperature compen-sated start mode (**T.C.ST**). If the unit is occupied or in tempera-ture compensated start mode, the occupied heating set point (**OHSP**) is used. In all other cases, the unoccupied heating setpoint (**UHSP**) is used.

The control will call out a low or high heat mode by comparing the controlling temperature to the heating set point and the heating set point offset. The set point offsets are used as additional help in customizing and tweaking comfort into the building space.

Table 48 — Heat/Cool Set Point Offsets

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
D.LV.T	COOL/HEAT SETPT. OFFSETS				
L.H.ON	Dmd Level Lo Heat On	-1 - 2	^F	DMDLHON	1.5
H.H.ON	Dmd Level(+) Hi Heat On	0.5 - 2.0	^F	DMDHHON	0.5
L.H.OF	Dmd Level(-) Lo Heat Off	0.5 - 2	^F	DMDLHOFF	1
L.C.ON	Dmd Level Lo Cool On	-1 - 2	^F	DMDLCON	1.5
H.C.ON	Dmd Level(+) Hi Cool On	0.5 - 2	^F	DMDHCON	0.5
L.C.OF	Dmd Level(-) Lo Cool Off	0.5 - 2	^F	DMDLCOFF	1
C.T.LV	Cool Trend Demand Level	0.1 - 5	^F	CTRENDLV	0.1
H.T.LV	Heat Trend Demand Level	0.1 - 5	^F	HTRENDLV	0.1
C.T.TM	Cool Trend Time	30 - 600	sec	CTRENDTM	120
H.T.TM	Heat Trend Time	30 - 600	sec	HTRENDTM	120

Demand Level Low Heat on Offset (**L.H.ON**) — This is the heating set point offset below the heating set point at which point Low Heat starts.

Demand Level High Heat on Offset (**H.H.ON**) — This is the heating set point offset below [the heating set point minus **L.H.ON**] at which point high heat starts.

Demand Level Low Heat Off Offset (**L.H.OF**) — This is the heating set point offset above [the heating set point minus **L.H.ON**] at which point the Low Heat mode ends.

See Fig. 7 for an example of offsets.

To enter into a LOW HEAT mode, if the controlling temperature falls below [the heating set point minus **L.H.ON**], then HVAC mode = LOW HEAT.

To enter into a HIGH HEAT mode, if the controlling temperature falls below [the heating set point minus **L.H.ON** minus **H.H.ON**], then HVAC mode = HIGH HEAT.

To get out of a LOW HEAT mode, the controlling temperature must rise above [the heating set point minus **L.H.ON** plus **L.H.OF**].

To get out of a HIGH HEAT mode, the controlling temperature must rise above [the heating set point minus **L.H.ON** plus **L.H.OF**/2].

The Run Status table in the local display allows the user to see the exact trip points for both the heating and cooling modes without doing the calculations.

Heat Trend Demand Level (**H.T.LV**) — This is the change in demand that must be seen within the time period specified by **H.T.TM** in order to hold off a HIGH HEAT mode regardless of demand. This is not applicable to VAV control types (**C.TYP**=1 and 2) in the occupied period. This technique has been referred to as "Comfort Trending." As long as a LOW HEAT mode is making progress in warming the space, the control will hold off on a HIGH HEAT mode. This is relevant for the space sensor machine control types (**C.TYP** = 5 and 6) because they may transition into the occupied mode and see an immediate and large heating demand when the set points change.

Heat Trend Time (**H.T.TM**) — This is the time period upon which the heat trend demand level (**H.T.LV**) operates and may work to hold off staging or a HIGH HEAT mode. This is not applicable to VAV control types (**C.TYP**=1 and 2) in the occupied period. See "Heat Trend Demand Level" section for more details.

HEAT MODE DIAGNOSTIC HELP — To quickly determine the current trip points for the low and high heat modes, there is a menu in the local display which lets the user quickly view the state of the system. This menu also contains the cool trip points as well. See Table 49 at the local display under **Run Status→TRIP**.

Table 49 — Mode Trip Helper Table

ITEM	EXPANSION	UNITS	CCN POINT
TRIP	MODE TRIP HELPER		
UN.C.S	Unoccup. Cool Mode Start	dF	UCCLSTRT
UN.C.E	Unoccup. Cool Mode End	dF	UCCL_END
OC.C.S	Occupied Cool Mode Start	dF	OCCLSTRT
OC.C.E	Occupied Cool Mode End	dF	OCCL_END
TEMP	Ctl.Temp RAT,SPT or Zone	dF	CTRLTEMP
OC.H.E	Occupied Heat Mode End	dF	OCHT_END
OC.H.S	Occupied Heat Mode Start	dF	OCHTSTRT
UN.H.E	Unoccup. Heat Mode End	dF	UCHT_END
UN.H.S	Unoccup. Heat Mode Start	dF	UCHTSTRT
HVAC	the current HVAC MODE		String

The controlling temperature is "*TEMP*" and is in the middle of the table for easy reference. Also, the "HVAC" mode can be viewed at the bottom of the table.

HT.CF = 1,2 (Two-Stage Gas and Electric Heat Control)

If the HVAC mode is LOW HEAT:

- If Electric Heat is configured, then the control will request the supply fan ON
- If Gas Heat is configured, then the IGC indoor fan input controls the supply fan request
- The control will turn on Heat Relay 1 (**HS1**)
- If Evaporator Discharge Temperature is less than 50 F, then the control will turn on Heat Relay 2 (**HS2**)*

If the HVAC mode is HIGH HEAT:

- If Electric Heat is configured, then the control will request the supply fan ON
- If Gas Heat is configured, then the IGC indoor fan input controls the supply fan request
- The control will turn on Heat Relay 1 (**HS1**)
- The control will turn on Heat Relay 2 (**HS2**)

*The logic for this "low heat" override is that one stage of heating will not be able to raise the temperature of the supply airstream sufficient to heat the space.
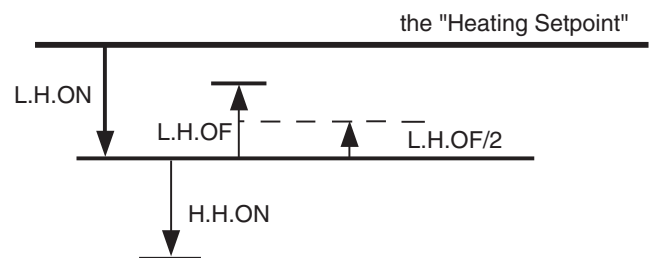
Fig. 7 — Heating Offsets

HT.CF = 3 (Staged Gas Heating Control) — As an option, the units with gas heat can be equipped with staged gas heat controls that will provide from 5 to 11 stages of heat capacity. This is intended for tempering mode and tempering economizer air when in a cooling mode and the dampers are fully closed. Tempering can also be used during a pre-occupancy purge to prevent low temperature air from being delivered to the space. Tempering for staged gas will be discussed in its own section. This section will focus on heat mode control, which ultimately is relevant to tempering, minus the consideration of the supply air heating control point.

The staged gas configurations are located at the local display under *Configuration→HEAT→SG.CF*. See Table 50.

Staged Gas Heat Type (*HT.ST*) — This configuration instructs the control how many stages and in what order are they staged.

Max Cap Change per Cycle (*CAP.M*) — This configuration limits the maximum change in capacity per PID run time cycle.

S.Gas DB Min.dF/PID Rate (*M.R.DB*) — This configuration is a deadband minimum temperature per second rate. See Staged Gas Heating logic below for more details.

St.Gas Temp.Dead Band (*S.G.DB*) — This configuration is a deadband delta temperature. See Staged Gas Heating logic below for more details.

Heat Rise in dF/Sec Clamp (*RISE*) — This configuration clamps heat staging up when the leaving-air temperature is rising too fast.

LAT Limit Config (*LAT.L*) — This configuration senses when leaving-air temperature is outside a delta temperature band around set point and allows staging to react quicker.

Limit Switch Monitoring? (*LIM.M*) — This configuration allows the operation of the limit switch monitoring routine. This should be set to NO as a limit switch temperature sensor is not used with A series units.

Limit Switch High Temp (*SW.H.T*) — This configuration is the temperature limit above which stages of heat will be shed.

Limit Switch Low Temp (*SW.L.T*) — This configuration is the temperature limit above which no additional stages of heat will be allowed.

Heat Control Prop. Gain (*HT.P*) — This configuration is the proportional term for the PID which runs in the HVAC mode LOW HEAT.

Heat Control Derv. Gain (*HT.D*) — This configuration is the derivative term for the PID which runs in the HVAC mode LOW HEAT.

Heat PID Rate Config (*HT.TM*) — This configuration is the PID run time rate.

Staged Gas Heating Logic

If the HVAC mode is HIGH HEAT:

• The supply fan for staged gas heating is controlled by the Integrated Gas Control (IGC) boards and unless the supply fan is on for a different reason, will be controlled by the IGC IFO input.
• Command all stages of heat ON

If the HVAC mode is LOW HEAT:

• The supply fan for staged gas heating is controlled by the Integrated Gas Control (IGC) boards and unless the supply fan is on for a different reason, will be controlled by the IGC IFO input.
• The unit will control stages of heat to the heating control point (*Run Status→VIEW→HT.C.P*). The heating control point in a LOW HEAT HVAC mode for staged gas is the heating supply air set point (*Setpoints→SA.HT*).

Staged Gas Heating PID Logic — The heat control loop is a PID (proportional/integral/derivative) design with exceptions, overrides and clamps. Capacity rises and falls based on set point and supply-air temperature. When the staged gas control is in Low Heat or Tempering Mode (HVAC mode), the algorithm calculates the desired heat capacity. The basic factors that govern the controlling technique are:

• how fast the algorithm is run.
• the amount of proportional and derivative gain applied.
• the maximum allowed capacity change each time this algorithm is run.
• deadband hold-off range when rate is low.

This routine is run once every "*HT.TM*" seconds. Every time the routine is run, the calculated sum is added to the control output value. In this manner, integral effect is achieved. Every time this algorithm is run, the following calculation is performed:

Error = *HT.C.P* − *LAT*
Error_last = error calculated previous time
P = *HT.P**(Error)
D = *HT.D**(Error - Error_last)

The P and D terms are overridden to zero if:

Error < *S.G.DB* AND Error > - *S.G.DB* AND D < *M.R.DB* AND D > - *M.R.DB* "P + D" are then clamped based on *CAP.M*. This sum can be no larger or no smaller than +*CAP.M* or –*CAP.M*.

Finally, the desired capacity is calculated:

Staged Gas Capacity Calculation = "P + D" + old Staged Gas Capacity Calculation

NOTE: The PID values should not be modified without approval from Carrier.

IMPORTANT: When gas or electric heat is used in a VAV application with third party terminals, the HIR relay output must be connected to the VAV terminals in the system in order to enforce a minimum heating airflow rate. The installer is responsible to ensure the total minimum heating cfm is not below limits set for the equipment. Failure to do so will result in limit switch tripping and may void warranty.

Table 50 — Staged Gas Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULTS
SG.CF	STAGED GAS CONFIGS				
HT.ST	Staged Gas Heat Type	0 - 4		HTSTGTYP	0*
CAP.M	Max Cap Change per Cycle	5 - 45		HTCAPMAX	45*
M.R.DB	S.Gas DB min.dF/PID Rate	0 - 5		HT_MR_DB	0.5
S.G.DB	St.Gas Temp. Dead Band	0 - 5	^F	HT_SG_DB	2
RISE	Heat Rise dF/sec Clamp	0.05 - 0.2	^F	HTSGRISE	0.06
LAT.L	LAT Limit Config	0 - 20	^F	HTLATLIM	10
LIM.M	Limit Switch Monitoring?	Yes/No		HTLIMMON	Yes
SW.H.T	Limit Switch High Temp	110 - 180	dF	HT_LIMHI	170*
SW.L.T	Limit Switch Low Temp	100 - 170	dF	HT_LIMLO	160*
HT.P	Heat Control Prop. Gain	0 - 1.5		HT_PGAIN	1
HT.D	Heat Control Derv. Gain	0 - 1.5		HT_DGAIN	1
HT.TM	Heat PID Rate Config	60 - 300	sec	HTSGPIDR	90

*Some configurations are model number dependent.

Staged Gas Heat Staging — Different unit sizes will control heat stages differently based on the amount of heating capacity included. These staging patterns are selected based on the model number. The selection of a set of staging patterns is controlled via the heat stage type configuration parameter (**HT.ST**). As the heating capacity rises and falls based on demand, the staged gas control logic will stage the heat relay patterns up and down, respectively. The Heat Stage Type configuration selects one of 4 staging patterns that the stage gas control will use. In addition to the staging patterns, the capacity for each stage is also determined by the staged gas heating PID control. Therefore, choosing the heat relay outputs is a function of the capacity desired, the heat staging patterns based on the heat stage type (**HT.ST**) and the capacity presented by each staging pattern. As the staged gas control desired capacity rises, it is continually checked against the capacity of the next staging pattern.

When the desired capacity is greater than or equal to the capacity of the next staging pattern, the next heat stage is selected (**Run Status→VIEW→HT.ST = Run Status→VIEW→ HT.ST** + 1). Similarly, as the capacity of the control drops, the desired capacity is continually checked against the next lower stage. When the desired capacity is less than or equal to the next lower staging pattern, the next lower heat stage pattern is selected (**Run Status→VIEW→HT.ST = Run Status→VIEW→ HT.ST** - 1). The first two staged gas heat outputs are located on the MBB board and outputs 3, 4, 5, and 6 are located on the SCB board. These outputs are used to yield from 5 to 11 stages as shown in Table 51. The heat stage selected (**Run Status→VIEW→HT.ST**) is clamped between 0 and the maximum number of stages possible (**Run Status→ VIEW→H.MAX**) for the chosen set of staging patterns. See Tables 52-55.

INTEGRATED GAS CONTROL BOARD LOGIC — All gas heat units are equipped with one or more Integrated Gas Control (IGC) boards. This board provides control for the ignition system for the gas heat sections. On size 030-050 low heat units there will be one IGC board. On size 030-050 high heat units and 060 low heat units there are two IGC boards. On size 060 high heat units there are three IGC boards. When a call for gas heat is initiated, power is sent to W on the IGC boards. For standard 2-stage heat, all boards are wired in parallel. For staged gas heat, each board is controlled separately. When energized, an LED on the IGC board will be turned on. See Table 56 for LED explanations. Each board will ensure that the rollout switch and limit switch are closed. The induced-draft motor is then energized. When the speed of the motor is proven with the Hall Effect Sensor on the motor, the ignition activation period begins. The burners ignite within 5 seconds. If the burners do not light, there is a 22-second delay before another 5-second attempt is made. If the burners still do not light, this sequence is repeated for 15 minutes. After 15 minutes have elapsed and the burners have not ignited then heating is locked out. The control will reset when the request for W (heat) is temporarily removed. When ignition occurs, the IGC board will continue to monitor the condition of the rollout switch, limit switches, Hall Effect Sensor, and the flame sensor. Forty-five seconds after ignition has occurred, the IGC will request that the indoor fan be turned on. The IGC fan output (IFO) is connected to the indoor fan input on the MBB which will indicate to the controls that the indoor fan should be turned on (if not already on). If for some reason the overtemperature limit switch trips prior to the start of the indoor fan blower, on the next attempt the 45-second delay will be shortened by 5 seconds. Gas will not be interrupted to the burners and heating will continue. Once modified, the fan delay will not change back to 45 seconds unless power is reset to the control. The IGC boards only control the first stage of gas heat on each gas valve. The second stages are controlled directly from the MBB board. The IGC board has a minimum on-time of 1 minute. In modes such as Service Test where long minimum on times are not enforced, the 1-minute timer on the IGC will still be followed and the gas will remain on for a minimum of 1 minute.

Table 51 — Staged Gas Heat

UNIT SIZE	HEAT CAPACITY	UNIT MODEL NO. POSITION NO. 5	Configuration→HEAT→SG.CF →HT.ST ENTRY VALUE
020-035	Low	S	1 = 5 STAGE
	High	T	2 = 7 STAGE
040-050	Low	S	1 = 5 STAGE
	High	T	1 = 5 STAGE
060	Low	S	4 = 11 STAGE
	High	T	3 = 9 STAGE

Table 52 — Staged Gas Heat Control Steps (Configuration→Heat→ SG.CF→HT.ST = 1)

STAGE	RELAY OUTPUT						CAPACITY %
	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	
	MBB-RLY8	MBB-RLY7	SCB-RLY1	SCB-RLY2	SCB-RLY3	SCB-RLY4	
	IGC1	MGV1	IGC2	MGV2	IGC3	MGV3	
0	OFF	OFF	OFF	OFF	OFF	OFF	0
1	ON	OFF	OFF	OFF	OFF	OFF	37
2	ON	ON	OFF	OFF	OFF	OFF	50
3	ON	OFF	ON	OFF	OFF	OFF	75
4	ON	ON	ON	OFF	OFF	OFF	87
5	ON	ON	ON	ON	OFF	OFF	100

Table 53 — Staged Gas Heat Control Steps (*Configuration→Heat→ SG.CT→HT.ST = 2*)

STAGE	RELAY OUTPUT						CAPACITY %
	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	
	MBB-RLY8	MBB-RLY7	SCB-RLY1	SCB-RLY2	SCB-RLY3	SCB-RLY4	
	IGC1	MGV1	IGC2	MGV2	IGC3	MGV3	
0	OFF	OFF	OFF	OFF	OFF	OFF	0
1	ON	OFF	OFF	OFF	OFF	OFF	25
2	ON	ON	OFF	OFF	OFF	OFF	33
3	OFF	OFF	ON	OFF	OFF	OFF	50
4	OFF	OFF	ON	ON	OFF	OFF	67
5	ON	OFF	ON	OFF	OFF	OFF	75
6	ON	ON	ON	OFF	OFF	OFF	83
7	ON	ON	ON	ON	OFF	OFF	100

Table 54 — Staged Gas Heat Control Steps (*Configuration→Heat→ SG.CT→HT.ST = 3*)

STAGE	RELAY OUTPUT						CAPACITY %
	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	
	MBB-RLY8	MBB-RLY7	SCB-RLY1	SCB-RLY2	SCB-RLY3	SCB-RLY4	
	IGC1	MGV1	IGC2	MGV2	IGC3	MGV3	
0	OFF	OFF	OFF	OFF	OFF	OFF	0
1	ON	OFF	OFF	OFF	OFF	OFF	25
2	ON	ON	OFF	OFF	OFF	OFF	33
3	ON	OFF	ON	OFF	OFF	OFF	50
4	ON	ON	ON	OFF	OFF	OFF	58
5	ON	ON	ON	ON	OFF	OFF	67
6	ON	OFF	ON	OFF	ON	OFF	75
7	ON	OFF	ON	ON	ON	OFF	83
8	ON	ON	ON	ON	ON	OFF	92
9	ON	ON	ON	ON	ON	OFF	100

Table 55 — Staged Gas Heat Control Steps (*Configuration→Heat→ SG.CT→HT.ST = 4*)

STAGE	RELAY OUTPUT						CAPACITY %
	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	
	MBB-RLY8	MBB-RLY7	SCB-RLY1	SCB-RLY2	SCB-RLY3	SCB-RLY4	
	IGC1	MGV1	IGC2	MGV2	IGC3	MGV3	
0	OFF	OFF	OFF	OFF	OFF	OFF	0
1	ON	OFF	OFF	OFF	OFF	OFF	19
2	ON	ON	OFF	OFF	OFF	OFF	25
3	ON	OFF	OFF	OFF	ON	OFF	38
4	ON	ON	OFF	OFF	ON	OFF	44
5	ON	ON	OFF	OFF	ON	ON	50
6	ON	OFF	ON	OFF	OFF	OFF	56
7	ON	ON	ON	OFF	OFF	OFF	63
8	ON	OFF	ON	OFF	ON	OFF	75
9	ON	OFF	ON	ON	ON	OFF	88
10	ON	ON	ON	ON	ON	OFF	94
11	ON	ON	ON	ON	ON	ON	100

Table 56 — IGC LED Indicators

LED INDICATION	ERROR CODE
On	Normal Operation
Off	Hardware Failure
1 Flash	Fan On/Off Delay Modified
2 Flashes	Limit Switch Fault
3 Flashes	Fame Sense Fault
4 Flashes	Five Consecutive Limit Switch Faults
5 Flashes	Ignition Lockout Fault
6 Flashes	Ignition Switch Fault
7 Flashes	Rollout Switch Fault
8 Flashes	Internal Control Fault
9 Flashes	Software Lockout

NOTES:
1. There is a 3 second pause between error code displays.
2. If more than one error code exists, all applicable error codes will be displayed in numerical sequence.
3. Error codes on the IGC will be lost if power to the unit is interrupted.

RELOCATE SAT (Supply Air Temperature) SENSOR FOR HEATING-LINKAGE APPLICATIONS — On CCN installations employing ComfortID™ terminals, the factory SAT location must be changed to a new location downstream of the unit's heating system. The ComfortID terminal controls read the SAT value for their "proof-of-heat" sequence before terminals open to Minimum Heating positions during unit heating sequence.

Determine a location in the supply duct that will provide a fairly uniform airflow. Typically this would be a minimum of 5 equivalent duct diameters downstream of the unit. Also, care should be taken to avoid placing the thermistor within a direct line-of-sight of the heating element to avoid radiant effects.

Run a new two-wire conductor cable from the control box through the low voltage conduit into the space inside the building and route the cable to the new sensor location.

Installing a New Sensor — Procure a duct-mount temperature sensor (Carrier P/N 33ZCSENPAT or equivalent 10-k ohm at 25 C NTC [negative temperature coefficient] sensor). Install the sensor through the side wall of the duct and secure.

Re-Using the Factory SAT Sensor — The factory sensor is attached to one of the supply fan housings. Disconnect the sensor from the factory harness. Fabricate a mounting method to insert the sensor through the duct wall and secure in place.

Attach the new conductor cable to the sensor leads and terminate in an appropriate junction box. Connect the opposite end inside the unit control box at the factory leads from MBB J8 terminals 11 and 12 (PNK) leads. Secure the unattached PNK leads from the factory harness to ensure no accidental contact with other terminals inside the control box.

MORNING WARM UP — Morning Warm Up is a period of time that assists CCN linkage in opening up downstream zone dampers for the first heating cycle of a day.

The Morning Warm Up Period is CCN linkage mode "2" and is relayed in the following conditions:

• Temperature Compensated Start Mode is active AND Heat Mode in effect AND LAT is warm enough or is to be ignored due to placement.

• The unit just went into occupied mode and there has been no cooling mode yet and a heat cycle occurs or was in progress when the unit went occupied.

In both cases, if and when the heat mode terminates, a heat cycle has occurred and any subsequent heat cycles will not be treated as a morning warm up period.

Static Pressure Control — Variable air volume (VAV) air-conditioning systems must provide varying amounts of air to the conditioned space. As air terminals downstream of the unit modulate their flows, the unit must simply maintain control over duct static pressure in order to accommodate the needs of the terminals, and therefore to meet the varying combined airflow requirement.

A 48/50AK,AY unit equipped with a duct pressure control system is provided with an optional variable frequency drive (VFD) for the supply fan. The speed of the fan can be controlled directly by the *Comfort*Link™ control. A transducer is used to measure duct static pressure. The signal from the transducer is received by the ECB-2 board and is then used in a PID control routine that outputs a 4 to 20 mA signal to the VFD.

Generally only VAV systems utilize static pressure control. It is required because as the system VAV terminals modulate closed when less air is required, there must be a means of controlling airflow from the unit, thereby effectively preventing overpressurization and its accompanying problems.

The three most fundamental configurations for most applications are *Configuration→SP→SP.CF*, which is the static pressure control type, *Configuration→SP→SP.S*, used to enable the static pressure sensor, and *Configuration→SP →SP.SP*, the static pressure set point to be maintained.

OPERATION — On units equipped with a VFD and a proper static pressure sensor, when *SP.CF*, *SP.S* and *SP.SP* are configured, a PID routine periodically measures the duct static pressure and calculates the error from set point. This error at any point in time is simply the duct static pressure set point minus the measured duct static. The error becomes the basis for the Proportional term of the PID. The routine also calculates the integral of the error over time, and the derivative (rate of change) of the error. A value is calculated as a result of this PID routine, and this value is then used to create an output signal used to adjust the VFD to maintain the static pressure set point.

Static pressure reset is the ability to force a lowering of the static pressure set point through an external control signal. Explained in detail further below, the control supports this in two separate ways; through a 4 to 20 mA signal input wired to the unit's isolator board input terminals (thereby facilitating third party control), or via CCN.

In the latter case, this feature leverages the communications capabilities of VAV systems employing ComfortID™ terminals under linkage. The system dynamically determines and maintains an optimal duct static pressure set point based on the actual load conditions in the space. This can result in a significant reduction in required fan energy by lowering the set point to only the level required to maintain adequate airflow throughout the system.

SETTING UP THE SYSTEM — The options for static pressure control are found under the Local Display Mode *Configuration→SP*. See Table 57.

Table 57 — Static Pressure Control Configuration

ITEM	TEXT DESCRIPTION	RANGE	UNITS	CCN POINT	DEFAULT
SP	SUPPLY STATIC PRESS.CFG.				
SP.CF	Static Pres. VFD Control?	0, 1		STATICFG	0*
SP.FN	Static Pres. Fan Control?	Yes/No		STATPFAN	Yes*
SP.S	Static Pressure Sensor	Enable/Disable		SPSENS	Disable*
SP.LO	Static Press. Low Range	−10 - 0	in. W.C.	SP_LOW	0
SP.HI	Static Press. High Range	0 - 10	in. W.C.	SP_HIGH	5
SP.SP	Static Pressure Setpoint	0 - 5	in. W.C.	SPSP	1.5
SP.MN	VFD Minimum Speed	10 - 50	%	STATPMIN	20
SP.MX	VFD Maximum Speed	50 - 100	%	STATPMAX	100
SP.FS	VFD Fire Speed Override	0 - 100	%	STATPFSO	100
S.PID	STAT.PRESS.PID CONFIGS				
SP.TM	Static Press. PID Run Rate	1 - 200	sec	SPIDRATE	2
SP.P	Static Press. Prop. Gain	0 - 100		STATP_PG	20
SP.I	Static Press. Intg. Gain	0 - 50		STATP_IG	2
SP.D	Static Press. Derv. Gain	0 - 50		STATP_DG	0
SP.SG	Static Press. System Gain	0 - 50		STATP_SG	1.0

*Some defaults are model number dependent.

Static Pressure Configuration (**SP.CF**) — This variable is used to configure the use of *Comfort*Link™ control for static pressure control. It has the following options:

0 (None) — No static pressure control by *Comfort*Link control. This would be used for a constant volume (CV) application when static pressure control is not required or for a VAV application if there will be third-party control of the VFD or IGV. In this latter case, a suitable means of control must be field installed.

1 (VFD Control) — This will enable the use of *Comfort*Link for static pressure control via a supply fan VFD.

Static Pressure Fan Control? (**SP.FN**) — This is automatically set to Yes when **SP.CF** = VFD Control. When the user would like the 4 to 20 mA output to trigger a VFD on, as opposed to the fan relay, **SP.FN** may be set to Yes when **SP.CF** = none. When the control turns the fan ON, the control will send an "**SP.MX**"% of the 4 to 20 mA signal to the third party VFD control.

Static Pressure Sensor (**SP.S**) — This variable enables the use of a supply duct static pressure sensor. This must be enabled to use *Comfort*Link control for static pressure control. If using a third-party control for the VFD, this should be disabled.

Static Pressure Low Range (**SP.LO**) — This is the minimum static pressure that the sensor will measure. For most sensors this will be 0 in. wg. The *Comfort*Link control will map this value to a 4 mA sensor input.

Static Pressure High Range (**SP.HI**) — This is the maximum static pressure that the sensor will measure. Commonly this will be 5 in. wg. The *Comfort*Link control will map this value to a 20 mA sensor input.

Static Pressure Set Point (**SP.SP**) — This is the static pressure control point. It is the point against which the *Comfort*Link control compares the actual measured supply duct pressure for determination of the error that is used for PID control. Generally one would set **SP.SP** to the minimum value necessary for proper operation of air terminals in the conditioned space at all load conditions. Too high of a value will cause unnecessary fan motor power consumption at part-load conditions and/or noise problems. Too low a value will result in insufficient airflow. Additional information will be found on page 49, under Static Pressure Reset.

VFD Minimum Speed (**SP.MN**) — This is the minimum speed for the supply fan VFD. Typically the value is chosen to maintain a minimum level of ventilation.

NOTE: Most VFDs have a built-in minimum speed adjustment which must be configured for 0% when using *Comfort*Link control for static pressure control.

VFD Maximum Speed (**SP.MX**) — This is the maximum speed for the supply fan VFD. This is usually set to 100%.

VFD Fire Speed Override (**SP.FS**) — This is the speed that the supply fan VFD will use during the fire modes; pressurization, evacuation and purge. This is usually set to 100%.

Static Pressure PID Config (**S.PID**) — Static pressure PID configuration can be accessed under this heading in the *Configuration→SP* submenu. Under most operating conditions the control PID factors will not require any adjustment and the factory defaults should be used. If persistent static pressure fluctuations are detected, small changes to these factors may improve performance. Decreasing the factors generally reduce the responsiveness of the control loop, while increasing the factors increase its responsiveness. Note the existing settings before making changes, and seek technical assistance from Carrier before making significant changes to these factors.

*Static Pressure PID Run Rate (**S.PID→SP.TM**)* — This is the number of seconds between duct static pressure readings taken by the *Comfort*Link PID routine.

*Static Pressure Proportional Gain (**S.PID→SP.P**)* — This is the proportional gain for the static pressure control PID control loop.

*Static Pressure Integral Gain (**S.PID→SP.I**)* — This is the integral gain for the static pressure control PID control loop.

*Static Pressure Derivative Gain (**S.PID→SP.D**)* — This is the derivative gain for the static pressure control PID control loop.

STATIC PRESSURE RESET — The configuration for Static Pressure Reset is found under *Configuration→Unit*.

ITEM	EXPANSION	RANGE	CCN POINT	DEFAULT
→SENS→SP.RS	Static Press. Reset Sensor.	Enable/Disable	SPRSTSEN	Disable

Static Pressure Reset Sensor (**SP.RS**) — If the outdoor air quality sensor is not configured (**Configuration→IAQ →AQ.CF→OQ.A.C**=0), then it is possible to use the outdoor air quality sensor location on the CEM board to perform static pressure reset via an external 4 to 20 mA input. Enabling this sensor will give the user the ability to reset from 0 to 3-in. wg of static pressure. The reset will apply to the supply static pressure set point (**Configuration→SP→SP.SP**), where 4 mA = 0-in. wg and 20 mA = 3-in. wg.

As an example, the static pressure reset input is measuring 6 mA, and the input is resetting 2 mA of its 16 mA control range. The 4 to 20 mA range corresponds directly to the 0 to 3 in. wg of reset. Therefore 2 mA reset is 2/16 * 3-in. wg = 0.375-in. wg of reset. If the static pressure set point (**SP.SP**) = 1.5-in. wg, then the static pressure control point for the system will be reset 1.5 – 0.375 = 1.125-in. wg.

For third party 4 to 20 mA SP reset, wire the input to the CEM using TB6-11 and 12.

Operation — The *Comfort*Link™ controls support the use of static pressure reset. For static pressure reset to occur, the unit must be part of a CCN system with access to CCN reset variable and the Linkage Master terminal system logic. The Linkage Master terminal monitors the primary air damper position of all the terminals in the system (done through LINKAGE with the new ComfortID™ air terminals).

The Linkage Master then calculates the amount of supply static pressure reduction necessary to cause the most open damper in the system to open more than the minimum value (60%) but not more than the maximum value (90% or negligible static pressure drop). This is a dynamic calculation, which occurs every two minutes whenever the system is operating. The calculation ensures that the supply static pressure is always enough to supply the required airflow at the worst case terminal but never more than necessary, so that the primary air dampers do not have to operate with an excessive pressure drop (more than required to maintain the airflow set point of each individual terminal in the system).

As the system operates, if the most open damper opens more than 90%, the system recalculates the pressure reduction variable and the value is reduced. Because the reset value is subtracted from the controlling set point at the equipment, the pressure set point increases and the primary air dampers close a little (to less than 90%). If the most open damper closes to less than 60%, the system recalculates the pressure reduction variable and the value is increased. This results in a decrease in the controlling set point at the equipment, which causes the primary air dampers to open a little more (to greater than 60%).

The rooftop unit has the static pressure set point programmed into the CCN control. This is the maximum set point that could ever be achieved under any condition. To simplify the installation and commissioning process for the field, this system control is designed so that the installer only needs to enter a maximum duct design pressure or maximum equipment pressure, whichever is less. There is no longer a need to calculate the worst case pressure drop at design conditions and then hope that some intermediate condition does not require a higher supply static pressure to meet the load

conditions. For example, a system design requirement may be 1.2 in. wg, the equipment may be capable of providing 3.0 in. wg and the supply duct is designed for 5.0 in. wg. In this case, the installer could enter 3.0 in. wg as the supply static pressure set point and allow the air terminal system to dynamically adjust the supply duct static pressure set point as required.

The system will determine the actual set point required delivering the required airflow at every terminal under the current load conditions. It will always be the lowest value under the given conditions, and as the conditions and airflow set point at each terminal change throughout the operating period, and so will the equipment static pressure set point.

The CCN system must have access to a CCN variable (SPRESET which is part of the equipment controller). In the algorithm for static pressure control, the SPRESET value is always subtracted from the configured static pressure set point by the equipment controller. The SPRESET variable is always checked to be a positive value or zero only (negative values are limited to zero). The result of the subtraction of the SPRESET variable from the configured set point is limited so that it cannot be less than zero. The result is that the system will dynamically determine the required duct static pressure based on the actual load conditions currently in the space. It eliminates the need to calculate the design supply static pressure set point. It also saves the energy that is the difference between the design static pressure set point and the required static pressure.

Third party 4 to 20 mA input — It is also possible to perform static pressure reset via an external 4 to 20 mA signal connected to the CEM board where 4 mA corresponds to 0 in. wg reset and 20 mA corresponds to 3 in. wg of reset. Please note that the static pressure 4 to 20 mA input shares the same input as the analog OAQ sensor. Therefore, both sensors cannot be used at the same time. To enable the static pressure reset 4 to 20 mA sensor, set (**Configuration→UNIT→SENS→SP.RS**) to Enabled.

RELATED POINTS — These points represent static pressure control and static pressure reset inputs and outputs. See Table 58.

Static Pressure mA (**SP.M**) — This variable reflects the value of the static pressure sensor signal received by the *Comfort*Link control. It may in some cases be helpful in troubleshooting.

Static Pressure mA Trim (**SP.M.T**) — This input allows a modest amount of trim to the 4 to 20 mA static pressure transducer signal, and can be used to calibrate a transducer.

Static Pressure Reset mA (**SP.R.M**) — This input reflects the value of a 4 to 20 mA static pressure reset signal applied to TB6 terminals 9 and 10 on the CEM board, from a third party control system.

Static Pressure Reset (**SP.RS**) — This variable reflects the value of a static pressure reset signal applied from a CCN system. The means of applying this reset is by forcing the value of the variable SPRESET through CCN.

Supply Fan VFD Speed (**S.VFD**) — This output can be used to check on the actual speed of the VFD. This may be helpful in some cases for troubleshooting.

Table 58 — Static Pressure Reset Related Points

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
Inputs					
→ **4-20** → **SP.M**	Static Pressure mA	4-20	mA	SP_MA	
→ **4-20** → **SP.M.T**	Static Pressure mA Trim	-2.0 - +2.0	mA	SPMATRIM	
→ **4-20** →**SP.R.M**	Static Pressure Reset mA	4-20	mA	SPRST_MA	0.0
→ **RSET** →**SP.RS**	Static Pressure Reset	0.0-3.0	in. wg	SPRESET	0.0
Outputs					
→ **Fans** → **S.VFD**	Supply Fan VFD Speed	0-100	%	SFAN_VFD	

Fan Status Monitoring

GENERAL — The A Series *Comfort*Link™ controls offer the capability to detect a failed supply fan through either a duct static pressure transducer or an accessory discrete switch. The fan status switch is an accessory that allows for the monitoring of a discrete switch, which trips above a differential pressure drop across the supply fan. For any unit with a factory-installed duct static pressure sensor, it is possible to measure duct pressure rise directly, which removes the need for a differential switch. All 48/50AK,AW units with a factory-installed supply fan VFD will have the duct static pressure sensor as standard.

SETTING UP THE SYSTEM — The fan status monitoring configurations are located in *Configuration→UNIT*. See Table 59.

Table 59 — Fan Status Monitoring Configuration

ITEM	EXPANSION	RANGE	CCN POINT
SFS.S	Fan Fail Shuts Down Unit	Yes/No	SFS_SHUT
SFS.M	Fan Stat Monitoring Type	0 - 2	SFS_MON

Fan Stat Monitoring Type (*SFS.M*) — This configuration selects the type of fan status monitoring to be performed.

0 - NONE — No switch or monitoring
1 - SWITCH — Use of the fan status switch
2 - SP RISE — Monitoring of the supply duct pressure.

Fan Fail Shuts Down Unit (*SFS.S*) — This configuration will configure the unit to shut down on a supply fan status fail or simply alert the condition and continue to run. When configured to YES, the control will shut down the unit if supply fan status monitoring fails and send out an alarm. If set to NO, the control will not shut down the unit if supply fan status monitoring fails but send out an alert.

SUPPLY FAN STATUS MONITORING LOGIC — Regardless of whether the user is monitoring a discrete switch or is monitoring static pressure, the timings for both techniques are the same and rely upon the configuration of static pressure control. The configuration that determines static pressure control is *Configuration→SP→SP.CF*. If this configuration is set to 0 (none), a fan failure condition must wait 60 continuous seconds before taking action. If this configuration is 1 (VFD), a fan failure condition must wait 3 continuous minutes before taking action.

If the unit is configured to monitor a fan status switch (*SFS.M* = 1), and if the supply fan commanded state does not match the supply fan status switch for 3 continuous minutes, then a fan status failure has occurred.

If the unit is configured for supply duct pressure monitoring (*SFS.M* = 2), then

- If the supply fan is requested ON and the static pressure reading is not greater than 0.2 in. wg for 3 continuous minutes, a fan failure has occurred.
- If the supply fan is requested OFF and the static pressure reading is not less than 0.2-in. wg for 3 continuous minutes, a fan failure has occurred.

Dirty Filter Switch — The unit can be equipped with a field-installed accessory dirty filter switch. The switch is located in the filter section. If a dirty filter switch is not installed, the switch input is configured to read "clean" all the time.

To enable the sensor for dirty filter monitoring set *Configuration→UNIT→SENS→FLT.S* to ENABLE. The state of the filter status switch can be read at *Inputs→GEN.I→FLT.S*. See Table 60.

Table 60 — Dirty Filter Switch Points

ITEM	EXPANSION	RANGE	CCN POINT
Configuration→UNIT →SENS→FLT.S	Filter Stat.Sw.Enabled ?	Enable/ Disable	FLTS_ENA
Inputs→GEN.I →FLT.S	Filter Status Input	DRTY/CLN	FLTS

Monitoring of the filter status switch is disabled in the Service Test mode and when the supply fan is not commanded on. If the fan is on and the unit is not in a test mode and the filter status switch reads "dirty" for 2 continuous minutes, an alert is generated. Recovery from this alert is done through a clearing of all alarms or after cleaning the filter and the switch reads "clean" for 30 seconds.

NOTE: The filter switch should be adjusted to allow for the operating cfm and the type of filter. Refer to the accessory installation instructions for information on adjusting the switch.

Economizer — The Economizer Control is used to manage the outside and return air dampers of the unit to provide ventilation air as well as free cooling based on several configuration options. This section contains a description of the economizer and its ability to provide free cooling. See the section on Indoor Air Quality for more information on setting up and using the economizer to perform demand controlled ventilation (DCV). See the Third Party Control section for a description on how to take over the operation of the economizer through external control.

The economizer system also permits this unit to perform smoke control functions based on external control switch inputs. Refer to the Smoke Control Modes section for detailed discussions.

Economizer control can be based on automatic control algorithms using unit-based set points and sensor inputs. This economizer control system can also be managed through external logic systems.

The economizer system is a factory-installed option. This unit can also have the following devices installed to enhance economizer control:

- Outside air humidity sensor
- Return air humidity sensor

NOTE: All these options require the Controls Expansion Module (CEM).

SETTING UP THE SYSTEM — The economizer configuration options are under the Local Display Mode *Configuration→ECON*. See Table 61.

Economizer Installed? (*EC.EN*) — If an economizer is not installed or is to be completely disabled the configuration option *EC.EN* may be set to No. Otherwise in the case of an installed economizer, this option must be set to Yes.

Economizer Minimum Position (*EC.MN*) — The configuration option *EC.MN* is the economizer minimum position. See the section on Indoor Air Quality for further information on how to reset the economizer further to gain energy savings and to more carefully monitor IAQ problems.

Economizer Maximum Position (*EC.MX*) — The upper limit of the economizer may be limited by setting *EC.MX*. It defaults to 98% to avoid problems associated with slight changes in the economizer damper's end stop over time. Typically this will not need to be adjusted.

Table 61 — Economizer Configuration Table

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
EC.EN	Economizer Installed?	Yes/No		ECON_ENA	Yes
EC.MN	Economizer Min.Position	0 - 100	%	ECONOMIN	5
EC.MX	Economizer Max.Position	0 - 100	%	ECONOMAX	98
E.TRM	Economzr Trim For SumZ ?	Yes/No		ECONTRIM	Yes
E.SEL	Econ ChangeOver Select	0 - 3		ECON_SEL	0
OA.E.C	OA Enthalpy ChgOvr Selct	1 - 5		OAEC_SEL	4
OA.EN	Outdr.Enth Compare Value	18 - 28		OAEN_CFG	24
OAT.L	High OAT Lockout Temp	-40 - 120	dF	OAT_LOCK	60
O.DEW	OA Dewpoint Temp Limit	50 - 62	dF	OADEWCFG	55
ORH.S	Outside Air RH Sensor	Enable/Disable		OARHSENS	Disable
E.TYP	Economizer Control Type	1 - 3		ECON_CTL	1
E.SW	Economizer Switch Config	0 - 2		ECOSWCFG	0
E.CFG	ECON.OPERATION CONFIGS				
E.P.GN	Economizer Prop.Gain	0.7 - 3.0		EC_PGAIN	1
E.RNG	Economizer Range Adjust	0.5 - 5	^F	EC_RANGE	2.5
E.SPD	Economizer Speed Adjust	0.1 - 10		EC_SPEED	0.75
E.DBD	Economizer Deadband	0.1 - 2	^F	EC_DBAND	0.5
UEFC	UNOCC.ECON.FREE COOLING				
FC.CF	Unoc Econ Free Cool Cfg	0-2		UEFC_CFG	0
FC.TM	Unoc Econ Free Cool Time	0 - 720	min	UEFCTIME	120
FC.L.O	Un.Ec.Free Cool OAT Lock	40 - 70	dF	UEFCNTLO	50

Economizer Trim for Sum Z? (*E.TRM*) — Sum Z is the adaptive cooling control algorithm used for multiple stages of mechanical cooling capacity. The configuration option, *E.TRM* is typically set to Yes, and allows the economizer to modulate to the same control point (Sum Z) that is used to control capacity staging. The advantage is lower compressor cycling coupled with tighter temperature control. Setting this option to No will cause the economizer, if it is able to provide free cooling, to open to the Economizer Max. Position (*EC.MX*) during mechanical cooling.

ECONOMIZER OPERATION — There are four potential elements which are considered concurrently which determine whether the economizer is able to provide free cooling:

1. Dry bulb changeover (outside-air temperature qualification)
2. Economizer switch (discrete control input monitoring)
3. Economizer changeover select (*E.SEL* economizer changeover select configuration option)
4. Outdoor dewpoint limit check (requires an installed outdoor relative humidity sensor installed)

Dry Bulb Changeover — Outside-air temperature may be viewed under *Temperatures→AIR.T→OAT*. The control constantly compares its outside-air temperature reading against the high temperature OAT lockout (*OAT.L*). If the temperature reads above *OAT.L*, the economizer will not be allowed to perform free cooling.

Economizer Switch — The state of the economizer switch can be viewed under *Inputs→GEN.I→E.SW*. The function of this input is determined by *Configuration →ECON→EC.SW.*

When set to *EC.SW = 0*, the switch is disabled. When set to *EC.SW = 1*, the economizer switch functions to enable/disable the economizer. When set to *EC.SW = 2*, the switch functions as an IAQ override switch. This functions just like the discrete IAQ input *Inputs→AIR.Q→IAQ.I* when *Configuration →IAQ→AQ.CF→IQ.I.C=2* (IAQ Discrete Override). See the Indoor Air Quality Control section for more information.

When *Configuration→ECON→EC.SW=1* and *Inputs→GEN.I→E.SW = No*, free cooling will not be allowed.

ECONOMIZER CHANGEOVER SELECT (*E.SEL*) — The control is capable of performing any one of the following changeover types in addition to both the dry bulb lockout and the external switch enable input:

E.SEL = 0   none
E.SEL = 1   Differential Dry Bulb Changeover
E.SEL = 2   Outdoor Enthalpy Changeover
E.SEL = 3   Differential Enthalpy Changeover

Differential Dry Bulb Changeover — As both return air and outside air temperature sensors are installed as standard on these units, the user may select this option, *E.SEL* = 1, to perform a qualification of return and outside air in the enabling/disabling of free cooling. If this option is selected and outside-air temperature is greater than return-air temperature, free cooling will not be allowed.

Outdoor Enthalpy Changeover — This option should be used in climates with higher humidity conditions. The A Series control can use an enthalpy switch or enthalpy sensor, or the standard installed outdoor dry bulb sensor and an accessory relative humidity sensor to calculate the enthalpy of the air.

Setting *Configuration→ECON→E.SEL* = 2 requires that the user configure *Configuration→ECON→OA.E.C*, the Outdoor Enthalpy Changeover Select, and install an outdoor relative humidity sensor. Once the sensor is installed, enable *Configuration→ECON→ORH.S*, the outdoor relative humidity sensor configuration option.

If the user selects one of the Honeywell curves, A,B,C or D, then *OA.E.C* options 1-4 should be selected. See Fig. 8 for a diagram of these curves on a psychrometric chart.

OA.E.C = 1   Honeywell A Curve
OA.E.C = 2   Honeywell B Curve
OA.E.C = 3   Honeywell C Curve
OA.E.C = 4   Honeywell D Curve
OA.E.C = 5   custom enthalpy curve

If the user selects *OA.E.C* = 5, a direct compare of outdoor enthalpy versus an enthalpy set point is done. This outdoor enthalpy set point limit is configurable, and is called *Configuration→ECON→OA.EN*.

Depending on what *Configuration→ECON→OA.E.C* is configured for, if the outdoor enthalpy exceeds the Honeywell curves or the outdoor enthalpy compare value (*Configuration →ECON→OA.EN)*, then free cooling will not be allowed.

Differential Enthalpy Changeover — This option compares the outdoor-air enthalpy to the return air enthalpy and chooses the option with the lowest enthalpy. This option should be used in climates with high humidity conditions. This option uses both humidity sensors and dry bulb sensors to calculate the enthalpy of the outdoor and return air. An accessory outdoor air humidity sensor (*ORH.S*) and return air humidity sensor (*RRH.S*) are used. The outdoor air relative humidity sensor config (*ORH.S*) and return air humidity sensor config (*Configuration→SENS→RRH.S*) must be enabled.
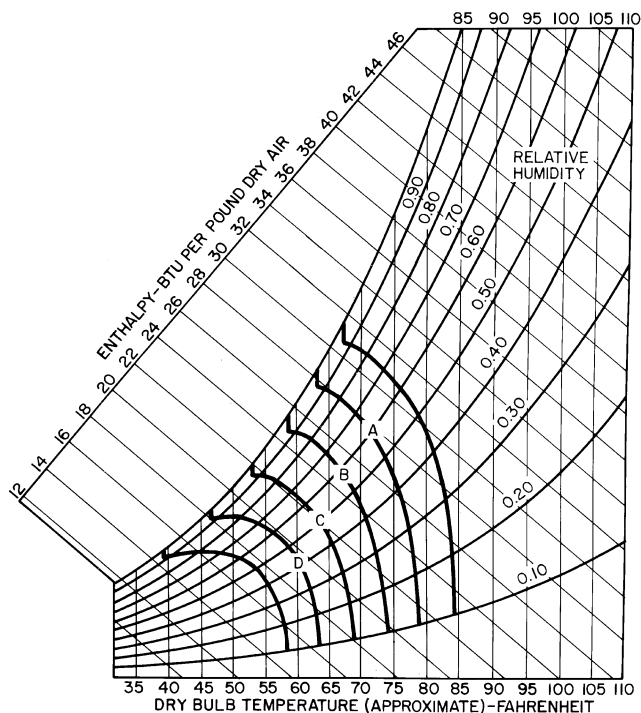
CONTROL CURVE	CONTROL POINT (approx Deg) AT 50% RH
A	73
B	68
C	63
D	58

Fig. 8 — Psychrometric Chart for Enthalpy Control

Outdoor Dewpoint Limit Check — If an outdoor relative humidity sensor is installed, the control is able to calculate the outdoor air dewpoint temperature and will compare this temperature against the outside air dewpoint temperature limit configuration (*Configuration→ECON→O.DEW*). If the outdoor air dewpoint temperature is greater than *O.DEW*, free cooling will not be allowed. Fig. 9 shows a horizontal limit line in the custom curve of the psychrometric chart. This is the outdoor air dewpoint limit boundary.

Custom Psychrometric Curves — Refer to the psychrometric chart and the standard Honeywell A-D curves in Fig. 8. The curves start from the bottom and rise vertically, angle to the left and then fold over. This corresponds to the limits imposed by dry bulb changeover, outdoor enthalpy changeover and outdoor dewpoint limiting respectively. Therefore, it is now possible to create any curve desired with the addition of one outdoor relative humidity sensor and the options for changeover now available. See Fig. 9 for an example of a custom curve constructed on a psychrometric chart.

UNOCCUPIED ECONOMIZER FREE COOLING — This Free Cooling function is used to start the supply fan and use the economizer to bring in outside air when the outside temperature is cool enough to pre-cool the space. This is done to delay the need for mechanical cooling when the system enters the occupied period. This function requires the use of a space temperature sensor.

When configured, the economizer will modulate during an unoccupied period and attempt to maintain space temperature to the occupied cooling set point. Once the need for cooling has been satisfied during this cycle, the fan will be stopped.

Configuring the economizer for Unoccupied Economizer Free Cooling is done in the *UEFC* group. There are three configuration options, *FC.CF, FC.TM* and *FC.LO*.

Unoccupied Economizer Free Cooling Configuration (*FC.CF*) — This option is used to configure the type of unoccupied economizer free cooling control that is desired.

0 = disable unoccupied economizer free cooling

1 = perform unocc. economizer free cooling as available during the entire unoccupied period.

2 = perform unocc. economizer free cooling as available, *FC.TM* minutes before the next occupied period.

Unoccupied Economizer Free Cooling Time Configuration (*FC.TM*) — This option is a configurable time period, prior to the next occupied period, that the control will allow unoccupied economizer free cooling to operate. This option is only applicable when *FC.CF* = 2.

Unoccupied Economizer Free Cooling Outside Lockout Temperature (*FC.LO*) — This configuration option allows the user to select an outside-air temperature below which unoccupied free cooling is not allowed. This is further explained in the logic section.

Unoccupied Economizer Free Cooling Logic — The following qualifications that must be true for unoccupied free cooling to operate:

• Unit configured for an economizer
• Space temperature sensor enabled and sensor reading within limits
• Unit in the unoccupied mode
• *FC.CF* set to 1 or *FC.CF* set to 2 and control is within *FC.TM* minutes of the next occupied period
• Not in the Temperature Compensated Start Mode
• Not in a cooling mode
• Not in a heating mode
• Not in a tempering mode
• Outside-air temperature sensor reading within limits
• Economizer would be allowed to cool if the fan were requested and in a cool mode
• OAT > *FC.LO* (1.0° F hysteresis applied)
• Unit not in a fire smoke mode
• No fan failure when configured to for unit to shut down on a fan failure

If all of the above conditions are satisfied:

Unoccupied Economizer Free Cooling will start when both of the following conditions are true:

$\{SPT > (OCSP + 2)\}$ **AND** $\{SPT > (OAT + 8)\}$

The Unoccupied Economizer Free Cooling Mode will stop when either of the following conditions are true:

$\{SPT < OCSP\}$ **OR** $\{SPT < (OAT + 3)\}$ where SPT = Space Temperature and OCSP = Occupied Cooling Set Point.

When the Unoccupied Economizer Free Cooling mode is active, the supply fan is turned on and the economizer damper modulated to control to the supply air set point (*Setpoints→SASP*) plus any supply air reset that may be applied (*Inputs→RSET→SA.S.R*).

ECONOMIZER OPERATION CONFIGURATION — The configuration items in the *E.CFG* menu group affect how the economizer modulates when attempting to follow an economizer cooling set point. Typically, they will not need adjustment. In fact, it is strongly advised not to adjust these configuration items from their default settings without first consulting a service engineering representative.

In addition, the economizer cooling algorithm is designed to automatically slow down the economizer actuator's rate of travel as outside air temperature decreases.
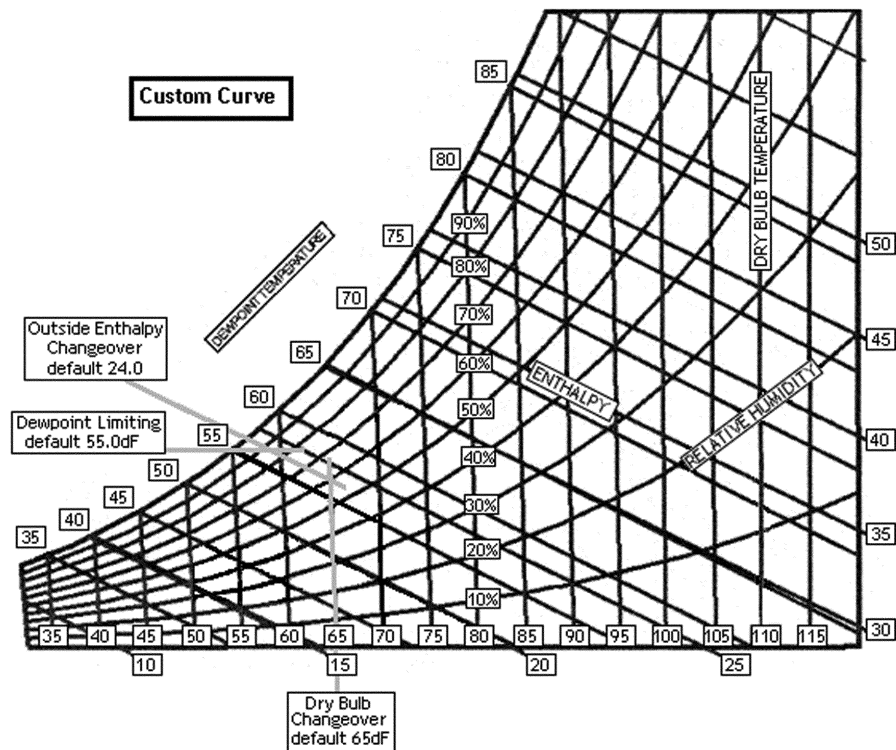
Fig. 9 — Custom Changeover Curve Example

ECONOMIZER DIAGNOSTIC HELP — Because there are so many conditions which might disable the economizer from being able to provide free cooling, the control has a display table to identify these potentially disabling sources. The user can check *ACTV*, the "Economizer Active" flag. If this flag is set to Yes there is no reason to check *DISA* (Economizer Disabling Conditions). If the flag is set to No, this means that at least one or more of the flags under the group *DISA* are set to Yes and the user can discover what is preventing the economizer from performing free cooling by checking the table.

The economizer's reported and commanded positions are also viewable, as well as outside air temperature, relative humidity, enthalpy and dew point temperature.

The following information can be found under the Local Display Mode *Run Status→ECON*. See Table 62.

Economizer Control Point Determination Logic — Once the economizer is allowed to provide free cooling, the economizer must determine exactly what set point it should try to maintain. The set point the economizer attempts to maintain when "free cooling" is located at *Run Status→VIEW→EC.C.P*. This is the economizer control point.

The control selects set points differently, based on the control type of the unit. This control type can be found at *Configuration→UNIT→C.TYP*. There are 6 types of control.

C.TYP = 1   VAV-RAT
C.TYP = 2   VAV-SPT
C.TYP = 3   TSTAT Multi-Staging
C.TYP = 4   TSTAT 2 Stage
C.TYP = 5   SPT Multi-Staging
C.TYP = 6   SPT 2 Stage

If the economizer is not allowed to do free cooling, then *EC.C.P* = 0.

If the economizer is allowed to do free cooling and the Unoccupied Free Cooling Mode is ON, then *EC.C.P = Setpoints→SASP + Inputs→RSET→SA.S.R*.

If the economizer is allowed to do free cooling and the Dehumidification mode is ON, then *EC.C.P* = the Cooling Control Point (*Run Status→VIEW→CL.C.P*).

If the *C.TYP* is either 4 or 6, and the unit is in a cool mode, then

If Stage = 0   *EC.C.P* = the Cooling Control Point (*Run Status→VIEW→CL.C.P*)

If Stage = 1   53.0 + economizer suction pressure reset (see below)

If Stage = 2   48.0 + economizer suction pressure reset (see below)

NOTE: To check the current cooling stage go to *Run Status→Cool→CUR.S*.

If the *C.TYP* is either 1,2,3 or 5, and the unit is in a cool mode, then *EC.C.P* = the Cooling Control Point (*Run Status→VIEW→CL.C.P*).

Economizer Suction Pressure Reset for Two-Stage Cooling — If the unit's control type is set to either 2-stage thermostat or 2-stage space temperature control, then there is no cooling control point. Stages 1 and 2 are brought on based on demand, irrespective of the evaporator discharge temperature. In this case, the economizer monitors suction pressure and resets the economizer control point accordingly in order to protect the unit from freezing. For those conditions when the economizer opens up fully but is not able to make set point, and then a compressor comes on, it is conceivable that the coil might freeze. This can be indirectly monitored by checking suction pressure. Rather than fail a circuit, the control will attempt to protect the unit by resetting the economizer control point until the suction pressure rises out of freezing conditions.

If either circuit's suction pressure drops to within 5 psig of the low suction pressure trip point, the control will start adding reset to the economizer control point if it is active. It will be possible to reset the control point upwards, 10 degrees (2 degrees per psig), between the low suction pressure trip point of 48 psig and 5 psig above it. If this does not work, and if the suction pressure drops below the trip point, then the control will further reset the control point 1 degree every 15 seconds up to a maximum of 10 degrees. The resulting effect will be to warm up the mixed air entering the evaporator, thereby raising the suction pressure.

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Table 62 — Economizer Run Status Table

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
ECN.P	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS	
ECN.C	Economizer Act.Cmd.Pos.	0-100	%	ECONOCMD	forcible
ACTV	Economizer Active ?	YES/NO		ECACTIVE	
DISA	ECON DISABLING CONDITIONS				
UNVAV	Econ Act. Unavailable?	YES/NO		ECONUNAV	
R.EC.D	Remote Econ. Disabled?	YES/NO		ECONDISA	
DBC	DBC - OAT Lockout?	YES/NO		DBC_STAT	
DEW	DEW - OA Dewpt.Lockout?	YES/NO		DEW_STAT	
DDBC	DDBD- OAT > RAT Lockout?	YES/NO		DDBCSTAT	
OAEC	OAEC- OA Enth Lockout?	YES/NO		OAECSTAT	
DEC	DEC - Diff.Enth.Lockout?	YES/NO		DEC_STAT	
EDT	EDT Sensor Bad?	YES/NO		EDT_STAT	
OAT	OAT Sensor Bad ?	YES/NO		OAT_STAT	
FORC	Economizer Forced ?	YES/NO		ECONFORC	
SFON	Supply Fan Not On 30s ?	YES/NO		SFONSTAT	
CLOF	Cool Mode Not In Effect?	YES/NO		COOL_OFF	
OAQL	OAQ Lockout in Effect ?	YES/NO		OAQLOCKD	
HELD	Econ Recovery Hold Off?	YES/NO		ECONHELD	
O.AIR	OUTSIDE AIR INFORMATION				
OAT	Outside Air Temperature		dF	OAT	forcible
OA.RH	Outside Air Rel. Humidity		%	OARH	forcible
OA.E	Outside Air Enthalpy			OAE	
OA.D.T	Outside Air Dewpoint Temp		dF	OADEWTMP	

Building Pressure Control — This control sequence provides control of the building pressure through the modulating flow rate function of the modulating power exhaust option. This function also provides control of the constant volume 2-stage power exhaust option.

BUILDING PRESSURE CONFIGURATION — The building pressure configurations are found at the local display under *Configuration→BP*. See Table 63.

Building Pressure Config (*BP.CF*) — This configuration selects the type of building pressure control.

- *BP.CF* = 0, No building pressure control
- *BP.CF* = 1, constant volume two-stage exhaust based on economizer position
- *BP.CF* = 2, Modulating building pressure control

Power Exhaust Motors (*BP.MT*) — This configuration is machine dependent and instructs the building pressure control algorithm as to whether the unit has 4 or 6 motors to control. The motors are controlled by three power exhaust relays A, B, and C. These relay outputs are located at the local display under *Outputs→FANS→PE.A,B,C*.

The following table illustrates the number of motors each relay is in control of based on *BP.MT*:

BP.MT	PE_A Relay	PE_B Relay	PE_C Relay
1 (4 motors)	1 Motor	2 Motors	1 Motor
2 (6 motors)	1 Motor	2 Motors	3 Motors

Building Pressure Sensor (*BP.S*) — This configuration allows the reading of a building pressure sensor when enabled. This is automatically enabled when *BP.CF* = 2.

Building Pressure (+/–) Range (*BP.R*) — This configuration establishes the range in in. wg that a 4 to 20 mA sensor will be scaled to. The control only allows sensors that measure both positive and negative pressure.

Building Pressure SETP (*BP.SP*) — This set point is the building pressure control set point. If the unit is configured for modulating building pressure control, then this is the set point that the control will control to.

Power Exhaust on Setp.1 (*BP.P1*) — When configured for building pressure control type *BP.CF* = 1 (constant volume two-stage control), the control will turn on the first power exhaust fan when the economizer's position exceeds this set point.

Power Exhaust on Setp.1 (*BP.P2*) — When configured for building pressure control type *BP.CF* = 1 (constant volume two-stage control), the control will turn on the second power exhaust fan when the economizer's position exceeds this set point.

Modulating PE Algorithm Select (*BP.SL*) — This configuration selects the algorithm used to step the power exhaust stages. This must be set to 1 at all times. The other selections are not used.

Building Pressure PID Evaluation Time (*BP.TM*) — This configuration is the run time rate of the multiple stage (modulating) power exhaust algorithm.

Building Pressure Threshold Adjustment (*BP.ZG*) — This configuration is not used. It currently has no effect on building pressure control.

High Building Pressure Level (*BP.HP*) — This configuration is the threshold level above the building pressure set point used to control stages of power exhaust when *BP.SL=1*.

Low Building Pressure Level (*BP.LP*) — This configuration is the threshold level below the building pressure set point used to control stages of power exhaust when *BP.SL=1*.

CONSTANT VOLUME 2-STAGE CONTROL (*BP.CF = 1*) OPERATION — Two exhaust fan relays will be turned on and off based on economizer position. The two trip set points are *BP.P1* and *BP.P2*. If the economizer is greater than or equal to *BP.P1*, then power exhaust stage 1 is requested and a 60-second timer is initialized. If the economizer is 5% below the *BP.P1*, then power exhaust stage 1 is turned off. Also, if the economizer position is less than *BP.P1* and the 60-second timer has expired, power exhaust stage 1 is turned off. The same logic applies to the second power exhaust stage, except the *BP.P2* trip point is monitored. If the economizer position is greater than or equal to *BP.P2*, then power exhaust stage 2 is energized and a 60-second timer is initialized. If the economizer is 5% below the *BP.P2* the second power exhaust stage turned off. If the economizer is less than *BP.P2* and the 60-second timer has expired, second stage power exhaust is turned off.

For *BP.CF=1*, the Table 64 illustrates the power exhaust stages 1 and 2, relay combinations based upon *Configuration →BP.MT* (4 or 6 motors).

MULTIPLE POWER EXHAUST STAGE BUILDING PRESSURE CONTROL (*BP.CF = 2*) OPERATION — Building pressure control is active whenever the supply fan is running. The control algorithm to be used (*BP.SL=1*) is a timed threshold technique for bringing stages of power exhaust on and off.

The number of power exhaust stages available for this control algorithm is a function of the number of motors it supports. This number of motors is defined by the *Configuration→BP →BP.MT* configuration. Table 65 illustrates the staging tables for this control algorithm based on *BP.MT*.

Table 63 — Building Pressure Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
BP	BUILDING PRESS. CONFIG				
BP.CF	Building Press. Config	0-2		BLDG_CFG	0*
BP.MT	Power Exhaust Motors	1-2		PWRM	1*
BP.S	Building Pressure Sensor	Enable/Dsable		BPSENS	Dsable*
BP.R	Bldg Press (+/–) Range	0 - 1.00		BP_RANGE	0.25
BP.SP	Building Pressure Setp.	-0.25 -> 0.25	"H2O	BPSP	0.05
BP.P1	Power Exhaust On Setp.1	0 - 100	%	PES1	35
BP.P2	Power Exhaust On Setp.2	0 - 100	%	PES2	75
B.CFG	BP ALGORITHM CONFIGS				
BP.SL	Modulating PE Alg. Slct.	1-3		BPSELECT	1
BP.TM	BP PID Evaluation Time	0 - 10	min	BPPERIOD	1
BP.ZG	BP Threshold Adjustment	0.1 - 10.0		BPZ_GAIN	1
BP.HP	High BP Level	0 - 1.000		BPHPLVL	0.05
BP.LP	Low BP Level	0 - 1.000		BPLPLVL	0.04

*Some configurations are machine dependent.

Table 64 — Power Exhaust Staging (*BP.CF*=1)

BP.MT = 1 (4 motors)	PE.A	PE.B	PE.C
Power Exhaust Stage 0	OFF	OFF	OFF
Power Exhaust Stage 1	OFF	ON	OFF
Power Exhaust Stage 2	ON	ON	ON

BP.MT = 2 (6 motors)	PE.A	PE.B	PE.C
Power Exhaust Stage 0	OFF	OFF	OFF
Power Exhaust Stage 1	OFF	OFF	ON
Power Exhaust Stage 2	ON	ON	ON

Table 65 — Power Exhaust Staging (*BP.CF*=2)

BP.MT = 1 (4 motors)	PE.A	PE.B	PE.C
Power Exhaust Stage 0	OFF	OFF	OFF
Power Exhaust Stage 1	ON	OFF	OFF
Power Exhaust Stage 2	OFF	ON	OFF
Power Exhaust Stage 3	ON	ON	OFF
Power Exhaust Stage 4	ON	ON	ON

BP.MT = 2 (6 motors)	PE.A	PE.B	PE.C
Power Exhaust Stage 0	OFF	OFF	OFF
Power Exhaust Stage 1	ON	OFF	OFF
Power Exhaust Stage 2	OFF	ON	OFF
Power Exhaust Stage 3	ON	ON	OFF
Power Exhaust Stage 4	ON	OFF	ON
Power Exhaust Stage 5	OFF	ON	ON
Power Exhaust Stage 6	ON	ON	ON

The configurations of interest in the controlling of building pressure with this algorithm are:

- *Configuration→BP→B.CFG→BP.HP* (building pressure high threshold level)
- *Configuration→BP→B.CFG→BP.LP* (building pressure low threshold level)
- *Configuration→BP→B.CFG→BP.TM* (building pressure timer)

This control function is allowed to add or select power exhaust stages at any time, except that a delay time must expire after a stage is added or subtracted. Any time a stage change is made, a timer is started which delays staging for 10 * *BP.TM* seconds. The default for *BP.TM* is 1, therefore the delay between stage changes is set to 10 seconds.

The logic to add or subtract a stage of power exhaust is:

- If building pressure (*Pressures→AIR.P→BP*) is greater than the building pressure set point (*Configuration→ BP→BPSP*) plus the building pressure high threshold level (*Configuration→BP→B.CFG→BP.HP*) **add** a stage of power exhaust.
- If building pressure (*Pressures→AIR.P→BP*) is less than the building pressure set point (*Configuration→ BP→BPSP*) minus the building pressure low threshold level (*Configuration→BP→B.CFG→BP.LP*) **subtract** a stage of power exhaust.

Smoke Control Modes — There are four smoke control modes that can be used to control smoke within areas serviced by the unit: Pressurization mode, Evacuation mode, Smoke Purge mode, and Fire Shutdown. Evacuation, Pressurization and Smoke Purge modes require the Controls Expansion Board (CEM). The Fire Shutdown input is located on the main board (MBB) on terminals TB5-10 and 11. The unit may also be equipped with a factory-installed return air smoke detector that is wired to TB5-10 and 11 and will shut the unit down if a smoke condition is determined. Field-monitoring wiring can be connected to terminal TB5-8 and 9 to monitor the smoke detector. Inputs on the CEM board can be used to put the unit in the Pressurization, Evacuation, and Smoke Purge modes. These switches or inputs are connected to TB6 as shown below. Refer to Major System Components section on page 85 for wiring diagrams.

Pressurization — TB6-12 and 13

Evacuation — TB6-13 and 14

Smoke Purge — TB6-13 and 15

Each mode must be energized individually on discrete inputs and the corresponding alarm is initiated when a mode is activated. The fire system provides a normally closed dry contact closure. Multiple smoke control inputs, sensed by the control will force the unit into a Fire Shutdown mode.

FIRE-SMOKE INPUTS — These discrete inputs can be found on the local display under *Inputs→FIRE*.

ITEM	EXPANSION	RANGE	CCN POINT	WRITE STATUS
FIRE	FIRE-SMOKE INPUTS			
FSD	Fire Shutdown Input	ALRM/NORM	FSD	forcible
PRES	Pressurization Input	ALRM/NORM	PRES	forcible
EVAC	Evacuation Input	ALRM/NORM	EVAC	forcible
PURG	Smoke Purge Input	ALRM/NORM	PURG	forcible

Fire Shutdown Mode — This mode will cause an immediate and complete shutdown of the unit.

Pressurization Mode — This mode attempts to raise the pressure of a space to prevent smoke infiltration from an adjacent space. Opening the economizer (thereby closing the return air damper), shutting down power exhaust and turning the indoor fan on will increase pressure in the space.

Evacuation Mode — This mode attempts to lower the pressure of the space to prevent infiltrating an adjacent space with its smoke. Closing the economizer (thereby opening the return-air damper), turning on the power exhaust and shutting down the indoor fan decrease pressure in the space.

Smoke Purge Mode — This mode attempts to draw out smoke from the space after the emergency condition. Opening the economizer (thereby closing the return-air damper), turning on both the power exhaust and indoor fan will evacuate smoke and bring in fresh air.

AIRFLOW CONTROL DURING THE FIRE-SMOKE MODES — All non-smoke related control outputs will get shut down in the fire-smoke modes. Those related to airflow will be controlled as explained below. The following matrix specifies all actions the control shall undertake when each mode occurs (outputs are forced internally with CCN priority number 1 - "Fire"):

DEVICE	PRESSURIZATION	PURGE	EVACUATION	FIRE SHUTDOWN
Economizer	100%	100%	0%	0%
Indoor Fan — VFD	ON/FSO*	ON/FSO*	OFF	OFF
Power Exhaust	OFF	ON	ON	OFF
Heat Interlock Relay	ON	ON	OFF	OFF

*"FSO" refers to the supply VFD fire speed override configurable speed.

RELEVANT ITEMS:

The economizer's commanded output can be found in *Outputs→ECON→ECN.C*.

The configurable fire speed override for supply fan VFD is in *Configuration→SP→SP.FS*.

The supply fan relay's commanded output can be found in *Outputs→FANS→S.FAN*.

The supply fan VFD's commanded speed can be found in *Outputs→FANS→S.VFD*.

Indoor Air Quality Control — The indoor air quality (IAQ) function will admit fresh air into the space whenever space air quality sensors detect high levels of CO_2.

When a space or return air CO_2 sensor is connected to the unit control, the unit's IAQ routine allows a demand-based control for ventilation air quantity, by providing a modulating outside air damper position that is proportional to CO_2 level. The ventilation damper position is varied between a minimum ventilation level (based on internal sources of contaminants and CO_2 levels other than from the effect of people) and the maximum design ventilation level (determined at maximum populated status in the building). Demand Control Ventilation (DCV) is also available when the *Comfort*Link™ unit is connected to a CCN system using ComfortID™ terminal controls.

This function also provides alternative control methods for controlling the amount of ventilation air being admitted, including fixed outdoor air ventilation rates (measured as cfm), external discrete sensor switch input and externally generated proportional signal controls.

The IAQ function requires the installation of the factory-option economizer system. The DCV sequences also require the connection of accessory (or field-supplied) space or return air CO_2 sensors. Fixed cfm rate control requires the factory-installed outdoor air cfm option. External control of the ventilation position requires supplemental devices, including a 4 to 20 mA signal, a 10-k ohm potentiometer, or a discrete switch input, depending on the method selected. Outside air CO_2 levels may also be monitored directly and high CO_2 economizer restriction applied when an outdoor air CO_2 sensor is connected. (The outdoor CO_2 sensor connection requires installation of the Controls Expansion Module [CEM].)

The *Comfort*Link control has the capability of DCV using an IAQ sensor. The indoor air quality (IAQ) is measured using a CO_2 sensor whose measurements are displayed in parts per million (ppm). The IAQ sensor can be field-installed in the return duct. There is also an accessory space IAQ sensor that can be installed directly in the occupied space. The sensor must provide a 4 to 20 mA output signal and must include its own 24-v supply. The sensor connects to terminal TB5-6 and 7. Be sure to leave the 182-ohm resistor in place on terminals 6 and 7.

OPERATION — The unit's indoor air quality algorithm modulates the position of the economizer damper between two user configurations depending upon the relationship between the IAQ and the outdoor air quality (OAQ). Both of these values can be read at the *Inputs→AIR.Q* submenu. The lower of these two configurable positions is referred to as the IAQ Demand Vent Min Position (*IAQ.M*), while the higher is referred to as Economizer Minimum Position (*EC.MN*). The *IAQ.M* should be set to an economizer position that brings in enough fresh air to remove contaminants and CO_2 generated by sources other than people. The *EC.MN* value should be set to an economizer position that brings in enough fresh air to remove contaminants and CO_2 generated by all sources including people. The *EC.MN* value is the design value for maximum occupancy.

The logic that is used to control the dampers in response to IAQ conditions is shown in Fig. 10. The *Comfort*Link control will begin to open the damper from the *IAQ.M* position when the IAQ level begins to exceed the OAQ level by a configurable amount, which is referred to as Differential Air Quality Low Limit (*DAQ.L*).

If OAQ is not being measured, OAQ can be manually configured. It should be set at around 400 to 450 ppm or measured with a handheld sensor during the commissioning of the unit. The OAQ reference level can be set using the OAQ Reference Set Point (*OAQ.U*). When the differential between IAQ and OAQ reaches the configurable Diff. Air Quality Hi Limit (*DAQ.H*), then the economizer position will be *EC.MN*.

When the IAQ–OAQ differential is between *DAQ.L* and *DAQ.H*, the control will modulate the damper between *IAQ.M* and *EC.MN* as shown in Fig. 10. The relationship is a linear relationship but other non-linear options can be used. The damper position will never exceed the bounds specified by *IAQ.M* and *EC.MN* during IAQ control.

If the building is occupied and the indoor fan is running and the differential between IAQ and OAQ is less than *DAQ.L*, the economizer will remain at *IAQ.M*. The economizer will not close completely. The damper position will be 0 when the fan is not running or the building is unoccupied. The damper position may exceed *EC.MN* in order to provide free cooling.

The *Comfort*Link control is configured for air quality sensors which provide 4 mA at 0 ppm and 20 mA at 2000 ppm. If a sensor has a different range, these bounds must be reconfigured. These pertinent configurations for ranging the air quality sensors are *IQ.R.L, IQ.R.H, OQ.R.L* and *OQ.R.H*. The bounds represent the PPM corresponding to 4 mA (low) and 20 mA (high) for IAQ and OAQ, respectively.

If OAQ exceeds the OAQ Lockout Value (*OAQ.L*), then the economizer will remain at *IAQ.M*. This is used to limit the use of outside air which outdoor air CO_2 levels are above the *OAQ.L* limit. Normally a linear control of the damper vs. the IAQ control signal can be used, but the control also supports non-linear control. Different curves can be used based on the Diff.IAQ Responsiveness Variable (*IAQ.R*). See Fig. 11.

SETTING UP THE SYSTEM — The IAQ configuration options are under the Local Display Mode *Configuration→IAQ*. See Table 66.

IAQ Analog Sensor Config (*Configuration→IAQ→AQ.CF→IQ.A.C*) — This is used to configure the type of IAQ position control. It has the following options:

- *IQ.A.C* = 0 (No analog input). If there is no other minimum position control, the economizer minimum position will be *Configuration→IAQ→EC.MN* and there will be no IAQ control.
- *IQ.A.C* = 1 (IAQ analog input). An indoor air (space or return air) CO_2 sensor is installed. If an outdoor air CO_2 sensor is also installed, or OAQ is broadcast on the CCN, or if a default OAQ value is used, then the unit can perform IAQ control.
- *IQ.A.C* = 2 (IAQ analog input with minimum position override) — If the differential between IAQ and OAQ is above *Configuration→IAQ→AQ.SP→DAQ.H*, the economizer minimum position will be the IAQ override position (*Configuration→IAQ→AQ.SP→IQ.O.P*).
- *IQ.A.C* = 3 (4 to 20 mA minimum position) — With a 4 to 20 mA signal connected to TB5-6 and 7, the economizer minimum position will be scaled linearly from 0% (4 mA) to *EC.MN* (20 mA).
- *IQ.A.C* = 4 (10K potentiometer minimum position) — With a 10K linear potentiometer connected to TB5-6 and 7, the economizer minimum position will be scaled linearly from 0% (0 Kohms) to *EC.MN* (10 Kohms).
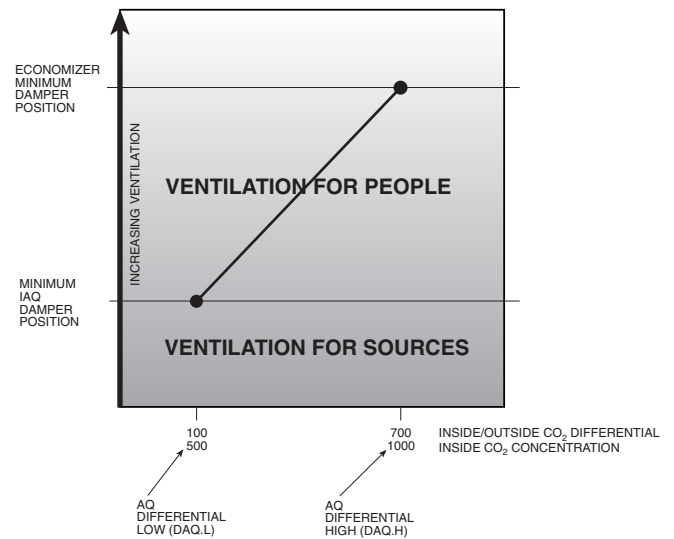
Fig. 10 — IAQ Control
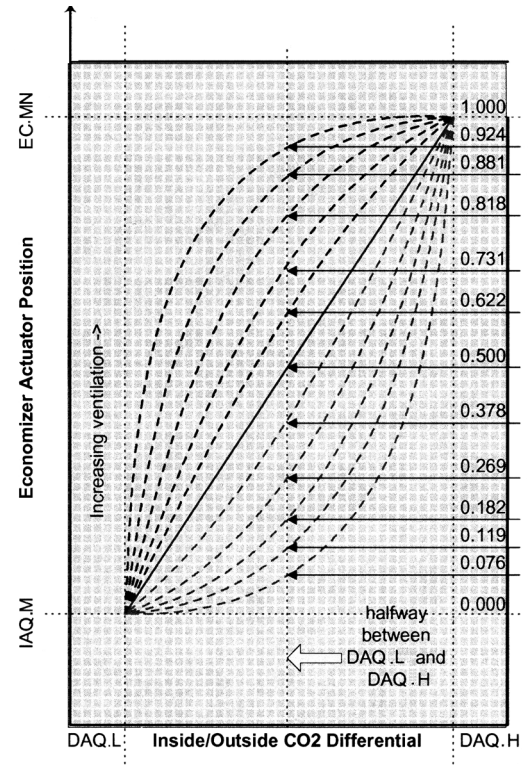
NOTE: Calculating the *IAQ.M* and *EC.MN* damper position based on differential IAQ measurement.

Based on the configuration parameter IAQREACT, the reaction to damper positioning based on differential air quality ppm can be adjusted.

IAQREACT = 1 to 5 (more responsive)
IAQREACT = 0 (linear)
IAQREACT = –1 to –5 (less responsive)

Fig. 11 — IAQ Response Curve

Table 66 — Indoor Air Quality Configuration

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT
DCV.C	DCV ECONOMIZER SETPOINTS				
EC.MN	Economizer Min.Position	0 - 100	%	ECONOMIN	5
IAQ.M	IAQ Demand Vent Min.Pos.	0 - 100	%	IAQMINP	0
AQ.CF	AIR QUALITY CONFIGS				
IQ.A.C	IAQ Analog Sensor Config	0 - 4		IAQANCFG	0
IQ.A.F	IAQ 4-20 ma Fan Config	0 - 2		IAQANFAN	0
IQ.I.C	IAQ Discrete Input Config	0 - 2		IAQINCFG	0
IQ.I.F	IAQ Disc.In. Fan Config	0 - 2		IAQINFAN	0
OQ.A.C	OAQ 4-20ma Sensor Config	0 - 2		OAQANCFG	0
AQ.SP	AIR QUALITY SETPOINTS				
IQ.O.P	IAQ Econo Override Pos.	0 - 100	%	IAQOVPOS	100
DAQ.L	Diff.Air Quality LoLimit	0 - 1000		DAQ_LOW	100
DAQ.H	Diff. Air Quality HiLimit	100 - 2000		DAQ_HIGH	700
D.F.OF	DAQ PPM Fan Off Setpoint	0 - 2000		DAQFNOFF	200
D.F.ON	DAQ PPM Fan On Setpoint	0 - 2000		DAQFNON	400
IAQ.R	Diff. AQ Responsiveness	-5 - 5		IAQREACT	0
OAQ.L	OAQ Lockout Value	0 - 2000		OAQLOCK	0
OAQ.U	User Determined OAQ	0 - 5000		OAQ_USER	400
AQ.S.R	AIR QUALITY SENSOR RANGE				
IQ.R.L	IAQ Low Reference	0 - 5000		IAQREFL	0
IQ.R.H	IAQ High Reference	0 - 5000		IAQREFH	2000
OQ.R.L	OAQ Low Reference	0 - 5000		OAQREFL	0
OQ.R.H	OAQ High Reference	0 - 5000		OAQREFH	2000
IAQ.P	IAQ PRE-OCCUPIED PURGE				
IQ.PG	IAQ Purge	Yes/No		IAQPURGE	No
IQ.P.T	IAQ Purge Duration	5 - 60	min	IAQPTIME	15
IQ.P.L	IAQ Purge LoTemp Min Pos	0 - 100	%	IAQPLTMP	10
IQ.P.H	IAQ Purge HiTemp Min Pos	0 - 100	%	IAQPHTMP	35
IQ.L.O	IAQ Purge OAT Lockout	35 - 70	dF	IAQPNTLO	50

IAQ Analog Fan Config (***Configuration→IAQ→AQ.CF→ IQ.A.F***) — This configuration is used to configure the control of the indoor fan. If this option is used then the IAQ sensor must be in the space and not in the return duct. It has the following configurations:

• *IQ.A.F* = 0 (No Fan Start) — IAQ demand will never override normal indoor fan operation during occupied or unoccupied period and turn it on.
• *IQ.A.F* = 1 (Fan On If Occupied) — IAQ demand will override normal indoor fan operation and turn it on (if off) only during the occupied period (CV operation with automatic fan).
• *IQ.A.F* = 2 (Fan On Occupied/Unoccupied) — IAQ demand will always override normal indoor fan operation and turn it on (if off) during both the occupied and unoccupied period. For *IQ.A.F* = 1 or 2, the fan will be turned on as described above when DAQ is above the DAQ Fan On Set Point (***Configuration→IAQ→AQ.SP→D.F.ON***). The fan will be turned off when DAQ is below the DAQ Fan Off Set Point (***Configuration→IAQ→AQ.SP→D.F.OF***). The control can also be set up to respond to a discrete IAQ input. The discrete input is connected to TB5-6 and 7.

IAQ Discrete Input Config (***Configuration→IAQ→AQ.CF →IQ.I.C***) — This configuration is used to set the type of IAQ sensor. The following are the options:

• *IQ.I.C* = 0 (No Discrete Input) — This is used to indicate that no discrete input will be used and the standard IAQ sensor input will be used.
• *IQ.I.C* = 1 (IAQ Discrete Input) — This will indicate that the IAQ level (high or low) will be indicated by the discrete input. When the IAQ level is low, the economizer minimum position will be ***Configuration→ IAQ→DCV.C→IAQ.M***.
• *IQ.I.C* = 2 (IAQ Discrete Input with Minimum Position Override) — This will indicate that the IAQ level (high or low) will be indicated by the discrete input and the economizer minimum position will be the IAQ override position, *IQ.P.O* (when high).

It is also necessary to configure how the fan operates when using the IAQ discrete input.

IAQ Discrete Fan Config (***Configuration→IAQ→AQ.CF →IQ.I.F***) — This is used to configure the operation of the fan during an IAQ demand condition. It has the following configurations:

• *IQ.I.F* = 0 (No Fan Start) — IAQ demand will never override normal indoor fan operation during occupied or unoccupied period and turn it on.
• *IQ.I.F* = 1 (Fan On If Occupied) — IAQ demand will override normal indoor fan operation and turn it on (if off) only during the occupied period (CV operation with automatic fan).
• *IQ.I.F* = 2 (Fan On Occupied/Unoccupied) — IAQ demand will always override normal indoor fan operation and turn it on (if off) during both the occupied and unoccupied period.

Economizer Min Position (***Configuration→IAQ→DCV.C →EC.MN***) — This is the fully occupied minimum economizer position.

IAQ Demand Vent Min Pos. (***Configuration→IAQ→ DCV.C→IAQ.M***) — This configuration will be used to set the minimum damper position in the occupied period when there is no IAQ demand.

IAQ Econo Override Pos (***Configuration→IAQ→AQ.SP→ IQ.O.P***) — This configuration is the position that the economizer goes to when override is in effect.

OAQ 4-20 mA Sensor Config (***Configuration→IAQ→ AQ.CF→OQ.A.C***) — This is used to configure the type of outdoor sensor that will be used for OAQ levels. It has the following configuration options:

• *OQ.A.C* = 0 (No Sensor) — No sensor will be used and the internal software reference setting will be used.
• *OQ.A.C* = 1 (OAQ Sensor with DAQ) — An outdoor CO_2 sensor will be used.
• *OQ.A.C* = 2 (4 to 20 mA Sensor without DAQ).

OAQ Lockout Value (***Configuration→IAQ→AQ.SP→ OAQ.L***) — This is the maximum OAQ level above which demand ventilation will be disabled.

Diff. Air Quality Lo Limit (***Configuration→IAQ→AQ.SP →DAQ.L***) — This is the differential CO_2 level at which IAQ control of the dampers will be initiated.

Diff. Air Quality Hi Limit (*Configuration→IAQ→ AQ.SP →DAQ.H*) — This is the differential CO_2 level at which IAQ control of the dampers will be at maximum and the dampers will be at the *Configuration→IAQ→DCV.C→EC.MN*.

DAQ ppm Fan On Set Point (*Configuration →IAQ→AQ.SP→D.F.ON*) — This is the CO_2 level at which the indoor fan will be turned on.

DAQ ppm Fan Off Set Point (*Configuration→IAQ →AQ.SP→D.F.OF*) — This is the CO_2 level at which the indoor fan will be turned off.

IAQ Low Reference (*Configuration→IAQ→AQ.S.R→ IQ.R.L*) — This is the reference that will be used with a to non-Carrier IAQ sensor that may have a different characteristic curve. It represents the CO_2 level at 4 mA.

IAQ High Reference (*Configuration→IAQ→AQ.SR →IQ.R.H*) — This is the reference that will be used with a non-Carrier IAQ sensor that may have a different characteristic curve. It represents the CO_2 level at 4 mA.

OAQ Low Reference (*Configuration→IAQ→AQ.S.R →OQ.R.L*) — This is the reference that will be used with a non-Carrier OAQ sensor that may have a different characteristic curve. It represents the CO_2 level at 4 mA.

OAQ High Reference (*Configuration→IAQ→AQ.S.R→ OQ.R.H*) — This is the reference that will be used with a non-Carrier OAQ sensor that may have a different characteristic curve. It represents the CO_2 level at 4 mA.

Diff. IAQ Responsiveness (*Configuration→IAQ→AQ.SP →IAQ.R*) — This is the configuration that is used to select the IAQ response curves as shown in Fig. 11.

PRE-OCCUPANCY PURGE — The control has the option for a pre-occupancy purge to refresh the air in the space prior to occupancy.

This feature is enabled by setting *Configuration→IAQ→ IAQ.P→IQ.PG* to Yes.

The IAQ Purge will operate under the following conditions:
- *IQ.PG* is enabled
- the unit is in the unoccupied state
- Current Time is valid
- Next Occupied Time is valid
- time is within two hours of the next occupied period
- time is within the purge duration (*Configuration→ IAQ→IAQ.P→IQ.P.T*)

If all of the above conditions are met, the following logic is used:

If OAT ≥ *IQ.L.O* and OAT ≤ OCSP and economizer is available then purge will be enabled and the economizer will be commanded to 100%.

Else, if OAT < *IQ.L.O* then the economizer will be positioned to the IAQ Purge LO Temp Min Pos (*Configuration→ IAQ→IAQ.P→IQ.P.L*)

If neither of the above are true then the dampers will be positioned to the IAQ Purge HI Temp Min Pos (*Configuration →IAQ→IAQ.P→IQ.P.H*)

If this mode is enabled the indoor fan and heat interlock relay (VAV) will be energized.

IAQ Purge (*Configuration→IAQ→IAQ.P→IQ.PG*) — This is used to enable IAQ pre-occupancy purge.

IAQ Purge Duration (*Configuration→IAQ→IAQ.P→ IQ.P.T*) — This is the maximum amount of time that a purge can occur.

IAQ Purge Lo Temp Min Pos (*Configuration→IAQ→ IAQ.P→IQ.P.L*) — This is used to configure a low limit for damper position to be used during the purge mode.

IAQ Purge Hi Temp Min Pos (*Configuration→IAQ→ IAQ.P→IQ.P.H*) — This is used to configure a maximum position for the dampers to be used during the purge cycle.

IAQ Purge OAT Lockout Temp (*Configuration→IAQ→ IAQ.P→IQ.L.O*) — Nighttime lockout temperature below which the purge cycle will be disabled.

Temperature Compensated Start — This logic is used when the unit is in the unoccupied state. The control will calculate early Start Bias time based on Space Temperature deviation from the occupied cooling and heating set points. This will allow the control to start the unit so that the space is at conditioned levels when the occupied period starts. This is required for ASHRAE 90.1 compliance. A space sensor is required for non-linkage applications.

SETTING UP THE SYSTEM — The settings for temperature compensated start can be found in the local display under *Configuration→UNIT*.

ITEM	EXPANSION	RANGE	UNITS	CCN POINT
TCS.C	Temp.Cmp.Strt.Cool Factr	0 - 60	min	TCSTCOOL
TCS.H	Temp.Cmp.Strt.Heat Factr	0 - 60	min	TCSTHEAT

TCST-Cool Factor (*TCS.C*) — This is the factor for the start time bias equation for cooling.

TCST-Heat Factor (*TCS.H*) — This is the factor for the start time bias equation for heating.

NOTE: Temperature compensated start is disabled when these factors are set to 0.

TEMPERATURE COMPENSATED START LOGIC — The following conditions must be met for the algorithm to run:
- Unit is in unoccupied state.
- Next occupied time is valid.
- Current time of day is valid.
- Valid space temperature reading is available (sensor or DAV-Linkage).

The algorithm will calculate a Start Bias time in minutes using the following equations:

If (space temperature > occupied cooling set point)

Start Bias Time = (space temperature – occupied cooling set point)* *TCS.C*

If (space temperature < occupied heating set point)

Start Bias Time = (occupied heating set point – space temperature)**TCS.H*

When the Start Bias Time is greater than zero the algorithm will subtract it from the next occupied time to calculate the new start time. When the new start time is reached, the Temperature Compensated Start mode is set (*Operating Modes→MODE→ T.C.ST*), the fan is started and the unit controlled as in an occupied state. Once set, Temperature Compensated mode will stay on until the unit goes into the Occupied mode. The Start Bias Time will be written into the CCN Linkage Equipment Table if the unit is controlled in DAV mode. If the Unoccupied Economizer Free Cool mode is active (*Operating Modes→HVAC* = "UNOCC FREE COOL") when temperature compensated start begins, the Unoccupied Free Cool mode will be stopped.

Carrier Comfort Network (CCN) — It is possible to configure the *Comfort*Link™ control to participate as an element of the Carrier Comfort Network (CCN) directly from the local display. This section will deal with explaining the various programmable options which are found under the *CCN* submenu in the *Configuration* mode.

The major configurations for CCN programming are located in the local displays at *Configuration→CCN*. See Table 67.

CCN Address (*CCNA*) — This configuration is the CCN address the rooftop is assigned.

Table 67 — CCN Configuration

ITEM	EXPANSION	RANGE	UNITS	POINT	DEFAULT
CCN	CCN CONFIGURATION				
CCNA	CCN Address	1 - 239		CCNADD	1
CCNB	CCN Bus Number	0 - 239		CCNBUS	0
BAUD	CCN Baud Rate	1 - 5		CCNBAUDD	3
BROD	CCN BROADCST DEFINITIONS				
TM.DT	CCN Time/Date Broadcast	ON/OFF		CCNBC	On
OAT.B	CCN OAT Broadcast	ON/OFF		OATBC	Off
ORH.B	CCN OARH Broadcast	ON/OFF		OARHBC	Off
OAQ.B	CCN OAQ Broadcast	ON/OFF		OAQBC	Off
G.S.B	Global Schedule Broadcst	ON/OFF		GSBC	Off
B.ACK	CCN Broadcast Ack'er	ON/OFF		CCNBCACK	Off
SC.OV	CCN SCHEDULES-OVERRIDES				
SCH.N	Schedule Number	0 - 99		SCHEDNUM	1
HOL.T	Accept Global Holidays?	YES/NO		HOLIDAYT	No
O.T.L.	Override Time Limit	0 - 4	HRS	OTL	1
OV.EX	Timed Override Hours	0 - 4	HRS	OVR_EXT	0
SPT.O	SPT Override Enabled ?	YES/NO		SPT_OVER	Yes
T58.O	T58 Override Enabled ?	YES/NO		T58_OVER	Yes
GL.OV	Global Sched. Override ?	YES/NO		GLBLOVER	No

CCN Bus Number (**CCNB**) — This configuration is the CCN bus the rooftop is assigned.

CCN Baud Rate (**BAUD**) — This configuration is the CCN baud rate.

CCN Time/Date Broadcast (**TM.DT**) — If this configuration is set to ON, the control will periodically send the time and date out onto the CCN bus once a minute. If this device is on a CCN network then it will be important to make sure that only one device on the bus has this configuration set to ON. If more than one time broadcaster is present, problems with the time will occur.

NOTE: Only the time and date broadcaster can perform daylight savings time adjustments. Even if the rooftop is stand alone, the user may want to set this to ON to accomplish the daylight/savings function.

CCN OAT Broadcast (**OAT.B**) — If this configuration is set to ON, the control will periodically broadcast its outside-air temperature at a rate of once every 30 minutes.

CCN OARH Broadcast (**ORH.B**) — If this configuration is set to ON, the control will periodically broadcast its outside air relative humidity at a rate of once every 30 minutes.

CCN OAQ Broadcast (**OAQ.B**) — If this configuration is set to ON, the control will periodically broadcast its outside air quality reading at a rate of once every 30 minutes.

Global Schedule Broadcast (**G.S.B**) — If this configuration is set to ON and the schedule number (**SCH.N**) is between 65 and 99, then the control will broadcast the internal time schedule once every 2 minutes.

CCN Broadcast Acknowledger (**B.ACK**) — If this configuration is set to ON, then when any broadcasting is done on the bus, this device will respond to and acknowledge. Only one device per bus can be configured for this option.

Schedule Number (**SCH.N**) — This configuration determines what schedule the control may follow.

SCH.N = 0   The control is always occupied.

SCH.N = 1   The control follows its internal time schedules. The user may enter any number between 1 and 64 but it will be overwritten to "1" by the control as it only has one internal schedule.

SCH.N = 65-99   The control is either set up to receive to a broadcasted time schedule set to this number or the control is set up to broadcast its internal time schedule (**G.S.B**) to the network and this is the global schedule number it is broadcasting. If this is the case, then the control still follows its internal time schedules.

Accept Global Holidays? (**HOL.T**) — If a device is broadcasting the time on the bus, it is possible to accept the time yet not accept the global holiday from the broadcast message.

Override Time Limit (**O.T.L**) — This configuration allows the user to decide how long an override occurs when it is initiated. The override may be configured from 1 to 4 hours. If the time is set to 0, the override function will become disabled.

Timed Override Hours (**OV.EX**) — This displays the current number of hours left in an override. It is possible to cancel an override in progress by writing "0" to this variable, thereby removing the override time left.

SPT Override Enabled? (**SPT.O**) — If a space sensor is present, then it is possible to override an unoccupied period by pushing the override button on the T55 or T56 sensor. This option allows the user to disable this function by setting this configuration to NO.

T58 Override Enabled? (**T58.O**) — The T58 sensor is a CCN device that allows cooling/heating set points to be adjusted, space temperature to be written to the rooftop unit, and the ability to initiate a timed override. This option allows the user to disable the override initiated from the T58 sensor by setting this option to NO.

Global Schedule Override? (**GL.OV**) — If the control is set to receive global schedules then it is also possible for the global schedule broadcaster to call out an override condition as well. This configuration allows the user to disable the global schedule broadcaster from overriding the control.

Alert Limit Configuration — The ALLM submenu is used to configure the alert limit set points. A list is shown in Table 68.

SPT Low Alert Limit/Occ (**SP.L.O**) — If the space temperature is below the configurable occupied SPT Low Alert Limit (**SP.L.O**), then Alert 300 will be generated and the unit will be stopped. The alert will automatically reset.

SPT High Alert Limit/Occ (**SP.H.O**) — If the space temperature is above the configurable occupied SPT High Alert Limit (**SP.H.O**), then Alert 301 will be generated and the unit will be stopped. The alert will automatically reset.

SPT Low Alert Limit/Unocc (**SP.L.U**) — If the space temperature is below the configurable unoccupied SPT Low Alert Limit (**SP.L.U**), then Alert 300 will be generated and the unit will be stopped. The alert will automatically reset.

SPT High Alert Limit/Unocc (**SP.H.U**) — If the space temperature is above the configurable unoccupied SPT High Alert Limit (**SP.H.U**), then Alert 301 will be generated and the unit will be stopped. The alert will automatically reset.

Table 68 — CONFIGURATION — ALLM Submenu

ITEM	EXPANSION	RANGE	UNITS	POINT	DEFAULT
SP.L.O	SPT lo alert limit/occ	-10-245	dF	SPLO	60
SP.H.O	SPT hi alert limit/occ	-10-245	dF	SPHO	85
SP.L.U	SPT lo alert limit/unocc	-10-245	dF	SPLU	45
SP.H.U	SPT hi alert limit/unocc	-10-245	dF	SPHU	100
SA.L.O	EDT lo alert limit/occ	-40-245	dF	SALO	40
SA.H.O	EDT hi alert limit/occ	-40-245	dF	SAHO	100
SA.L.U	EDT lo alert limit/unocc	-40-245	dF	SALU	40
SA.H.U	EDT hi alert limit/unocc	-40-245	dF	SAHU	100
RA.L.O	RAT lo alert limit/occ	-40-245	dF	RALO	60
RA.H.O	RAT hi alert limit/occ	-40-245	dF	RAHO	90
RA.L.U	RAT lo alert limit/unocc	-40-245	dF	RALU	40
RA.H.U	RAT hi alert limit/unocc	-40-245	dF	RAHU	100
R.RH.L	RARH low alert limit	0-100	%	RRHL	0
R.RH.H	RARH high alert limit	0-100	%	RRHH	100
SP.L	SP low alert limit	0-5	"H2O	SPL	0
SP.H	SP high alert limit	0-5	"H2O	SPH	2
BP.L	BP lo alert limit	-0.25-0.25	"H2O	BPL	-0.25
BP.H	BP high alert limit	-0.25-0.25	"H2O	BPH	0.25
IAQ.H	IAQ high alert limit	0-5000		IAQH	1200

EDT Low Alert Limit/Occ (***SA.L.O***) — If the space temperature is below the configurable occupied evaporator discharge temperature (EDT) Low Alert Limit (***SA.L.O***), then Alert 302 will be generated and cooling operation will be stopped but heating operation will continue. The alert will automatically reset.

EDT High Alert Limit/Occ (***SA.H.O***) — If the space temperature is above the configurable occupied EDT High Alert Limit (***SA.H.O***), then Alert 303 will be generated and heating operation will be stopped but cooling operation will continue. The alert will automatically reset.

EDT Low Alert Limit/Unocc (***SA.L.U***) — If the space temperature is below the configurable unoccupied EDT Low Alert Limit (***SA.L.U***), then Alert 302 will be generated and cooling operation will be stopped but heating operation will continue. The alert will automatically reset.

EDT High Alert Limit/Unocc (***SA.H.U***) — If the space temperature is above the configurable unoccupied EDT High Alert Limit (***SA.H.U***), then Alert 303 will be generated and heating operation will be stopped but cooling operation will continue. The alert will automatically reset.

RAT Low Alert Limit/Occ (***RA.L.O***) — If the return-air temperature is below the configurable occupied RAT Low Alert Limit (***RA.L.O***), then Alert 304 will be generated and internal routines will be modified. Unit operation will continue but VAV heating operation will be disabled. The alert will automatically reset.

RAT High Alert Limit/Occ (***RA.H.O***) — If the return-air temperature is above the configurable occupied RAT High Alert Limit (***RA.H.O***), then Alert 305 will be generated and operation will continue. The alert will automatically reset.

RAT Low Alert Limit/Unocc (***RA.L.U***) — If the return-air temperature is below the configurable unoccupied RAT Low Alert Limit (***RA.L.U***), then Alert 304 will be generated. Unit operation will continue but VAV heating operation will be disabled. The alert will automatically reset.

RAT High Alert Limit/Unocc (***RA.H.U***) — If the return-air temperature is above the configurable unoccupied RAT High Alert Limit (***RA.H.U***), then Alert 305 will be generated. Operation will continue. The alert will automatically reset.

RARH Low Alert Limit (***R.RH.L***) — If the unit is configured to use a return air relative humidity sensor (***Configuration→UNIT→SENS→RRH.S***), and the measured level is below the configurable RH Low Alert Limit (***R.RH.L***), then Alert 308 will occur. The unit will continue to run and the alert will automatically reset.

RARH High Alert Limit (***R.RH.H***) — If the unit is configured to use a return air relative humidity sensor (***Configuration→UNIT→SENS→RRHS***), and the measured level is above the configurable RARH High Alert Limit (***R.RH.H***), then Alert 309 will occur. The unit will continue to run and the alert will automatically reset.

Supply Duct Pressure Low Alert Limit (***SP.L***) — If the unit is a VAV unit with a supply duct pressure sensor and the measured supply duct static pressure is below the configurable SP Low Alert Limit (***DP.L***), then Alert 310 will occur. The unit will continue to run and the alert will automatically reset.

Supply Duct Pressure High Alert Limit (***SP.H***) — If the unit is a VAV unit with a supply duct pressure sensor and the measured supply duct static pressure is above the configurable SP High Alert Limit (***SP.H***), then Alert 311 will occur. The unit will continue to run and the alert will automatically reset.

Building Pressure Low Alert Limit (***BP.L***) — If the unit is configured to use modulating power exhaust then a building static pressure limit can be configured using the BP Low Alert Limit (***BP.L***). If the measured pressure is below the limit then Alert 312 will occur.

Building Pressure High Alert Limit (***BP.H***) — If the unit is configured to use modulating power exhaust then a building static pressure limit can be configured using the BP Hi Alert Limit (***BP.H***). If the measured pressure is above the limit, then Alert 313 will occur.

Indoor Air Quality High Alert Limit (***IAQ.H***) — If the unit is configured to use a CO_2 sensor and the level is above the configurable IAQ High Alert Limit (***IAQ.H***) then the alert will occur. The unit will continue to run and the alert will automatically reset.

Sensor Trim Configuration — The TRIM submenu is used to calibrate the sensor trim settings. The trim settings are used when the actual measured reading does not match the sensor output. The sensor can be adjusted to match the actual measured reading with the trim function. A list is shown in Table 69.

> IMPORTANT: Sensor trim must not be used to extend unit operation past the allowable operating range. Doing so may void the warranty.

Air Temperature Leaving Supply Fan Sensor (***SAT.T***) — This variable is used to adjust the supply fan temperature sensor reading. The sensor reading can be adjusted ± 10° F to match the actual measured temperature.

Return Air Temperature Sensor Trim (***RAT.T***) — This variable is used to adjust the return air temperature sensor reading. The sensor reading can be adjusted ± 10° F to match the actual measured temperature.

Table 69 — CONFIGURATION — TRIM Submenu

ITEM	EXPANSION	RANGE	UNITS	POINT	DEFAULT
TRIM	SENSOR TRIM CONFIG.				
SAT.T	Air Temp Lvg SF Trim	-10 - 10	^F	SAT_TRIM	0
RAT.T	RAT Trim	-10 - 10	^F	RAT_TRIM	0
OAT.T	OAT Trim	-10 - 10	^F	OAT_TRIM	0
SPT.T	SPT Trim	-10 - 10	^F	SPT_TRIM	0
CTA.T	Cir A Sat. Cond. Temp Trim	-30 - 30	^F	SCTA_TRIM	0
CTB.T	Cir B Sat. Cond. Temp Trim	-30 - 30	^F	SCTB_TRIM	0
SP.A.T	Suct.Press.Circ.A Trim	-50 - 50	PSIG	SPA_TRIM	0
SP.B.T	Suct.Press.Circ.B Trim	-50 - 50	PSIG	SPB_TRIM	0

Outdoor Air Temperature Sensor Trim (**OAT.T**) — This variable is used to adjust the outdoor air temperature sensor reading. The sensor reading can be adjusted ± 10° F to match the actual measured temperature.

Space Temperature Sensor Trim (**SPT.T**) — This variable is used to adjust the space temperature sensor reading. The sensor reading can be adjusted ± 10° F to match the actual measured temperature.

Circuit A Saturated Condenser Temperature Trim (**CTA.T**) — This variable is used to adjust the saturated condenser temperature sensor reading for circuit A. The sensor reading can be adjusted ± 30° F to match the actual measured temperature.

Circuit B Saturated Condenser Temperature Trim (**CTB.T**) — This variable is used to adjust the saturated condenser temperature sensor reading for circuit B. The sensor reading can be adjusted ± 30° F to match the actual measured temperature.

Suction Pressure Circuit A Trim (**SP.A.T**) — This variable is used to adjust the suction pressure sensor reading for circuit A. The sensor reading can be adjusted ± 50 psig to match the actual measured pressure.

Suction Pressure Circuit B Trim (**SP.B.T**) — This variable is used to adjust the suction pressure sensor reading for circuit B. The sensor reading can be adjusted ± 50 psig to match the actual measured pressure.

4 to 20 mA Inputs — There are a number of 4 to 20 mA inputs which may be calibrated. These inputs are located in **Inputs→4-20**. They are:

- **SP.M.T** — static pressure milliamp trim
- **BP.M.T** — building pressure milliamp trim
- **OA.M.T** — outside air cfm milliamp trim
- **RA.M.T** — return air cfm milliamp trim
- **SA.M.T** — supply air cfm milliamp trim

Discrete Switch Logic Configuration —

The *SW.LG* submenu is used to configure the normally open/normally closed settings of switches and inputs. This is used when field-supplied switches or input devices are used instead of Carrier devices. The normally open or normally closed setting may be different on a field-supplied device. These points are used to match the control logic to the field-supplied device.

The defaults for this switch logic section will not normally need changing. However, if a field-installed switch is used that is different from the Carrier switch, these settings may need adjustment.

IMPORTANT: Many of the switch inputs to the control can be configured to operate as normally open or normally closed.

Settings for switch logic are found at the local displays under the **Configuration→SW.LG** submenu. See Table 70.

Filter Status Input — Clean (**FTS.L**) — The filter status input for clean filters is set for normally open. If a field-supplied filter status switch is used that is normally closed for a clean filter, change this variable to closed.

IGC Feedback — Off (**IGC.L**) — The input for IGC feedback is set for normally open for off. If a field-supplied IGC feedback switch is used that is normally closed for feedback off, change this variable to closed.

Remote Switch — Off (**RMI.L**) — The remote switch is set for normally open when off. If a field-supplied control switch is used that is normally closed for an off signal, change this variable to closed.

Economizer Switch — No (**ECS.L**) — The economizer switch is set for normally open when low. If a field-supplied economizer switch is used that is normally closed when low, change this variable to closed.

Fan Status Switch — Off (**SFS.L**) — The fan status switch input is set for normally open for off. If a field-supplied fan status switch is used that is normally closed, change this variable to closed.

Demand Limit Switch 1 — Off (**DL1.L**) — The demand limit switch no. 1 input is set for normally open for off. If a field-supplied demand limit switch is used that is normally closed, change this variable to closed.

Demand Limit Switch 2 — Off (**DL2.L**) — The demand limit switch no. 2 input is set for normally open for off. If a field-supplied demand limit switch is used that is normally closed, change this variable to closed.

IAQ Discrete Input — Low (**IAQ.L**) — The IAQ discrete input is set for normally open when low. If a field-supplied IAQ discrete input is used that is normally closed, change this variable to closed.

Fire Shutdown — Off (**FSD.L**) — The fire shutdown input is set for normally open when off. If a field-supplied fire shutdown input is used that is normally closed, change this variable to closed.

Pressurization Switch — Off (**PRS.L**) — The pressurization input is set for normally open when off. If a field-supplied pressurization input is used that is normally closed, change this variable to closed.

Evacuation Switch — Off (**EVC.L**) — The evacuation input is set for normally open when off. If a field-supplied evacuation input is used that is normally closed, change this variable to closed.

Smoke Purge — Off (**PRG.L**) — The smoke purge input is set for normally open when off. If a field-supplied smoke purge input is used that is normally closed, change this variable to closed.

Display Configuration —

The *DISP* submenu is used to configure the local display settings. A list is shown in Table 71.

Test Display LEDs (**TEST**) — This is used to test the operation of the *Comfort*Link™ display.

Metric Display (**METR**) — This variable is used to change the display from English units to Metric units.

Language Selection (**LANG**) — This variable is used to change the language of the *Comfort*Link display. At this time, only English is available.

Password Enable (**PAS.E**) — This variable enables or disables the use of a password. The password is used to restrict use of the control to change configurations.

Service Password (**PASS**) — This variable is the 4-digit numeric password that is required if enabled.

Table 70 — Switch Logic Configuration

ITEM	EXPANSION	RANGE	CCN POINT	DEFAULT
SW.LG	SWITCH LOGIC: NO / NC			
FTS.L	Filter Status Inpt-Clean	Open/Close	FLTSLOGC	Open
IGC.L	IGC Feedback - Off	Open/Close	GASFANLG	Open
RMI.L	RemSw Off-Unoc-Strt-NoOv	Open/Close	RMTINLOG	Open
ECS.L	Economizer Switch - No	Open/Close	ECOSWLOG	Open
SFS.L	Fan Status Sw. - Off	Open/Close	SFSLOGIC	Open
DL1.L	Dmd.Lmt.Sw.1 - Off	Open/Close	DMD_SW1L	Open
DL2.L	Dmd.Lmt.Sw.2 - Off	Open/Close	DMD_SW2L	Open
IAQ.L	IAQ Disc.Input - Low	Open/Close	IAQINLOG	Open
FSD.L	Fire Shutdown - Off	Open/Close	FSDLOGIC	Open
PRS.L	Pressurization Sw. - Off	Open/Close	PRESLOGC	Open
EVC.L	Evacuation Sw. - Off	Open/Close	EVACLOGC	Open
PRG.L	Smoke Purge Sw. - Off	Open/Close	PURGLOGC	Open

Table 71 — CONFIGURATION — DISP Submenu

ITEM	EXPANSION	RANGE	UNITS	POINT	DEFAULT
TEST	Test Display LEDs	ON/OFF		TEST	Off
METR	Metric Display	ON/OFF		DISPUNIT	Off
LANG	Language Selection	0-1(multi-text strings)		LANGUAGE	0
PAS.E	Password Enable	ENABLE/DISABLE		PASS_EBL	Enable
PASS	Service Password	0000-9999		PASSWORD	1111

Remote Control Switch Input — The remote switch input is located on the ECB-1 board and connected to TB6 terminals 1 and 3. The switch can be used for several remote control functions. See Table 72.

Table 72 — Remote Switch Configuration

ITEM	EXPANSION	RANGE	CCN POINT
REMT	Remote Input State	ON/OFF	RMTIN
RM.CF	Remote Switch Config	0 - 3	RMTINCFG
RMI.L	RemSw Off-Unoc-Strt-NoOv	Open/Close	RMTINLOG

Remote Input State (*Inputs→GEN.I→REMT*) — This is the actual real time state of the remote input.

Remote Switch Config (*Configuration→UNIT→RM.CF*) — This is the configuration that allows the user to assign different types of functionality to the remote discrete input.

• 0 — NO REMOTE SW — The remote switch will not be used.
• 1 — OCC-UNOCC SW — The remote switch input will control the occupancy state. When the remote switch input is ON, the unit will forced into the occupied mode. When the remote switch is OFF, the unit will be forced into the unoccupied mode.
• 2 — STRT/STOP — The remote switch input will start and stop the unit. When the unit is commanded to stop, any timeguards in place on compressors will be honored first. When the remote switch is ON, the unit will be commanded to stop. When the remote switch is OFF the unit will be enabled to operate.

• 3 — OVERRIDE SW — The remote switch can be used to override any internal or external time schedule being used by the control and force the unit into an occupied mode when the remote input state is ON. When the remote switch is ON, the unit will be forced into an occupied state. When the remote switch is OFF, the unit will use its internal or external time schedules.

Remote Switch Logic Configuration (*Configuration→SW.LG→RMI.L*) — The control allows for the configuration of a normally open/closed status of the remote input switch via *RMI.L*. If this variable is configured OPEN, then when the switch is open, the remote input switch perceives the logic state as OFF. Correspondingly, if *RMI.L* is set to CLOSED, the remote input switch will perceive a closed switch as meaning OFF. See Table 73.

Hot Gas Bypass — Hot gas bypass is an active part of the A-Series *Comfort*Link™ capacity staging and minimum evaporator load protection functions. It is controlled though the Minimum Load Valve function.

The hot gas bypass option consists of a solenoid valve with a fixed orifice sized to provide a nominal 3-ton evaporator load bypass. A hot gas refrigerant line routes the bypassed hot gas from Circuit A's discharge line to Circuit A's evaporator distributor. When the unit control calls for hot gas bypass, the hot gas enters the evaporator coil and adds refrigeration load to the compressor circuit to reduce the cooling effect from Circuit A.

The hot gas bypass system is a factory-installed option installed on Circuit A only. This function is enabled at *Configuration→COOL→MLV*. When this function is enabled, an additional stage of cooling capacity is provided by the unit control staging sequences (see Table 42).

Table 73 — Remote Switch Logic Configuration

REMOTE SWITCH LOGIC CONFIGURATION (*RMI.L*)	SWITCH STATUS	REMOTE INPUT STATE (REMT)	REMOTE SWITCH CONFIGURATION (*RM.CF*)			
			0	1	2	3
			No Remote Switch	Occ-Unocc Switch	Start/Stop	Override
OPEN	OPEN	OFF	xxxxx	Unoccupied	Start	No Override
	CLOSED	ON	xxxxx	Occupied	Stop	Override
CLOSED	OPEN	ON	xxxxx	Occupied	Stop	Override
	CLOSED	OFF	xxxxx	Unoccupied	Start	No Override

Space Temperature Offset — Space Temperature Offset corresponds to a slider on a T56 sensor that allows the occupant to adjust the space temperature by a configured range during an occupied period. This sensor is only applicable to units that are configured as either 2-Stage SPT or Multi-Stage SPT control (*Configuration→UNIT→C.TYP* = 5 or 6).

ITEM	EXPANSION	RANGE	UNITS	CCN POINT
SP.O.S	Space Temp Offset Sensor	Enable/ Disable		SPTOSENS
SP.O.R	Space Temp Offset Range	1 - 10		SPTO_RNG
SPTO	Space Temperature Offset	+- *SP.O.R*	^F	SPTO

Space Temperature Offset Sensor (*Configuration→UNIT →SENS→SP.O.S*) — This configuration disables the reading of the offset slider.

Space Temperature Offset Range (*Configuration- →UNIT→SENS→SP.O.R*) — This configuration establishes the range, in degrees F, that the T56 slider can affect *SPTO* when adjusting the slider from the far left (*-SP.O.R*) to the far right (*+SP.O.R*). The default is 5° F.

Space Temperature Offset Value (*Temperatures→AIR.T →SPTO*) — The Space Temperature Offset Value is the reading of the slider potentiometer in the T56 that is resolved to delta degrees based on *SP.O.R*.

TIME CLOCK CONFIGURATION

This section describes each Time Clock menu item. Not every point will need to be configured for every unit. Refer to the Controls Quick Start section for more information on what set points need to be configured for different applications. The Time Clock menu items are discussed in the same order that they are displayed in the Time Clock table. The Time Clock table is shown in Table 74.

Hour and Minute (*HH.MM*) — The hour and minute of the time clock are displayed in 24-hour, military time. Time can be adjusted manually by the user.

When connected to the CCN, the unit can be configured to transmit time over the network or receive time from a network device. All devices on the CCN should use the same time. Only one device on the CCN should broadcast time or problems will occur.

Month of Year (*MNTH*) — This variable is the current month of the calendar year.

Day of Month (*DOM*) — This variable is the current day (1 to 31) of the month.

Day of Week (*DAY*) — This variable is the current day of the week (Monday through Sunday).

Year (*YEAR*) — This variable is the current year (for example, 2005).

Local Time Schedule (*SCH.L*) — This submenu is used to program the time schedules. There are 8 periods (*PER.1* through *PER.8*). Each time period can be used to set up a local schedule for the unit. Refer to the Programming Operating Schedules section below for more information.

MONDAY IN PERIOD (*PER.X→DAYS→MON*) — This variable is used to include or remove Monday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Monday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Monday. This variable can be set for Periods 1 through 8.

TUESDAY IN PERIOD (*PER.X→DAYS→TUE*) — This variable is used to include or remove Tuesday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Tuesday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Tuesday. This variable can be set for Periods 1 through 8.

WEDNESDAY IN PERIOD (*PER.X→DAYS→WED*) — This variable is used to include or remove Wednesday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Wednesday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Wednesday. This variable can be set for Periods 1 through 8.

THURSDAY IN PERIOD (*PER.X→DAYS→THU*) — This variable is used to include or remove Thursday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Thursday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Thursday. This variable can be set for Periods 1 through 8.

FRIDAY IN PERIOD (*PER.X→DAYS→FRI*) — This variable is used to include or remove Friday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Friday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Friday. This variable can be set for Periods 1 through 8.

SATURDAY IN PERIOD (*PER.X→DAYS→SAT*) — This variable is used to include or remove Saturday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Saturday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Saturday. This variable can be set for Periods 1 through 8.

SUNDAY IN PERIOD (*PER.X→DAYS→SUN*) — This variable is used to include or remove Sunday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then Sunday will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on Sunday. This variable can be set for Periods 1 through 8.

Table 74 — TIME CLOCK Menu

ITEM	EXPANSION	RANGE	POINT	DEFAULT
TIME	**TIME OF DAY**			
HH.MM	Hour and Minute	00:00	TIME	
DATE	**MONTH,DATE,DAY AND YEAR**			
MNTH	Month of Year	multi-text strings	MOY	
DOM	Day of Month	0-31	DOM	
DAY	Day of Week	multi-text strings	DOWDISP	
YEAR	Year	e.g. 2003	YOCDISP	
SCH.L	**LOCAL TIME SCHEDULE**			
PER.1	PERIOD 1			
PER.1→DAYS	DAY FLAGS FOR PERIOD 1			Period 1 only
PER.1→DAYS→MON	Monday in Period	YES/NO	PER1MON	Yes
PER.1→DAYS→TUE	Tuesday in Period	YES/NO	PER1TUE	Yes
PER.1→DAYS→WED	Wednesday in Period	YES/NO	PER1WED	Yes
PER.1→DAYS→THU	Thursday in Period	YES/NO	PER1THU	Yes
PER.1→DAYS→FRI	Friday in Period	YES/NO	PER1FRI	Yes
PER.1→DAYS→SAT	Saturday in Period	YES/NO	PER1SAT	Yes
PER.1→DAYS→SUN	Sunday in Period	YES/NO	PER1SUN	Yes
PER.1→DAYS→HOL	Holiday in Period	YES/NO	PER1HOL	Yes
PER.1→OCC	Occupied from	00:00	PER1_OCC	00:00
PER.1→UNC	Occupied to	00:00	PER1_UNC	24:00
Repeat for periods 2-8				
HOL.L	**LOCAL HOLIDAY SCHEDULES**			
HD.01	HOLIDAY SCHEDULE 01			
HD.01→MON	Holiday Start Month	0-12	HOL_MON1	
HD.01→DAY	Start Day	0-31	HOL_DAY1	
HD.01→LEN	Duration (Days)	0-99	HOL_LEN1	
Repeat for holidays 2-30				
DAY.S	**DAYLIGHT SAVINGS TIME**			
DS.ST	DAYLIGHT SAVINGS START			
DS.ST→ST.MN	Month	1 - 12	STARTM	4
DS.ST→ST.WK	Week	1 - 5	STARTW	1
DS.ST→ST.DY	Day	1 - 7	STARTD	7
DS.ST→MIN.A	Minutes to Add	0 - 90	MINADD	60
DS.SP	**DAYLIGHTS SAVINGS STOP**			
DS.SP→SP.MN	Month	1 - 12	STOPM	10
DS.SP→SP.WK	Week	1 - 5	STOPW	5
DS.SP→SP.DY	Day	1 - 7	STOPD	7
DS.SP→MIN.S	Minutes to Subtract	0 - 90	MINSUB	60

HOLIDAY IN PERIOD (***PER.X→DAYS→HOL***) — This variable is used to include or remove a Holiday from the schedule. Each period is assigned an occupied on and off time. If this variable is set to YES, then holidays will be included in that period's occupied time schedule. If this variable is set to NO, then the period's occupied time schedule will not be used on holidays. This variable can be set for Periods 1 through 8.

OCCUPIED FROM (***PER.X→OCC***) — This variable is used to configure the start time of the Occupied period. All days in the same period set to YES will enter into Occupied mode at this time.

OCCUPIED TO (***PER.X→UNC***) — This variable is used to configure the end time of the Occupied period. All days in the same period set to YES will exit Occupied mode at this time.

Local Holiday Schedules (*HOL.L*) — This submenu is used to program the local holiday schedules. Up to 30 holidays can be configured. When a holiday occurs, the unit will follow the occupied schedules that have the HOLIDAY IN PERIOD point set to YES.

Holiday Start Month (***HD.01*** to ***HD.30→MON***) — This is the start month for the holiday. The numbers 1 to 12 correspond to the months of the year (e.g., January = 1).

Holiday Start Day (***HD.01*** to ***HD.30→DAY***) — This is the start day of the month for the holiday. The day can be set from 1 to 31.

Holiday Duration (***HD.01*** to ***HD.30→LEN***) — This is the length in days of the holiday. The holiday can last up to 99 days.

Daylight Savings Time (*DAY.S*) — The daylight savings time function is used in applications where daylight savings time occurs. The function will automatically correct the clock on the days configured for daylight savings time.

DAYLIGHT SAVINGS START (***DS.ST***) — This submenu configures the start date and time for daylight savings.

Daylight Savings Start Month (***DS.ST→ST.MN***) — This is the start month for daylight savings time. The numbers 1 to 12 correspond to the months of the year (e.g., January = 1).

Daylight Savings Start Week (***DS.ST→ST.WK***) — This is the start week of the month for daylight savings. The week can be set from 1 to 5.

Daylight Savings Start Day (***DS.ST→ST.DY***) — This is the start day of the week for daylight savings. The day can be set from 1 to 7 (Sunday=1, Monday=2, etc.).

Daylight Savings Minutes To Add (***DS.ST→MIN.A***) — This is the amount of time that will be added to the time clock for daylight savings.

DAYLIGHT SAVINGS STOP (***DS.SP***) — This submenu configures the end date and time for daylight savings.

Daylight Savings Stop Month (***DS.SP→SP.MN***) — This is the stop month for daylight savings time. The numbers 1 to 12 correspond to the months of the year (e.g., January = 1).

Daylight Savings Stop Week (***DS.SP→SP.WK***) — This is the stop week of the month for daylight savings. The week can be set from 1 to 5.

Daylight Savings Stop Day (***DS.SP→SP.DY***) — This is the stop day of the week for daylight savings. The day can be set from 1 to 7 (Sunday=1, Monday=2, etc.).

Daylight Savings Minutes To Subtract (***DS.SP→MIN.S***) — This is the amount of time that will be removed from the time clock after daylight savings ends.

TROUBLESHOOTING

The Scrolling Marquee display shows the actual operating conditions of the unit while it is running. If there are alarms or there have been alarms, they will be displayed in either the current alarm list or the history alarm list. The Service Test mode allows proper operation of the compressors, fans, and other components to be checked while the unit is not operating.

Complete Unit Stoppage — There are several conditions that can cause the unit not to provide heating or cooling. If an alarm is active which causes the unit to shut down, diagnose the problem using the information provided in the Alarms and Alerts section on page 78, but also check for the following:

- Cooling and heating loads are satisfied.
- Programmed schedule.
- General power failure.
- Tripped control circuit transformers circuit breakers.
- Tripped compressor circuit breakers.
- Unit is turned off through the CCN network.

Single Circuit Stoppage — If a single circuit stops incorrectly, there are several possible causes. The problem should be investigated using information from the Alarms and Alerts section on page 78.

Service Analysis — Detailed service analysis can be found in Tables 75-77 and in Fig. 12.

Restart Procedure — Before attempting to restart the machine, check the alarm list to determine the cause of the shutdown. If the shutdown alarm for a particular circuit has occurred, determine and correct the cause before allowing the unit to run under its own control again. When there is problem, the unit should be diagnosed in Service Test mode. The alarms must be reset before the circuit can operate in either Normal mode or Service Test mode.

Thermistor Troubleshooting — The electronic control uses five 5K-thermistors for the saturated condensing temperature sensor SCT.A and SCT.B. See Tables 78 and 79 for temperature vs. resistance data.

When replacing thermistors SDT.A and SDT.B, reuse the original hardware. These thermistors must be clamped tightly to the hairpins of the condenser.

The EDT, OAT, RAT, LAT, T55, T56, and T58 space temperature sensors use 10K thermistors. Resistances at various temperatures are listed in Tables 80 and 81.

THERMISTOR/TEMPERATURE SENSOR CHECK — A high quality digital volt-ohmmeter is required to perform this check.

1. Connect the digital voltmeter across the appropriate thermistor terminals at the J8 terminal strip on the Main Base Board.

2. Using the voltage reading obtained, read the sensor temperature from Tables 78-81.

3. To check thermistor accuracy, measure temperature at probe location with an accurate thermocouple-type temperature-measuring instrument. Insulate thermocouple to avoid ambient temperatures from influencing reading. Temperature measured by thermocouple and temperature determined from thermistor voltage reading should be close, 5° F (3° C) if care was taken in applying thermocouple and taking readings.

If a more accurate check is required, unit must be shut down and thermistor removed and checked at a known temperature (freezing point or boiling point of water) using either voltage drop measured across thermistor at the J8 terminal, or by determining the resistance with unit shut down and thermistor disconnected from J8. Compare the values determined with the value read by the control in the Temperatures mode using the Scrolling Marquee display.

Transducer Troubleshooting — The electronic control uses 2 suction pressure transducers to measure the suction pressure of circuits A and B. The pressure/voltage characteristics of these transducers are in shown in Table 82. The accuracy of these transducers can be verified by connecting an accurate pressure gage to the second refrigerant port in the suction line.

Table 75 — Cooling Service Analysis

PROBLEM	SOLUTION
COMPRESSOR DOES NOT RUN	
Active Alarm	Check active alarms using local display.
Contactor Open	
1. Power off.	1. Restore power.
2. Fuses blown in field power circuit.	2. After finding cause and correcting, replace with correct size fuse.
3. No control power.	3. Check secondary fuse(s); replace with correct type and size. Replace transformer if primary windings receiving power.
4. Compressor circuit breaker tripped.	4. Check for excessive compressor current draw. Reset breaker; replace if defective.
5. Safety device lockout circuit active.	5. Reset lockout circuit at circuit breaker.
6. Low-pressure switch open.	6. Check for refrigerant undercharge, obstruction of indoor airflow, or whether compressor suction shutoff valve is fully open. Make sure liquid line solenoid valve(s) is open.
7. High-pressure switch open.	7. Check for refrigerant overcharge, obstruction of outdoor airflow, air in system or whether compressor discharge valve is fully open. Be sure outdoor fans are operating correctly.
8. Loose electrical connections.	8. Tighten all connections.
9. Compressor stuck.	9. See compressor service literature.
Contactor Closed	
1. Compressor leads loose.	1. Check connections.
2. Motor windings open.	2. See compressor service literature.
3. Single phasing.	3. Check for blown fuse. Check for loose connection at compressor terminal.
COMPRESSOR STOPS ON HIGH PRESSURE	
Outdoor Fan On	
1. High-pressure switch faulty.	1. Replace switch.
2. Airflow restricted.	2. Remove obstruction.
3. Air recirculating.	3. Clear airflow area.
4. Noncondensables in system.	4. Purge and recharge as required.
5. Refrigerant overcharge.	5. Purge as required.
6. Line voltage incorrect.	6. Consult power company.
7. Refrigerant system restrictions.	7. Check or replace filter drier, expansion valve, etc. Check that compressor discharge valve is fully open.
Outdoor Fan Off	
1. Fan slips on shaft.	1. Tighten fan hub setscrews.
2. Motor not running.	2. Check power and capacitor.
3. Motor bearings stuck.	3. Replace bearings.
4. Motor overload open.	4. Check overload rating. Check for fan blade obstruction.
5. Motor burned out.	5. Replace motor.
COMPRESSOR CYCLES ON LOW PRESSURE	
Indoor-Air Fan Running	
1. Filter drier plugged.	1. Replace filter drier.
2. Expansion valve power head defective.	2. Replace power head.
3. Low refrigerant charge.	3. Add charge. Check low-pressure switch setting.
Airflow Restricted	
1. Coil iced up.	1. Check refrigerant charge.
2. Coil dirty.	2. Clean coil fins.
3. Air filters dirty.	3. Clean or replace filters.
4. Dampers closed.	4. Check damper operation and position.
Indoor-Air Fan Stopped	
1. Electrical connections loose.	1. Tighten all connections.
2. Fan relay defective.	2. Replace relay.
3. Motor overload open.	3. Power supply.
4. Motor defective.	4. Replace motor.
5. Fan belt broken or slipping.	5. Replace or tighten belt.

LEGEND

VFD — Variable Frequency Drive

Table 75 — Cooling Service Analysis (cont)

PROBLEM	SOLUTION
COMPRESSOR RUNNING BUT COOLING INSUFFICIENT	
<u>**Suction Pressure Low**</u> **1. Refrigerant charge low.** **2. Head pressure low.** **3. Air filters dirty.** **4. Expansion valve power head defective.** **5. Indoor coil partially iced.** **6. Indoor airflow restricted.**	1. Add refrigerant. 2. Check refrigerant charge. 3. Clean or replace filters. 4. Replace power head. 5. Check low-pressure setting. 6. Remove obstruction.
<u>**Suction Pressure High**</u> **1. Compressor valve defective.** **2. Heat load excessive.**	1. See compressor service literature. 2. Check for open doors or windows in vicinity of fan coil.
UNIT OPERATES TOO LONG OR CONTINUOUSLY **1. Low refrigerant charge.** **2. Control contacts fused.** **3. Air in system.** **4. Partially plugged expansion valve or filter drier.**	1. Add refrigerant 2. Replace control. 3. Purge and evacuate system. 4. Clean or replace.
SYSTEM IS NOISY **1. Piping vibration.** **2. Compressor noisy.**	1. Support piping as required. 2. Check valve plates for valve noise. Replace compressor if bearings are worn.
COMPRESSOR LOSES OIL **1. Leak in system.** **2. Crankcase heaters not energized during shutdown.**	1. Repair leak. 2. Check wiring and relays. Check heater and replace if defective.
FROSTED SUCTION LINE **Expansion valve admitting excess refrigerant.**	Adjust expansion valve.
HOT LIQUID LINE **1. Shortage of refrigerant due to leak.** **2. Expansion valve opens too wide.**	1. Repair leak and recharge. 2. Adjust expansion valve.
FROSTED LIQUID LINE **Restricted filter drier.**	Remove restriction or replace.
CONTACTOR OPEN **1. Power off.** **2. Fuses blown in field power circuit.** **3. No control power.**	1. Restore power. 2. After finding cause and correcting, replace with correct fuses. 3. Check secondary fuses. Replace with correct type and size. Replace transformer if primary windings are receiving power.
CONTACTOR CLOSED **1. VFD overload function tripped.** **2. Motor leads loose.** **3. Motor windings open.** **4. Single phasing.** **5. Belts broken or thrown.**	1. Refer to separate VFD technical manual for troubleshooting instructions. 2. Check connections at motor lead junction box. 3. Check motor windings. 4. Check for blown fuse. Check for loose connections at motor junction box. 5. Check belts. Replace as complete set if necessary.

LEGEND

VFD — Variable Frequency Drive

Table 76 — Gas Heating Service Analysis

PROBLEM	CAUSE	REMEDY
Burners Will Not Ignite.	Active alarm.	Check active alarms using *Comfort*Link™ Scrolling Marquee.
	No power to unit.	Check power supply, fuses, wiring, and circuit breakers.
	No power to IGC (Integrated Gas Control).	Check fuses and plugs.
	Heaters off due to time guard to prevent short cycling.	Check using *Comfort*Link Scrolling Marquee.
	Control calling for Cooling.	Check using *Comfort*Link Scrolling Marquee.
	No gas at main burners.	Check gas line for air and purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to re-light unit.
	Water in gas line.	Drain water and install drip.
Inadequate Heating.	Dirty air filters.	Replace air filters.
	Gas input too low.	Check gas pressure at manifold. Refer to gas valve adjustment in Installation, Start-up, and Service Manual.
	Control calling for W1only (low heat).	Allow time for W2 to energize.
	Unit undersized for load.	Decrease load.
	Restricted airflow.	Remove restriction.
	Too much outdoor air.	Check economizer position and configuration. Adjust minimum position using *Comfort*Link Scrolling Marquee.
	Limit switch cycles main burners.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
Poor Flame Characteristics.	Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO, sooting flame, or floating flame.	Check all screws around flue outlets and burner compartment. Tighten as necessary.
		Cracked heat exchanger, replace.
		Unit is over-fired, reduce input. Adjust gas line or manifold pressure.
		Check vent for restriction. Clean as necessary.
		Check orifice to burner alignment.
Burners Will Not Turn Off.	Unit is in Minimum on-time.	Check using *Comfort*Link Scrolling Marquee.
	Unit running in Service Test Mode.	Check using *Comfort*Link Scrolling Marquee.

Table 77 — Electric Heat Service Analysis

PROBLEM	CAUSE	REMEDY
No Heat.	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker.
	Thermostat occupancy schedule set point not calling for Heating.	Check using *Comfort*Link Scrolling Marquee.
	No 24 vac at primary contactor.	Check transformer and circuit breaker.
	No power (high voltage) to L2 of primary contactor.	Check safety switches "one-shot" backup and auto limit.
	Bad electrical elements.	Power off unit and remove high voltage wires. Check resistance of heater, replace if open.

Left column boxes (LED flashing codes)

- 1 FLASH - INDOOR FAN DELAY MODIFIED (HEATING)
- 2 FLASHES - OPENING OF LIMIT SWITCH
- 3 FLASHES - FLAME SENSOR INDICATES FLAME WITH CLOSED GAS VALVE
- 4 FLASHES - LIMIT SWITCH CYCLED 4 TIMES ON SINGLE CALL FOR HEAT
- 5 FLASHES - IGNITION LOCKOUT (No ignition within 15 minutes)
- 6 FLASHES - INDUCED DRAFT MOTOR FAULT (No signal from the Hall Effect Sensor for 60 seconds)
- 7 FLASHES - OPENING OF ROLLOUT SWITCH
- 8 FLASHES - HARDWARE OR SOFTWARE FAULT
- 9 FLASHES - SOFTWARE LOCKOUT

Flowchart

LED is → FLASHING (to left boxes)

LED is → OFF → 24 VOLTS BETWEEN R & C ON J2? → YES → DEFECTIVE IGC BOARD

24 VOLTS BETWEEN R & C ON J2? → No →
1. BLOWN 5 AMP FUSE
2. DEFECTIVE 24V TRANS.
3. BROKEN WIRE
4. NO POWER TO UNIT

LED is → ON → CALL FOR

CALL FOR → COOLING:
- COMPRESSOR & OUTDOOR FAN MOTOR START IMMEDIATELY
- 1 SECOND ON DELAY FOR INDOOR FAN
- COOLING DEMAND SATISFIED
- COMPRESSOR AND OUTDOOR FAN STOP IMMEDIATELY
- 30 SECOND OFF DELAY FOR INDOOR FAN

CALL FOR → HEATING:
- 'W1' FROM BASE CONTROL BOARD ENERGIZES 'W' ON IGC - 1 MINUTE LOCK-ON
- COMBUSTION RELAY ON IGC IS ENERGIZED
- COMBUSTION RELAY ENERGIZES INDUCED DRAFT MOTOR (IDM) THROUGH TERMINAL 'CM' ON IGC
- IF IDM IS TURNING AT CORRECT SPEED (AT LEAST 2400 RPM), HALL EFFECT SENSOR SENDS CORRECT SIGNAL TO TERMINAL 'J1' ON IGC

IF LIMIT SWITCH AND ROLLOUT SWITCH ARE CLOSED, IGC SAFETY LOGIC WILL INITIATE IGNITION SEQUENCE

→ IGC HIGH VOLTAGE TRANSFORMER CREATES A 10,000 VOLT SPARK FOR 5 SECONDS

→ IGC SAFETY LOGIC OPENS GAS VALVE FOR 5 SECONDS

DOES IGC DETECT .2 MICROAMPS FOR 2 SECONDS

→ No → IGC SAFETY LOGIC WILL SHUT OFF GAS VALVE AND SPARK → 20 SECOND PURGE OF HEAT EXCHANGER → IS THIS THE 33RD RETRY? (OR 15 MINUTES)
- No → (back to ignition sequence)
- Yes → IGNITION LOCKOUT (5 FLASHES OF LED)

DOES IGC DETECT .2 MICROAMPS FOR 2 SECONDS → Yes → AFTER 45 SECONDS (OR LESS IF THE TIMING HAS BEEN REDUCED DUE TO LIMIT SWITCH TRIPS) IGC WILL ENERGIZE BLOWER RELAY

→ DID LIMIT SWITCH OPEN BEFORE THE 45 SECONDS (OR THE MODIFIED TIME) HAS TIMED OUT?
- Yes → SUBTRACT 5 SECONDS (OR ANOTHER 5 SECONDS) FROM INDOOR FAN ON TIME DELAY
- No → NORMAL HEATING OPERATION

→ HEATING DEMAND SATISFIED

→ IDM STOPS, SAFETY LOGIC SHUTS OFF GAS VALVE

→ 45 SECOND BLOWER SHUTOFF DELAY (DELAY EXTENDED BY 5 SECONDS FOR EACH LIMIT SWITCH TRIP - MAXIMUM DELAY: 3 MINUTES)

LEGEND

IDM — Induced-Draft Motor
IGC — Integrated Gas Unit Controller

NOTE: Thermostat Fan Switch in the "AUTO" position.

Fig. 12 — IGC Service Analysis Logic

Table 78 — 5K Thermistor Temperature vs. Resistance (SCT Sensors) (English)

TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−25	3.699	98,010	59	1.982	7,686	143	0.511	1,190
−24	3.689	94,707	60	1.956	7,665	144	0.502	1,165
−23	3.679	91,522	61	1.930	7,468	145	0.494	1,141
−22	3.668	88,449	62	1.905	7,277	146	0.485	1,118
−21	3.658	85,486	63	1.879	7,091	147	0.477	1,095
−20	3.647	82,627	64	1.854	6,911	148	0.469	1,072
−19	3.636	79,871	65	1.829	6,735	149	0.461	1,050
−18	3.624	77,212	66	1.804	6,564	150	0.453	1,029
−17	3.613	74,648	67	1.779	6,399	151	0.445	1,007
−16	3.601	72,175	68	1.754	6,238	152	0.438	986
−15	3.588	69,790	69	1.729	6,081	153	0.430	965
−14	3.576	67,490	70	1.705	5,929	154	0.423	945
−13	3.563	65,272	71	1.681	5,781	155	0.416	925
−12	3.550	63,133	72	1.656	5,637	156	0.408	906
−11	3.536	61,070	73	1.632	5,497	157	0.402	887
−10	3.523	59,081	74	1.609	5,361	158	0.395	868
−9	3.509	57,162	75	1.585	5,229	159	0.388	850
−8	3.494	55,311	76	1.562	5,101	160	0.381	832
−7	3.480	53,526	77	1.538	4,976	161	0.375	815
−6	3.465	51,804	78	1.516	4,855	162	0.369	798
−5	3.450	50,143	79	1.493	4,737	163	0.362	782
−4	3.434	48,541	80	1.470	4,622	164	0.356	765
−3	3.418	46,996	81	1.448	4,511	165	0.350	750
−2	3.402	45,505	82	1.426	4,403	166	0.344	734
−1	3.386	44,066	83	1.404	4,298	167	0.339	719
0	3.369	42,679	84	1.382	4,196	168	0.333	705
1	3.352	41,339	85	1.361	4,096	169	0.327	690
2	3.335	40,047	86	1.340	4,000	170	0.322	677
3	3.317	38,800	87	1.319	3,906	171	0.317	663
4	3.299	37,596	88	1.298	3,814	172	0.311	650
5	3.281	36,435	89	1.278	3,726	173	0.306	638
6	3.262	35,313	90	1.257	3,640	174	0.301	626
7	3.243	34,231	91	1.237	3,556	175	0.296	614
8	3.224	33,185	92	1.217	3,474	176	0.291	602
9	3.205	32,176	93	1.198	3,395	177	0.286	591
10	3.185	31,202	94	1.179	3,318	178	0.282	581
11	3.165	30,260	95	1.160	3,243	179	0.277	570
12	3.145	29,351	96	1.141	3,170	180	0.272	561
13	3.124	28,473	97	1.122	3,099	181	0.268	551
14	3.103	27,624	98	1.104	3,031	182	0.264	542
15	3.082	26,804	99	1.086	2,964	183	0.259	533
16	3.060	26,011	100	1.068	2,898	184	0.255	524
17	3.038	25,245	101	1.051	2,835	185	0.251	516
18	3.016	24,505	102	1.033	2,773	186	0.247	508
19	2.994	23,789	103	1.016	2,713	187	0.243	501
20	2.972	23,096	104	0.999	2,655	188	0.239	494
21	2.949	22,427	105	0.983	2,597	189	0.235	487
22	2.926	21,779	106	0.966	2,542	190	0.231	480
23	2.903	21,153	107	0.950	2,488	191	0.228	473
24	2.879	20,547	108	0.934	2,436	192	0.224	467
25	2.856	19,960	109	0.918	2,385	193	0.220	461
26	2.832	19,393	110	0.903	2,335	194	0.217	456
27	2.808	18,843	111	0.888	2,286	195	0.213	450
28	2.784	18,311	112	0.873	2,239	196	0.210	445
29	2.759	17,796	113	0.858	2,192	197	0.206	439
30	2.735	17,297	114	0.843	2,147	198	0.203	434
31	2.710	16,814	115	0.829	2,103	199	0.200	429
32	2.685	16,346	116	0.815	2,060	200	0.197	424
33	2.660	15,892	117	0.801	2,018	201	0.194	419
34	2.634	15,453	118	0.787	1,977	202	0.191	415
35	2.609	15,027	119	0.774	1,937	203	0.188	410
36	2.583	14,614	120	0.761	1,898	204	0.185	405
37	2.558	14,214	121	0.748	1,860	205	0.182	401
38	2.532	13,826	122	0.735	1,822	206	0.179	396
39	2.506	13,449	123	0.723	1,786	207	0.176	391
40	2.480	13,084	124	0.710	1,750	208	0.173	386
41	2.454	12,730	125	0.698	1,715	209	0.171	382
42	2.428	12,387	126	0.686	1,680	210	0.168	377
43	2.402	12,053	127	0.674	1,647	211	0.165	372
44	2.376	11,730	128	0.663	1,614	212	0.163	367
45	2.349	11,416	129	0.651	1,582	213	0.160	361
46	2.323	11,112	130	0.640	1,550	214	0.158	356
47	2.296	10,816	131	0.629	1,519	215	0.155	350
48	2.270	10,529	132	0.618	1,489	216	0.153	344
49	2.244	10,250	133	0.608	1,459	217	0.151	338
50	2.217	9,979	134	0.597	1,430	218	0.148	332
51	2.191	9,717	135	0.587	1,401	219	0.146	325
52	2.165	9,461	136	0.577	1,373	220	0.144	318
53	2.138	9,213	137	0.567	1,345	221	0.142	311
54	2.112	8,973	138	0.557	1,318	222	0.140	304
55	2.086	8,739	139	0.548	1,291	223	0.138	297
56	2.060	8,511	140	0.538	1,265	224	0.135	289
57	2.034	8,291	141	0.529	1,240	225	0.133	282
58	2.008	8,076	142	0.520	1,214			

Table 79 — 5K Thermistor Temperature vs. Resistance (SCT Sensors) (SI)

TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−32	3.705	100,260	15	1.982	7,855	62	0.506	1,158
−31	3.687	94,165	16	1.935	7,499	63	0.490	1,118
−30	3.668	88,480	17	1.889	7,161	64	0.475	1,079
−29	3.649	83,170	18	1.844	6,840	65	0.461	1,041
−28	3.629	78,125	19	1.799	6,536	66	0.447	1,006
−27	3.608	73,580	20	1.754	6,246	67	0.433	971
−26	3.586	69,250	21	1.710	5,971	68	0.420	938
−25	3.563	65,205	22	1.666	5,710	69	0.407	906
−24	3.539	61,420	23	1.623	5,461	70	0.395	876
−23	3.514	57,875	24	1.580	5,225	71	0.383	836
−22	3.489	54,555	25	1.538	5,000	72	0.371	805
−21	3.462	51,450	26	1.497	4,786	73	0.360	775
−20	3.434	48,536	27	1.457	4,583	74	0.349	747
−19	3.406	45,807	28	1.417	4,389	75	0.339	719
−18	3.376	43,247	29	1.378	4,204	76	0.329	693
−17	3.345	40,845	30	1.340	4,028	77	0.319	669
−16	3.313	38,592	31	1.302	3,861	78	0.309	645
−15	3.281	38,476	32	1.265	3,701	79	0.300	623
−14	3.247	34,489	33	1.229	3,549	80	0.291	602
−13	3.212	32,621	34	1.194	3,404	81	0.283	583
−12	3.177	30,866	35	1.160	3,266	82	0.274	564
−11	3.140	29,216	36	1.126	3,134	83	0.266	547
−10	3.103	27,633	37	1.093	3,008	84	0.258	531
−9	3.065	26,202	38	1.061	2,888	85	0.251	516
−8	3.025	24,827	39	1.030	2,773	86	0.244	502
−7	2.985	23,532	40	0.999	2,663	87	0.237	489
−6	2.945	22,313	41	0.969	2,559	88	0.230	477
−5	2.903	21,163	42	0.940	2,459	89	0.223	466
−4	2.860	20,079	43	0.912	2,363	90	0.217	456
−3	2.817	19,058	44	0.885	2,272	91	0.211	446
−2	2.774	18,094	45	0.858	2,184	92	0.204	436
−1	2.730	17,184	46	0.832	2,101	93	0.199	427
0	2.685	16,325	47	0.807	2,021	94	0.193	419
1	2.639	15,515	48	0.782	1,944	95	0.188	410
2	2.593	14,749	49	0.758	1,871	96	0.182	402
3	2.547	14,026	50	0.735	1,801	97	0.177	393
4	2.500	13,342	51	0.713	1,734	98	0.172	385
5	2.454	12,696	52	0.691	1,670	99	0.168	376
6	2.407	12,085	53	0.669	1,609	100	0.163	367
7	2.360	11,506	54	0.649	1,550	101	0.158	357
8	2.312	10,959	55	0.629	1,493	102	0.154	346
9	2.265	10,441	56	0.610	1,439	103	0.150	335
10	2.217	9,949	57	0.591	1,387	104	0.146	324
11	2.170	9,485	58	0.573	1,337	105	0.142	312
12	2.123	9,044	59	0.555	1,290	106	0.138	299
13	2.076	8,627	60	0.538	1,244	107	0.134	285
14	2.029	8,231	61	0.522	1,200			

Table 80 — 10K Thermistor vs. Resistance (T55, T56, OAT, RAT, EDT, LAT Sensors) (English)

TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (F)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−25	4.758	196,453	61	2.994	14,925	147	0.890	2,166
−24	4.750	189,692	62	2.963	14,549	148	0.876	2,124
−23	4.741	183,300	63	2.932	14,180	149	0.862	2,083
−22	4.733	177,000	64	2.901	13,824	150	0.848	2,043
−21	4.724	171,079	65	2.870	13,478	151	0.835	2,003
−20	4.715	165,238	66	2.839	13,139	152	0.821	1,966
−19	4.705	159,717	67	2.808	12,814	153	0.808	1,928
−18	4.696	154,344	68	2.777	12,493	154	0.795	1,891
−17	4.686	149,194	69	2.746	12,187	155	0.782	1,855
−16	4.676	144,250	70	2.715	11,884	156	0.770	1,820
−15	4.665	139,443	71	2.684	11,593	157	0.758	1,786
−14	4.655	134,891	72	2.653	11,308	158	0.745	1,752
−13	4.644	130,402	73	2.622	11,031	159	0.733	1,719
−12	4.633	126,183	74	2.592	10,764	160	0.722	1,687
−11	4.621	122,018	75	2.561	10,501	161	0.710	1,656
−10	4.609	118,076	76	2.530	10,249	162	0.699	1,625
−9	4.597	114,236	77	2.500	10,000	163	0.687	1,594
−8	4.585	110,549	78	2.470	9,762	164	0.676	1,565
−7	4.572	107,006	79	2.439	9,526	165	0.666	1,536
−6	4.560	103,558	80	2.409	9,300	166	0.655	1,508
−5	4.546	100,287	81	2.379	9,078	167	0.645	1,480
−4	4.533	97,060	82	2.349	8,862	168	0.634	1,453
−3	4.519	94,020	83	2.319	8,653	169	0.624	1,426
−2	4.505	91,019	84	2.290	8,448	170	0.614	1,400
−1	4.490	88,171	85	2.260	8,251	171	0.604	1,375
0	4.476	85,396	86	2.231	8,056	172	0.595	1,350
1	4.461	82,729	87	2.202	7,869	173	0.585	1,326
2	4.445	80,162	88	2.173	7,685	174	0.576	1,302
3	4.429	77,662	89	2.144	7,507	175	0.567	1,278
4	4.413	75,286	90	2.115	7,333	176	0.558	1,255
5	4.397	72,940	91	2.087	7,165	177	0.549	1,233
6	4.380	70,727	92	2.059	6,999	178	0.540	1,211
7	4.363	68,542	93	2.030	6,838	179	0.532	1,190
8	4.346	66,465	94	2.003	6,683	180	0.523	1,169
9	4.328	64,439	95	1.975	6,530	181	0.515	1,148
10	4.310	62,491	96	1.948	6,383	182	0.507	1,128
11	4.292	60,612	97	1.921	6,238	183	0.499	1,108
12	4.273	58,781	98	1.894	6,098	184	0.491	1,089
13	4.254	57,039	99	1.867	5,961	185	0.483	1,070
14	4.235	55,319	100	1.841	5,827	186	0.476	1,052
15	4.215	53,693	101	1.815	5,698	187	0.468	1,033
16	4.195	52,086	102	1.789	5,571	188	0.461	1,016
17	4.174	50,557	103	1.763	5,449	189	0.454	998
18	4.153	49,065	104	1.738	5,327	190	0.447	981
19	4.132	47,627	105	1.713	5,210	191	0.440	964
20	4.111	46,240	106	1.688	5,095	192	0.433	947
21	4.089	44,888	107	1.663	4,984	193	0.426	931
22	4.067	43,598	108	1.639	4,876	194	0.419	915
23	4.044	42,324	109	1.615	4,769	195	0.413	900
24	4.021	41,118	110	1.591	4,666	196	0.407	885
25	3.998	39,926	111	1.567	4,564	197	0.400	870
26	3.975	38,790	112	1.544	4,467	198	0.394	855
27	3.951	37,681	113	1.521	4,370	199	0.388	841
28	3.927	36,610	114	1.498	4,277	200	0.382	827
29	3.903	35,577	115	1.475	4,185	201	0.376	814
30	3.878	34,569	116	1.453	4,096	202	0.370	800
31	3.853	33,606	117	1.431	4,008	203	0.365	787
32	3.828	32,654	118	1.409	3,923	204	0.359	774
33	3.802	31,752	119	1.387	3,840	205	0.354	762
34	3.776	30,860	120	1.366	3,759	206	0.349	749
35	3.750	30,009	121	1.345	3,681	207	0.343	737
36	3.723	29,177	122	1.324	3,603	208	0.338	725
37	3.697	28,373	123	1.304	3,529	209	0.333	714
38	3.670	27,597	124	1.284	3,455	210	0.328	702
39	3.654	26,838	125	1.264	3,383	211	0.323	691
40	3.615	26,113	126	1.244	3,313	212	0.318	680
41	3.587	25,396	127	1.225	3,244	213	0.314	670
42	3.559	24,715	128	1.206	3,178	214	0.309	659
43	3.531	24,042	129	1.187	3,112	215	0.305	649
44	3.503	23,399	130	1.168	3,049	216	0.300	639
45	3.474	22,770	131	1.150	2,986	217	0.296	629
46	3.445	22,161	132	1.132	2,926	218	0.292	620
47	3.416	21,573	133	1.114	2,866	219	0.288	610
48	3.387	20,998	134	1.096	2,809	220	0.284	601
49	3.357	20,447	135	1.079	2,752	221	0.279	592
50	3.328	19,903	136	1.062	2,697	222	0.275	583
51	3.298	19,386	137	1.045	2,643	223	0.272	574
52	3.268	18,874	138	1.028	2,590	224	0.268	566
53	3.238	18,384	139	1.012	2,539	225	0.264	557
54	3.208	17,904	140	0.996	2,488			
55	3.178	17,441	141	0.980	2,439			
56	3.147	16,991	142	0.965	2,391			
57	3.117	16,552	143	0.949	2,343			
58	3.086	16,131	144	0.934	2,297			
59	3.056	15,714	145	0.919	2,253			
60	3.025	15,317	146	0.905	2,209			

Table 81 — 10K Thermistor vs. Resistance (T55, T56, OAT, RAT, EDT, LAT Sensors) (SI)

TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)	TEMP (C)	VOLTAGE DROP (V)	RESISTANCE (Ohms)
−32	4.762	200,510	15	3.056	15,714	62	0.940	2,315
−31	4.748	188,340	16	3.000	15,000	63	0.913	2,235
−30	4.733	177,000	17	2.944	14,323	64	0.887	2,157
−29	4.716	166,342	18	2.889	13,681	65	0.862	2,083
−28	4.700	156,404	19	2.833	13,071	66	0.837	2,011
−27	4.682	147,134	20	2.777	12,493	67	0.813	1,943
−26	4.663	138,482	21	2.721	11,942	68	0.790	1,876
−25	4.644	130,402	22	2.666	11,418	69	0.767	1,813
−24	4.624	122,807	23	2.610	10,921	70	0.745	1,752
−23	4.602	115,710	24	2.555	10,449	71	0.724	1,693
−22	4.580	109,075	25	2.500	10,000	72	0.703	1,637
−21	4.557	102,868	26	2.445	9,571	73	0.683	1,582
−20	4.533	97,060	27	2.391	9,164	74	0.663	1,530
−19	4.508	91,588	28	2.337	8,776	75	0.645	1,480
−18	4.482	86,463	29	2.284	8,407	76	0.626	1,431
−17	4.455	81,662	30	2.231	8,056	77	0.608	1,385
−16	4.426	77,162	31	2.178	7,720	78	0.591	1,340
−15	4.397	72,940	32	2.127	7,401	79	0.574	1,297
−14	4.367	68,957	33	2.075	7,096	80	0.558	1,255
−13	4.335	65,219	34	2.025	6,806	81	0.542	1,215
−12	4.303	61,711	35	1.975	6,530	82	0.527	1,177
−11	4.269	58,415	36	1.926	6,266	83	0.512	1,140
−10	4.235	55,319	37	1.878	6,014	84	0.497	1,104
−9	4.199	52,392	38	1.830	5,774	85	0.483	1,070
−8	4.162	49,640	39	1.784	5,546	86	0.470	1,037
−7	4.124	47,052	40	1.738	5,327	87	0.457	1,005
−6	4.085	44,617	41	1.692	5,117	88	0.444	974
−5	4.044	42,324	42	1.648	4,918	89	0.431	944
−4	4.003	40,153	43	1.605	4,727	90	0.419	915
−3	3.961	38,109	44	1.562	4,544	91	0.408	889
−2	3.917	36,182	45	1.521	4,370	92	0.396	861
−1	3.873	34,367	46	1.480	4,203	93	0.386	836
0	3.828	32,654	47	1.439	4,042	94	0.375	811
1	3.781	31,030	48	1.400	3,889	95	0.365	787
2	3.734	29,498	49	1.362	3,743	96	0.355	764
3	3.686	28,052	50	1.324	3,603	97	0.345	742
4	3.637	26,686	51	1.288	3,469	98	0.336	721
5	3.587	25,396	52	1.252	3,340	99	0.327	700
6	3.537	24,171	53	1.217	3,217	100	0.318	680
7	3.485	23,013	54	1.183	3,099	101	0.310	661
8	3.433	21,918	55	1.150	2,986	102	0.302	643
9	3.381	20,883	56	1.117	2,878	103	0.294	626
10	3.328	19,903	57	1.086	2,774	104	0.287	609
11	3.274	18,972	58	1.055	2,675	105	0.279	592
12	3.220	18,090	59	1.025	2,579	106	0.272	576
13	3.165	17,255	60	0.996	2,488	107	0.265	561
14	3.111	16,474	61	0.968	2,400			

Table 82 — Suction Pressure Transducer Pressure (PSIG) vs. Voltage (SSP-A, SSP-B)

PRESSURE (PSIG)	VOLTAGE DROP (V)	PRESSURE (PSIG)	VOLTAGE DROP (V)	PRESSURE (PSIG)	VOLTAGE DROP (V)	PRESSURE (PSIG)	VOLTAGE DROP (V)
0	0.290	34	1.436	68	2.582	102	3.728
1	0.324	35	1.470	69	2.615	103	3.761
2	0.357	36	1.503	70	2.649	104	3.795
3	0.391	37	1.537	71	2.683	105	3.829
4	0.425	38	1.571	72	2.717	106	3.862
5	0.458	39	1.604	73	2.750	107	3.896
6	0.492	40	1.638	74	2.784	108	3.930
7	0.526	41	1.672	75	2.818	109	3.964
8	0.560	42	1.705	76	2.851	110	3.997
9	0.593	43	1.739	77	2.885	111	4.031
10	0.627	44	1.773	78	2.919	112	4.065
11	0.661	45	1.807	79	2.952	113	4.098
12	0.694	46	1.840	80	2.986	114	4.132
13	0.728	47	1.874	81	3.020	115	4.166
14	0.762	48	1.908	82	3.054	116	4.200
15	0.795	49	1.941	83	3.087	117	4.233
16	0.829	50	1.975	84	3.121	118	4.267
17	0.863	51	2.009	85	3.155	119	4.301
18	0.897	52	2.042	86	3.188	120	4.334
19	0.930	53	2.076	87	3.222	121	4.368
20	0.964	54	2.110	88	3.256	122	4.402
21	0.998	55	2.144	89	3.290	123	4.435
22	1.031	56	2.177	90	3.323	124	4.469
23	1.065	57	2.211	91	3.357	125	4.503
24	1.099	58	2.245	92	3.391	126	4.537
25	1.132	59	2.278	93	3.424	127	4.570
26	1.166	60	2.312	94	3.458	128	4.604
27	1.200	61	2.346	95	3.492	129	4.638
28	1.234	62	2.380	96	3.525	130	4.671
29	1.267	63	2.413	97	3.559	131	4.705
30	1.301	64	2.447	98	3.593	132	4.739
31	1.335	65	2.481	99	3.627	133	4.772
32	1.368	66	2.514	100	3.660	134	4.806
33	1.402	67	2.548	101	3.694	135	4.840

Forcing Inputs and Outputs — Many variables may be forced both from the CCN and directly at the local display. This can be useful during diagnostic testing and also during operation, typically as part of an advanced third party control scheme. See Appendix A and B.

NOTE: In the case of a power reset, any force in effect at the time of the power reset will be cleared.

CONTROL LEVEL FORCING — If any of the following points are forced with a priority level of 7 (consult CCN literature for a description of priority levels), the software clears the force from the point if it has not been written to or forced again within the timeout periods defined below:

Temperatures→AIR.T→OAT	Outside Air Temperature	30 minutes
Temperatures→AIR.T→RAT	Return Air Temperature	3 minutes
Temperatures→AIR.T→SPT	Space Temperature	3 minutes
Inputs→RSET→SP.RS	Static Pressure Reset	30 minutes
Inputs→REL.H→OA.RH	Outside Air Relative Humidity	30 minutes
Inputs→AIR.Q→OAQ	Outside Air Quality	30 minutes

Run Status Menu — The Run Status menu provides the user important information about the unit. The Run Status table can be used to troubleshoot problems and to help determine how and why the unit is operating.

AUTO VIEW OF RUN STATUS — The Auto View of Run Status display table provides the most important unit information. The HVAC Mode (*Run Status→VIEW→ HVAC*) informs the user what HVAC mode the unit is currently in. Refer to the Modes section on page 26 for information on HVAC modes. The occupied status, unit temperatures, unit set points, and stage information can also be shown. See Table 83.

Run Status→VIEW→HVAC — Displays the current HVAC Mode(s) by name. HVAC Modes include:

OFF	VENT	HIGH HEAT
STARTING UP	HIGH COOL	FIRE SHUT DOWN
SHUTTING DOWN	LOW COOL	PRESSURIZATION
DISABLED	UNOCC FREE COOL	EVACUATION
SOFTSTOP REQUEST	TEMPERING HICOOL	SMOKE PURGE
REM SW DISABLE	TEMPERING LOCOOL	
COMP STUCK ON	TEMPERING VENT	
TEST	LOW HEAT	

Run Status→VIEW→OCC — Displays the current occupancy status of the control.

Run Status→VIEW→MAT — Displays the current value for mixed-air temperature. This value is calculated based on return-air and outside-air temperatures and economizer damper position.

Run Status→VIEW→EDT — Displays the current evaporator discharge air temperature during Cooling modes. This value is read at the supply air thermistor location (or at cooling coil thermistor array if unit is equipped with hydronic heating coil).

Run Status→VIEW→LAT — Displays the current leaving-air temperature during Vent and Hydronic Heating modes. This value is read at the supply air thermistor location.

Run Status→VIEW→EC.C.P — Displays the current economizer control point value (a target value for air temperature leaving the evaporator coil location).

Run Status→VIEW→ECN.P — Displays the current actual economizer position (in percentage open).

Run Status→VIEW→CL.C.P — Displays the current cooling control point (a target value for air temperature leaving the evaporator coil location).

Run Status→VIEW→C.CAP — Displays the current amount of unit cooling capacity (in percent of maximum).

Run Status→VIEW→HT.C.P — Displays the current heating control point, for use with staged gas control option only (a target value for air temperature leaving the supply duct).

Run Status→VIEW→HT.ST — Displays the current number of heating stages active (for staged gas control option only). Compare to following point.

Run Status→VIEW→H.MAX — Displays the maximum number of heat stages available for this model.

ECONOMIZER RUN STATUS — The Economizer Run Status display table provides information about the economizer and can be used to troubleshoot economizer problems. See Table 84. The current position, commanded position, and whether the economizer is active can be displayed. All the disabling conditions for the economizer and outside air information is also displayed.

COOLING INFORMATION — The Cooling Information run status display table provides information on the cooling operation of the unit. See Table 85.

Current Running Capacity (*C.CAP*) — This variable represents the amount of capacity currently running as a percent.

Current Cool Stage (*CUR.S*) — This variable represents the cool stage currently running.

Requested Cool Stage (*REQ.S*) — This variable represents the requested cool stage. Cooling relay timeguards in place may prevent the requested cool stage from matching the current cool stage.

Maximum Cool Stages (*MAX.S*) — This variable is the maximum number of cooling stages the control is configured for and capable of controlling.

Active Demand Limit (*DEM.L*) — If demand limit is active, this variable will represent the amount of capacity that the control is currently limited to.

Capacity Load Factor (*SMZ*) — This factor builds up or down over time (–100 to +100) and is used as the means of adding or subtracting a cooling stage during run time. It is a normalized representation of the relationship between "Sum" and "Z". See the SUMZ Cooling Algorithm section on page 37.

Next Stage EDT Decrease (*ADD.R*) — This variable represents (if adding a stage of cooling) how much the temperature should drop in degrees depending on the *R.PCT* calculation and how much additional capacity is to be added.

$ADD.R = R.PCT * (C.CAP$ – capacity after adding a cooling stage)

For example: If *R.PCT* = 0.2 and the control would be adding 20% cooling capacity by taking the next step up, 0.2 times 20 = 4 F *ADD.R*

Next Stage EDT Increase (*SUB.R*) — This variable represents (if subtracting a stage of cooling) how much the temperature should rise in degrees depending on the *R.PCT* calculation and how much capacity is to be subtracted.

$SUB.R = R.PCT * (C.CAP$ – capacity after subtracting a cooling stage)

For Example: If *R.PCT* = 0.2 and the control would be subtracting 30% capacity by taking the next step down, 0.2 times –30 = –6 F *SUB.R*.

Rise Per Percent Capacity (*R.PCT*) — This is a real time calculation that represents the amount of degrees of drop/rise across the evaporator coil versus percent of current running capacity.

$R.PCT = (MAT – EDT)/C.CAP$

Cap Deadband Subtracting (*Y.MIN*) — This is a control variable used for Low Temp Override (*L.TMP*) and Slow Change Override (*SLOW*).

$Y.MIN = –SUB.R*0.4375$

Cap Deadband Adding (*Y.PLU*) — This is a control variable used for High Temp Override (*H.TMP*) and Slow Change Override (*SLOW*).

$Y.PLU = –ADD.R*0.4375$

Cap Threshold Subtracting (*Z.MIN*) — This parameter is used in the calculation of *SMZ* and is calculated as follows:

$Z.MIN = $ *Configuration→COOL→Z.GN* $ * (–10 + (4*$ $(–SUB.R))) * 0.6$

Cap Threshold Adding (**Z.PLU**) — This parameter is used in the calculation of SMZ and is calculated as follows:

$$Z.PLU = Configuration{\rightarrow}COOL{\rightarrow}Z.GN * (10 + (4*(-ADD.R))) * 0.6$$

High Temp Cap Override (**H.TMP**) — If stages of mechanical cooling are on and the error is greater than twice **Y.PLU**, and the rate of change of error is greater than 0.5° F, then a stage of mechanical cooling will be added every 30 seconds. This override is intended to react to situations where the load rapidly increases.

Low Temp Cap Override (**L.TMP**) — If the error is less than twice **Y.MIN**, and the rate of change of error is less than –0.5° F, then a mechanical stage will be removed every 30 seconds. This override is intended to quickly react to situations where the load is rapidly reduced.

Pull Down Cap Override (**PULL**) — If the error from set point is above 4° F, and the rate of change is less than –1° F per minute, then pulldown is in effect, and "SUM" is set to 0. This keeps mechanical cooling stages from being added when the error is very large, but there is no load in the space. Pulldown for units is expected to rarely occur, but is included for the rare situation when it is needed. Most likely pulldown will occur when mechanical cooling first becomes available shortly after

the control goes into an occupied mode (after a warm unoccupied mode).

Slow Change Cap Override (**SLOW**) — With a rooftop unit, the design rise at 100% total unit capacity is generally around 30° F. For a unit with 4 stages, each stage represents about 7.5° F of change to EDT. If stages could reliably be cycled at very fast rates, the set point could be maintained very precisely. Since it is not desirable to cycle compressors more than 6 cycles per hour, slow change override takes care of keeping the PID under control when "relatively" close to set point.

MODE TRIP HELPER — The Mode Trip Helper table provides information on the unit modes and when the modes start and stop. See Table 86. This information can be used to help determine why the unit is in the current mode.

CCN/LINKAGE DISPLAY TABLE — The CCN/Linkage display table provides information on unit linkage. See Table 87.

COMPRESSOR RUN HOURS DISPLAY TABLE — The Compressor Run Hours Display Table displays the number of run time hours for each compressor. See Table 88.

COMPRESSOR STARTS DISPLAY TABLE — The Compressor Starts Display Table displays the number of starts for each compressor. See Table 89.

Table 83 — Auto View of Run Status Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
VIEW	AUTO VIEW OF RUN STATUS				
HVAC	ascii string spelling out the hvac modes			string	
OCC	Occupied ?	YES/NO		OCCUPIED	forcible
MAT	Mixed Air Temperature		dF	MAT	
EDT	Evaporator Discharge Tmp		dF	EDT	
LAT	Leaving Air Temperature		dF	LAT	
EC.C.P	Economizer Control Point		dF	ECONCPNT	
ECN.P	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS	
CL.C.P	Cooling Control Point		dF	COOLCPNT	
C.CAP	Current Running Capacity			CAPTOTAL	
HT.C.P	Heating Control Point		dF	HEATCPNT	
HT.ST	Requested Heat Stage			HT_STAGE	
H.MAX	Maximum Heat Stages			HTMAXSTG	

Table 84 — Economizer Run Status Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
ECON	ECONOMIZER RUN STATUS				
ECN.P	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS	
ECN.C	Economizer Act.Cmd.Pos.	0-100	%	ECONOCMD	forcible
ACTV	Economizer Active ?	YES/NO		ECACTIVE	
DISA	ECON DISABLING CONDITIONS				
UNAV	Econ Act. Unavailable?	YES/NO		ECONUNAV	
R.EC.D	Remote Econ. Disabled?	YES/NO		ECONDISA	
DBC	DBC - OAT Lockout?	YES/NO		DBC_STAT	
DEW	DEW - OA Dewpt.Lockout?	YES/NO		DEW_STAT	
DDBC	DDBD- OAT > RAT Lockout?	YES/NO		DDBCSTAT	
OAEC	OAEC- OA Enth Lockout?	YES/NO		OAECSTAT	
DEC	DEC - Diff.Enth.Lockout?	YES/NO		DEC_STAT	
EDT	EDT Sensor Bad?	YES/NO		EDT_STAT	
OAT	OAT Sensor Bad ?	YES/NO		OAT_STAT	
FORC	Economizer Forced ?	YES/NO		ECONFORC	
SFON	Supply Fan Not On 30s ?	YES/NO		SFONSTAT	
CLOF	Cool Mode Not In Effect?	YES/NO		COOL_OFF	
OAQL	OAQ Lockout in Effect ?	YES/NO		OAQLOCKD	
HELD	Econ Recovery Hold Off?	YES/NO		ECONHELD	
O.AIR	OUTSIDE AIR INFORMATION				
OAT	Outside Air Temperature		dF	OAT	forcible
OA.RH	Outside Air Rel. Humidity		%	OARH	forcible
OA.E	Outside Air Enthalpy			OAE	
OA.D.T	OutsideAir Dewpoint Temp		dF	OADEWTMP	

Table 85 — Cooling Information Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
COOL	COOLING INFORMATION				
C.CAP	Current Running Capacity		%	CAPTOTAL	
CUR.S	Current Cool Stage			COOL_STG	
REQ.S	Requested Cool Stage			CL_STAGE	
MAX.S	Maximum Cool Stages			CLMAXSTG	
DEM.L	Active Demand Limit		%	DEM_LIM	forcible
SUMZ	COOL CAP. STAGE CONTROL				
SMZ	Capacity Load Factor	−100 → +100		SMZ	
ADD.R	Next Stage EDT Decrease		^F	ADDRISE	
SUB.R	Next Stage EDT Increase		^F	SUBRISE	
R.PCT	Rise Per Percent Capacity			RISE_PCT	
Y.MIN	Cap Deadband Subtracting			Y_MINUS	
Y.PLU	Cap Deadband Adding			Y_PLUS	
Z.MIN	Cap Threshold Subtracting			Z_MINUS	
Z.PLU	Cap Threshold Adding			Z_PLUS	
H.TMP	High Temp Cap Override			HI_TEMP	
L.TMP	Low Temp Cap Override			LOW_TEMP	
PULL	Pull Down Cap Override			PULLDOWN	
SLOW	Slow Change Cap Override			SLO_CHNG	

Table 86 — Mode Trip Helper Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
TRIP	MODE TRIP HELPER				
UN.C.S	Unoccup. Cool Mode Start			UCCLSTRT	
UN.C.E	Unoccup. Cool Mode End			UCCL_END	
OC.C.S	Occupied Cool Mode Start			OCCLSTRT	
OC.C.E	Occupied Cool Mode End			OCCL_END	
TEMP	Ctl.Temp RAT,SPT or Zone			CTRLTEMP	
OC.H.E	Occupied Heat Mode End			OCHT_END	
OC.H.S	Occupied Heat Mode Start			OCHTSTRT	
UN.H.E	Unoccup. Heat Mode End			UCHT_END	
UN.H.S	Unoccup. Heat Mode Start			UCHTSTRT	
HVAC	ascii string spelling out the hvac modes			string	

Table 87 — CCN/Linkage Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
LINK	CCN - LINKAGE				
MODE	Linkage Active - CCN	ON/OFF		MODELINK	
L.Z.T	Linkage Zone Control Tmp		dF	LZT	
L.C.SP	Linkage Curr. Cool Setpt		dF	LCSP	
L.H.SP	Linkage Curr. Heat Setpt		dF	LHSP	

Table 88 — Compressor Run Hours Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
HRS	COMPRESSOR RUN HOURS				
HR.A1	Compressor A1 Run Hours	0-999999	HRS	HR_A1	config
HR.A2	Compressor A2 Run Hours	0-999999	HRS	HR_A2	config
HR.B1	Compressor B1 Run Hours	0-999999	HRS	HR_B1	config
HR.B2	Compressor B2 Run Hours	0-999999	HRS	HR_B2	config

Table 89 — Compressor Starts Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
STRT	COMPRESSOR STARTS				
ST.A1	Compressor A1 Starts	0-999999		CY_A1	config
ST.A2	Compressor A2 Starts	0-999999		CY_A2	config
ST.B1	Compressor B1 Starts	0-999999		CY_B1	config
ST.B2	Compressor B2 Starts	0-999999		CY_B2	config

TIME GUARD DISPLAY TABLE — The Time Guard Display Table delay time for each compressor and heat relay. See Table 90.

SOFTWARE VERSION NUMBERS DISPLAY TABLE — The Software Version Numbers Display Table displays the software version numbers of the unit boards and devices. See Table 91.

Table 90 — Time Guard Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
TMGD	TIMEGUARDS				
TG.A1	Compressor A1 Timeguard			CMPA1_TG	
TG.A2	Compressor A2 Timeguard			CMPA2_TG	
TG.B1	Compressor B1 Timeguard			CMPB1_TG	
TG.B2	Compressor B2 Timeguard			CMPB2_TG	
TG.H1	Heat Relay 1 Timeguard			HS1_TG	
TG.H2	Heat Relay 2 Timeguard			HS2_TG	
TG.H3	Heat Relay 3 Timeguard			HS3_TG	
TG.H4	Heat Relay 4 Timeguard			HS4_TG	
TG.H5	Heat Relay 5 Timeguard			HS5_TG	
TG.H6	Heat Relay 6 Timeguard			HS6_TG	

Table 91 — Software Version Numbers Display Table

ITEM	EXPANSION	RANGE	UNITS	POINT	WRITE STATUS
VERS	SOFTWARE VERSION NUMBERS				
MBB	CESR131343-xx-xx			string	
ECB1	CESR131249-xx-xx			string	
ECB2	CESR131249-xx-xx			string	
SCB	CESR131226-xx-xx			string	
CEM	CESR131174-xx-xx			string	
MARQ	CESR131171-xx-xx			string	
NAVI	CESR130227-xx-xx			string	

Alarms and Alerts — There are a variety of different alerts and alarms in the system.

P — Pre-Alert: Part of the unit is temporarily down. The alarm is not broadcast on the CCN Network. The alarm relay is not energized. After an allowable number of retries, if the function does not recover, the pre-alert will be upgraded to an alert or an alarm.

T — Alert: Part of the unit is down, but the unit is still partially able to provide cooling or heating.

A — Alarm: The unit is down and is unable to provide cooling or heating.

All alarms are displayed with a code of AXXX where the A is the category of alarm (Pre-Alert, Alert, or Alarm) and XXX is the number.

The response of the control system to various alerts and alarms depends on the seriousness of the particular alert or alarm. In the mildest case, an alert does not affect the operation of the unit in any manner. An alert can also cause a "strike." A "striking" alert will cause the circuit to shut down for 15 minutes. This feature reduces the likelihood of false alarms causing a properly working system to be shutdown incorrectly. If three strikes occur before the circuit has an opportunity to show that it can function properly, the circuit will strike out, causing the shutdown alarm for that particular circuit. Once activated, the shutdown alarm can only be cleared via an alarm reset.

Circuits with strikes are given an opportunity to reset their strike counter to zero. As discussed above, a strike typically causes the circuit to shut down. Fifteen minutes later, that circuit will once again be allowed to run. If the circuit is able to run for 1 minute, its replacement circuit will be allowed to shut down (if not required to run to satisfy requested stages). However, the "troubled" circuit must run continuously for 5 minutes with no detectable problems before the strike counter is reset to zero.

All the alarms and alerts are summarized in Table 92.

Table 92 — Alert and Alarm Codes

ALARM OR ALERT NUMBER	DESCRIPTION	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
A051	A051 Circuit A, Compressor 1 Current Detected After Shutdown	Turn off all compressors	Manual	Welded Contact
P051	Compressor A1 Safety Trip	Add strike to Compressor	Automatic (max 3)	High pressure switch, compressor current, wiring error
T051	Circuit A, Compressor 1 Failure	Compressor locked off	Manual	Exceeded 3 strike limit
A052	Circuit A, Compressor 2 Current Detected After Shutdown	Turn off all compressors	Manual	Welded Contact
P052	Circuit A, Compressor 2 Failure	Add strike to Compressor	Automatic (max 3)	High pressure switch, compressor current, wiring error
T052	Circuit A, Compressor 2 Failure	Compressor locked off	Manual	Exceeded 3 strike limit
A055	Circuit B, Compressor 1 Current Detected After Shutdown	Turn off all compressors	Manual	Welded Contact
P055	Circuit B, Compressor 1 Failure	Add strike to Compressor	Automatic (max 3)	High pressure switch, compressor current, wiring error
T055	Circuit B, Compressor 1 Failure	Compressor locked off	Manual	Exceeded 3 strike limit
A056	Circuit B, Compressor 2 Current Detected After Shutdown	Turn off all compressors	Manual	Welded Contact
P056	Circuit B, Compressor 2 Failure	Add strike to Compressor	Automatic (max 3)	High pressure switch, compressor current, wiring error
T056	Circuit B, Compressor 2 Failure	Compressor locked off	Manual	Exceeded 3 strike limit
T064	Circuit A Saturated Condensing Thermistor Failure	Use OAT for head pressure control	Automatic	Faulty thermistor or wiring error
T065	Circuit B Saturated Condensing Thermistor Failure	Use OAT for head pressure control	Automatic	Faulty thermistor or wiring error
T072	Remote Setpoint/Reset Input Failure	Unit Shutdown	Automatic	Faulty remote input on CEM board
T073	Outside Air Temperature Thermistor Failure	Stop use of economizer	Automatic	Faulty thermistor or wiring error
T074	Space Temperature Thermistor Failure	Unit Shutdown	Automatic	Faulty thermistor or wiring error
T075	Return Air Thermistor Failure	Continue to run unit	Automatic	Faulty thermistor or wiring error
T076	Outside Air Relative Humidity Sensor Failure	Use OAT changeover control	Automatic	Faulty sensor or wiring error
T078	Return Air Relative Humidity Sensor Failure	Use differential drybulb changeover	Automatic	Faulty sensor or wiring error
T082	Space Temperature Offset Sensor Failure	Use Space temperature without offset	Automatic	Faulty sensor or wiring error
T092	Circuit A Suction Pressure Transducer Failure	Stop circuit	Automatic	Faulty sensor, wiring error
T093	Circuit B Suction Pressure Transducer Failure	Stop circuit	Automatic	Faulty sensor, wiring error
T110	Circuit A Loss of Charge	Stop circuit	Manual	Low refrigerant charge
T111	Circuit B Loss of Charge	Stop circuit	Manual	Low refrigerant charge
A120	Circuit A Low Saturated Suction Temperature Alarm.	Stop circuit	Manual	Low refrigerant charge, low airflow, dirty coil, broken fan belt, TXV problem
T120	Circuit A Low Saturated Suction Temperature Alert.	Stop circuit	Automatic	Low refrigerant charge, low airflow, dirty coil, broken fan belt, TXV problem
A121	Circuit B Low Saturated Suction Temperature Alarm.	Stop circuit	Manual	Low refrigerant charge, low airflow, dirty coil, broken fan belt, TXV problem
T121	Circuit B Low Saturated Suction Temperature Alert.	Stop circuit	Automatic	Low refrigerant charge, low airflow, dirty coil, broken fan belt, TXV problem
T122	Circuit A High Saturated Suction Temperature	Stop circuit	Manual	TXV problem
T123	Circuit B High Saturated Suction Temperature	Stop circuit	Manual	TXV problem
T126	Circuit A High Head Pressure	Stop circuit	Automatic	Dirty condenser, condenser fan failure
T127	Circuit B High Head Pressure	Stop circuit	Automatic	Dirty condenser, condenser fan failure
A150	Unit is in Emergency Stop	Stop units	Manual	External shutdown command
T153	Real Time Clock Hardware Failure	Stop unit	Manual	Control Board failure, check lights
A154	Serial EEPROM Hardware Failure	Stop unit	Manual	Control Board failure, check lights
T155	Serial EEPROM Storage Failure Error	Stop unit	Manual	Control Board failure, check lights
A156	Critical Serial EEPROM Storage Failure Error	Stop unit	Manual	Control Board failure, check lights
A157	A/D Hardware Failure	Stop unit	Manual	Control Board failure, check lights
A171	Loss of communications with the staged Gas control board	Stop gas heat	Automatic	Control Board failure, check lights
A172	Loss of communications with the Control Expansion Board	Stop options on CEM	Automatic	Control Board failure, check lights
A173	Loss of communications with the ECB1 Board	Stop economizer & power exh	Automatic	Control Board failure, check lights
A174	Loss of communications with the ECB2 board	Stop unit	Automatic	Control Board failure, check lights
T177	4-20 MA Demand Limit Failure	Stop demand limiting	Automatic	Input failure, wiring error
T178	4-20 MA Static Pressure Reset Fail	Stop static pressure reset	Automatic	Input Failure, wiring error
A200	Linkage Timeout Error - Loss of Communication	Stop unit	Manual	Wiring errors, board failures
T210	Building Pressure Transducer Failure	Close economizer, stop exhaust	Automatic	Sensor failure, wiring error
T211	Static Pressure Transducer Failure	Stop unit	Automatic	Sensor failure, wiring error
T220	Indoor Air Quality Sensor Failure	Stop IAQ control	Automatic	Sensor failure, wiring error
T221	Outdoor Air Quality Sensor Failure	Use a default value for IAQ	Automatic	Sensor failure, wiring error
T229	Economizer Minimum Position Override Sensor Failure	Use software configured minimum	Automatic	Input failure, wiring error
T245	Outside Air CFM Sensor Failure	not used at this time		not used
T246	Supply Air CFM Sensor Failure	not used at this time		not used
T247	Return Air CFM Sensor Failure	not used at this time		not used

LEGEND

A — Alarm
P — Pre-Alert
T — Alert

Table 92 — Alert and Alarm Codes (cont)

ALARM OR ALERT NUMBER	DESCRIPTION	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
T300	Space Temperature Below Limit	Stop cooling, but continue to heat	Automatic	Outdoor dampers stuck, no load
T301	Space Temperature Above Limit	Stop heating, but continue to cool	Automatic	High load, dampers open
T302	Supply Temperature Below Limit	Continue to run unit	Automatic	Dampers open, check configuration setpoint
T303	Supply Temperature Above Limit	Continue to run unit	Automatic	Dampers open, check configuration setpoint
T304	Return Temperature Below Limit	Continue to run unit	Automatic	Dampers open, check configuration setpoint
T305	Return Temperature Above Limit	Continue to run unit	Automatic	Dampers open, check configuration setpoint
T308	Return Air Relative Humidity Below Limit	Alert	Automatic	Configuration error, or sensor error
T309	Return Air Relative Humidity Above Limit	Continue to run unit	Automatic	Dampers open, check configuration setpoint
T310	Supply Duct Static Pressure Below Limit	Continue to run unit	Automatic	VFD problem, broken fan belt
T311	Supply Duct Static Pressure Above Limit	Continue to run unit	Automatic	VFD problem, broken fan belt
T312	Building Static Pressure Below Limit	Continue to run unit	Automatic	Exhaust issues, check setpoint
T313	Building Static Pressure Above Limit	Continue to run unit	Automatic	Exhaust issues, check setpoint
T314	IAQ Above Limit	Continue to run unit	Automatic	Damper or IAQ control issues
A404	Fire Shut Down Emergency Mode (fire-smoke)	Unit Shutdown	Automatic	Smoke detector switch or external switch
A405	Evacuation Emergency Mode	Run power exhaust	Automatic	Special fire mode control
A406	Pressurization Emergency Mode	Run supply fan	Automatic	Special fire mode control
A407	Smoke Purge Emergency Mode	Run supply and exhaust fans	Automatic	Special fire mode control
T408	Dirty Air Filter	Continue to run unit	Automatic	Dirty filter, switch setting
A409	Supply Fan Status Failure	Stop unit	Automatic	Fan drive failure
T409	Supply Fan Status Failure	Continue to run unit	Automatic	Fan drive failure, or sensor failure
T414	Loss of Communication with the Belimo Actuator	Close economizer	Automatic	Calibrate economizer, economizer failure, wiring
T414	Belimo Actuator Direction Error	Close economizer	Automatic	Motor direction switch wrong, wiring
T414	Belimo Actuator Failure	Attempt to close economizer	Automatic	Motor failure
T414	Belimo Actuator Hunting Alert	Close economizer	Automatic	Motor moving too often
T414	Belimo Actuator Range Error	Close economizer	Automatic	Calibrate economizer
T420	R-W1 Jumper Must Be Installed to Run Heat in Service Test	No heat	Automatic	Add red wire jumpers
T421	Thermostat Y2 Input Activated without Y1 Activated	Assume Y2 is Y1	Automatic	Thermostat wiring error
T422	Thermostat W2 Input Activated without W1 Activated	Assume W2 is W1	Automatic	Thermostat wiring error
T423	Thermostat Y and W Inputs Activated Simultaneously	Alert	Automatic	Thermostat issues
T424	Thermostat G Input Not Seen on a Call for Cooling	Turn fan on	Automatic	Thermostat or wiring issues
T500	Current Sensor Board Failure - A1	Stop compressor A1	Automatic	Faulty board or wiring
T501	Current Sensor Board Failure - A2	Stop compressor A2	Automatic	Faulty board or wiring
T502	Current Sensor Board Failure - B1	Stop compressor B1	Automatic	Faulty board or wiring
T503	Current Sensor Board Failure - B2	Stop compressor B2	Automatic	Faulty board or wiring
A700	Supply Air Temperature Sensor Failure	Stop staged gas heat	Automatic	Faulty sensor or wiring error
T701	Supply Air Temperature Thermistor 1 Failure	Stop staged gas heat	Automatic	Faulty sensor or wiring error
T702	Supply Air Temperature Thermistor 2 Failure	Stop staged gas heat	Automatic	Faulty sensor or wiring error
T703	Supply Air Temperature Thermistor 3 Failure	Stop staged gas heat	Automatic	Faulty sensor or wiring error
A704	Staged Gas Leaving Air Temp Sum Total Failure	Stop staged gas heat	Automatic	Faulty sensor or wiring error
T705	Limit Switch Thermistor Failure	Stop staged gas heat	Automatic	Faulty switch or wiring

LEGEND

A — Alarm
P — Pre-Alert
T — Alert

DIAGNOSTIC ALARM CODES AND POSSIBLE CAUSES

<u>Alert Codes 51, 52, 55 and 56 (Compressor Safety)</u> — Alert codes 51, 52, 55, and 56 are for compressors A1, A2, B1, and B2 respectively. These alerts occur when the Current Sensor (CS) does not detect compressor current during compressor operation. When this occurs, the control turns off the compressor and logs a strike for the respective circuit. These alerts reset automatically.

If the current sensor board reads OFF while the compressor relay has been commanded ON for a period of 4 continuous seconds, an alert is generated.

Any time this alert occurs, a strike will be called out on the affected compressor. If three successive strikes occur the compressor will be locked out requiring a manual reset or power reset of the circuit board. The clearing of strikes during compressor operation is a combination of 3 complete cycles or 15 continuous minutes of run time operation. So, if there are one or two strikes on the compressor and three short cycles (ON-OFF, ON-OFF, ON-OFF) less than 15 minutes each occur, the strikes will be reset to zero for the affected compressor. Also, if the compressor turns on and runs for 15 minutes straight with no compressor failure, the compressor's strikes are cleared as well.

NOTE: Until the compressor is locked out, for the first two strikes, the alert will not be broadcast to the network, nor will the alarm relay be closed.

The possible causes are:
• High-pressure switch (HPS) open. The HPS-pressure switch is wired in series with compressor relays on the MBB. If the high-pressure switch opens during compressor operation, the compressor stops, and the CS no longer detects current, causing the control to activate this alert.
• Compressor internal overload protection is open. The internal overloads are used on the Scroll Tech compressors (black) and smaller Maneurop compressors used on the 020, 025, 027, 030, 035 units and 040 A1, A2 compressors.

- Internal compressor temperature sensor trip. The large Maneurop compressors (blue) used on the 040 B1, B2, 050, and 060 units have an internal temperature sensor.
- Circuit Breaker trip. The compressors are protected from short circuit by a breaker in the control box. On the 020-035 and 040 A1, A2 units there is one breaker per two compressors and on the 040 B1, B2 and 050, 060 compressors there is one breaker per compressor because there is not internal overloads.
- Wiring error. A wiring error might not allow the compressor to start.

To check out alerts 51, 52, 55 and 56:

1. Turn on the compressor in question using Service Test mode. If the compressor does not start, then most likely the problem is one of the following: HPS open, open internal protection, circuit breaker trip, incorrect safety wiring, or incorrect compressor wiring.
2. If the compressor does start verify it is rotating in the correct direction.

IMPORTANT: Prolonged operation in the wrong direction can damage the compressor. Correct rotation can be verified by a gage set and looking for a differential pressure rise on start-up.

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3. If the compressor starts, verify that the indoor and outdoor fans are operating properly.
4. If the CS is always detecting current, then verify that the compressor is on. If the compressor is on, check the contactor and the relay on the MBB. If the compressor is off and there is no current, verify CS wiring and replace if necessary.
5. Return to Normal mode and observe compressor operation to verify that compressor current sensor is working and condenser fans are energized after compressor starts.

<u>Alarm Codes 51, 52, 55 and 56 (Current Detected After Turnoff)</u> — Alarm codes 51, 52, 55, and 56 are for compressors A1, A2, B1, B2 respectively. These alarms occur when the Current Sensor (CS) detects current when the compressor should be off. When this occurs, the control turns off the compressor and logs a strike for the respective circuit. Use the Scrolling Marquee to reset the alert.

If the current sensor board reads ON while the compressor relay has been commanded OFF for a period of 4 continuous seconds, an alarm is generated. These alarms are only monitored for a period of 10 seconds after the compressor relay has been commanded OFF. This is done to facilitate a service technician forcing a relay to test a compressor.

In addition, if a compressor stuck failure occurs and the current sensor board reports the compressor and the request off, certain diagnostics will take place.

1. If any of the 4 compressors are diagnosed as stuck on and the current sensor board is on and the request is off, the control will request the supply fan which will automatically start building air flow control.
2. Heating will be disabled while any one of the compressors has this problem.

The possible causes are:
- Welded contactor.
- Frozen compressor relay on MBB.

To check out alarms 51, 52, 55, and 56

1. Place the unit in Service Test mode. All compressors should be Off.
2. Verify that there is not 24v at the contactor coil. If there is 24v at the contactor, check relay on MBB and wiring.
3. Check for welded contactor.
4. Verify CS wiring.

5. Return to Normal mode and observe compressor operation to verify that compressor current sensor is working and condenser fans are energized after compressor starts.

<u>Alert Codes 64, and 65 (Condensing Temp. Failure)</u> — Alert codes 64, and 65 are for circuits A and B, respectively. These alerts occur when the saturated condensing temperatures (*Temperatures→REF.T→SCT.A* and *SCT.B*) are outside the range –40 to 240 F (–40 to 116 C). When this occurs, the control uses the outdoor temperature (OAT) to control the outdoor fans. The control will default to control based on the OAT sensor and will turn on OFC.B when the ambient is above 65 F and off when the ambient is below 50 F.

If the SCT and OAT sensors have all failed then the control should turn on OFC.B when compressors are on.

The cause of the alert is usually a faulty thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

<u>Alert Code 72 (Remote Setpoint/Rest Input Failure)</u> — If the unit is configured to use the remote EDT 4 to 20 mA reset input (*Configuration→EDT.R→RES.S*) and the sensor reading is less than 2 mA or greater than 22 mA then the alert will occur. When this occurs the control will default to the internal set points. The sensor is connected to the optional CEM module. For this sensor to be used, the EDT 4 to 20 mA reset input (*Configuration→EDT.R→RES.S*) must be set to enable.

<u>Alert Code 73 (Outside Air Temp. Failure)</u> — This alert occurs when the outside air temperature sensor (*Temperatures→AIR.T→OAT*) is outside the range –40 to 240 F (–40 to 116 C). Failure of this thermistor (*Temperatures→AIR.T →OAT*) will disable any elements of the control which requires its use. Economizer control beyond the vent position and the calculation of mixed air temperature for the sumZ algorithm will not be possible. This alert resets automatically. The cause of the alert is usually a faulty thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

<u>Alert Code 74 (Space Temp. Failure)</u> — This alert occurs when the space temperature sensor (*Temperatures→AIR.T →SPT*) is outside the range –40 to 240 F (–40 to 116 C). This alert will only occur if the unit is configured to use a space temperature sensor. Configuration is done through the Unit Control Type (*Configuration→UNIT→C.TYP*) configuration. Failure of this thermistor (*Temperatures→AIR.T→SPT*) will disable any elements of the control which requires its use. If the unit is configured for SPT 2 stage or SPT multi-stage operation and the sensor fails, no cooling or heating mode may be chosen. This alert resets automatically. The cause of the alert is usually a faulty thermistor in the T55, T56, or T58 device, a shorted or open thermistor caused by a wiring error, or a loose connection.

<u>Alert Code 75 (Return Air Temp. Failure)</u> — This alert occurs when the return air temperature sensor (*Temperatures→AIR.T→RAT*) is outside the range –40 to 240 F (–40 to 116 C). The RAT is standard on all units and is located in the return section near the auxiliary control box. This alert resets automatically. The cause of the alert is usually a faulty thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

Failure of this thermistor (*Temperatures→AIR.T→RAT*) will disable any elements of the control which requires its use. Elements of failure include:

- the calculation of mixed air temperature for sumZ control
- the selection of a mode for VAV units
- economizer differential enthalpy or dry bulb control
- Return air temp supply air reset

<u>Alert Code 76 (Outside Air Relative Humidity Sensor Failure)</u> — This alert occurs when the outside air humidity sensor (*Inputs→REL.H→OA.RH*) has a reading less than 2 mA or greater than 22 mA. Failure of this sensor will disable any elements of the control which requires its use including economizer outdoor and differential enthalpy control. The OA.RH

sensor is located in the economizer hood and is used for control of the economizer. The sensor is a loop powered 4 to 20 mA sensor. This alert resets automatically. The cause of the alert is usually a faulty sensor, a shorted or open sensor caused by a wiring error, or a loose connection. The unit must be configured to use the sensor through the Outside Air RH Sensor (*Configuration→ECON→ORH.S*) setting.

Alert Code 78 (Return Air Relative Humidity Sensor Failure) — This alert occurs when the return air humidity sensor (*Inputs→REL.H→RA.RH*) has a reading less than 2 mA or greater than 22 mA. Failure of this sensor (*Inputs→REL.H→RA.RH*) will disable any elements of the control which requires its use including economizer differential enthalpy control.

The RA.RH sensor is located in the return air section near the auxiliary control box. The sensor is a loop powered 4 to 20 mA sensor. This alert resets automatically. The cause of the alert is usually a faulty sensor, a shorted or open sensor caused by a wiring error, or a loose connection. The unit must be configured to use the sensor through the Outside Air RH Sensor (*Configuration→SENS→RRH.S*) setting.

Alert Code 82 (Space Temperature Offset Failure) — If the unit is configured to use a space temperature sensor and is using a T56 sensor with an offset potentiometer, then the alert will occur if the potentiometer is outside the allowable range. The control will default to the software applicable set point because there is no offset available that may be applied to space temperature. The alert will automatically clear. The unit must be configured for one of the SPT control options through the Unit Control Type (*Configuration→UNIT→C.TYP*) configuration.

Alert Codes 92, 93, (Suction Pres. Trans. Failure) — Alert codes 92, and 93 are for circuits A and B respectively. These alerts occur when the pressure is outside the range 0.5 to 134.5 psig. A circuit cannot run when this alert is active. Use the Scrolling Marquee to reset the alert. The cause of the alert is usually a faulty transducer, faulty 5v power supply, or a loose connection.

Alert Codes 110, 111 (Loss of Charge) — Alert codes 110, and 111 are for circuits A, and B respectively. These alerts occur when the compressor is OFF and the suction pressure is less than 5 psig and the OAT is above –5 F for 1 continuous minute. The alert will automatically clear when the suction pressure transducer reading is valid and greater than 15 psig. The cause of the alert is usually low refrigerant pressure or a faulty suction pressure transducer.

Alert and Alarm Code 120, 121 (Low Saturated Suction Temperature) — Alert codes 120 and 121 are used to protect the coil from freeze-up during operation. Alert 120 is for circuit A and 121 for circuit B. If the saturated suction temperature is less than 28 F for 15 minutes, less than 20 F for 5 minutes, or less than 5 F for 20 continuous seconds then the alert will occur for the appropriate circuit. The circuit will be allowed to restart in 15 minutes. If more than three alerts occur then the circuit will be locked out and an alarm is generated. If the saturated suction is greater than 34 F for more than one hour then the counter will be reset.

Alert Code 122 and 123 (High Saturated Suction Temperature) — Alert codes 122 and 123 occur when compressors in a circuit have been running for at least 5 minutes and the circuit saturated suction is greater than 60 F. The high saturated suction alert is generated and the circuit is shut down. This condition resets after OAT drops by 5° F. Alert code 122 is for circuit A and 123 for circuit B.

Alert Codes 126, 127 (Circuit High Head Pressure) — Alert codes 126, and 127 are for circuits A and B respectively. These alerts occur when the appropriate saturated condensing temperature is greater than 150 F. The cause of the alarm is usually an overcharged system, high outdoor ambient temperature coupled with dirty outdoor coil, plugged filter drier, or a faulty high-pressure switch.

The alert will clear automatically or when the OAT drops 5° F from the time of the alert.

Alarm Code 150 (Unit in Emergency Stop) — If the fire safety input condition occurs to indicate a fire or smoke condition, then Alarm code 150 will occur and the unit will be immediately stopped. Through separate inputs the unit can be put into purge, evacuation, and pressurization. This requires a manual reset.

If the CCN point name "EMSTOP" in the System table is set to emergency stop, the unit will shut down immediately and broadcast an alarm back to the CCN indicating that the unit is down. This alarm will clear when the variable is set back to "enable".

Alert Code 153 — Real Time Clock Hardware Failure — A problem has been detected with the real timeclock on the MBB. Try resetting the power and check the indicator lights. If the alert continues, the board should be replaced.

Alarm Code 154 — Serial EEPROM Hardware Failure — A problem has been detected with the EEPROM on the MBB. Try resetting the power and check the indicator lights. If the alarm continues, the board should be replaced.

Alert Code 155 — Serial EEPROM Storage Error — A problem has been detected with the EEPROM storage on the MBB. Try resetting the power and check the indicator lights. If the alert continues, the board should be replaced.

Alarm Code 156 — Critical Serial EEPROM Storage Error — A problem has been detected with the EEPROM storage on the MBB. Try resetting the power and check the indicator lights. If the alarm continues, the board should be replaced.

Alarm Code 157 — A/D Serial EEPROM Storage Failure Error — A problem has been detected with A/D conversion on the boards. Try resetting the power and check the indicator lights. If the alarm continues, the board should be replaced.

Alarm Code 171 — Loss of Communications with the Staged Gas Control Board — This alarm indicates that there are communications problems with the staged gas heat control board, which is located in the gas section on units equipped with staged gas heat. If this alarm occurs, the staged gas heat will be disabled. The alarm will automatically reset.

Alarm Code 172 — Loss of Communications with the Controls Expansion Board — This alarm indicates that there are communications problems with the Controls Expansion Board. All functions performed by the CEM will stop, which can include demand limit, reset, fire control modes, and the fan status switch. The alarm will automatically reset.

Alarm Code 173 — Loss of Communications with the ECB1 — This alarm indicates that there are communications problems with the Economizer Control Board. This will result in the economizer and the power exhaust not working and the dampers to be fully closed. The exhaust fans will stop. The alarm will automatically reset.

Alarm Code 174 — Loss of Communications with the ECB2 — This alarm indicates that there are communications problems with the ECB2 which controls the VAV unit indoor fan inverter speed and hot gas bypass on CV and VAV units. Because the control of the fan is critical to unit operation, the unit will be stopped. The alarm will automatically reset.

Alert Code 177 (4-20 mA Demand Limit Failure) — This alert indicates a problem with the optional remote 4 to 20 mA demand limit signal (*Inputs→4-20→DLM.M*) that is connected to the CEM module (if the signal reads less than 2 mA or is above 22 mA). If this occurs, then demand limiting will be disabled. The unit must be configured for 4 to 20 mA Demand Limiting using the Demand Limit Select (*Configuration→DMD.L→DM.L.S*).

Alert code 178 (4-20 mA Static Pressure Reset Failure) — If this transducer fails (if the signal reads less than 2 mA or is above 22 mA), and the unit is configured to perform static pressure reset with this transducer, no static pressure reset will be performed and an alert will be generated. Recovery is automatic. Reason for error is either a faulty sensor, wiring error, or damaged input on the CEM control board.

Alarm Code 200 (Linkage Timeout Error — Loss of Communications) — If linkage is established via the CCN with ComfortID™ terminals, a 5-minute timeout on loss of communication will be monitored. If 5 minutes expires since the last communication from a VAV Linkage Master, the unit will remove the link and flag the alert. When the rooftop looses its link, the temperature and set points are derived locally. Recovery is automatic on re-establishment of communications. Reason for failure may be wiring error, too much bus activity, or damaged 485 drivers.

Alert Code 210 (Building Pressure Transducer Failure) — The building pressure transducer (*Pressures→AIR.P→BP*) fails if the signal from the 4 to 20 mA building pressure transducer (used to control the power exhaust fans and the building pressure) is above 22 mA or below 2 mA. If the alert occurs, then the economizer will be closed and the power exhaust fans turned off. This alert will automatically reset. Check the building pressure transducer and sensor tubing. The sensor is located in the auxiliary control box. The alert will automatically reset.

Alert Code 211 (Static Pressure Transducer Failure) — The static pressure transducer (*Pressures→AIR.P→SP*) fails if the signal from the 4 to 20 mA static pressure transducer (used to control the VFD speed) is above 22 mA or below 2 mA. This failure will cause the unit to stop due to the potential damage that could occur due to over-pressurization. Check the pressure transducer and sensor tubing. The sensor is located in the auxiliary control box. The alert will automatically reset.

Alert Code 220 (Indoor Air Quality Sensor Failure) — If the indoor air quality sensor (*Inputs→AIR.Q→IAQ*) fails, demand control ventilation is not possible. The control defaults to the max vent position. Recovery is automatic. Reason for error is either a faulty sensor, wiring error, or damaged input on the MBB control board.

Alert Code 221 (Outdoor Air Quality Sensor Failure) — If the outdoor air quality sensor (*Inputs→AIR.Q→OAQ*) fails, OAQ defaults to 400 ppm and demand control ventilation will continue. Recovery is automatic. Reason for error is either a faulty sensor, wiring error, or damaged input on the CEM control board.

Alert Code 229 (Economizer Minimum Position Override Sensor Failure) — If the unit is configured to use the remote position override for the economizer and the input Econo Min. Pos. Override (*Configuration→IAQ→AQ.SP→IQ.O.P*) input 4 to 20 mA reading is less than 2 mA or greater than 22 mA then an alert will occur and the default software minimum position will be used for the economizer. The alert will automatically reset.

Alert Code 300 (Space Temperature Below Limit) — If the space temperature is below the configurable SPT Low Alert Limits (occupied [*Configuration→ALLM→SP.L.O*] for 5 minutes or unoccupied [*Configuration→ALLM→SP.L.U*] for 10 minutes), then an alert will be broadcast. The alert will automatically reset.

Alert Code 301 (Space Temperature Above Limit) — If the space temperature is above the configurable SPT High Alert Limits (occupied [*Configuration→ALLM→SP.H.O*] for 5 minutes or unoccupied [*Configuration→ALLM→SP.H.U*] for 10 minutes), then an alert will be broadcast. The alert will automatically reset.

Alert Code 302 (Supply Temperature Below Limit) — If the supply-air temperature measured by the supply temperature sensor is below the configurable SAT LO Alert Limit/Occ (*Configuration→ALLM→SA.L.O*) for 5 minutes or the Low Supply air temperature alert limit unoccupied mode (*Configuration→ALLM→SA.L.U*) for 10 minutes, then an alert will be broadcast.

Alert Code 303 (Supply Temperature Above Limit) — If the supply temperature is above the configurable SAT HI Alert Limit Occ (*Configuration→ALLM→SAH.O*) for 5 minutes or the SAT HI Alert Limit/Unocc (*Configuration→ALLM→SA.H.U*) for 10 minutes, then an alert will be broadcast. The alert will automatically reset.

Alert Code 304 (Return Air Temperature Below Limit) — If the return-air temperature measured by the RAT sensor is below the configurable RAT LO Alert Limit/Occ (*Configuration→ALLM→RA.L.O*) for 5 minutes or RAT HI Alert Limit/Occ (*Configuration→ALLM→RA.L.U*) for 10 minutes, then an alert will be broadcast.

Alert Code 305 (Return Air Temperature Above Limit) — If the return-air temperature is below the RAT HI Alert Limit/Occ (*Configuration→ALLM→RA.H.O*) for 5 minutes or RAT HI Alert Limit/Occ (*Configuration→ALLM→RA.H.U*) for 10 minutes, then an alert will be broadcast. The alert will automatically reset.

Alert Code 308 (Return Air Relative Humidity Below Limit) — If the unit is configured to use a return air relative humidity sensor through the Return Air RH Sensor (*Configuration→UNIT→SENS→RRH.S*) setting, and the measured level is below the configurable RH Low Alert Limit (*Configuration→ALLM→R.RH.L*) for 5 minutes, then the alert will occur. The unit will continue to run and the alert will automatically reset.

Alert Code 309 (Return Air Relative Humidity Above Limit) — If the unit is configured to use a return air relative humidity sensor through the Return Air RH Sensor (*Configuration→UNIT→SENS→RRH.S*) setting, and the measured level is above the configurable RH High Alert Limit (*Configuration→ALLM→R.RH.H*) for 5 minutes, then the alert will occur. Unit will continue to run and the alert will automatically reset.

Alert Code 310 (Supply Duct Pressure Below Limit) — If the unit is a VAV unit with a supply duct pressure sensor and the measured supply duct static pressure (*Pressures→AIR.P→SP*) is below the configurable SP Low Alert Limit (*Configuration→ALLM→SP.L*) for 5 minutes, then the alert will occur. The unit will continue to run and the alert will automatically reset.

Alert Code 311 (Supply Duct Pressure Above Limit) — If the unit is a VAV unit with a supply duct pressure sensor and the measured supply duct static pressure (*Pressures→AIR.P→SP*) is above the configurable SP Low Alert Limit (*Configuration→ALLM→SP.H*) for 5 minutes, then the alert will occur. The unit will continue to run and the alert will automatically reset.

Alert Code 312 (Building Static Pressure Below Limit) — If the unit is configured to use modulating power exhaust then a building static pressure limit can be configured using the BP Low Alert Limit (*Configuration→ALLM→BP.L*). If the measured pressure (*Pressures→AIR.P→BP*) is below the limit for 5 minutes then the alert will occur.

Alert Code 313 (Building Static Pressure Above Limit) — If the unit is configured to use modulating power exhaust then a building static pressure limit can be configured using the BP HI Alert Limit (*Configuration→ALLM→BP.H*). If the measured pressure (*Pressures→AIR.P→BP*) is above the limit for 5 minutes, then the alert will occur.

Alert Code 314 (IAQ Above Limit) — If the unit is configured to use an CO_2 sensor and the level (*Inputs→AIR.Q→IAQ*) is above the configurable IAQ High Alert Limit (*Configuration→ALLM→IAQ.H*) for 5 minutes then the alert will occur. The unit will continue to run and the alert will automatically reset.

Alarm Code 404 (Fire Shutdown) — This alarm occurs when the fire shutdown input is active (either open or closed depending upon its configuration). If the fire shut down input is energized (fire shutdown is in effect), or if two fire smoke modes are incorrectly energized at the same time, a fire shutdown mode will occur. This is an emergency mode requiring the complete shutdown of the unit. Recovery is automatic when the inputs are no longer on.

This alarm is usually caused by an auxiliary device that is trying to shut down the unit (e.g., smoke detector). The input for Fire Shutdown is at **Inputs→FIRE→FSD**. The switch logic configuration for this switch input can be found at variable **Configuration→SW.LG→FSD.L**. Verify that the configuration is set correctly, verify the wiring and auxiliary device. This alarm resets automatically.

Alarm Code 405 (Evacuation Emergency Mode) — Unit has been placed in the fire evacuation mode by means of the external command for evacuation (**Inputs→FIRE→EVAC**).

If the evacuation input on the CEM is energized, an evacuation mode occurs which flags an alarm. This mode attempts to lower the pressure of the space to prevent smoke from moving into another space. This is the reverse of the Pressurization mode. Closing the economizer, opening the return air damper, turning on the power exhaust, and shutting down the indoor fan will decrease pressure in the space. Recovery is automatic when the input is no longer on.

Alarm Code 406 (Pressurization Emergency Mode) — Unit has been placed in the fire pressurization mode by means of the External command for pressurization (**Inputs→FIRE→PRES**).

If the pressurization input on the CEM is energized, a pressurization mode occurs which flags an alarm. This mode attempts to raise the pressure of a space to prevent smoke infiltration from another space. The space with smoke should be in an Evacuation mode attempting to lower its pressure. Opening the economizer, closing the return air damper, shutting down power exhaust, and turning the indoor fan on will increase pressure in the space. Recovery is automatic when the input is no longer on.

Alarm Code 407 (Purge Emergency Mode) — Unit has been placed in the fire pressurization mode by means of the External command for pressurization (**Inputs→FIRE→PURG**).

If the smoke purge input on the CEM is energized, a smoke purge mode occurs which flags an alarm. This mode attempts to draw out smoke from the space after the emergency condition. Opening the economizer, closing the return air damper, and turning on both the power exhaust and indoor fan will evacuate smoke and bring in fresh air. Recovery is automatic when the input is no longer on.

Alert Code 408 (Dirty Air Filter) — If no dirty filter switch is installed, the switch will read "clean filter" all the time. Therefore the dirty filter routine runs continuously and diagnoses the input. Because of the different possible times it takes to generate static pressure, this routine waits 2 minutes after the fan starts before the dirty filter switch is monitored. If the dirty filter switch reads "dirty filter" for 2 continuous minutes, an alert is generated. No system action is taken. This is a reminder that it is time to change the filters in the unit. Recovery from this alert is through a clearing of all alarms (manual) or after the dirty filter switch reads clean for 30 continuous seconds (automatic).

Because the Dirty Air Filter switch can be configured normally opened or closed, the switch might be open or closed. The configuration for this switch input can be found at variable **Configuration→SW.LG→SFS.L**. Verify that the configuration is set correctly. Verify the wiring and filter status switch. The hose should be connected to the low side of the switch. This alert resets automatically. The dirty filter switch is enabled at **Configuration→UNIT→SENS→FLT.S**.

Alarm and Alert Codes 409 (Supply Fan Commanded On, Sensed Off Failure and Supply Fan Commanded Off, Sensed On Failure) —Both the alert and the alarm refer to the same failure. The only difference between the alarm and alert is that in the case where the supply fan status configuration to shut down the unit is set to YES (**Configuration→UNIT→SFS.S**), the alarm will be generated AND the unit will be shut down. It is possible to configure **Configuration→UNIT→SFS.M** to either a switch or to monitor a 0.2-in. wg rise in duct pressure if the unit is VAV with duct pressure control (IGV or VFD).

The timings for failure for both are the same and are illustrated in the following table:

Unit Type/Mode	minimum ON time wait	minimum OFF time wait
CV (no gas heat)	30 seconds	1 minute
CV (gas heat)	2 minutes	4 minutes
VAV (IGV/no gas heat)	2 minutes	4 minutes
VAV (VFD/no gas heat)	1 minute	1 minute
VAV (IGV/gas heat)	4 minutes	4 minutes
VAV (VFD/gas heat)	3 minutes	4 minutes

Recovery is manual. Reason for failure may be a broken fan belt, failed fan relay or failed supply fan status switch.

Alert Code 414 (Loss of Communication with Belimo Actuator) — The Belimo economizer motor is a digital controlled motor. The *Comfort*Link™ control can monitor the status of the motor. If there is a problem, this alert will occur. The control will attempt to close the economizer dampers.

Alert Code 414 (Belimo Actuator Direction Error) — This alert occurs when the economizer damper direction switch is in the wrong position. The direction switch should be in the clockwise position and the actuator should be mounted so that the CW face of the actuator is accessible. Correct if necessary. This alert clears automatically.

Alert Code 414 (Belimo Actuator Failure) — This alert occurs when the commanded damper position is changing too rapidly. This alert resets automatically.

Alert Code 414 (Belimo Actuator Hunting Alert) — This alert occurs when there is excess movement of the economizer motor. Check the mechanical actuation of the dampers.

Alert Code 414 (Belimo Actuator Range Error) — This alert occurs when the economizer range of motion is less than 90 degrees. Initiate economizer calibration (**Service Test→INDP→E.CAL**) using the Service Test menu.

Alert Code 420 (R-W1 Jumper Not Installed in Space Temp Mode) — This alert occurs when the control mode is Space Temperature Mode via Auto Select or Space Temp Select yet there is no power to W1. Verify that space temperature mode is the desired mode or add jumper between R and W1. This alert resets automatically.

Alert Code 420 (R-W1 Jumper Must be Installed to Run Heat in Service Test) — This alert occurs when a request for a heat output has occurred yet the W1 input is not high. A jumper must be installed between R and W1 when trying to test heat in Service Test. The alert will clear when Service Test is exited or if another Service Test mode is selected. Remove jumper when done using Service Test if the unit is operating with a thermostat. The jumper should only be left in place if the unit is operating with a Space Temperature sensor.

Alert Code 421 (Y2 without Y1) — This alert occurs in Thermostat Mode when Y2 is energized and Y1 is not. Verify thermostat and thermostat wiring. When Y2 turns on, the software will behave as if Y1 and Y2 are both on. When Y2 turns off, the software will behave as if Y1 and Y2 are both Off. This alert resets automatically when Y1 is turned on.

Alert Code 422 (W2 without W1) — This alert occurs in Thermostat Mode when W2 is energized and W1 is not. Verify thermostat and thermostat wiring. When W2 turns on, the software will behave as if W1 and W2 are both on. When W2 turns off, the software will behave as if W1 and W2 are both off. This alert resets automatically when W1 is turned on.

Alert Code 423 (Y and W Simultaneously) — This alert occurs in Thermostat Mode when Y1 or Y2 is energized simultaneously with W1 or W2. Verify thermostat and thermostat wiring. The software will enter either the cooling or heating mode depending upon which input turned on first. This alert resets automatically when Y1 and Y2 are not on simultaneously with W1 and W2.

Alert Codes 500, 501, 502, 503 (Current Sensor Failure) — Alert codes 500, 501, 502, and 503 are for compressors A1, A2, B1, and B2 respectively. These alerts occur when the output of the current sensor (CS) is a constant high value. These alerts reset automatically. If the problem cannot be resolved and the CS board must be replaced, the CS board can be temporarily disabled while securing a replaced board. A CS board is disabled by setting *Configuration→COOL→CS.A1, CS.A2, CS.B1* or *CS.B2* to Disable.

If the current sensor board malfunctions or is not properly connected to its assigned digital input, an alert will be generated. It takes 2 to 4 seconds to log the alert. If the alert is logged, it stays for a minimum of 15 seconds to provide the application a reasonable time to catch the failure. Compressors will be not be inhibited by this failure. Recovery is automatic. Reason for failure may be a faulty current sensor board, incorrect wiring, or a damaged input on the MBB control board.

Alarm Code 700 (Supply Air Temperature Sensor Failure) — If the EDT sensor has been relocated after the heating section then this alarm will indicate a failure of this sensor. This alarm occurs when the Supply Air temperature sensor (*Temperatures→AIR.T→SAT*) is outside the range –40 to 240 F (–40 to 116 C). This alarm resets automatically. The cause of the alarm is usually a faulty thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

Alert Codes 701 (Staged Gas 1 Thermistor Failure)
702 (Staged Gas 2 Thermistor Failure)
703 (Staged Gas 3 Thermistor Failure) — If any of the staged gas thermistors (*Temperatures→AIR.T→S.GL1-3*) fails, an alert will be generated and the remaining thermistors will be averaged together (*Temperatures→AIR.T→S.GLS*) without the failed thermistor. Recovery is automatic. Reason for failure may be incorrect wiring, faulty thermistor, or a damaged input on the staged gas control board (SCB).

A704 (Staged Gas Leaving Air Temperature Sum Total Failure) — If all three staged gas thermistors (*Temperatures→AIR.T→S.GL1-3*) fail (the sensor is outside the range of –40 F to 240 F), staged gas will be shut down and this alarm will be generated. Recovery is automatic. Reason for failure may be faulty wiring, faulty thermistors, or damaged inputs on the staged gas control board (SCB).

Alert Code 705 (Limit Switch Thermistor Failure) — A failure (the sensor is outside the range of –40 F to 240 F) of this thermistor (*Temperatures→AIR.T→S.GLM*) will cause an alert to occur and a disabling of the limit switch monitoring function for the staged gas control board (SCB). Recovery is automatic. Reason for failure may be due to faulty wiring, a faulty thermistor, or a damaged input on the staged gas control board (SCB).

MAJOR SYSTEM COMPONENTS

General — The 48/50A series package rooftop units with electric cooling and with gas heating (48A units) or electric cooling and electric heating (50A units) contain the *Comfort*Link™ electronic control system that monitors all operations of the rooftop. The control system is composed of several components as listed below. See Fig. 13-19 for typical control and power component schematics. Figures 20 and 21 show the layout of the control box, unit, and thermistor and transducer locations.

Factory-Installed Components

MAIN BASE BOARD (MBB) — See Fig 22. The MBB is the center of the *Comfort*Link control system. The MBB contains the major portion of the operating software and controls the operation of the unit. The MBB has 22 inputs and 11 outputs. See Table 93 for the inputs and output assignments. The MBB also continuously monitors additional data from the optional ECB1, ECB2, SCB, and CEM boards through the LEN communications port. The MBB also interfaces with the Carrier Comfort Network through the CCN communications port. The board is located in the main control box.

ECONOMIZER BOARD (ECB1) — The ECB1 controls the economizer actuator and the power exhaust fans. The ECB1 operates the economizer motor using a digital communication signal that also provides status and diagnostics for the economizer motor. See Fig. 23. The ECB1 also controls the operation of the power exhaust motors and provides up to 6 stages of digitally sequenced power exhaust either based on the economizer motor position or the building pressure. The board has 4 inputs and 6 outputs. Details can be found in Table 94. The ECB1 board is located in an auxiliary box located at the end of the unit behind the filter access door. The board also contains a second LEN port than can be used with the accessory Navigator™ display.

VAV BOARD (ECB2) — The VAV board (which is the same hardware as the ECB1) is used to control the supply fan on VAV units. See Fig. 23. It sends a 4 to 20 mA signal to the VFD based on a supply duct pressure sensor connected to the board. The board also accepts a signal from another pressure sensor that monitors building pressure and controls the operation of the optional modulating power exhaust motors. The board will also be used on CV units with the optional building pressure control feature and modulating power exhaust. This board is also used to control a digitally controlled hot gas bypass solenoid with an integral orifice for use in low load applications. This board is located in the auxiliary control box. Input and output assignments are summarized in Table 95.

STAGED GAS HEAT BOARD (SCB) — When optional staged gas heat is used on CV and VAV units, the SCB board is installed and controls operation of the gas valves. See Fig. 24. The SCB also provides additional sensors for monitoring of the supply-air temperature. This board is located in the gas heat section of the unit. The inputs and outputs are summarized in Table 96.

CONTROL EXPANSION MODULE (CEM) — The optional CEM (also available as an accessory) is used to accept inputs for additional sensors or control sequence switches, including:

- smoke control mode field switches
- VAV Supply Air Temperature Set Point reset using an external 4 to 20 mA signal
- outdoor air CO_2 sensor (for supply duct pressure reset using an eternal 4 to 20 mA signal)
- external fan status pressure switch input (CV units)
- demand limit sequence proportional signal or discrete switches

The CEM board is located in the main control box. See Fig. 25. The inputs and outputs are summarized in Table 97.

INTEGRATED GAS CONTROL (IGC) — One IGC is provided with each bank of gas heat exchangers (2 used on the size 020-050 units and 3 on the size 060 unit). The IGC controls the direct spark ignition system and monitors the rollout switch, limit switches, and induced-draft motor Hall Effect switch. The IGC is equipped with an LED (light-emitting diode) for diagnostics. See Table 98.

COMPRESSOR PROTECTION BOARD (CS) — This board monitors the status of the compressor by sensing the current flow to the compressors and then provides digital status signal to the MBB.
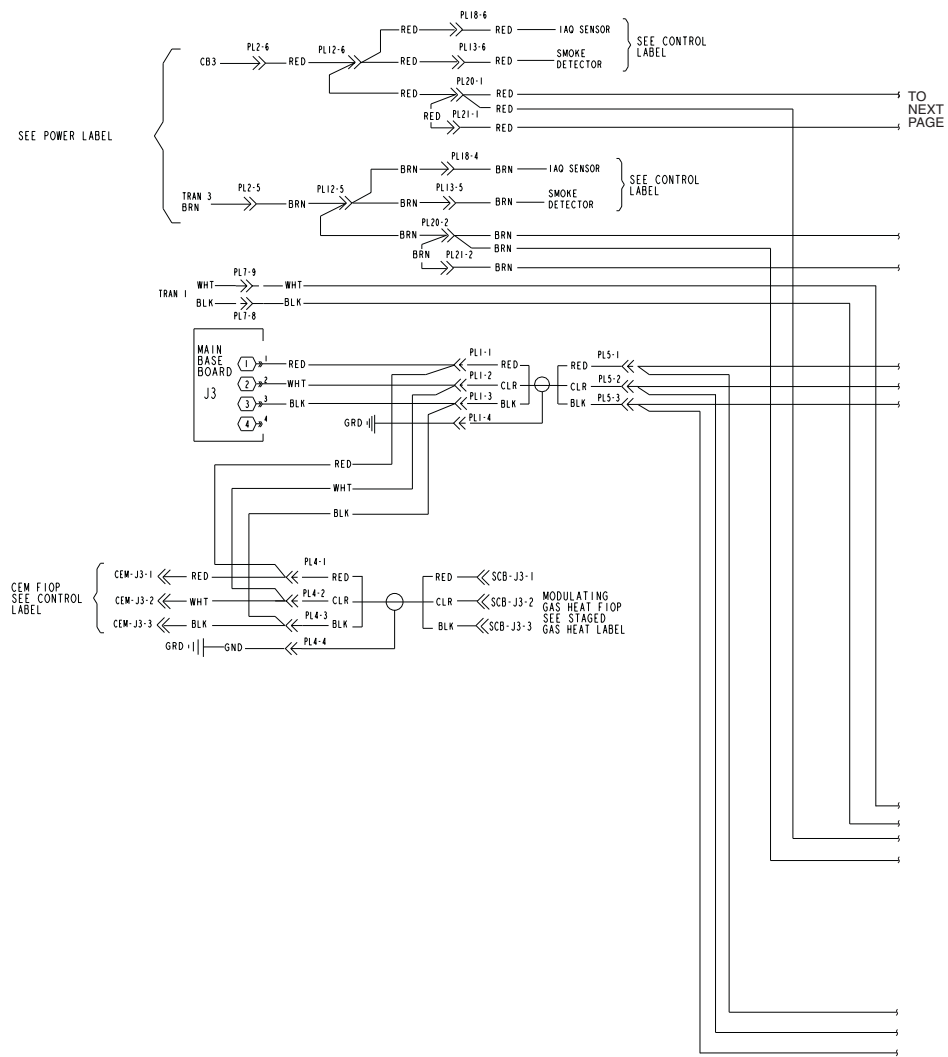
Fig. 13 — Typical Main Control Box Wiring Schematic

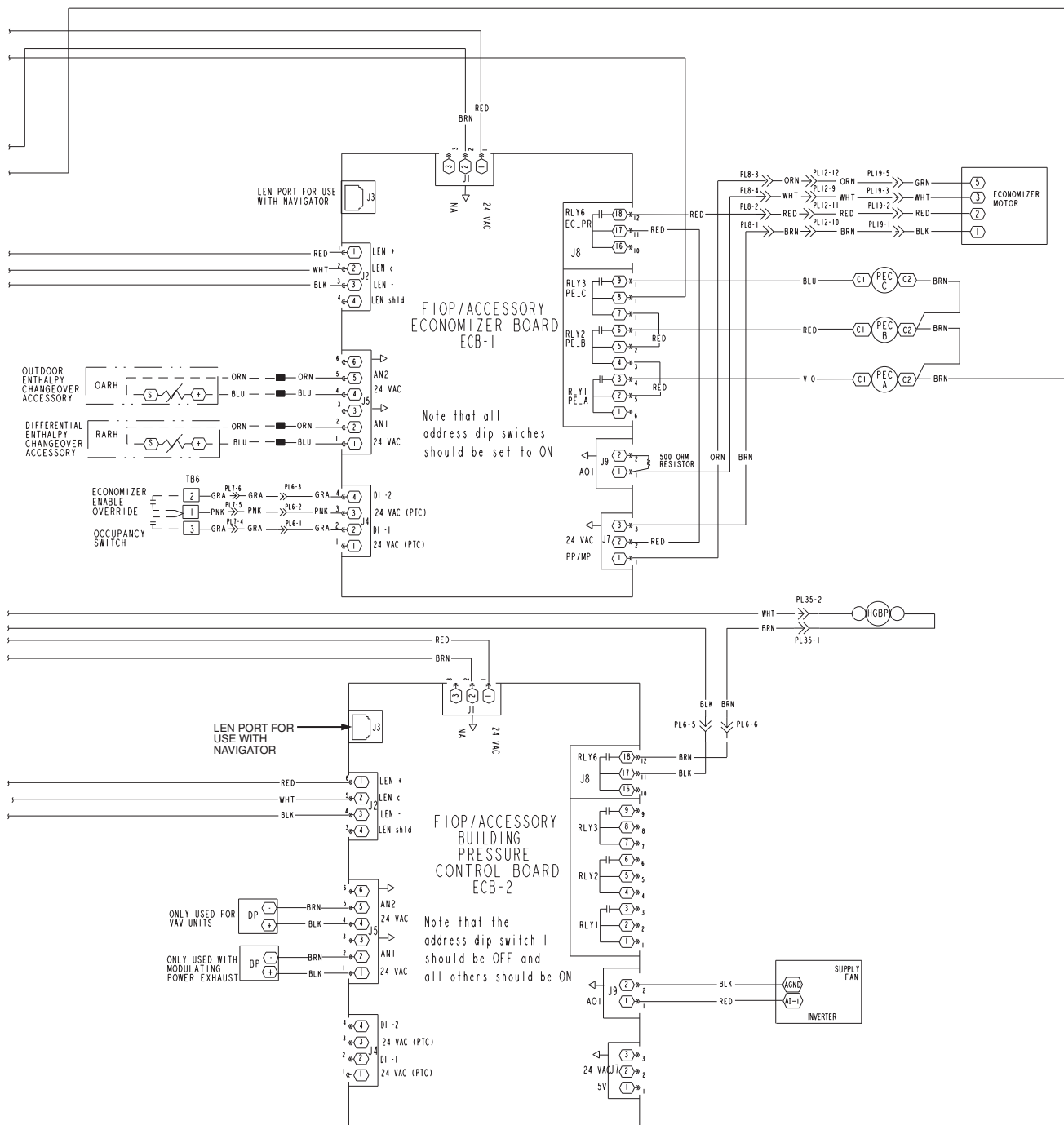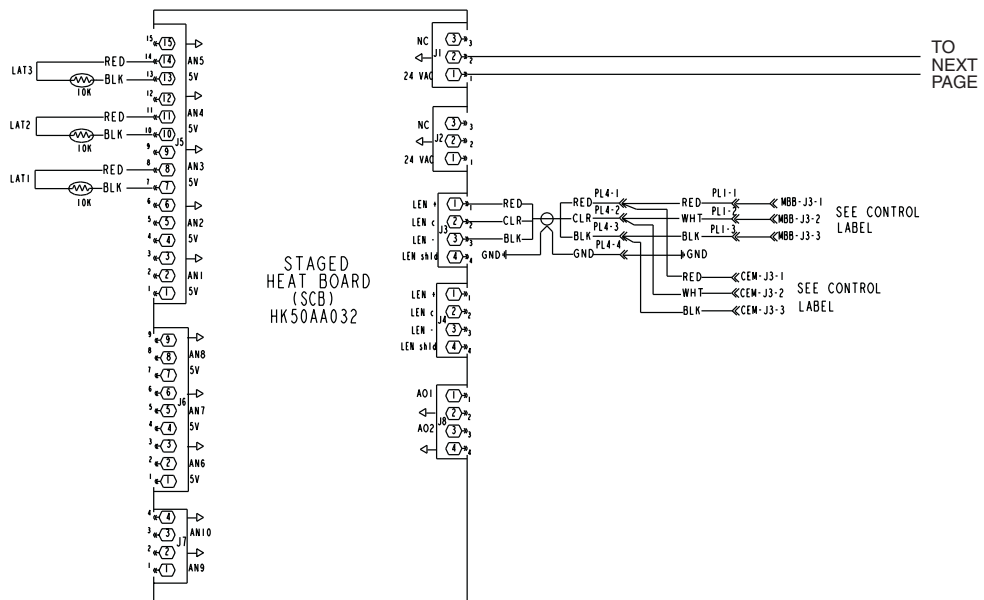**Fig. 14 — Auxiliary Control Box Wiring Schematic**

Fig. 14 — Auxiliary Control Box Wiring Schematic (cont)

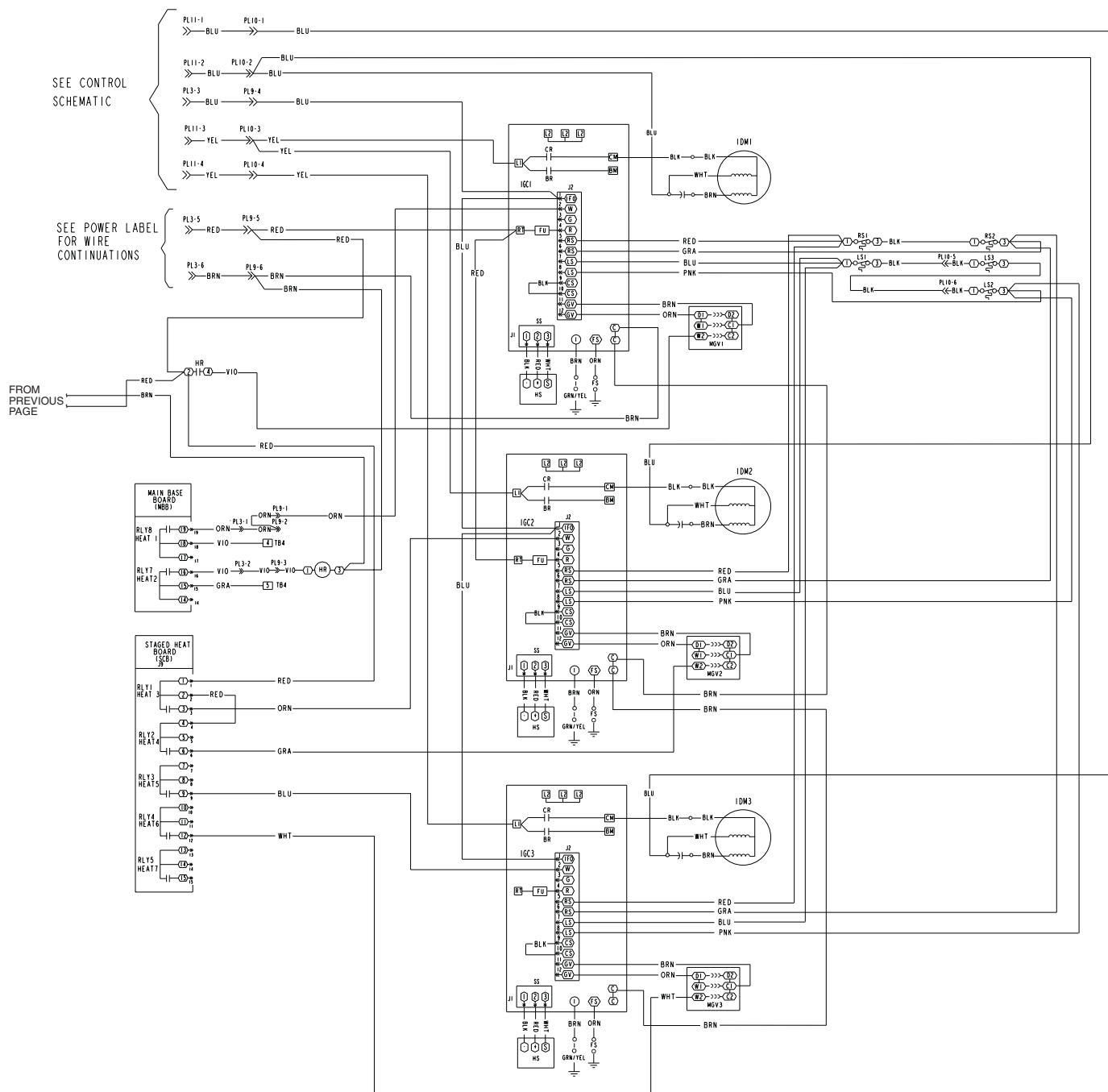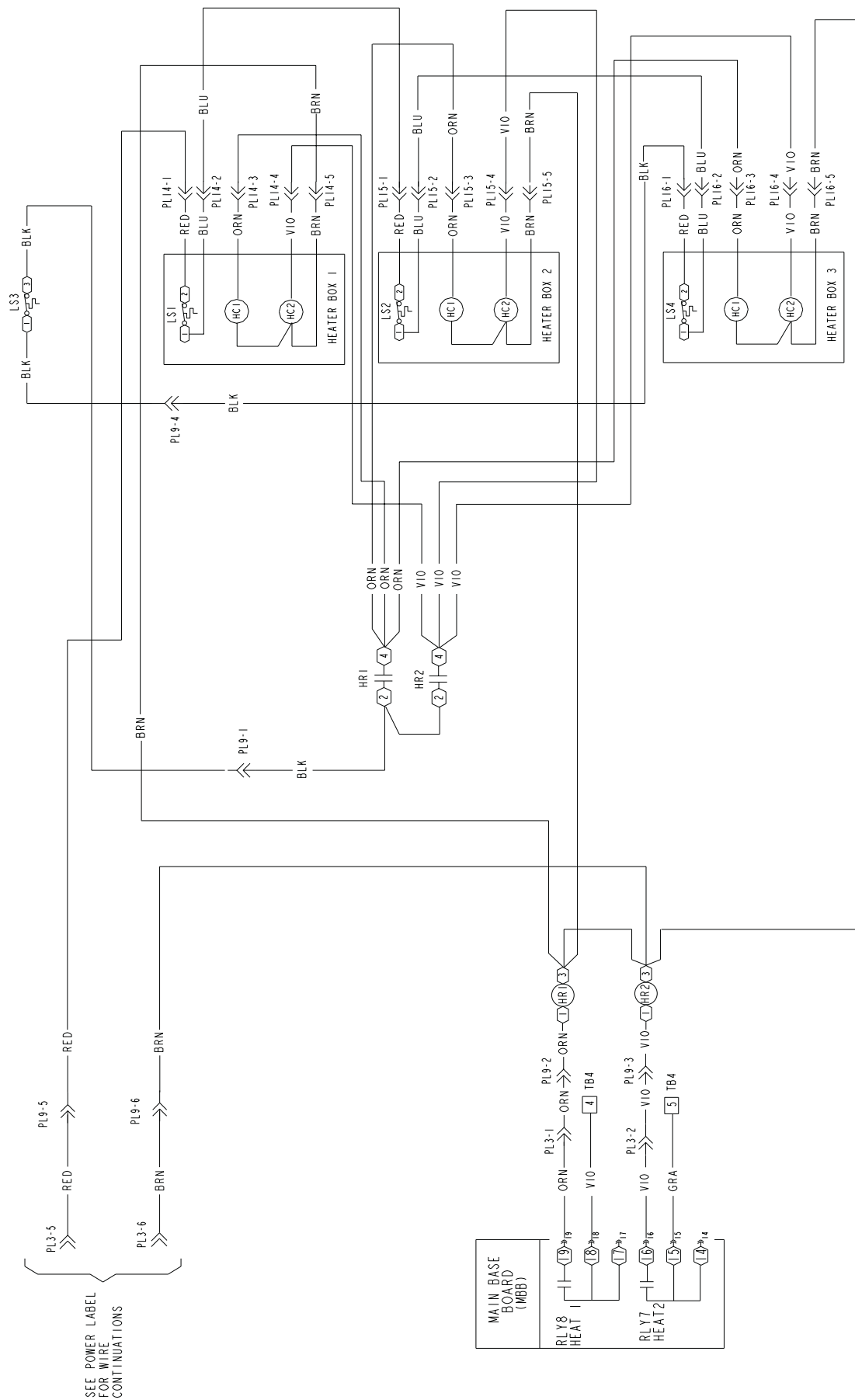**Fig. 15 — Typical 2 Stage Gas Heat Wiring Schematic (Size 060 Unit Shown)**

Fig. 16 — Typical Staged Gas Heat Wiring Schematic (Size 060 Unit Shown)

Fig. 16 — Typical Staged Gas Heat Wiring Schematic (Size 060 Unit Shown) (cont)

Fig. 17 — Typical Electric Heat Control Schematic — 50AJ,AK,AW,AY (Size 060 Shown)

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Fig. 18 — Typical Power Schematic (Size 060 Unit Shown)

NOTE: 1. TRANSFORMER WIRING FOR SUPPLY VOLTAGES ARE SHOWN IN
TABLE C & D. FOR 208/230 VOLT UNITS THE TRANSFORMERS ARE
FACTORY WIRED FOR 230 VOLT AND MUST BE REWIRED IN THE FIELD
FOR 208 VOLT APPLICATIONS.
2. ON 208/230 VOLT UNITS CS SENSORS SENSE CURRENT THROUGH
SMALLER GAGE WIRE RUN IN PARALLEL TO THE MAIN POWER BLACK WIRE.
FOR OTHER VOLTAGES SENSOR WILL BE IN MAIN POWER LINE.

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TABLE C

208-230/460V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 460V	H1 (BLK)
230V	H2 (BLK)
208V	H3 (BLK)
COMM	H4 (YEL)
SECONDARY VOLTAGE 115V	X1 (BLK)
COMM	X2 (YEL)

575V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 575V	H1 (BLK)
COMM	H4 (YEL)
SECONDARY VOLTAGE 115V	X1 (BLK)
COMM	X3 (YEL)

400V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 400V 380V	H2 (BLK) H3 (BLK)
COMM	H4 (YEL)
SECONDARY VOLTAGE 115V	X1 (BLK) X2-X4 X1-X3
COMM	X4 (YEL)

TABLE D

208-230/460V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 460V	BLK
230V	ORN
208V	RED
COMM	YEL
SECONDARY VOLTAGE 24V	X1 (BLK)
COMM	X2 (YEL)

575V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 575V	BLK
COMM	YEL
SECONDARY VOLTAGE 24V	X1 (BLK)
COMM	X3 (YEL)

400V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 400V 380V	BLK
COMM	YEL
SECONDARY VOLTAGE 24V	X1 (BLK)
COMM	X4 (YEL)

VARIABLE FREQUENCY INVERTER DRIVE — IFM

INVERTER SOURCE / MOTOR — L1 T1 BLK 1, L2 T2 YEL 2, L3 T3 BLU 3

POWER EXHAUST FIOP
AND ACCESSORY

FROM PREVIOUS PAGE

Fig. 18 — Typical Power Schematic (Size 060 Unit Shown) (cont)

Fig. 19 — Controls Option Wiring Schematic
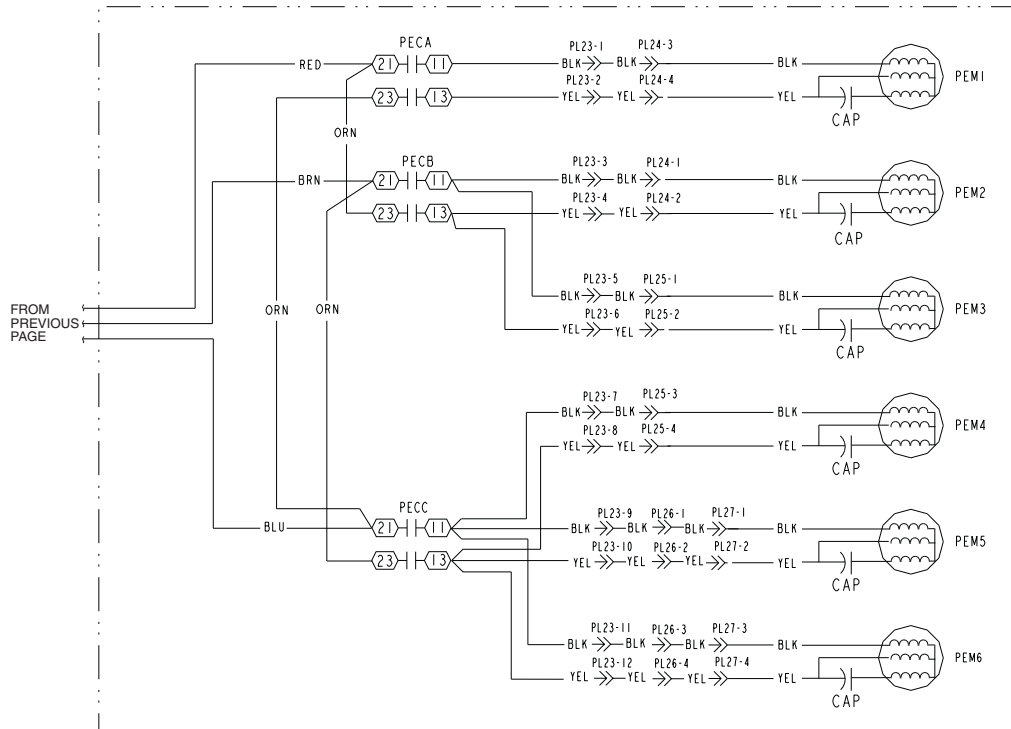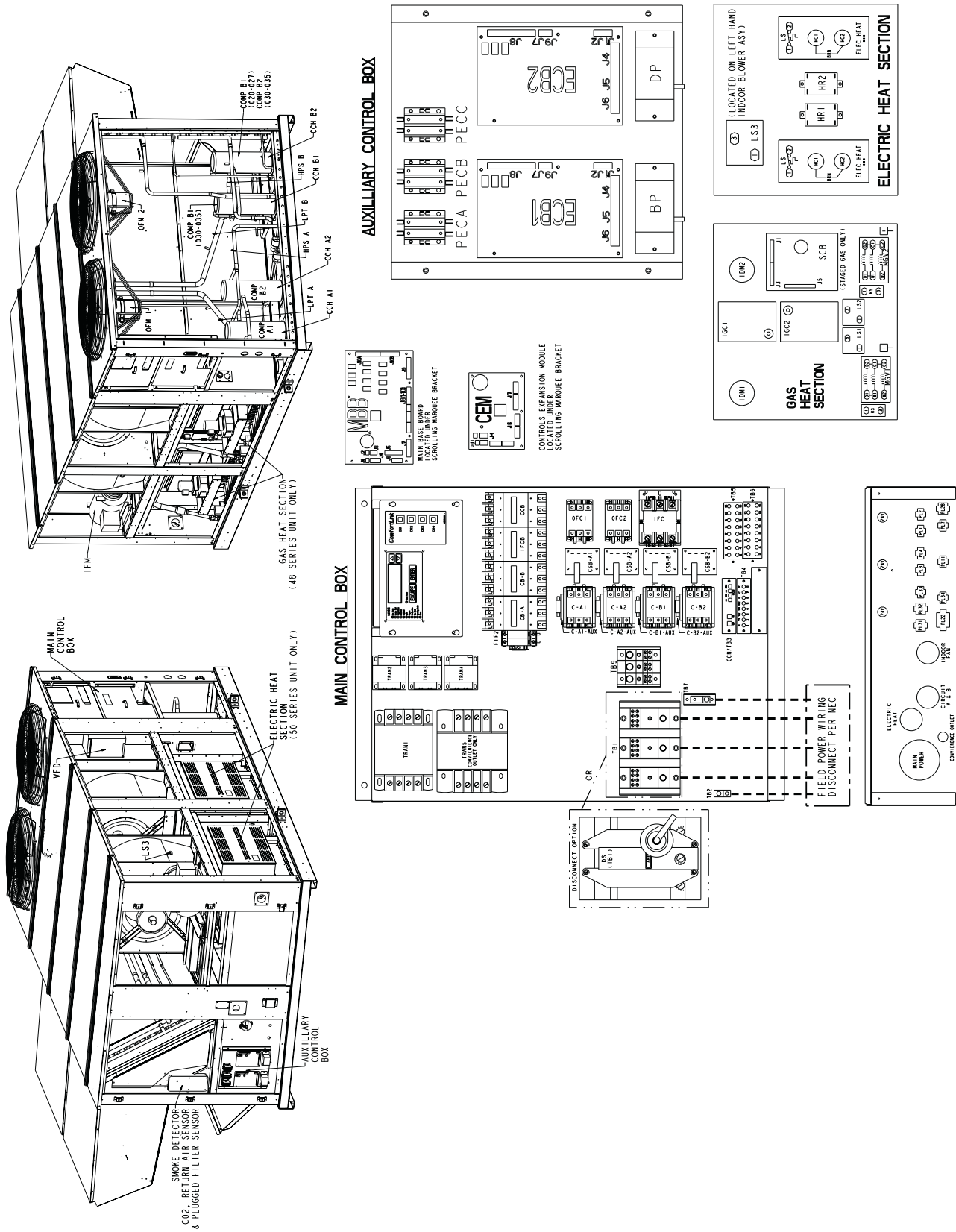
Fig. 20 — Small Chassis Component Location (Size 020-035 Units)
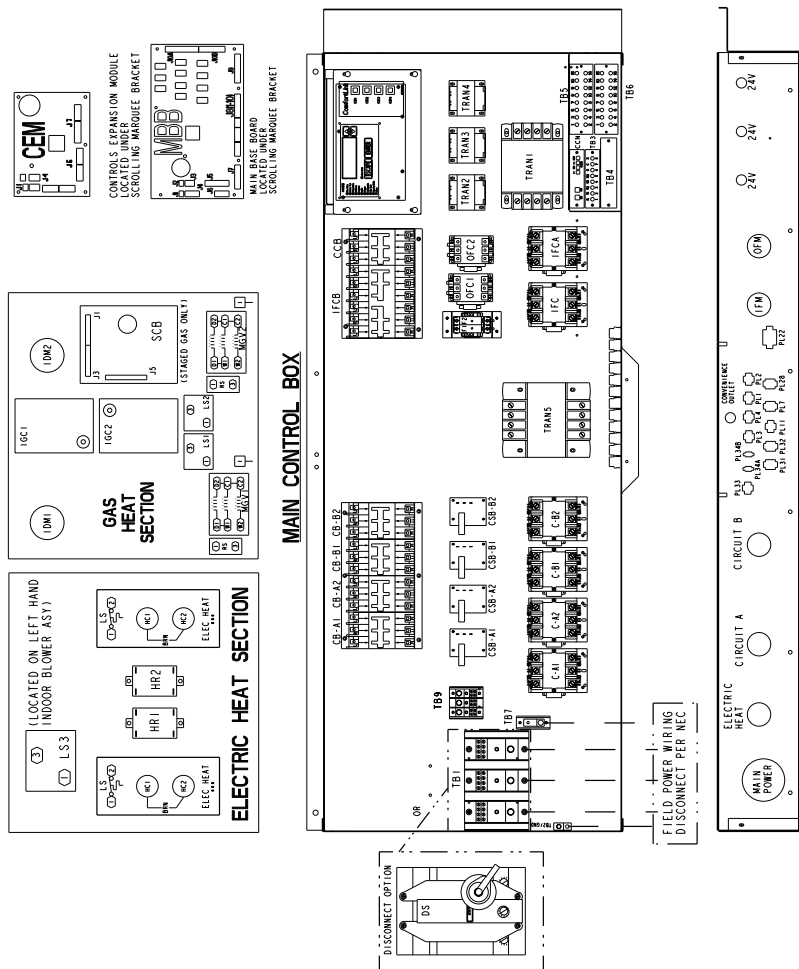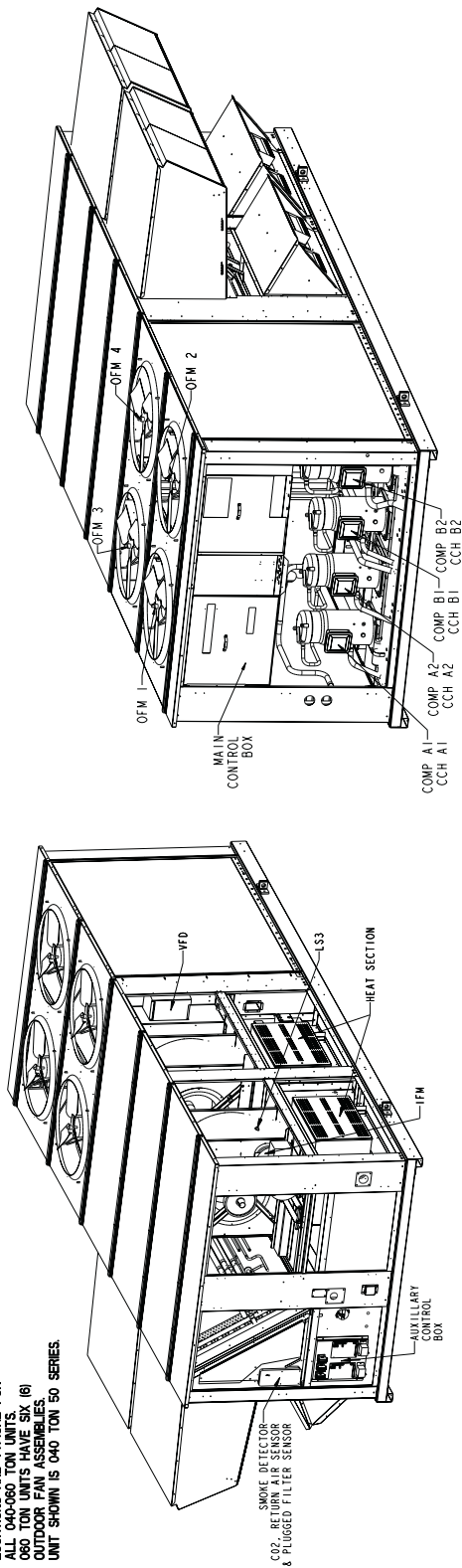
Fig. 21 — Large Chassis Component Locations (Size 040-060 Units)

LEGEND AND NOTES FOR FIG. 13-21

LEGEND

A	—	Circuit A
AUX	—	Auxiliary Contact
B	—	Circuit B
BP	—	Building Pressure Transducer
C	—	Contactor, Compressor
CAP	—	Capacitor
CB	—	Circuit Breaker
CCB	—	Control Circuit Breaker
CCH	—	Crankcase Heater
CCN	—	Carrier Comfort Network
CEM	—	Controls Expansion Module
COMP	—	Compressor Motor
CR	—	Control Relay
CS	—	Compressor Safety
CSB	—	Compressor Current Sensing Board
DP	—	Duct Pressure Sensor
DS	—	Disconnect Switch
ECB-1	—	Economizer Control Board
ECB-2	—	Building and Supplier Air Control Board
EDT	—	Evaporator Discharge Air Temperature
FIOP	—	Factory-Installed Option
FS	—	Flame Sensor
FU	—	Fuse
GND	—	Ground
HC	—	Heat Contactor
HGBP	—	Hot Gas Bypass
HPS	—	High Pressure Switch
HR	—	Heat Relay
HS	—	Hall Effect Induced Draft Motor Switch
IAQ	—	Indoor Air Quality
IDM	—	Induced Draft Motor
IFC	—	Indoor Fan Contactor
IFCB	—	Indoor Fan Circuit Breaker
IFM	—	Indoor Fan Motor
IGC	—	Integrated Gas Control Board
IP	—	Internal Compressor Protector
LAT	—	Staged Gas Temperature Sensor
LEN	—	Local Equipment Network
LS	—	Limit Switch
MBB	—	Main Base Board
MGV	—	Main Gas Valve
OARH	—	Outdoor Air Relative Humidity
OAT	—	Outdoor Air Temperature Sensor
OFC	—	Outdoor Fan Contactor
OFM	—	Outdoor Fan Motor
PEC	—	Power Exhaust Contactor
PEM	—	Power Exhaust Motor
PL	—	Plug

RARH	—	Return Air Relative Humidity
RAT	—	Return Air Temperature Sensor
RLY	—	Relay
RS	—	Rollout Switch
SCB	—	Staged Gas Heat Control Board
SCT	—	Saturated Condensing Temperature Sensor
SDU	—	Scroll Marquee Display
SST	—	Saturated Suction Temperature Sensor
T-55	—	Room Temperature Sensor
T-56	—	Room Temperature Sensor with Setpoint
TB	—	Terminal Block
TRAN	—	Transformer
VAV	—	Variable Air Volume
VFD	—	Variable Frequency Drive

[x]	Terminal Block
◯	Terminal (Unmarked)
⬡ x	Terminal (Marked)
●	Splice
——————	Factory Wiring
- - - -	Field Wiring
▬▬▬▬	To indicate common potential only. Not to represent wiring.
—··—	To Indicate FIOP or Accessory

THERMOSTAT MARKINGS

BM	—	Blower Motor
C	—	Common
CM	—	Inducer Motor
CS	—	Centrifugal Switch
G	—	Fan
IFO	—	Indoor Fan On
L1	—	Line 1
R	—	Thermostat Power
RT	—	Power Supply
SS	—	Speed Sensor
W1	—	Thermostat Heat Stage 1
W2	—	Thermostat Heat Stage 2
X	—	Alarm Output
Y1	—	Thermostat Cooling Stage 1
Y2	—	Thermostat Cooling Stage 2

NOTES:
1. Factory wiring is in accordance with the National Electrical Codes. Any field modifications or additions must be in compliance with all applicable codes.
2. Use 75° C min wire for field power supply, use copper wires for all units.
3. All circuit breakers "Must Trip Amps" are equal to or less than 156% RLA.

4. Compressor and fan motors are thermally protected — three phase motors protected against primary single phase conditions.
5. Red jumper wire must be added between R, W1, and W2 for space temperature sensor and all VAV units with heat and temporarily during service-test mode when the heaters need to operate.
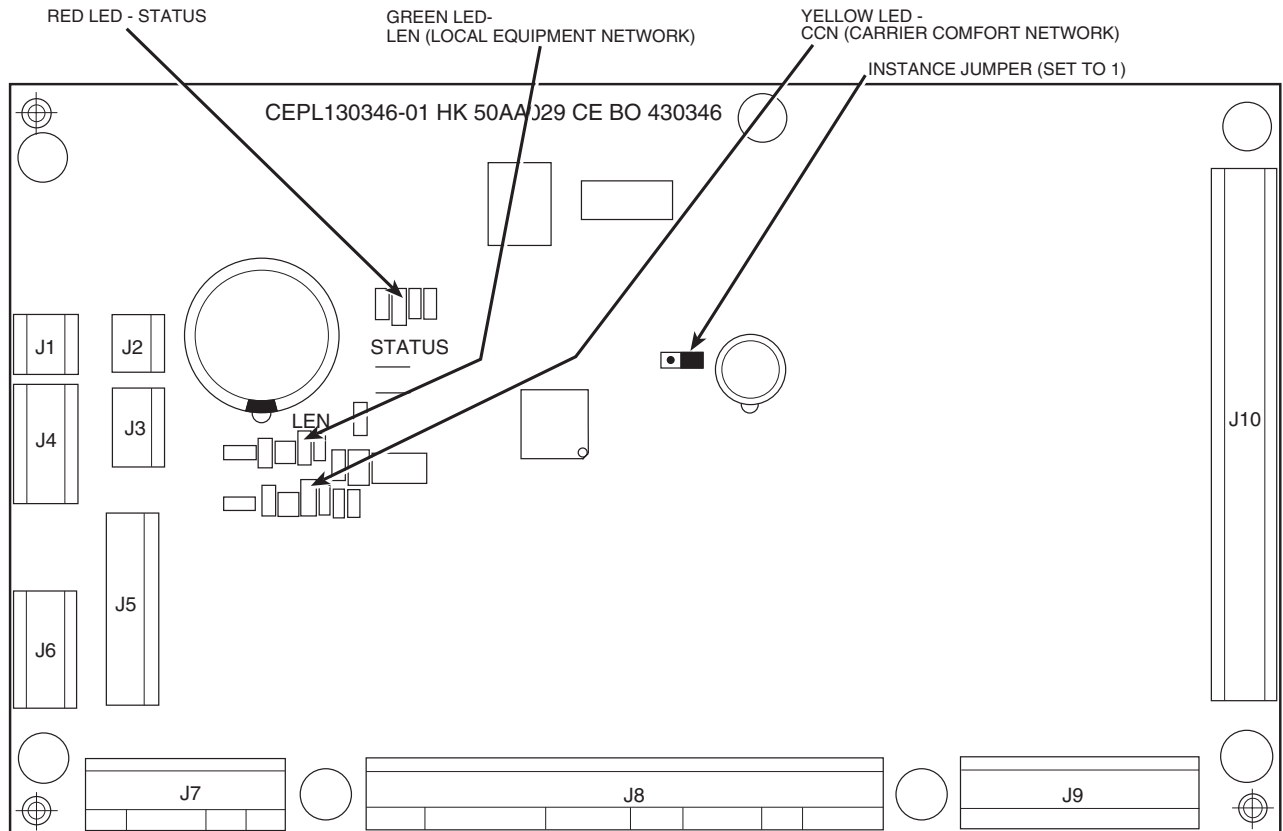
Fig. 22 — Main Base Board (MBB)

Table 93 — Main Control Board (MBB) Inputs and Outputs

POINT NAME	POINT DESCRIPTION	I/O POINT NAME	PLUG AND PIN REFERENCE	SIGNAL PIN(S)	PORT STATE
INPUTS					
GASFAN	YAC Indoor Fan relay (fan request from YAC)	DI1	J6, 3-4	4	0 = 24vac, 1= 0vac
FSD	Fire Shutdown switch input	DI2	J6, 5-6	6	0 = 24vac, 1= 0vac
G	Thermostat 'G' input/Remote Occupied	DI3	J7, 1-2	2	0 = 24vac, 1= 0vac
W2	Thermostat 'W2' input	DI4	J7, 3-4	4	0 = 24vac, 1= 0vac
W1	Thermostat 'W1' input	DI5	J7, 5-6	6	0 = 24vac, 1= 0vac
Y2	Thermostat 'Y2' input	DI6	J7, 7-8	8	0 = 24vac, 1= 0vac
Y1	Thermostat 'Y1' input	DI7	J7, 9-10	10	0 = 24vac, 1= 0vac
CSB_A1	Compressor A1 current sensor	DIG1	J9, 10-12	10=5v, 11=Vin, 12=GND	0 = 5vdc, 1 = 0vdc
CSB_A2	Compressor A2 current sensor	DIG2	J9, 7-9	7=5v, 8=Vin, 9=GND	0 = 5vdc, 1 = 0vdc
CSB_B1	Compressor B1 current sensor	DIG3	J9, 4-6	4=5v, 5=Vin, 6 =GND	0 = 5vdc, 1 = 0vdc
CSB_B2	Compressor B2 current sensor	DIG4	J9, 1-3	1=5v, 2=Vin, 3=GND	0 = 5vdc, 1 = 0vdc
DP_A/SCTA	Circuit A saturated condensing pressure/temp	AN1	J8, 21-23	21=5v, 22=Vin, 23=GND (thermistor 21-22)	(0-5vdc, thermistor, ohms)
DP_B/SCTB	Circuit B saturated condensing pressure/temp	AN2	J8, 24-26	24=5v, 25=Vin, 26=GND (thermistor 24-25)	(0-5vdc, thermistor, ohms)
SP_A/SSTA	Circuit A saturated suction pressure/temp	AN3	J8, 15-17	15=5v, 16=Vin, 17=GND (thermistor 15-16)	(0-5vdc, thermistor, ohms)
SP_B/SSTB	Circuit B saturated suction pressure/temp	AN4	J8, 18-20	18=5v, 19=Vin, 20=GND (thermistor 18-20)	(0-5vdc, thermistor, ohms)
RAT	Return air temperature	AN5	J8, 9-10	9	(thermistor, ohms)
SAT_TEMP	Supply air temperature	AN6	J8, 11-12	11	(thermistor, ohms)
OAT	Outdoor air temperature	AN7	J8, 13-14	13	(thermistor, ohms)
SPT	Space temperature (T55/56)	AN8	J8, 1-2	1	(thermistor, ohms)
SPTO	Space temperature offset (T56)	AN9	J8, 3-4	3	(thermistor, ohms)
IAQ,/IAQMINOV	IAQ analog input	AN10	J8, 5-6	5	(thermistor, ohms)
FLTS	Filter Status	AN11	J8, 7-8	7	(thermistor, ohms)
OUTPUTS					
CMPB2	Compressor B2	RLY 1	J10, 20-21	20 = RLY1A (=RLY2A), 21 = RLY1B	1 = Closes RLY1A/RLY1B
CMPB1	Compressor B1	RLY 2	J10, 22-23	22 = RLY2A (=RLY1A), 23 = RLY2B	1 = Closes RLY2A/RLY2B
CMPA2	Compressor A2	RLY 3	J10, 24-25	24 = RLY3A (=RLY4A), 25 = RLY3B	1 = Closes RLY3A/RLY3B
CMPA1	Compressor A1	RLY 4	J10, 26-27	26 = RLY4A (=RLY3A), 27 = RLY4B	1 = Closes RLY4A/RLY4B
CONDFANB	Condenser fan B	RLY 5	J10, 10-11	10 = RLY5A (=RLY6A), 11 = RLY5B	1 = Closes RLY5A/RLY5B
CONDFANA	Condenser fan A	RLY 6	J10, 12-13	12 = RLY6A (=RLY5A), 13 = RLY6B	1 = Closes RLY6A/RLY6B
HS2	Heat stage 2	RLY7	J10, 14-16	14 = 15 = RLY7A, 16 = RLY7B	1 = Closes RLY7A/RLY7B
HS1	Heat stage 1	RLY 8	J10, 17-19	17 = 18 = RLY8A, 19 = RLY8B	1 = Closes RLY8A/RLY8B
HIR	Heat interlock relay	RLY 9	J10, 4-6	4 = 5 = RLY9A, 6 = RLY9B	1 = Closes RLY9A/RLY9B
SF	Supply fan	RLY 10	J10, 7-9	7 = 8 = RLY10A, 9 = RLY10B	1 = Closes RLY10A/RLY10B
ALRM	Alarm output relay	RLY 11	J10, 1-3	1 = 2 = RLY11A, 3 = RLY11B	1 = Closes RLY11A/RLY11B

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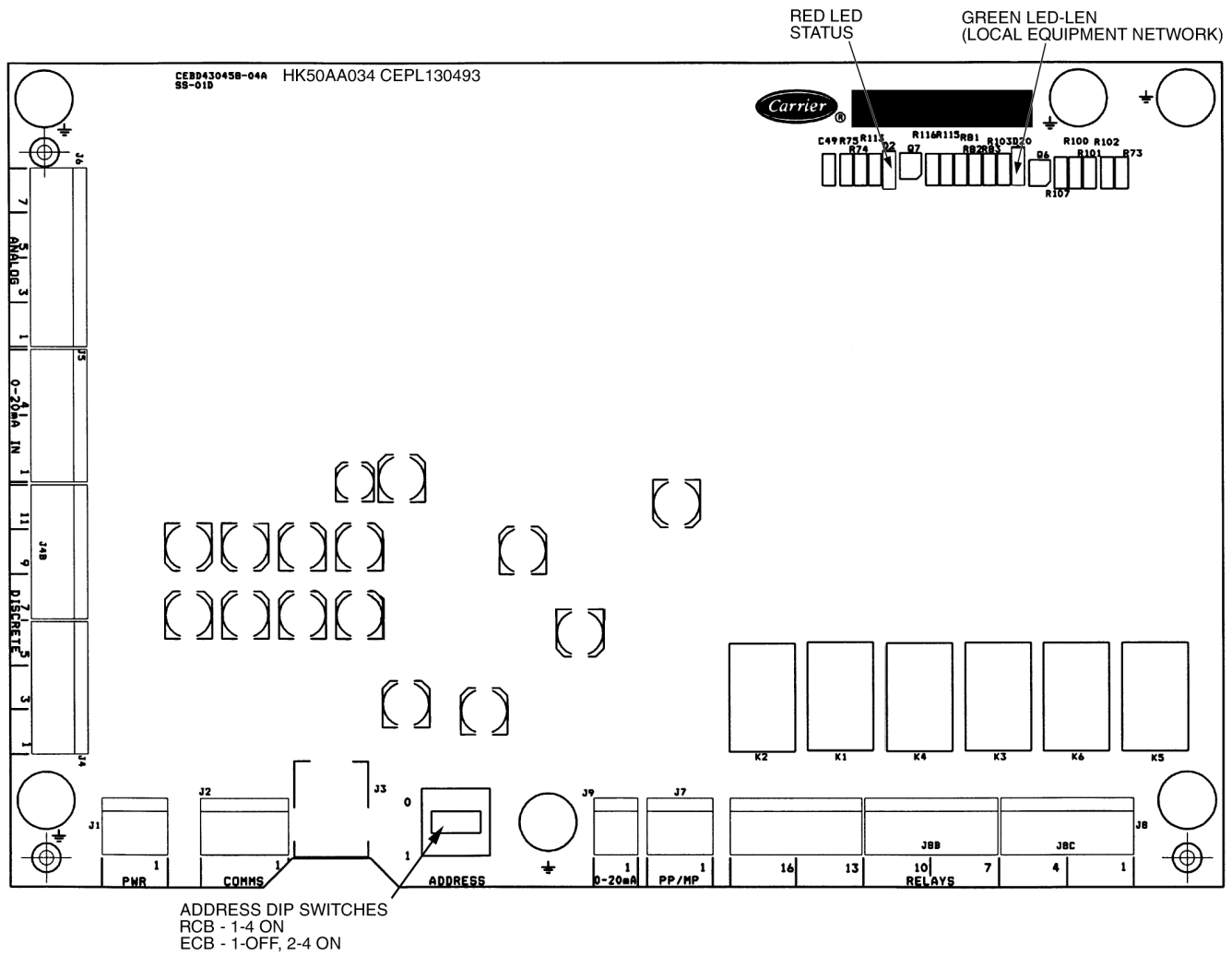
Fig. 23 — Economizer Control Board (ECB1) and VAV Control Board (ECB2)

Table 94 — Economizer Control Board (ECB1) Inputs and Outputs

POINT NAME	POINT DESCRIPTION	I/O POINT NAME	PLUG AND PIN REFERENCE	SIGNAL PIN(S)	PORT STATE
INPUTS					
RMTIN	Remote occupancy	DI1	J4, 1-2	2	24VAC = 1, 0VAC = 0
ECONENBL, ECOORIDE	Economizer enable	DI2	J4, 3-4	4	24VAC = 1, 0VAC = 0
RARH	Return air relative humidity	AN1	J5, 1-3	1=24VDC, 2=0-20mA in, 3=GND	0-20mA
OARH	Outdoor air relative humidity	AN2	J5, 4-6	4=24VDC, 5=0-20mA in, 6=GND	0-20mA
OUTPUTS					
ECONOCMD	Economizer actuator (analog control)	AO1	J9, 1-2	1=0-20mA, 2=GND	0-20mA OUT
ECONOCMD	Economizer actuator (digital control)	PP/MP	J7, 1-3	1=PP/MP Data, 2=24VAC, 3=GND	Belimo PP/MP Protocol
PE_A	Power Exhaust stage A	RLY1	J8, 1-3	1 = 2 = RLY1A, 3 = RLY1B	1 = Closes RLY1A/RLY1B
PE_B	Power Exhaust stage B	RLY 2	J8, 4-6	4 =5 = RLY2A, 6 = RLY2B	1 = Closes RLY2A/RLY2B
PE_C	Power Exhaust stage C	RLY 3	J8, 7-9	7 = 8 = RLY3A, 9 = RLY3B	1 = Closes RLY3A/RLY3B
ECON_PWR	Economizer Power	RLY 6	J8, 16-18	16 = 17 = RLY6A, 18 = RLY6B	1 = Closes RLY6A/RLY6B

Table 95 — Valve Control Board (ECB2) Inputs and Outputs

POINT NAME	POINT DESCRIPTION	I/O POINT NAME	PLUG AND PIN REFERENCE	SIGNAL PIN(S)	PORT STATE
INPUTS					
		DI1	J4, 1-2	2	24VAC = 1, 0VAC = 0
		DI2	J4, 3-4	4	24VAC = 1, 0VAC = 0
BP	Building static pressure	AN1	J5, 1-3	1=24VDC, 2=0-20mA in, 3=GND	0-20mA
SP	Supply Duct static pressure	AN2	J5, 4-6	4=24VDC, 5=0-20mA in, 6=GND	0-20mA
OUTPUTS					
SFAN_VFD	Supply Fan Inverter speed	AO1	J9, 1-2	1=0-20mA, 2=GND	0-20mA OUT
		PP/MP	J7, 1-3	1=PP/MP Data, 2=24VAC, 3=GND	Belimo PP/MP Protocol
		RLY1	J8, 1-3	1 = 2 = RLY1A, 3 = RLY1B	1 = Closes RLY1A/RLY1B
		RLY 2	J8, 4-6	4 =5 = RLY2A, 6 = RLY2B	1 = Closes RLY2A/RLY2B
		RLY 3	J8, 7-9	7 = 8 = RLY3A, 9 = RLY3B	1 = Closes RLY3A/RLY3B
MLV	Minimum load valve	RLY 6	J8, 16-18	16 = 17 = RLY6A, 18 = RLY6B	1 = Closes RLY6A/RLY6B
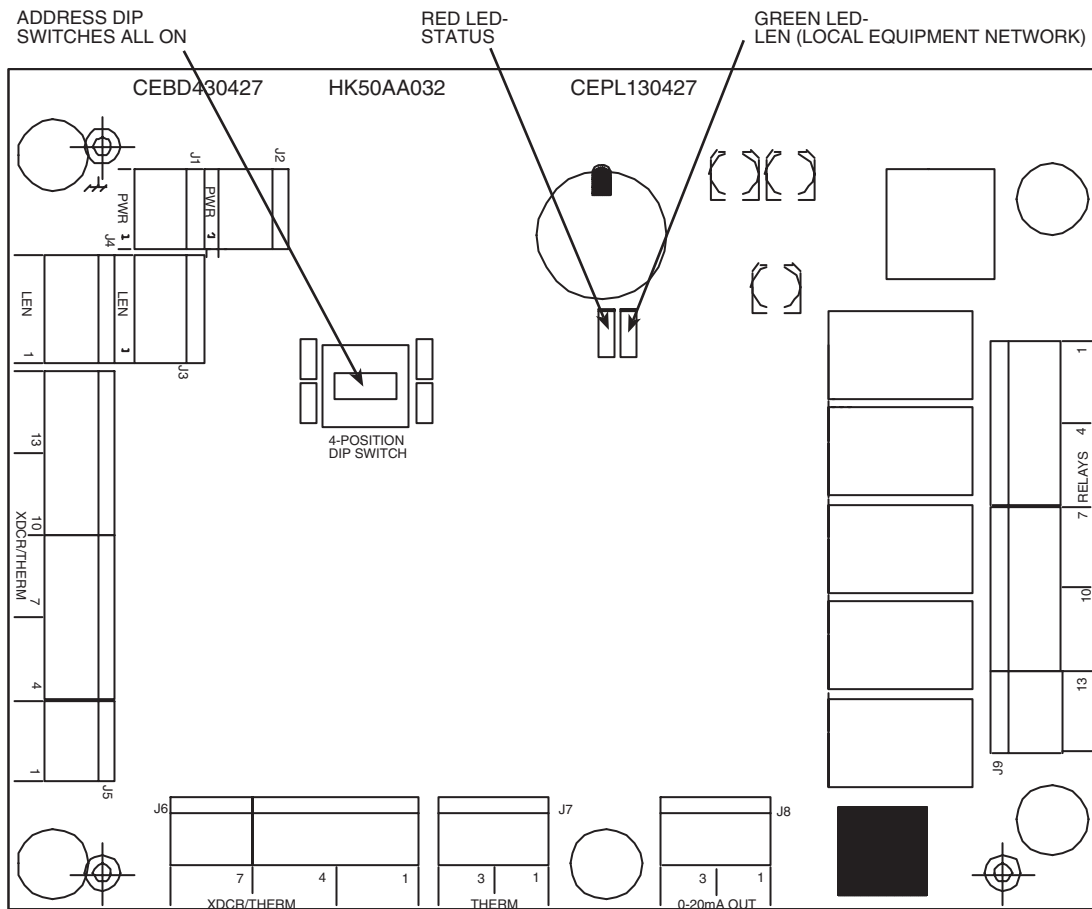
Fig. 24 — Staged Gas Heat Control Board (SCB)

Table 96 — Staged Gas Control Board (SCB) Inputs and Outputs

POINT NAME	POINT DESCRIPTION	I/O POINT NAME	PLUG AND PIN REFERENCE	SIGNAL PIN(S)	PORT STATE
INPUTS					
		AN1	J5, 1-3	1=5v, 2=Vin, 3=GND (thermistor 1-2)	(0-5VDC, thermistor, ohms)
		AN2	J5, 4-6	4=5v, 5=Vin, 6=GND (thermistor 4-5)	(0-5VDC, thermistor, ohms)
LAT1SGAS	Leaving air temperature 1	AN3	J5, 7-9	7=5v, 8=Vin, 9=GND (thermistor 7-8)	(0-5VDC, thermistor, ohms)
LAT2SGAS	Leaving air temperature 2	AN4	J5, 10-12	10=5v, 11=Vin, 12=GND (thermistor 10-11)	(0-5VDC, thermistor, ohms)
LAT3SGAS	Leaving air temperature 3	AN5	J5, 13-15	13=5v, 14=Vin, 15=GND (thermistor 13-14)	(0-5VDC, thermistor, ohms)
		AN6	J6, 1-3	1=5v, 2=Vin, 3=GND (thermistor 1-2)	(0-5VDC, thermistor, ohms)
		AN7	J6, 4-6	4=5v, 5=Vin, 6=GND (thermistor 4-5)	(0-5VDC, thermistor, ohms)
		AN8	J6, 7-9	7=5v, 8=Vin, 9=GND (thermistor 7-8)	(0-5VDC, thermistor, ohms)
		AN9	J7, 1-2	1	(thermistor, ohms)
		AN10	J7, 3-4	3	(thermistor, ohms)
OUTPUTS					
		AO1	J8, 1-2	1=0-20mA, 2=GND	0-20mA OUT
		AO2	J8, 3-4	3=0-20mA, 4=GND	0-20mA OUT
HS3	Heat Stage 3	RLY1	J9, 1-3	1 = 2 = RLY1A, 3 = RLY1B	1 = Closes RLY1A/RLY1B
HS4	Heat Stage 4	RLY 2	J9, 4-6	4 =5 = RLY2A, 6 = RLY2B	1 = Closes RLY2A/RLY2B
HS5	Heat Stage 5	RLY 3	J9, 7-9	7 = 8 = RLY3A, 9 = RLY3B	1 = Closes RLY3A/RLY3B
HS6	Heat Stage 6	RLY 4	J9, 10-12	10 = 11 = RLY4A, 12 = RLY4B	1 = Closes RLY4A/RLY4B
		RLY 5	J9, 13-15	13 = 14 = RLY5A, 15 = RLY5B	1 = Closes RLY5A/RLY5B
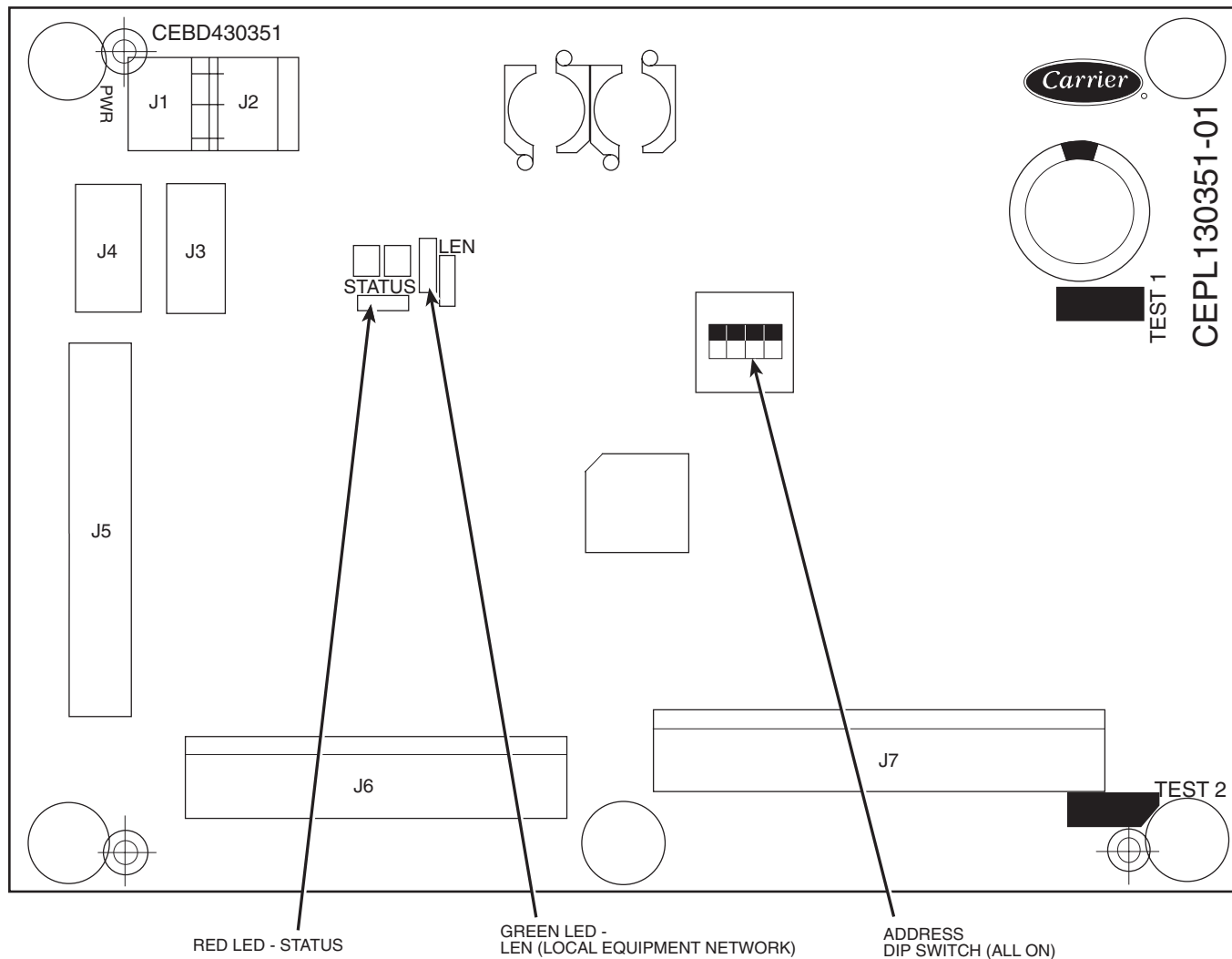
Fig. 25 — Controls Expansion Board (CEM)

Table 97 — Controls Expansion Board (CEM) Inputs

POINT NAME	POINT DESCRIPTION	I/O POINT NAME	PLUG AND PIN REFERENCE	SIGNAL PIN(S)	PORT STATE
INPUTS					
SFS	Supply Fan Status switch	DI 1	J7, 1-2	2	0 = 24vac, 1= 0vac
DMD_SW1	Demand Limit - Redline	DI 2	J7, 3-4	4	0 = 24vac, 1= 0vac
DMD_SW2	Demand Limit - Load Shed	DI 3	J7, 5-6	6	0 = 24vac, 1= 0vac
PRES	Pressurization	DI 4	J7, 7-8	8	0 = 24vac, 1= 0vac
EVAC	Evacuation	DI 5	J7, 9-10	10	0 = 24vac, 1= 0vac
PURG	Purge	DI 6	J7, 11-12	12	0 = 24vac, 1= 0vac
IAQIN	Indoor Air Quality Switch	DI 7	J7, 13-14	14	0 = 24vac, 1= 0vac
		AN7	J6, 1-3	2 (1 = loop power)	(0-20mA input)
DMDLMTMA	4-20mA Demand Limit	AN8	J6, 4-6	5 (4 = loop power)	(0-20mA input)
EDTRESMA	4-20mA Evaporator Discharge SP Reset	AN9	J6, 7-9	8 (7 = loop power)	(0-20mA input)
OAQ	Outside Air CO_2 Sensor	AN10	J6, 10-12	11 (10 = loop power)	(0-20mA input)
SPRESET	SP Reset milliamps	AN10	J6, 10-12	11 (10 = loop power)	(0-20mA input)

SCROLLING MARQUEE — This device is the keypad interface used to access the control information, read sensor values, and test the unit. The Scrolling Marquee display is a 4-key, 4-character, 16-segment LED display as well as an Alarm Status LED. See Fig. 26. The display is easy to operate using 4 buttons and a group of 11 LED's that indicate the following menu structures:

• Run Status
• Service Test
• Temperatures
• Pressures
• Set points
• Inputs
• Outputs
• Configuration
• Timeclock
• Operating Modes
• Alarms

Through the Scrolling Marquee the user can access all the inputs and outputs to check on their values and status. Because the unit is equipped with suction pressure transducers and discharge saturation temperature sensors it can also display pressures typically obtained from gages. The control includes a full alarm history, which can be accessed from the display. In addition, through the Scrolling Marquee the user can access a built-in test routine that can be used at start-up commission and to diagnose operational problems with the unit. The Scrolling Marquee is located in the main control box and is standard on all units.

SUPPLY FAN — The 20 to 50 ton units are equipped with two 15 x 11-in. forward-curved fans. The 60 ton units have three 15 x 11-in. fans. They are on a common shaft and are driven by single belt drive 3-phase motor. The fan is controlled directly by the *Comfort*Link™ controls.

VARIABLE FREQUENCY DRIVE (VFD) — On variable volume units, the supply fan speed is controlled by a 3-phase VFD. The VFD is located in the fan section behind a removable panel as shown in Fig. 20 and 21. The VFD speed is controlled directly by the *Comfort*Link controls through a 4 to 20 mA signal based on a supply duct pressure sensor. The inverter has a display, which can be used for service diagnostics, but setup of the supply duct pressure set point and control loop factors is done through the Scrolling Marquee display.

The VFD is powered during normal operation to prevent condensation from forming on the boards during the off mode and is stopped by driving the speed to 0 (by sending a 2 mA signal to the VFD).

The A series units use ABB ACH550 VFDs on all 230-3-60 and 460-3-60 units. An ABB ACS800 or Toshiba E3 VFD is used on 575-3-60 units. The interface wiring for the VFDs is shown in Fig. 27. Terminal designations are shown in Table 99.

Table 98 — IGC Board Inputs and Outputs

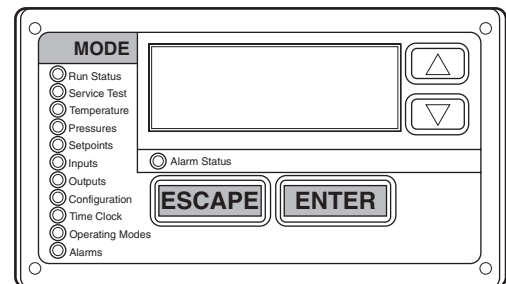| POINT NAME	POINT DESCRIPTION	CONNECTOR PIN NO.
INPUTS		
RT	24 Volt Power Supply	R1,C
W	Heat Demand	2
G	Fan	3
LS	Limit Switch	7,8
RS	Rollout Switch	5,6
SS	Hall Effect Sensor	1,2,3
CS	Centrifugal Switch (Not Used)	9,10
FS	Flame Sense	FS
OUTPUTS		
CM	Induced Draft Motor	CM
IFO	Indoor Fan	IFO
R	24 Volt Power Output (Not Used)	R
SPARK	Sparker	—
LED	Display LED	

Fig. 26 — Scrolling Marquee

POWER EXHAUST — The units can be equipped with an optional power exhaust system. The power exhaust fans are forward-curved fans with direct-drive motors. The motors are controlled directly by the *Comfort*Link™ control through the ECB1 board. On the 20 to 50 ton units there are 4 fans. On the 60 ton units there are 6 fans. The fan sequences are controlled to provide 4 stages on the 20 to 50 ton units and 6 stages on the 60 ton unit. There are two control methods. For CV applications the fans can be configured for 2 stages based on adjustable economizer damper positions. For VAV applications and CV units with the building pressure control option, the fans are sequenced to maintain a building pressure set point based on a building pressure transducer.

ECONOMIZER MOTOR — The economizer outside air and return air dampers are gear-driven dampers without linkage. A digitally controlled economizer motor controls their position. The motor position is controlled by the ECB1 board by means of a digital two-way communication signal. This allows for accurate control of the motors as well as feedback information and diagnostics information. The control has a self-calibration routine that allows the motor position to be configured at initial unit start-up. The motor is located on the economizer and can be reached through the filter access door.

THERMISTORS AND PRESSURE TRANSDUCERS — The unit is equipped with thermistors for measurement of temperatures.

The units also have two pressure transducers that are connected to the low side of the system. These two pressure transducers measure the low side pressure and are used for low pressure protection and coil freeze protection.

By using the Saturated Condensing Temperature Sensors and the low side pressure transducers, the *Comfort*Link control displays the high and low side pressures and saturation temperatures and a normal gage set is not required.

SMOKE DETECTOR — The units can be equipped with an optional smoke detector located in the return air. The detector is wired to the *Comfort*Link controls and, if activated, will stop the unit by means of a special fire mode. The smoke detector can also be wired to an external alarm system through TB5 terminals 10 and 11. The sensor is located in the return air section behind the filter access door.

FILTER STATUS SWITCH — The units can be equipped with an optional filter status switch. The switch measures the pressure drop across the filters and closes when an adjustable pressure set point is exceeded. The sensor is located in the return air section behind the filter access door.

RETURN AIR CO_2 SENSOR — The unit can also be equipped with a return air IAQ CO_2 sensor that is used for the demand control ventilation. The sensor is located in the return air section and can be accessed from the filter access door.

BOARD ADDRESSES — Each board in the system has an address. The MBB has a default address of 1 but it does have an instance jumper that should be set to 1 as shown in Fig. 22. For the other boards in the system there is a 4-dip switch header on each board that should be set as shown below.

Board Address Settings

BOARD	SW1	SW2	SW3	SW4
ECB1	0	0	0	0
ECB2	1	0	0	0
SCB	0	0	0	0
CEM	0	0	0	0

0 = On; 1 = Off

Table 99 — VFD Terminal Designations

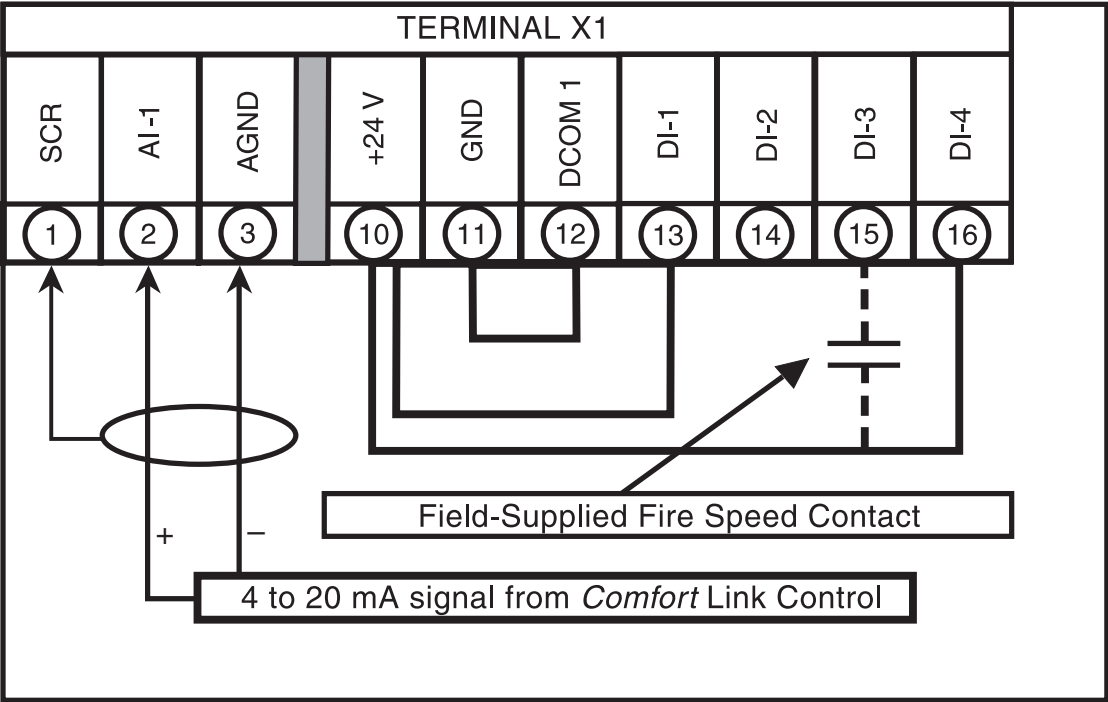| TERMINAL	FUNCTION
U1 V1 W1	Three-Phase Main Circuit Input Power Supply
U2 V2 W2	Three-Phase AC Output to Motor, 0 V to Maximum Input Voltage Level
X1-11 (GND) X1-12 (COMMON)	Factory-supplied jumper
X1-10 (24 VDC) X1-13 (DI-1)	Run (factory-supplied jumper)
X1-10 (24 VDC) X1-16 (DI-4)	Start Enable 1 (factory-supplied jumper). When opened the drive goes to emergency stop.
X1-2 (AI-1) X1-3 (AGND)	Factory wired for 4 to 20 mA remote input

Fig. 27 — VFD Wiring

FIELD CONNECTION TERMINAL STRIPS — Field connection terminal strips are located in the main control box. See Fig. 28 and Table 100.

Accessory Control Components — In addition to the factory-installed options, the units can also be equipped with several field-installed accessories that expand the control features of the unit. The following hardware components can be used as accessories.

ROOM THERMOSTATS (48/50AJ,AW ONLY) — The *Comfort*Link™ controls support a conventional electro-mechanical or electronic thermostat that uses the Y1, Y2, W1, W2, and G signals. The control also supports an additional input for an occupied/unoccupied command that is available on some new thermostats. The *Comfort*Link control can be configured to run with multiple stages of capacity which allows up to 6 stages of capacity. Although the unit can be configured for normal 2-stage control, it is recommended that the multi-stage control be used. The room thermostat is connected to TB4.

SPACE SENSOR — The *Comfort*Link control supports the use of space temperature sensors. The T55 and T56 sensors and CCN communicating T58 room sensor can be used. The T55 and T56 sensors are connected to TB5 terminal 3, 4, and 5. The T58 sensor is connected to the CCN connections on TB3. When a T55, T56, or T58 sensor is used, the user must install the red jumpers from R to W1, and W2 on TB4 for the heat function to work correctly.

SPACE CO_2 SENSORS — The *Comfort*Link control also supports a CO_2 IAQ sensor that can be located in the space for use in demand ventilation. The sensor must be a 4 to 20 mA sensor and should be connected to TB5 terminal 6 and 7. See Fig. 29 for sensor wiring.
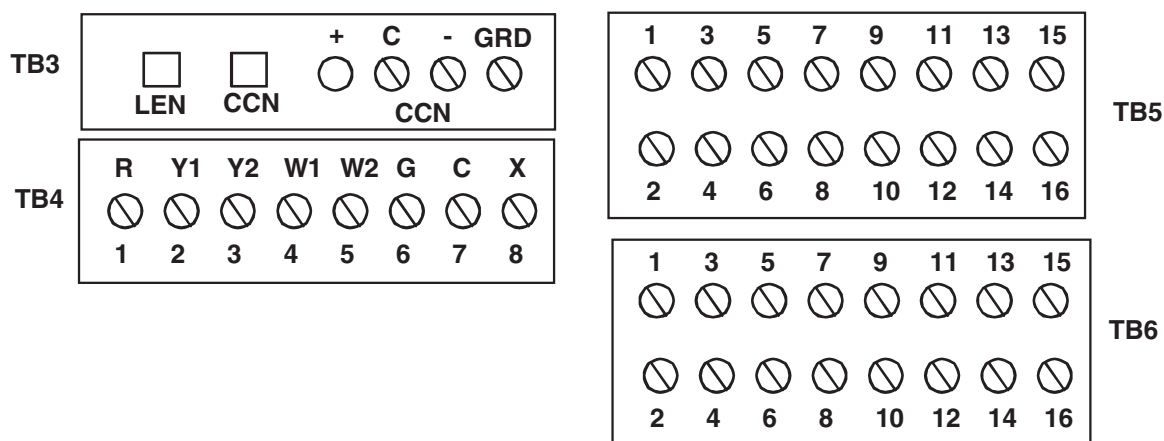
Fig. 28 — Field Connection Terminal Strips (Main Control Box)
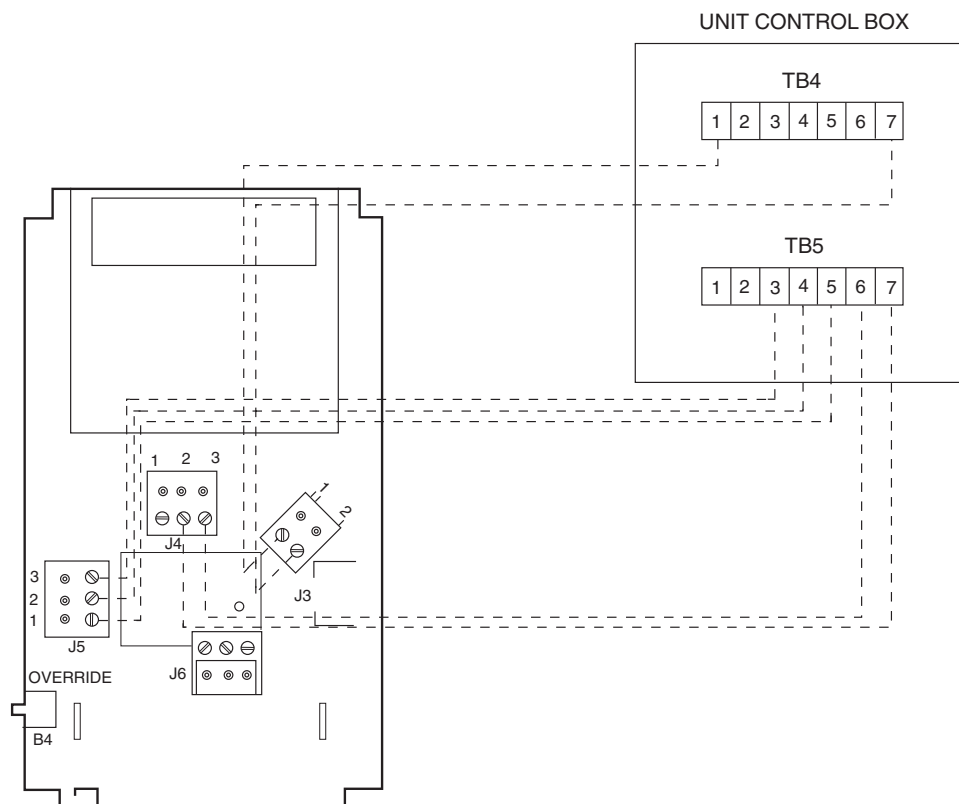
Fig. 29 — CO_2 and Space Temperature Sensor Wiring (33ZCT55CO2 and 33ZCT56CO2)

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Table 100 — Field Connection Terminal Strips

TERMINAL BOARD	TERMINAL NO.	DESCRIPTION	TYPE
TB-1 - POWER CONNECTION OR DISCONNECT (in Main Control Box)			
TB1	11	L1 power supply	208-230/460/575/380/-3-60, 400-3-50
	12	L2 power supply	208-230/460/575/380/-3-60, 400-3-50
	13	L3 power supply	208-230/460/575/380/-3-60, 400-3-50
TB-2 - GROUND (in Main Control Box)			
TB2	1	Neutral Power	
TB-3 - CCN COMMUNICATIONS (HY84HA096) (in Main Control Box)			
TB3	1	LEN +	5 VDC, logic
	2	LEN C	5 VDC, logic
	3	LEN –	5 VDC, logic
	4	24 VAC	24 VAC
	5	CCN +	5 VDC, logic
	6	CCN c	5 VDC, logic
	7	CCN –	5 VDC, logic
	8	Grd	ground
TB-4 - THEROMSTAT CONNECTIONS (HY84HA090) (in Main Control Box)			
TB4	1	Thermostat R	24VAC
	2	Thermostat Y1	24VAC
	3	Thermostat Y2	24VAC
	4	Thermostat W1	24VAC
	5	Thermostat W2	24VAC
	6	Thermostat G	24VAC
	7	Thermostat C	24VAC
	8	Thermostat X	24VAC
TB-5 - FIELD CONNECTIONS (HY84HA101) (in Main Control Box)			
TB5	1	VAV Heater Interlock Relay, Ground	external 24 VDC relay
	2	VAV Heater Interlock Relay, 24 VAC	external 24 VDC relay
	3	T56 Sensor	5VDC
	4	T56/T58 Ground	5VDC
	5	T58 Setpoint	5VDC
	6	Indoor Air IAQ Remote Sensor/Remote Pot/Remote 4-20 mA	4-20 mA, ext. powered w/res or 0-5 VDC
	7	Indoor Air IAQ Remote Sensor/Remote Pot/Remote 4-20 mA	4-20 mA, ext. powered w/res or 0-5 VDC
	8	Smoke Detector Remote Alarm	external contacts
	9	Smoke Detector Remote Alarm	external contacts
	10	Fire Shutdown	24 VAC external
	11	Fire Shutdown	external contact
	12	Fire Control Common	external contact
	13	Fire Pressurization	external contact
	14	Fire Evacuation	external contact
	15	Fire Smoke Purge	external contact
	16	Not Used	—
TB-6 - FIELD CONNECTIONS (HY84HA101) (in Main Control Box)			
TB6	1	Remote Occupied/Economizer Enable 24 VAC	external 24 VAC contact
	2	Remote Economizer Contact	external 24 VAC contact
	3	Remote Occupied Contact	external 24 VAC contact
	4	Demand Limit Contacts Common	external 24 VAC contact
	5	Demand Limit Redline	external 24 VAC contact
	6	Demand Limit Loadshed	external 24 VAC contact
	7	Demand Limit 4-20 mA	externally powered 4-20 mA
	8	Demand Limit 4-20 mA	externally powered 4-20 mA
	9	Remote Supply Air Setpoint 4-20 mA	externally powered 4-20 mA
	10	Remote Supply Air Setpoint 4-20 mA	externally powered 4-20 mA
	11	Outdoor Air IAQ 4-20 mA	externally powered 4-20 mA
	12	Outdoor Air IAQ 4-20 mA	externally powered 4-20 mA
	13	IAQ Remote Switch	external contact
	14	IAQ Remote Switch	external contact
	15	Not Used	—
	16	Not Used	—
TB-7 - ELECTRIC HEAT POWER BLOCK (in Electric Heat section)			
TB7	1	L1 Power Supply	208-230/460/575/380/-3-60, 400-3-50
	2	L2 Power Supply	208-230/460/575/380/-3-60, 400-3-50
	3	L3 Power Supply	208-230/460/575/380/-3-60, 400-3-50

ECONOMIZER HUMIDITY CHANGEOVER SENSORS — The *Comfort*Link™ controls support 5 different changeover schemes for the economizer. These are:

- Outdoor air dry bulb
- Differential dry bulb
- Outdoor air enthalpy curves
- Differential enthalpy
- Custom curves (a combination of an enthalpy/dewpoint curve and a dry bulb curve).

The units are equipped as standard with an outside air and return air dry bulb sensor which supports the dry bulb changeover methods. If the other methods are to be used, then a field-installed humidity sensor must be installed for outdoor air enthalpy and customer curve control and two humidity sensors must be installed for differential enthalpy. Installation holes are pre-drilled and wire harnesses are installed in every unit for connection of the humidity sensors. The *Comfort*Link control converts the measured humidity into enthalpy, dewpoint, and the humidity changeover curves.

MOTORMASTER® V CONTROL — For operation below 32 F when an economizer is not used, the units can be equipped with an accessory Motormaster V control, which controls the speed of the stage 1 condenser fans. The Motormaster V control is a 3-phase inverter that controls the speed of the fans based on a pressure transducer connected to the liquid line. On 20 to 35 ton units, one fan will be controlled. On 40 to 60 ton units, two fans will be controlled. For units equipped with an economizer, there should not be a need for this control because the economizer can provide free cooling using outside air, which will be significantly lower in operating cost.

The accessory Motormaster V speed control is a completely self-contained control and is not controlled by the unit's *Comfort*Link control. On size 60 units, the Motormaster control configuration (**M.M.**) must be set to YES. See page 32.

ACCESSORY NAVIGATOR™ DISPLAY — The accessory handheld Navigator display can be used with the 48/50A series units. See Fig. 30. The Navigator display operates the same way as the Scrolling Marquee device. The ECB1 and ECB2 boards contain a second LEN port (J3 connection) than can be used with the handheld Navigator display.

CONTROL MODULE COMMUNICATIONS

Red LED — Proper operation of the control boards can be visually checked by looking at the red status LEDs as shown on Fig. 22-25. When operating correctly, the red status LEDs should blink in unison at a rate of once every 2 seconds. If the red LEDs are not blinking in unison, verify that correct power is being supplied to all modules. Also, be sure that the Main Base Board is supplied with the current software. If necessary, reload current software. If the problem still persists, replace the MBB. A board LED that is lit continuously or blinking at a rate of once per second or faster indicates that the board should be replaced.

Green LED — The boards also have a green LED, which is the indicator of the operation of the LEN communications, which is used for communications between the boards. On the MBB board the Local Equipment Network (LEN) LED should always be blinking whenever power is on. All other boards have a LEN LED that will blink whenever power is on and there is communication occurring. If LEN LED is not blinking, check LEN connections for potential communication errors (J3 and J4 connectors). A 3-wire sensor bus accomplishes communication between modules. These 3 wires run in parallel from module to module.

Yellow LED — The MBB has one yellow LED. The Carrier Comfort Network (CCN) LED will blink during times of network communication. The other boards do not have a CCN communications port.

CARRIER COMFORT NETWORK INTERFACE — The 48/50A series units can be connected to the CCN if desired. The communication bus wiring is a shielded, 3-conductor cable with drain wire and is field supplied and installed. See the Installation instructions for wiring information. The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system elements on either side of it. This is also required for the negative and signal ground pins of each system element. Wiring connections for CCN should be made at TB3. See Fig. 31. Consult the CCN Contractor's Manual for further information.

NOTE: Conductors and drain wire must be 20-AWG (American Wire Gage) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of –20 C to 60 C is required.

It is important when connecting to a CCN communication bus that a color-coding scheme be used for the entire network to simplify the installation. It is recommended that red be used for the signal positive, black for the signal negative and white for the signal ground. Use a similar scheme for cables containing different colored wires.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only). To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground), and black (–) conductors. (Substitute appropriate colors for different colored cables.)
3. Connect the red wire to (+) terminal on TB3 of the plug, the white wire to COM terminal, and the black wire to the (–) terminal.
4. The RJ14 CCN connector on TB3 can also be used, but is only intended for temporary connection (for example, a laptop computer running Service Tool).
5. Restore power to unit.

> IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent the unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check the CCN connector and cable. Run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.
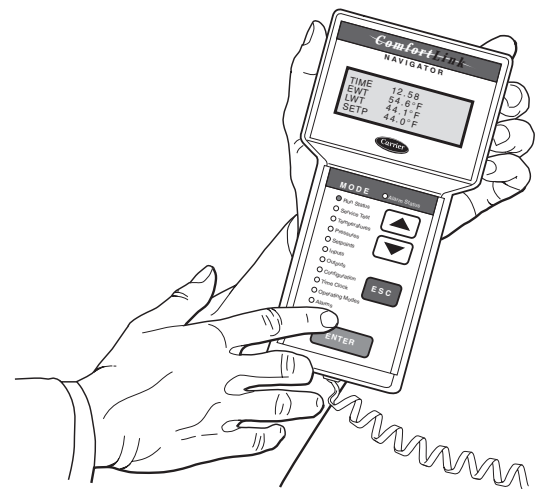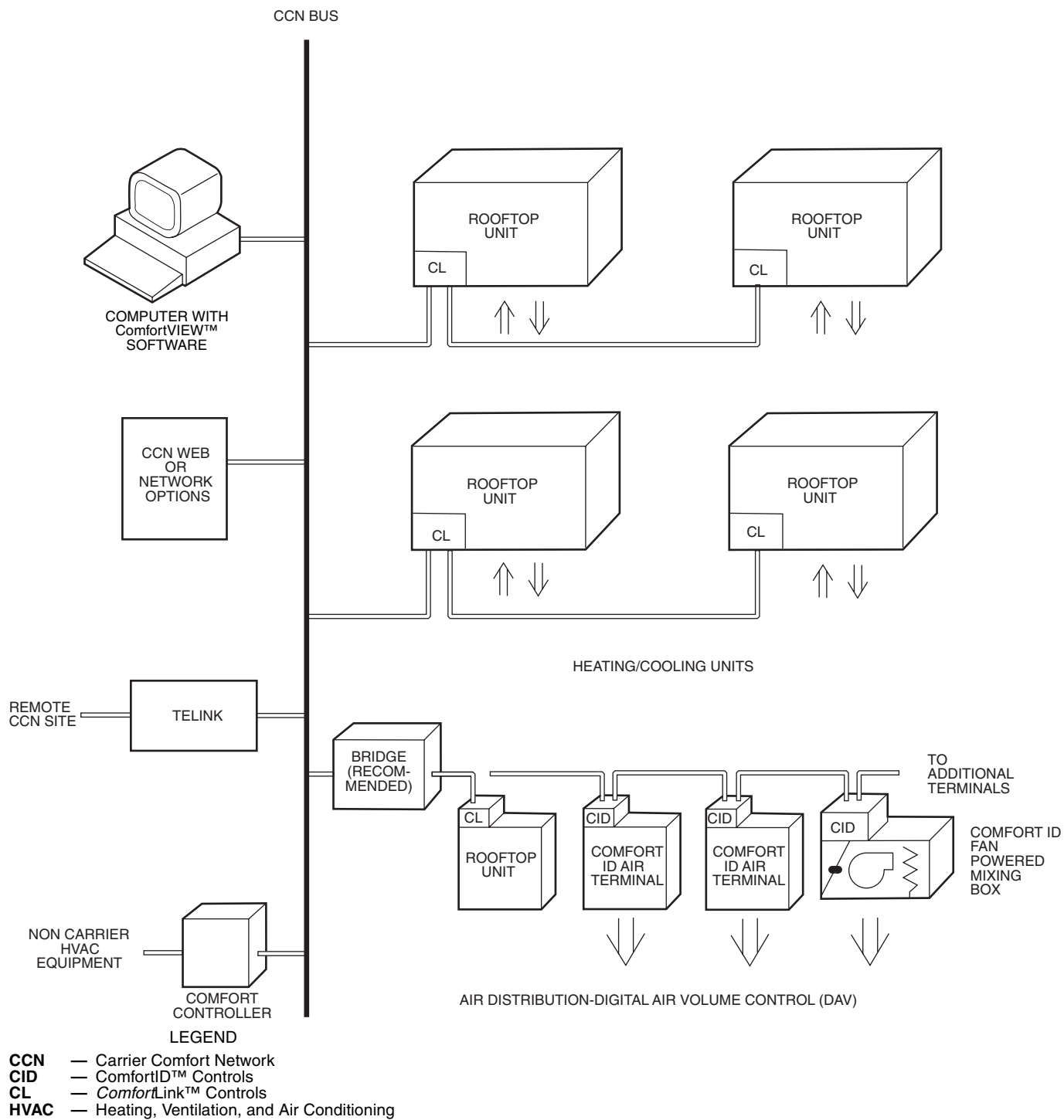

Fig. 30 — Accessory Navigator Display

CCN BUS

COMPUTER WITH
ComfortVIEW™
SOFTWARE

ROOFTOP
UNIT
CL

ROOFTOP
UNIT
CL

CCN WEB
OR
NETWORK
OPTIONS

ROOFTOP
UNIT
CL

ROOFTOP
UNIT
CL

HEATING/COOLING UNITS

REMOTE
CCN SITE

TELINK

BRIDGE
(RECOM-
MENDED)

CL
ROOFTOP
UNIT

CID
COMFORT
ID AIR
TERMINAL

CID
COMFORT
ID AIR
TERMINAL

CID

TO
ADDITIONAL
TERMINALS

COMFORT ID
FAN
POWERED
MIXING
BOX

NON CARRIER
HVAC
EQUIPMENT

COMFORT
CONTROLLER

AIR DISTRIBUTION-DIGITAL AIR VOLUME CONTROL (DAV)

LEGEND

CCN — Carrier Comfort Network
CID — ComfortID™ Controls
CL — *Comfort*Link™ Controls
HVAC — Heating, Ventilation, and Air Conditioning

Fig. 31 — CCN System Architecture

SERVICE

Service Access — All unit components can be reached through clearly labelled hinged access doors. These doors are not equipped with tiebacks, so if heavy duty servicing is needed, either remove them or prop them open to prevent accidental closure.

Each door is held closed with 3 latches. The latches are secured to the unit with a single 1/4-in. - 20 x 1/2-in. long bolt. See Fig. 32.

To open, loosen the latch bolt using a 7/16-in. wrench. Pivot the latch so it is not in contact with the door. Open the door. To shut, reverse the above procedure.

NOTE: Disassembly of the top cover may be required under special service circumstances. It is very important that the orientation and position of the top cover be marked on the unit prior to disassembly. This will allow proper replacement of the top cover onto the unit and prevent rainwater from leaking into the unit.

IMPORTANT: After servicing is completed, make sure door is closed and relatched properly, and that the latches are tight. Failure to do so can result in water leakage into the evaporator section of the unit.

Cleaning — Inspect unit interior at beginning of each heating and cooling season and as operating conditions require. Remove unit side panels and/or open doors for access to unit interior.

MAIN BURNERS — At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust if necessary. Check spark gap. See Fig. 33. Refer to Main Burners section on page 113.

FLUE GAS PASSAGEWAYS — The flue collector box and heat exchanger cells may be inspected by removing gas section access panel, flue box cover, collector box, and main burner assembly (Fig. 34 and 35). Refer to Main Burners section on page 113 for burner removal sequence. If cleaning is required, clean all parts with a wire brush. Reassemble using new high-temperature insulation for sealing.

COMBUSTION-AIR BLOWER — Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, remove heat exchanger access panel. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel assembly by removing screws holding motor mounting plate to top of combustion fan housing (Fig. 34 and 35). The motor, scroll, and wheel assembly can be removed from the unit. Remove scroll from plate. Remove the blower wheel from the motor shaft and clean with a detergent or solvent. Replace motor and wheel assembly.

COIL MAINTENANCE AND CLEANING RECOMMENDATION — Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

Remove Surface Loaded Fibers — Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges can be easily bent over and damage to the coating of a protected coil) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

Periodic Clean Water Rinse — A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with very low velocity water stream to avoid damaging the fin edges. Monthly cleaning as described below is recommended.

Routine Cleaning of Coil Surfaces — Monthly cleaning with Totaline® environmentally sound coil cleaner is essential to extend the life of coils. This cleaner is available from Carrier Replacement parts division as part number P902-0301 for a one gallon container, and part number P902-0305 for a 5 gallon container. It is recommended that all coils, including standard aluminum, pre-coated, copper/copper or E-coated coils be cleaned with the Totaline environmentally sound coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

Avoid the use of:
• Coil brighteners
• Acid cleaning prior to painting
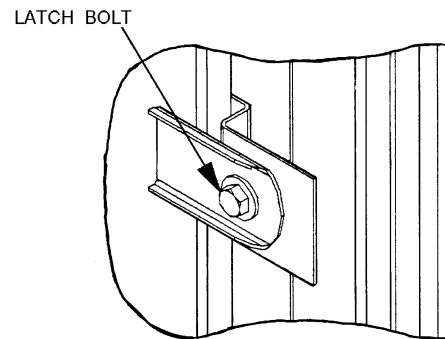• High pressure washers
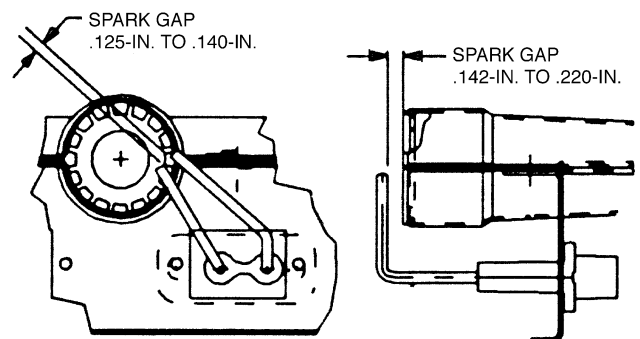• Poor quality water for cleaning

Fig. 32 — Door Latch

Fig. 33 — Spark Gap Adjustment

Totaline® environmentally sound coil cleaner is non-flammable, hypoallergenic, nonbacterial, and a USDA accepted biodegradable agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

Totaline Environmentally Sound Coil Cleaner Application Equipment
• 2$\frac{1}{2}$ gallon garden sprayer
• Water rinse with low velocity spray nozzle

⚠ CAUTION

Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indoor coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Totaline environmentally sound coil cleaner as described above.

⚠ CAUTION

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdown may occur.

Totaline Environmentally Sound Coil Cleaner Application Instructions

1. Proper eye protection such as safety glasses is recommended during mixing and application.
2. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
3. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
4. Mix Totaline environmentally sound coil cleaner in a 2$\frac{1}{2}$ gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100 F.

NOTE: Do <u>NOT</u> <u>USE</u> water in excess of 130 F, as the enzymatic activity will be destroyed.

5. Thoroughly apply Totaline environmentally sound coil cleaner solution to all coil surfaces including finned area, tube sheets and coil headers.
6. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up-and-down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage.
7. Ensure cleaner thoroughly penetrates deep into finned areas.

8. Interior and exterior finned areas must be thoroughly cleaned.
9. Finned surfaces should remain wet with cleaning solution for 10 minutes.
10. Ensure surfaces are not allowed to dry before rinsing. Reapplying cleaner as needed to ensure 10-minute saturation is achieved.
11. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

CONDENSATE DRAIN — Check and clean each year at start of cooling season. In winter, keep drains and traps dry.

FILTERS — Clean or replace at start of each heating and cooling season, or more often if operating conditions require. Refer to Installation Instructions for type and size.

NOTE: The unit requires industrial grade throwaway filters capable of withstanding face velocities up to 625 fpm.

OUTDOOR-AIR INLET SCREENS — Clean screens with steam or hot water and a mild detergent. Do not use disposable filters in place of screens.

Lubrication

FAN SHAFT BEARINGS — Lubricate bearings at least every 6 months with suitable bearing grease. Do not over grease. Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

CONDENSER AND EVAPORATOR-FAN MOTOR BEARINGS — The condenser and evaporator-fan motors have permanently sealed bearings, so no field lubrication is necessary.
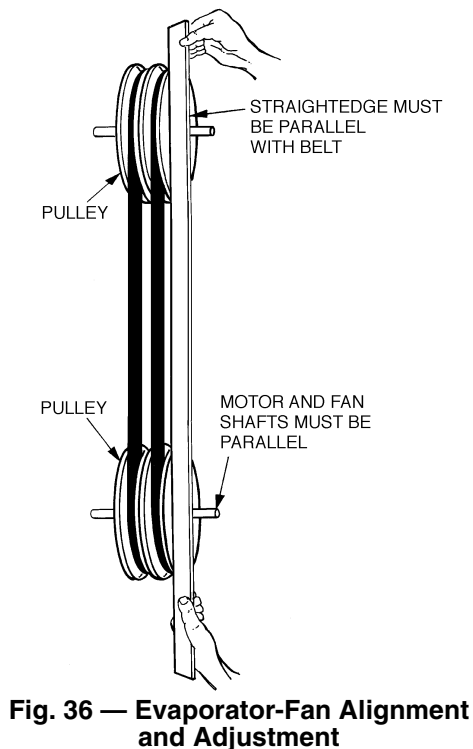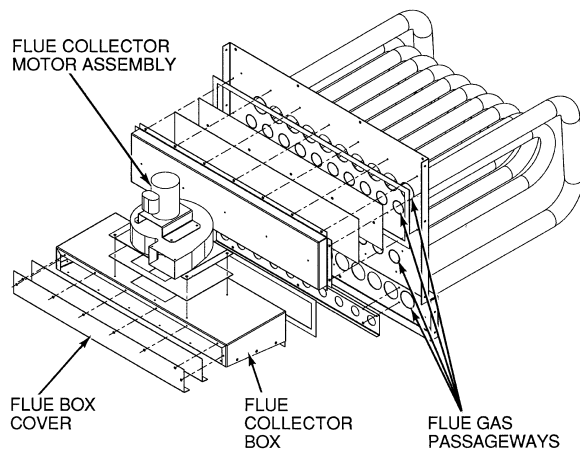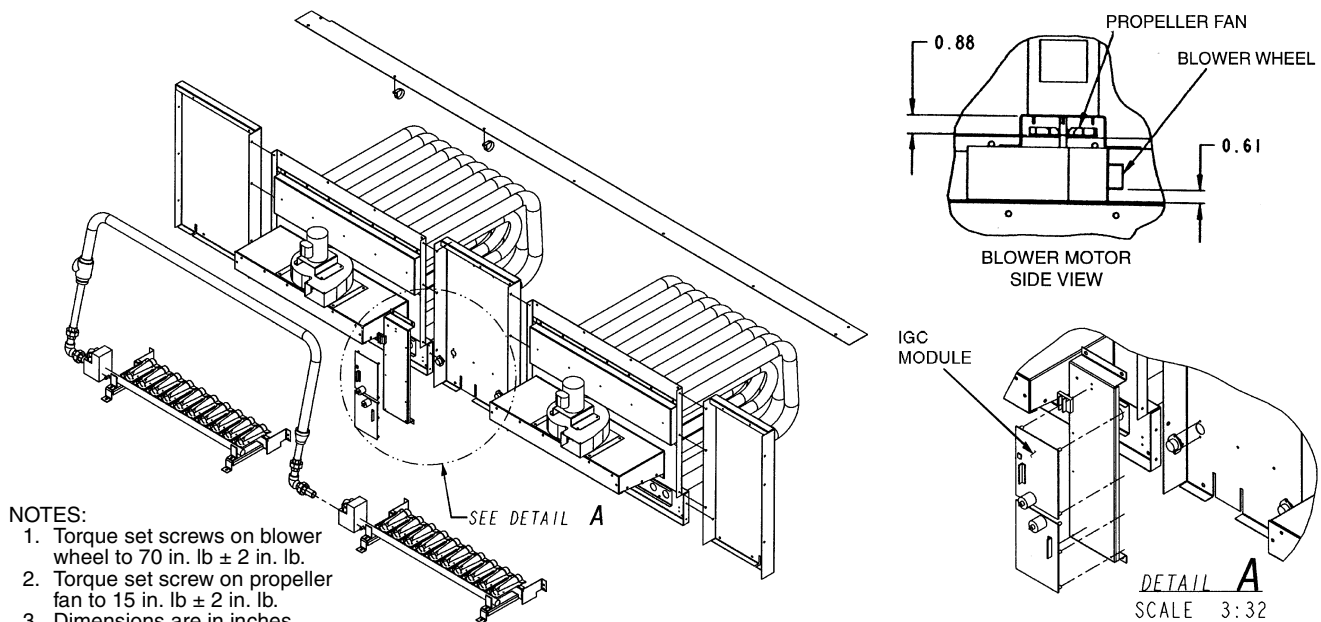
Evaporator Fan Performance Adjustment (Fig. 36) — Fan motor pulleys are designed for speed shown in Physical Data table in unit Installation Instructions (factory speed setting).

IMPORTANT: Check to ensure that the unit drive matches the duct static pressure using Tables 3-25.

To change fan speeds, change pulleys.
To align fan and motor pulleys:
1. Shut off unit power supply.
2. Loosen fan shaft pulley bushing.
3. Slide fan pulley along fan shaft.
4. Make angular alignment by loosening motor from mounting plate.
5. Retighten pulley.
6. Return power to the unit.

NOTES:
1. Torque set screws on blower wheel to 70 in. lb ± 2 in. lb.
2. Torque set screw on propeller fan to 15 in. lb ± 2 in. lb.
3. Dimensions are in inches.

Fig. 34 — Typical Gas Heating Section

Fig. 35 — Gas Heat Section Details

Fig. 36 — Evaporator-Fan Alignment and Adjustment

Evaporator Fan Coupling Assembly — If the coupling has been removed for other blower assembly component repair or replacement, it is critical that the coupling be reassembled and aligned correctly to prevent premature failures.

REASSEMBLING THE COUPLING INTO THE UNIT (Fig. 37)

1. Prior to reassembling the coupling, loosen the 4 bearing mounting bolts, which secure the 2 bearings on either side of the coupling. Remove the drive belts.

2. Reassemble the coupling with the bearings loose. This allows the coupling to find its own self-alignment position.

3. Check the hub-to-shaft fit for close fitting clearances. Replace hubs if high clearances are determined.

4. Check the key for close-fitted clearances on the sides and 0.015 in. clearance over the top of the key. Replace key if necessary.

5. Be sure that hub flanges, flex members, spacer, and hardware are clean and free of oil.

6. Place the flanges onto the shafts with the hub facing outward. Do not tighten the set screws at this time.

7. Outside of the unit, assemble the flex members to the center drive shaft with 4 bolts and nuts. The flex members have collars that need to be inserted into the smaller hole of the drive shaft flange.

8. Assemble the flex member/drive shaft assembly to one of the shaft flanges, using 2 bolts and nuts. Slide the other shaft flange towards the assembly and assemble using 2 bolts and nuts. If the shafts are not misaligned, the collar in the flex member should line up with the shaft flange holes.

9. Torque nuts properly to 95 to 100 ft-lb. Do not turn a coupling bolt. Always turn the nut. Always use thread lubricant or anti-seize compound to prevent thread galling.

10. The ends of the shafts should be flush with the inside of the shaft flange. Torque the set screws to 25 ft-lb.

11. After assembly is complete, slowly rotate the shafts by hand for 30 to 60 seconds.

12. Tighten the bearing mounting bolts, using care not to place any loads on the shaft which would cause flexure to the shafts.

111

13. Reinstall drive belts. (Refer to Belt Tension Adjustment section below.)

14. Visually inspect the assembly. If the shafts are overly misaligned, the drive shaft flange will not be parallel with the shaft flanges.

15. Recheck nut torque after 1 to 2 hours of operation. Bolts tend to relax after being initially torqued.

Evaporator Fan Service and Replacement

1. Turn off unit power supply.
2. Remove supply-air section panels.
3. Remove belt and blower pulley.
4. Loosen setscrews in blower wheels.
5. Remove locking collars from bearings.
6. Remove shaft.
7. Remove venturi on opposite side of bearing.
8. Lift out wheel.
9. Reverse above procedure to reinstall fan.
10. Check and adjust belt tension as necessary.
11. Restore power to unit.

Belt Tension Adjustment — To adjust belt tension:

1. Turn off unit power supply.
2. Loosen motor mounting nuts and bolts. See Fig. 38.
3. Loosen fan motor nuts.
4. Turn motor jacking bolts to move motor mounting plate left or right for proper belt tension. A slight bow should be present in the belt on the slack side of the drive while running under full load.
5. Tighten nuts.
6. Adjust bolts and nut on mounting plate to secure motor in fixed position. Recheck belt tension after 24 hours of operation. Adjust as necessary. Refer to Installation Instructions for proper tension values.
7. Restore power to unit.

Evaporator-Fan Motor Replacement

1. Turn off unit power supply.
2. Remove upper outside panel and open hinged door to gain access to motor.
3. Fully retract motor plate adjusting bolts.
4. Loosen the 2 rear (nearest the evaporator coil) motor plate nuts.
5. Remove the 2 front motor plate nuts and carriage bolts.
6. Slide motor plate to the rear (toward the coil) and remove fan belt(s).
7. Slide motor plate to the front and hand tighten one of the rear motor plate nuts (tight enough to prevent the motor plate from sliding back but loose enough to allow the plate to pivot upward).

8. Pivot the front of the motor plate upward enough to allow access to the motor mounting hex bolts and secure in place by inserting a prop.

9. Remove the nuts from the motor mounting hex bolts and remove motor.

10. Replace the locktooth washer under the motor base with a new washer. Be sure that the washer contacts the motor base surface.

11. Reverse above steps to install new motor.

Condenser-Fan Adjustment

1. Turn off unit power supply.
2. Remove fan guard.
3. Loosen fan hub setscrews.
4. Adjust fan height on shaft using a straightedge placed across venturi and measure per Fig. 39.
5. Fill hub recess with permagum if rubber hubcap is missing.
6. Tighten setscrews and replace panel(s).
7. Turn on unit power.

Four-Inch Filter Replacement — The 4-Inch Filter Change Mode variable is used to service the unit when 4-in. filters are used. When the filters need to be changed, set *Service Test→F.4.CH* = YES. The unit will be placed in Service Test mode and the economizer will move to the 40% open position to facilitate removal of the 4-in. filters. After the filters have been changed, set *Service Test→F.4.CH* = NO to return the unit to normal operation.

Power Failure — The economizer damper motor is a spring return design. In event of power failure, dampers will return to fully closed position until power is restored.

Refrigerant Charge — Amount of refrigerant charge is listed on unit nameplate. Refer to Carrier GTAC II; Module 5; Charging, Recovery, Recycling, and Reclamation section for charging methods and procedures.

Unit panels must be in place when unit is operating during charging procedure.

NOTE: Do not use recycled refrigerant as it may contain contaminants.

NO CHARGE — Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant from the unit nameplate.

LOW CHARGE COOLING — Connect the gage set and a temperature measuring device to the liquid line. Ensure that all condenser fans are operating. It may be necessary to block part of the coil on cold days to ensure that condensing pressures are high enough to turn on the fans. Adjust the refrigerant change in each circuit to obtain 20 F ± 2° F of liquid subcooling.

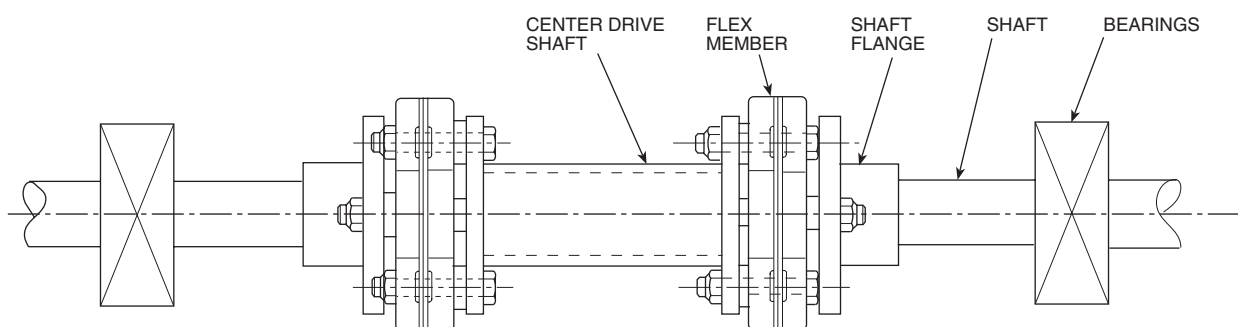NOTE: Indoor-air cfm must be within normal operating range of unit.

Fig. 37 — Evaporator Fan Coupling

CENTER DRIVE SHAFT FLEX MEMBER SHAFT FLANGE SHAFT BEARINGS

Thermostatic Expansion Valve (TXV) — Each circuit has a TXV. The TXV is nonadjustable and is factory set to maintain 10 to 13° F superheat leaving the evaporator coil. The TXV controls flow of liquid refrigerant to the evaporator coils.

Gas Valve Adjustment

NATURAL GAS — The 2-stage gas valve opens and closes in response to the thermostat or limit control.

When power is supplied to valve terminals 3 and 4, the pilot valve opens to the preset position. When power is supplied to terminals 1 and 2, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body (3.5 in. wg).

To adjust regulator:

1. Set thermostat at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove $1/8$-in. pipe plug from manifold. Install a water manometer pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat (high fire).
6. Remove screw cap covering regulator adjustment screw (See Fig. 40).
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.
8. Once desired pressure is established, set unit to no call for heat (3.3-in. wg high fire).
9. Turn main gas valve to OFF position.
10. Remove pressure-measuring device and replace $1/8$-in. pipe plug and screw cap.
11. Turn main gas valve to ON position and check heating operation.

Main Burners — For all applications, main burners are factory set and should require no adjustment.

MAIN BURNER REMOVAL (Fig. 41)

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power supply to unit.
3. Remove heating access panel.
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
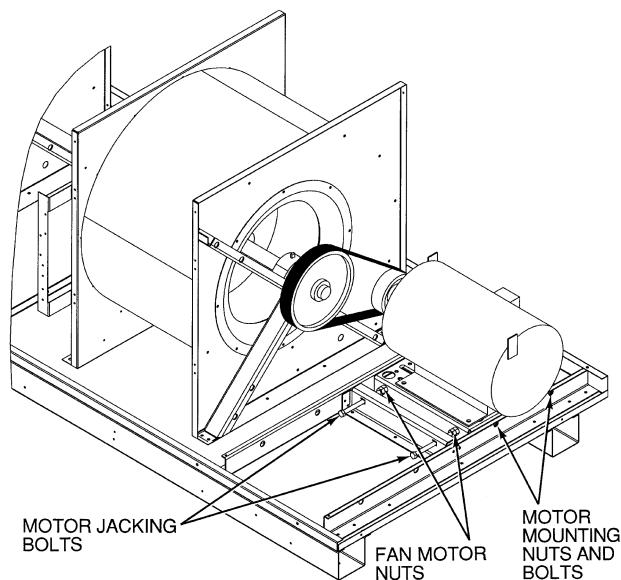
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws securing manifold bracket to basepan.
9. Remove 4 screws that hold the burner support plate flange to the vestibule plate.
10. Lift burner assembly out of unit.
11. Reverse procedure to re-install burners.

Filter Drier — Replace whenever refrigerant system is exposed to atmosphere.

Replacement Parts — A complete list of replacement parts may be obtained from any Carrier distributor upon request.

Fig. 39 — Condenser-Fan Adjustment

Fig. 40 — Gas Valve (Part Number EF33CB271)

Fig. 38 — Belt Tension Adjustment

Fig. 41 — Main Burner Removal

APPENDIX A — LOCAL DISPLAY TABLES

MODE — RUN STATUS

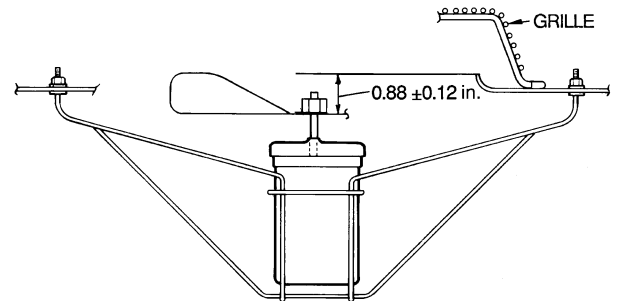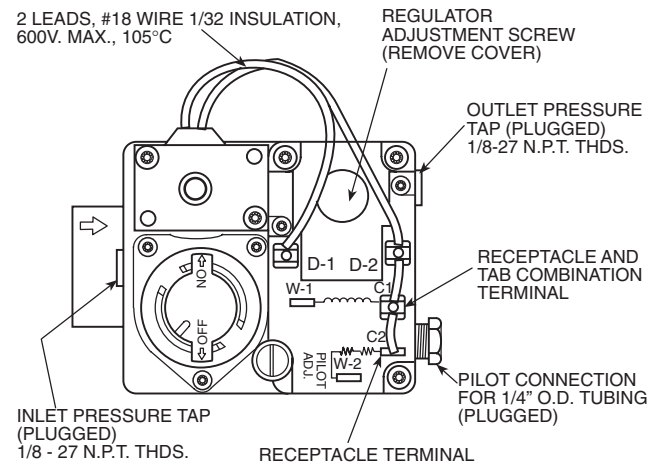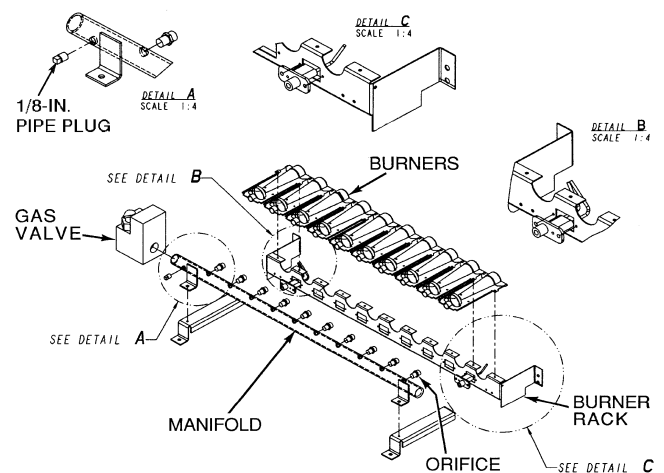| ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS	PAGE NO.
VIEW	AUTO VIEW OF RUN STATUS					
→HVAC	ascii string spelling out the hvac modes			string		75
→OCC	Occupied ?	YES/NO		OCCUPIED	forcible	75
→MAT	Mixed Air Temperature		dF	MAT		75
→EDT	Evaporator Discharge Tmp		dF	EDT		75
→LAT	Leaving Air Temperature		dF	LAT		75
→EC.C.P	Economizer Control Point		dF	ECONCPNT		75
→ECN.P	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS		75
→CL.C.P	Cooling Control Point		dF	COOLCPNT		75
→C.CAP	Current Running Capacity			CAPTOTAL		75
→HT.C.P	Heating Control Point		dF	HEATCPNT		75
→HT.ST	Requested Heat Stage			HT_STAGE		75
→H.MAX	Maximum Heat Stages			HTMAXSTG		75
ECON	ECONOMIZER RUN STATUS					
→ECN.P	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS		75
→ECN.C	Economizer Act.Cmd.Pos.	0-100	%	ECONOCMD	forcible	75
→ACTV	Economizer Active ?	YES/NO		ECACTIVE		75
→DISA	ECON DISABLING CONDITIONS					75
→DISA→UNAV	Econ Act. Unavailable?	YES/NO		ECONUNAV		75
→DISA→R.EC.D	Remote Econ. Disabled ?	YES/NO		ECONDISA		75
→DISA→DBC	DBC - OAT Lockout?	YES/NO		DBC_STAT		75
→DISA→DEW	DEW - OA Dewpt.Lockout?	YES/NO		DEW_STAT		75
→DISA→DDBC	DDBD- OAT > RAT Lockout?	YES/NO		DDBCSTAT		75
→DISA→OAEC	OAEC- OA Enth Lockout?	YES/NO		OAECSTAT		75
→DISA→DEC	DEC - Diff.Enth.Lockout?	YES/NO		DEC_STAT		75
→DISA→EDT	EDT Sensor Bad?	YES/NO		EDT_STAT		75
→DISA→OAT	OAT Sensor Bad ?	YES/NO		OAT_STAT		75
→DISA→FORC	Economizer Forced ?	YES/NO		ECONFORC		75
→DISA→SFON	Supply Fan Not On 30s ?	YES/NO		SFONSTAT		75
→DISA→CLOF	Cool Mode Not In Effect?	YES/NO		COOL_OFF		75
→DISA→OAQL	OAQ Lockout in Effect ?	YES/NO		OAQLOCKD		75
→DISA→HELD	Econ Recovery Hold Off?	YES/NO		ECONHELD		75
→O.AIR	OUTSIDE AIR INFORMATION					75
→O.AIR→OAT	Outside Air Temperature		dF	OAT	forcible	75
→O.AIR→OA.RH	Outside Air Rel. Humidity		%	OARH	forcible	75
→O.AIR→OA.E	Outside Air Enthalpy			OAE		75
→O.AIR→OA.D.T	OutsideAir Dewpoint Temp		dF	OADEWTMP		75
COOL	COOLING INFORMATION					
→C.CAP	Current Running Capacity		%	CAPTOTAL		75
→CUR.S	Current Cool Stage			COOL_STG		75
→MAX.S	Maximum Cool Stages			CLMAXSTG		75
→DEM.L	Active Demand Limit			DEM_LIM	forcible	75
→SUMZ	COOL CAP. STAGE CONTROL					75
→SUMZ→SMZ	Capacity Load Factor		%	SMZ		75
→SUMZ→ADD.R	Next Stage EDT Decrease		deltaF	ADDRISE		75
→SUMZ→SUB.R	Next Stage EDT Increase		deltaF	SUBRISE		75
→SUMZ→R.PCT	Rise Per Percent Capacity			RISE_PCT		75
→SUMZ→Y.MIN	Cap Deadband Subtracting			Y_MINUS		75
→SUMZ→Y.PLU	Cap Deadband Adding			Y_PLUS		75
→SUMZ→Z.MIN	Cap Threshold Subtracting			Z_MINUS		75
→SUMZ→Z.PLU	Cap Threshold Adding			Z_PLUS		76
→SUMZ→H.TMP	High Temp Cap Override			HI_TEMP		76
→SUMZ→L.TMP	Low Temp Cap Override			LOW_TEMP		76
→SUMZ→PULL	Pull Down Cap Override			PULLDOWN		76
→SUMZ→SLOW	Slow Change Cap Override			SLO_CHNG		76
TRIP	MODE TRIP HELPER					
→UN.C.S	Unoccup. Cool Mode Start			UCCLSTRT		76
→UN.C.E	Unoccup. Cool Mode End			UCCL_END		76
→OC.C.S	Occupied Cool Mode Start			OCCLSTRT		76
→OC.C.E	Occupied Cool Mode End			OCCL_END		76
→TEMP	Ctl.Temp RAT,SPT or Zone			CTRLTEMP		76
→OC.H.E	Occupied Heat Mode End			OCHT_END		76
→OC.H.S	Occupied Heat Mode Start			OCHTSTRT		76
→UN.H.E	Unoccup. Heat Mode End			UCHT_END		76
→UN.H.S	Unoccup. Heat Mode Start			UCHTSTRT		76
→HVAC	ascii string spelling out the hvac modes			string		76
LINK	CCN - LINKAGE					
→MODE	Linkage Active - CCN	ON/OFF		MODELINK		76
→L.Z.T	Linkage Zone Control Tmp		dF	LZT		76
→L.C.SP	Linkage Curr. Cool Setpt		dF	LCSP		76
→L.H.SP	Linkage Curr. Heat Setpt		dF	LHSP		76
HRS	COMPRESSOR RUN HOURS					
→HR.A1	Compressor A1 Run Hours	0-999999	HRS	HR_A1	config	76
→HR.A2	Compressor A2 Run Hours	0-999999	HRS	HR_A2	config	76
→HR.B1	Compressor B1 Run Hours	0-999999	HRS	HR_B1	config	76
→HR.B2	Compressor B2 Run Hours	0-999999	HRS	HR_B2	config	76
STRT	COMPRESSOR STARTS					
→ST.A1	Compressor A1 Starts	0-999999		CY_A1	config	76
→ST.A2	Compressor A2 Starts	0-999999		CY_A2	config	76
→ST.B1	Compressor B1 Starts	0-999999		CY_B1	config	76
→ST.B2	Compressor B2 Starts	0-999999		CY_B2	config	76

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS	PAGE NO.
TMGD	TIMEGUARDS					
→*TG.A1*	Compressor A1 Timeguard			CMPA1_TG		77
→*TG.A2*	Compressor A2 Timeguard			CMPA2_TG		77
→*TG.B1*	Compressor B1 Timeguard			CMPB1_TG		77
→*TG.B2*	Compressor B2 Timeguard			CMPB2_TG		77
→*TG.H1*	Heat Relay 1 Timeguard			HS1_TG		77
→*TG.H2*	Heat Relay 2 Timeguard			HS2_TG		77
→*TG.H3*	Heat Relay 3 Timeguard			HS3_TG		77
→*TG.H4*	Heat Relay 4 Timeguard			HS4_TG		77
→*TG.H5*	Heat Relay 5 Timeguard			HS5_TG		77
→*TG.H6*	Heat Relay 6 Timeguard			HS6_TG		77
VERS	SOFTWARE VERSION NUMBERS					
→*MBB*	CESR131343-xx-xx			string		77
→*ECB1*	CESR131249-xx-xx			string		77
→*ECB2*	CESR131249-xx-xx			string		77
→*SCB*	CESR131226-xx-xx			string		77
→*CEM*	CESR131174-xx-xx			string		77
→*MARQ*	CESR131171-xx-xx			string		77
→*NAVI*	CESR130227-xx-xx			string		77

MODE — SERVICE TEST

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS	PAGE NO.
TEST	Service Test Mode	ON/OFF		MAN_CTRL		
STOP	Local Machine Disable	YES/NO		UNITSTOP	config	23
S.STP	Soft Stop Request	YES/NO		SOFTSTOP	forcible	23
FAN.F	Supply Fan Request	YES/NO		SFANFORC	forcible	23
F.4.CH	4 in. Filter Change Mode	YES/NO		FILT4CHG		23
INDP	TEST INDEPENDENT OUTPUTS					
→*ECN.C*	Economizer Act.Cmd.Pos.			ECONCTST		24
→*E.PWR*	Economizer Power Test			ECONPTST		24
→*E.CAL*	Calibrate the Economizer?			ECON_CAL		24
→*PE.A*	Power Exhaust Relay A			PE_A_TST		24
→*PE.B*	Power Exhaust Relay B			PE_B_TST		24
→*PE.C*	Power Exhaust Relay C			PE_C_TST		24
→*H.I.R*	Heat Interlock Relay	ON/OFF		HIR_TST		24
→*ALRM*	Remote Alarm Relay	ON/OFF		ALRM_TST		24
FANS	TEST FANS					
→*S.FAN*	Supply Fan Relay	ON/OFF		SFAN_TST		24
→*S.VFD*	Supply Fan VFD Speed	0-100	%	SGVFDTST		24
→*CD.F.A*	Condenser Fan Circuit A	ON/OFF		CNDA_TST		24
→*CD.F.B*	Condenser Fan Circuit B	ON/OFF		CNDB_TST		24
COOL	TEST COOLING					
→*A1*	Compressor A1 Relay	ON/OFF		CMPA1TST		24
→*A2*	Compressor A2 Relay	ON/OFF		CMPA2TST		24
→*MLV*	Min. Load Valve (HGBP)	ON/OFF		MLV_TST		24
→*B1*	Compressor B1 Relay	ON/OFF		CMPB1TST		24
→*B2*	Compressor B2 Relay	ON/OFF		CMPB2TST		24
HEAT	TEST HEATING					
→*HT.1*	Heat Relay 1	ON/OFF		HS1_TST		24
→*HT.2*	Heat Relay 2	ON/OFF		HS2_TST		24
→*HT.3*	Relay 3 W1 Gas Valve 2	ON/OFF		HS3_TST		24
→*HT.4*	Relay 4 W2 Gas Valve 2	ON/OFF		HS4_TST		24
→*HT.5*	Relay 5 W1 Gas Valve 3	ON/OFF		HS5_TST		24
→*HT.6*	Relay 6 W2 Gas Valve 3	ON/OFF		HS6_TST		24

MODE — TEMPERATURES

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
AIR.T	AIR TEMPERATURES				
→*CTRL*	CONTROL TEMPS				
→*CTRL→EDT*	Evaporator Discharge Tmp		dF	EDT	
→*CTRL→LAT*	Leaving Air Temperature		dF	LAT	
→*CTRL→MAT*	Mixed Air Temperature		dF	MAT	
→*CTRL→R.TMP*	Controlling Return Temp		df	RETURN_T	forcible
→*CTRL→S.TMP*	Controlling Space Temp		df	SPACE_T	forcible
→*SAT*	Air Tmp Lvg Supply Fan		dF	SAT	
→*OAT*	Outside Air Temperature	−40 - 240	dF	OAT	forcible
→*RAT*	Return Air Temperature		dF	RAT	forcible
→*SPT*	Space Temperature	−40 - 240	dF	SPT	forcible
→*SPTO*	Space Temperature Offset		^F	SPTO	forcible
→*S.G.LS*	Staged Gas LAT Sum		dF	LAT_SGAS	
→*S.G.L1*	Staged Gas LAT 1		dF	LAT1SGAS	
→*S.G.L2*	Staged Gas LAT 2		dF	LAT2SGAS	
→*S.G.L3*	Staged Gas LAT 3		dF	LAT3SGAS	
→*S.G.LM*	Staged Gas Limit Sw.Temp		dF	LIMSWTMP	
REF.T	REFRIGERANT TEMPERATURES				
→*SCT.A*	Cir A Sat.Condensing Tmp		dF	SCTA	
→*SST.A*	Cir A Sat.Suction Temp.		dF	SSTA	
→*SCT.B*	Cir B Sat.Condensing Tmp		dF	SCTB	
→*SST.B*	Cir B Sat.Suction Temp.		dF	SSTB	

APPENDIX A — LOCAL DISPLAY TABLES (cont)

MODE — PRESSURES

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
AIR.P	AIR PRESSURES				
→**SP**	Static Pressure		"H2O	SP	
→**BP**	Building Pressure		"H2O	BP	
REF.P	REFRIGERANT PRESSURES				
→**DP.A**	Cir A Discharge Pressure		PSIG	DP_A	
→**SP.A**	Cir A Suction Pressure		PSIG	SP_A	
→**DP.B**	Cir B Discharge Pressure		PSIG	DP_B	
→**SP.B**	Cir B Suction Pressure		PSIG	SP_B	

MODE — SET POINTS

ITEM	DESCRIPTION	RANGE	UNITS	CCN POINT	DEFAULT
OHSP	Occupied Heat Setpoint	55-80	dF	OHSP	68
OCSP	Occupied Cool Setpoint	55-80	dF	OCSP	75
UHSP	Unoccupied Heat Setpoint	40-80	dF	UHSP	55
UCSP	Unoccupied Cool Setpoint	75-95	dF	UCSP	90
GAP	Heat-Cool Setpoint Gap	2-10	deltaF	HCSP_GAP	5
V.C.ON	VAV Occ. Cool On Delta	0-25	deltaF	VAVOCON	3.5
V.C.OF	VAV Occ. Cool Off Delta	1-25	deltaF	VAVOCOFF	2
SASP	Supply Air Setpoint	45-75	dF	SASP	55
SA.HI	Supply Air Setpoint Hi	45-75	dF	SASP_HI	55
SA.LO	Supply Air Setpoint Lo	45-75	dF	SASP_LO	60
SA.HT	Heating Supply Air Setpt	90-145	dF	SASPHEAT	85
T.PRG	Tempering Purge SASP	−20-80	dF	TEMPPURG	50
T.CL	Tempering in Cool SASP	5-75	dF	TEMPCOOL	5
T.V.OC	Tempering Vent Occ SASP	−20-80	dF	TEMPVOCC	65
T.V.UN	Tempering Vent Unocc. SASP	−20-80	dF	TEMPVUNC	50

MODE — INPUTS

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
GEN.I	GENERAL INPUTS				
→**FLT.S**	Filter Status Input	DRTY/CLN		FLTS	forcible
→**G.FAN**	Fan Request From IGC	ON/OFF		IGCFAN	
→**REMT**	Remote Input State	*		RMTIN	forcible
→**E.SW**	Economizer Control Input	YES/NO		ECOSW	forcible
→**E.ENA**	Remote Economizer Enable	YES/NO		ECONENBL	forcible
→**E.OVR**	Econo Position Override	YES/NO		ECOORIDE	forcible
→**S.FN.S**	Supply Fan Status Switch	ON/OFF		SFS	forcible
→**DL.S1**	Demand Limit Switch 1	ON/OFF		DMD_SW1	forcible
→**DL.S2**	Demand Limit Switch 2	ON/OFF		DMD_SW2	forcible
FD.BK	COMPRESSOR FEEDBACK				
→**CS.A1**	Compressor A1 Feedback	ON/OFF		CSB_A1	
→**CS.A2**	Compressor A2 Feedback	ON/OFF		CSB_A2	
→**CS.B1**	Compressor B1 Feedback	ON/OFF		CSB_B1	
→**CS.B2**	Compressor B2 Feedback	ON/OFF		CSB_B2	
STAT	THERMOSTAT INPUTS				
→**G**	Thermostat G Input	ON/OFF		G	forcible
→**W1**	Thermostat W1 Input	ON/OFF		W1	forcible
→**W2**	Thermostat W2 Input	ON/OFF		W2	forcible
→**Y1**	Thermostat Y1 Input	ON/OFF		Y1	forcible
→**Y2**	Thermostat Y2 Input	ON/OFF		Y2	forcible
FIRE	FIRE-SMOKE INPUTS				
→**FSD**	Fire Shutdown Input	ALARM/NORMAL		FSD	forcible
→**PRES**	Pressurization Input	ALARM/NORMAL		PRES	forcible
→**EVAC**	Evacuation Input	ALARM/NORMAL		EVAC	forcible
→**PURG**	Smoke Purge Input	ALARM/NORMAL		PURG	forcible
REL.H	RELATIVE HUMIDITY				
→**OA.RH**	Outside Air Rel. Humidity		%	OARH	forcible
→**OA.EN**	Outdoor Air Enthalpy			OAE	
→**OA.DP**	OutsideAir Dewpoint Temp		dF	OADEWTMP	
→**RA.RH**	Return Air Rel. Humidity		%	RARH	forcible
→**RA.EN**	Return Air Enthalpy			RAE	
AIR.Q	AIR QUALITY SENSORS				
→**IAQ.I**	IAQ - Discrete Input	HIGH/LOW		IAQIN	forcible
→**IAQ**	IAQ - PPM Return CO2			IAQ	forcible
→**OAQ**	OAQ - PPM Return CO2			OAQ	forcible
→**DAQ**	Diff.Air Quality in PPM			DAQ	
→**IQ.P.O**	IAQ Min.Pos. Override		%	IAQMINOV	forcible
RSET	RESET INPUTS				
→**SA.S.R**	Supply Air Setpnt. Reset		^F	SASPRSET	forcible
→**SP.RS**	Static Pressure Reset			SPRESET	forcible

*The display text changes depending on the remote switch configuration (**Configuration→UNIT→RM.CF**). If **RM.CF** is set to 0 (No Remote Switch), then the display text will be "On" or "Off." If **RM.CF** is set to 1 (Occupied/Unoccupied Switch), then the display text will be "Occupied" or "Unoccupied." If **RM.CF** is set to 2 (Start/Stop), then the display text will be "Stop" or "Start." If **RM.CF** is set to 3 (Override Switch), then the display text will be "No Override" or "Override."

MODE — INPUTS (cont)

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
4-20	4-20 MILLIAMP INPUTS				
→*IAQ.M*	IAQ Milliamps		ma	IAQ_MA	
→*OAQ.M*	OAQ Milliamps		ma	OAQ_MA	
→*SP.R.M*	SP Reset milliamps		ma	SPRST_MA	
→*DML.M*	4-20 ma Demand Signal		ma	DMDLMTMA	forcible
→*EDR.M*	EDT Reset Milliamps		ma	EDTRESMA	
→*ORH.M*	OARH Milliamps		ma	OARH_MA	
→*RRH.M*	RARH Milliamps		ma	RARH_MA	
→*BP.M*	BP Milliamps		ma	BP_MA	
→*BP.M.T*	Bldg. Pressure Trim (ma)	−2.0 - 2.0		BPMATRIM	config
→*SP.M*	SP Milliamps		ma	SP_MA	
→*SP.M.T*	Static Press. Trim (ma)	−2.0 - 2.0		SPMATRIM	config

*The display text changes depending on the remote switch configuration (*Configuration→UNIT→RM.CF*). If *RM.CF* is set to 0 (No Remote Switch), then the display text will be "On" or "Off." If *RM.CF* is set to 1 (Occupied/Unoccupied Switch), then the display text will be "Occupied" or "Unoccupied." If *RM.CF* is set to 2 (Start/Stop), then the display text will be "Stop" or "Start." If *RM.CF* is set to 3 (Override Switch), then the display text will be "No Override" or "Override."

MODE — OUTPUTS

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
FANS	FANS				
→*S.FAN*	Supply Fan Relay	ON/OFF		SFAN_RLY	
→*S.VFD*	Supply Fan VFD Speed	0-100	%	SFAN_VFD	
→*P.E.A*	Power Exhaust Relay A	ON/OFF		PE_A	
→*P.E.B*	Power Exhaust Relay B	ON/OFF		PE_B	
→*P.E.C*	Power Exhaust Relay C	ON/OFF		PE_C	
→*CD.F.A*	Condenser Fan Circuit A	ON/OFF		CONDFANA	
→*CD.F.B*	Condenser Fan Circuit B	ON/OFF		CONDFANB	
COOL	COOLING				
→*A1*	Compressor A1 Relay	ON/OFF		CMPA1	
→*A2*	Compressor A2 Relay	ON/OFF		CMPA2	
→*MLV*	Min. Load Valve (HGBP)	ON/OFF		MLV	
→*B1*	Compressor B1 Relay	ON/OFF		CMPB1	
→*B2*	Compressor B2 Relay	ON/OFF		CMPB2	
HEAT	HEATING				
→*HT.1*	Heat Relay 1	ON/OFF		HS1	
→*HT.2*	Heat Relay 2	ON/OFF		HS2	
→*HT.3*	Relay 3 W1 Gas Valve 2	ON/OFF		HS3	
→*HT.4*	Relay 4 W2 Gas Valve 2	ON/OFF		HS4	
→*HT.5*	Relay 5 W1 Gas Valve 3	ON/OFF		HS5	
→*HT.6*	Relay 6 W2 Gas Valve 3	ON/OFF		HS6	
→*H.I.R*	Heat Interlock Relay	ON/OFF		HIR	forcible
ECON	ECONOMIZER				
→*ECN.P*	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS	
→*ECN.C*	Economizer Act.Cmd.Pos.	0-100	%	ECONOCMD	forcible
→*E.PWR*	Economizer Power Relay	ON/OFF		ECON_PWR	forcible
GEN.O	GENERAL OUTPUTS				
ALRM	Remote Alarm Relay	ON/OFF		ALRM	forcible

MODE — CONFIGURATION

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
UNIT	UNIT CONFIGURATION					
→*C.TYP*	Machine Control Type	1 - 6 (multi-text strings)		CTRLTYPE	4	29
→*CV.FN*	Fan Mode (0=Auto, 1=Cont)	0 - 1 (multi-text strings)		FAN_MODE	1	29
→*RM.CF*	Remote Switch Config	0 - 3 (multi-text strings)		RMTINCFG	0	29
→*CEM*	CEM Module Installed	Yes/No		CEM_BRD	No	29
→*TCS.C*	Temp.Cmp.Strt.Cool Factr	0 - 60	min	TCSTCOOL	0	29
→*TCS.H*	Temp.Cmp.Strt.Heat Factr	0 - 60	min	TCSTHEAT	0	29
→*SFS.S*	Fan Fail Shuts Down Unit	Yes/No		SFS_SHUT	No	29
→*SFS.M*	Fan Stat Monitoring Type	0 - 2 (multi-text strings)		SFS_MON	0	29
→*VAV.S*	VAV Unocc.Fan Retry Time	0 - 720	min	SAMPMINS	50	29
→*SIZE*	Unit Size (20-60)	20 - 60		UNITSIZE	20	29
→*DP.XR*	Disch.Press. Transducers	Yes/No		DP_TRANS	No	30
→*MAT.S*	MAT Calc Config	0 - 1 (multi-text strings)		MAT_SEL	1	30
→*MAT.R*	Reset MAT Table Entries?	Yes/No		MATRESET	No	30
→*ALTI*	Altitude........in feet:	0 - 60000		ALTITUDE	0	30
→*SENS*	INPUT SENSOR CONFIG					30
→*SENS*→*SPT.S*	Space Temp Sensor	Enable/Disable		SPTSENS	Disable	30
→*SENS*→*SP.O.S*	Space Temp Offset Sensor	Enable/Disable		SPTOSENS	Disable	30
→*SENS*→*SP.O.R*	Space Temp Offset Range	1 - 10		SPTO_RNG	5	30
→*SENS*→*RRH.S*	Return Air RH Sensor	Enable/Disable		RARHSENS	Disable	30
→*SENS*→*FLT.S*	Filter Stat.Sw.Enabled ?	Enable/Disable		FLTS_ENA	Disable	30
→*SENS*→*SP.RS*	Stat. Pres. Reset Sensor	Enable/Disable		SPRSTSEN	Disable	30

MODE — CONFIGURATION (cont)

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
COOL	COOLING CONFIGURATION					
→*Z.GN*	Capacity Threshold Adjst	−10 - 10		Z_GAIN	1	32
→*MC.LO*	Compressor Lockout Temp	−20 - 55	dF	OATLCOMP	40	32
→*C.FOD*	Fan-Off Delay, Mech Cool	0 - 600	sec	COOL_FOD	60	32
→*MLV*	Min. Load Valve? (HGBP)	Yes/No		MLV_SEL	No	32
→*M.M.*	Motor Master Control	Yes/No		MOTRMAST	No	32
→*HPSP*	Head Pressure Setpoint	80 - 150	dF	HPSP	113	32
→*A1.EN*	Enable Compressor A1	Enable/Disable		CMPA1ENA	Enable	32
→*A2.EN*	Enable Compressor A2	Enable/Disable		CMPA2ENA	Enable	32
→*B1.EN*	Enable Compressor B1	Enable/Disable		CMPB1ENA	Enable	32
→*B2.EN*	Enable Compressor B2	Enable/Disable		CMPB2ENA	Enable	32
→*CS.A1*	CSB A1 Feedback Alarm	Enable/Disable		CSB_A1EN	Enable	32
→*CS.A2*	CSB A2 Feedback Alarm	Enable/Disable		CSB_A2EN	Enable	32
→*CS.B1*	CSB B1 Feedback Alarm	Enable/Disable		CSB_B1EN	Enable	32
→*CS.B2*	CSB B2 Feedback Alarm	Enable/Disable		CSB_B2EN	Enable	32
→*REV.R*	Rev Rotation Verified ?	Yes/No		REVR_VER	No	33
EDT.R	EVAP.DISCHRGE TEMP RESET					
→*RS.CF*	EDT Reset Configuration	0 - 3 (multi-text strings)		EDRSTCFG	2	31
→*RTIO*	Reset Ratio	0 - 10		RTIO	2	31
→*LIMT*	Reset Limit	0 - 20	deltaF	LIMT	10	31
→*RES.S*	EDT 4-20 ma Reset Input	Enable/Disable		EDTRSENS	Disable	31
HEAT	HEATING CONFIGURATION					
→*HT.CF*	Heating Control Type	0 - 4		HEATTYPE	0	42
→*HT.SP*	Heating Supply Air Setpt	80 - 120	dF	SASPHEAT	85	42
→*OC.EN*	Occupied Heating Enabled	Yes/No		HTOCCENA	No	42
→*LAT.M*	MBB Sensor Heat Relocate	Yes/No		HTLATMON	No	42
→*G.FOD*	Fan-Off Delay, Gas Heat	45-600		GAS_FOD	45	42
→*E.FOD*	Fan-Off Delay, Elec Heat	10-600		HEAT_FOD	30	42
→*SG.CF*	STAGED GAS CONFIGS					
→*SG.CF*→*HT.ST*	Staged Gas Heat Type	0 - 4		HTSTGTYP	0	44
→*SG.CF*→*CAP.M*	Max Cap Change per Cycle	5 - 45		HTCAPMAX	45	44
→*SG.CF*→*M.R.DB*	S.Gas DB min.dF/PID Rate	0 - 5		HT_MR_DB	0.5	44
→*SG.CF*→*S.G.DB*	St.Gas Temp. Dead Band	0 - 5	^F	HT_SG_DB	2	44
→*SG.CF*→*RISE*	Heat Rise dF/sec Clamp	0.05 - 0.2		HTSGRISE	0.06	44
→*SG.CF*→*LAT.L*	LAT Limit Config	0 - 20	^F	HTLATLIM	10	44
→*SG.CF*→*LIM.M*	Limit Switch Monitoring?	Yes/No		HTLIMMON	No	44
→*SG.CF*→*SW.H.T*	Limit Switch High Temp	110 - 180	dF	HT_LIMHI	170	44
→*SG.CF*→*SW.L.T*	Limit Switch Low Temp	100 - 170	dF	HT_LIMLO	160	44
→*SG.CF*→*HT.P*	Heat Control Prop. Gain	0 - 1.5		HT_PGAIN	1	44
→*SG.CF*→*HT.D*	Heat Control Derv. Gain	0 - 1.5		HT_DGAIN	1	44
→*SG.CF*→*HT.TM*	Heat PID Rate Config	60 - 300	sec	HTSGPIDR	90	44
SP	SUPPLY STATIC PRESS.CFG.					
→*SP.CF*	Static Pressure Config	0 - 1 (multi-text strings)		STATICFG	No	48
→*SP.FN*	Static Pres.Fan Control?	Yes		STATPFAN	Yes	48
→*SP.S*	Static Pressure Sensor	Enable/Disable		SPSENS	Disable	48
→*SP.LO*	Static Press. Low Range	−10 - 0		SP_LOW	0	48
→*SP.HI*	Static Press. High Range	0 - 10		SP_HIGH	5	48
→*SP.SP*	Static Pressure Setpoint	0 - 5	"H2O	SPSP	1.5	48
→*SP.MN*	VFD Minimum Speed	10 - 50	%	STATPMIN	20	48
→*SP.MX*	VFD Maximum Speed	50 - 100	%	STATPMAX	100	48
→*SP.FS*	VFD Fire Speed Override	0 - 100	%	STATPFSO	100	48
→*S.PID*	STAT.PRESS.PID CONFIGS					48
→*S.PID->SP.TM*	Stat.Pres.PID Run Rate	1 - 200	sec	SPIDRATE	2	48
→*S.PID->SP.P*	Static Press. Prop. Gain	0 - 100		STATP_PG	20	48
→*S.PID->SP.I*	Static Pressure Intg. Gain	0 - 50		STATP_IG	2	48
→*S.PID->SP.D*	Static Pressure Derv. Gain	0 - 50		STATP_DG	0	48
→*S.PID->SP.SG*	Static Press.System Gain	0 - 50		STATP_SG	1	48
ECON	ECONOMIZER CONFIGURATION					
→*EC.EN*	Economizer Installed?	Yes/No		ECON_ENA	Yes	50
→*EC.MN*	Economizer Min.Position	0 - 100	%	ECONOMIN	5	50
→*EC.MX*	Economizer Max.Position	0 - 100	%	ECONOMAX	98	50
→*E.TRM*	Economzr Trim For SumZ ?	Yes/No		ECONTRIM	Yes	51
→*E.SEL*	Econ ChangeOver Select	0 - 3 (multi-text strings)		ECON_SEL	1	51
→*OA.E.C*	OA Enthalpy ChgOvr Selct	1 - 5 (multi-text strings)		OAEC_SEL	4	51
→*OA.EN*	Outdr.Enth Compare Value	18 - 28		OAEN_CFG	24	51
→*OAT.L*	High OAT Lockout Temp	55 - 120	dF	OAT_LOCK	60	51
→*O.DEW*	OA Dewpoint Temp Limit	50 - 62	dF	OADEWCFG	55	52
→*ORH.S*	Outside Air RH Sensor	Enable/Disable		OARHSENS	Disable	51
→*E.TYP*	Economizer Control Type	1-3 (multi-text strings)		ECON_CTL	1	53
→*EC.SW*	Economizer Switch Config	0 - 2 (multi-text strings)		ECOSWCFG	0	51
→*E.CFG*	ECON.OPERATION CONFIGS					
→*E.CFG*→*E.P.GN*	Economizer Prop.Gain	0.7 - 3.0		EC_PGAIN	1	52
→*E.CFG*→*E.RNG*	Economizer Range Adjust	0.5 - 5.0	^F	EC_RANGE	2.5	52
→*E.CFG*→*E.SPD*	Economizer Speed Adjust	0.1 - 10.0		EC_SPEED	0.75	52
→*E.CFG*→*E.DBD*	Economizer Deadband	0.1 - 2.0	^F	EC_DBAND	0.5	52
→*UEFC*	UNOCC.ECON.FREE COOLING					
→*UEFC*→*FC.CF*	Unoc Econ Free Cool Cfg	0-2 (multi-text strings)		UEFC_CFG	0	52
→*UEFC*→*FC.TM*	Unoc Econ Free Cool Time	0 - 720	min	UEFCTIME	120	52
→*UEFC*→*FC.L.O*	Un.Ec.Free Cool OAT Lock	40 - 70	dF	UEFCNTLO	50	52

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
BP	BUILDING PRESS. CONFIG					
→***BP.CF***	Building Press. Config	0-2		BLDG_CFG	0	54
→***BP.MT***	Power Exhaust Motors	1-2		PWRM	1	54
→***BP.S***	Building Pressure Sensor	Enable/Dsable		BPSENS	Dsable	54
→***BP.R***	Bldg Press (+/-) Range	0 - 1.00		BP_RANGE	0.25	54
→***BP.SP***	Building Pressure Setp.	−0.25 -> 0.25	"H2O	BPSP	0.05	54
→***BP.P1***	Power Exhaust On Setp.1	0 - 100	%	PES1	35	54
→***BP.P2***	Power Exhaust On Setp.2	0 - 100	%	PES2	75	54
→***B.CFG***	BP ALGORITHM CONFIGS					54
→***B.CFG***→***BP.SL***	Modulating PE Alg. Slct.	1-3		BPSELECT	1	54
→***B.CFG***→***BP.TM***	BP PID Evaluation Time	0 - 10	min	BPPERIOD	1	54
→***B.CFG***→***BP.ZG***	BP Threshold Adjustment	0.1 - 10.0		BPZ_GAIN	1	54
→***B.CFG***→***BP.HP***	High BP Level	0 - 1.000		BPHPLVL	0.05	54
→***B.CFG***→***BP.LP***	Low BP Level	0 - 1.000		BPLPLVL	0.04	54
D.LV.T	COOL/HEAT SETPT. OFFSETS					
→***L.H.ON***	Dmd Level Lo Heat On	−1 - 2	^F	DMDLHON	1.5	34, 43
→***H.H.ON***	Dmd Level(+) Hi Heat On	0.5 - 2.0	^F	DMDHHON	0.5	34, 43
→***L.H.OF***	Dmd Level(-) Lo Heat Off	0.5 - 2	^F	DMDLHOFF	1	34, 43
→***L.C.ON***	Dmd Level Lo Cool On	−1 - 2	^F	DMDLCON	1.5	34, 43
→***H.C.ON***	Dmd Level(+) Hi Cool On	0.5 - 2	^F	DMDHCON	0.5	34, 43
→***L.C.OF***	Dmd Level(-) Lo Cool Off	0.5 - 2	^F	DMDLCOFF	1	34, 43
→***C.T.LV***	Cool Trend Demand Level	0.1 - 5	^F	CTRENDLV	0.1	34, 43
→***H.T.LV***	Heat Trend Demand Level	0.1 - 5	^F	HTRENDLV	0.1	34, 43
→***C.T.TM***	Cool Trend Time	30 - 600	sec	CTRENDTM	120	34, 43
→***H.T.TM***	Heat Trend Time	30 - 600	sec	HTRENDTM	120	34, 43
DMD.L	DEMAND LIMIT CONFIG.					
→***DM.L.S***	Demand Limit Select	0 - 3 (multi-text strings)		DMD_CTRL	0	39
→***D.L.20***	Demand Limit at 20 ma	0 - 100	%	DMT20MA	100	40
→***SH.NM***	Loadshed Group Number	0 - 99		SHED_NUM	0	40
→***SH.DL***	Loadshed Demand Delta	0 - 60	%	SHED_DEL	0	40
→***SH.TM***	Maximum Loadshed Time	0 - 120	min	SHED_TIM	60	40
→***D.L.S1***	Demand Limit Sw.1 Setpt.	0 - 100	%	DLSWSP1	80	40
→***D.L.S2***	Demand Limit Sw.2 Setpt.	0 - 100	%	DLSWSP2	50	40
IAQ	INDOOR AIR QUALITY CFG.					
→***DCV.C***	DCV ECONOMIZER SETPOINTS					
→***DCV.C***→***EC.MN***	Economizer Min.Position	0 - 100	%	ECONOMIN	5	58
→***DCV.C***→***IAQ.M***	IAQ Demand Vent Min.Pos.	0 - 100	%	IAQMINP	0	58
→***AQ.CF***	AIR QUALITY CONFIGS					
→***AQ.CF***→***IQ.A.C***	IAQ Analog Sensor Config	0 - 4 (multi-text strings)		IAQANCFG	0	57
→***AQ.CF***→***IQ.A.F***	IAQ 4-20 ma Fan Config	0 - 2 (multi-text strings)		IAQANFAN	0	58
→***AQ.CF***→***IQ.I.C***	IAQ Discrete Input Config	0 - 2 (multi-text strings)		IAQINCFG	0	58
→***AQ.CF***→***IQ.I.F***	IAQ Disc.In. Fan Config	0 - 2 (multi-text strings)		IAQINFAN	0	58
→***AQ.CF***→***OQ.A.C***	OAQ 4-20ma Sensor Config	0 - 2 (multi-text strings)		OAQANCFG	0	58
→***AQ.SP***	AIR QUALITY SETPOINTS					
→***AQ.SP***→***IQ.O.P***	IAQ Econ Override Pos.	0 - 100	%	IAQOVPOS	100	59
→***AQ.SP***→***DAQ.L***	Diff.Air Quality LoLimit	0 - 1000		DAQ_LOW	100	58
→***AQ.SP***→***DAQ.H***	Diff.Air Quality HiLimit	100 - 2000		DAQ_HIGH	700	59
→***AQ.SP***→***D.F.OF***	DAQ PPM Fan Off Setpoint	0 - 2000		DAQFNOFF	200	59
→***AQ.SP***→***D.F.ON***	DAQ PPM Fan On Setpoint	0 - 2000		DAQFNON	400	59
→***AQ.SP***→***IAQ.R***	Diff. AQ Responsiveness	−5 - 5		IAQREACT	0	59
→***AQ.SP***→***OAQ.L***	OAQ Lockout Value	0 - 2000		OAQLOCK	0	58
→***AQ.SP***→***OAQ.U***	User Determined OAQ	0 - 5000		OAQ_USER	400	59
→***AQ.S.R***	AIR QUALITY SENSOR RANGE					
→***AQ.S.R***→***IQ.R.L***	IAQ Low Reference	0 - 5000		IAQREFL	0	59
→***AQ.S.R***→***IQ.R.H***	IAQ High Reference	0 - 5000		IAQREFH	2000	59
→***AQ.S.R***→***OQ.R.L***	OAQ Low Reference	0 - 5000		OAQREFL	0	59
→***AQ.S.R***→***OQ.R.H***	OAQ High Reference	0 - 5000		OAQREFH	2000	59
→***IAQ.P***	IAQ PRE-OCCUPIED PURGE					
→***IAQ.P***→***IQ.PG***	IAQ Purge	Yes/No		IAQPURGE	No	59
→***IAQ.P***→***IQ.P.T***	IAQ Purge Duration	5-60	min	IAQPTIME	15	59
→***IAQ.P***→***IQ.P.L***	IAQ Purge LoTemp Min Pos	0-100	%	IAQPLTMP	10	59
→***IAQ.P***→***IQ.P.H***	IAQ Purge HiTemp Min Pos	0-100	%	IAQPHTMP	35	59
→***IAQ.P***→***IQ.L.O***	IAQ Purge OAT Lockout	35-70	dF	IAQPNTLO	50	59
CCN	CCN CONFIGURATION					
→***CCNA***	CCN Address	1 - 239		CCNADD	1	59
→***CCNB***	CCN Bus Number	0 - 239		CCNBUS	0	60
→***BAUD***	CCN Baud Rate	1 - 5 (multi-text strings)		CCNBAUDD	3	60
→***BROD***	CCN BROADCST DEFINITIONS					
→***BROD***→***TM.DT***	CCN Time/Date Broadcast	ON/OFF		CCNBC	On	60
→***BROD***→***OAT.B***	CCN OAT Broadcast	ON/OFF		OATBC	Off	60
→***BROD***→***ORH.B***	CCN OARH Broadcast	ON/OFF		OARHBC	Off	60
→***BROD***→***OAQ.B***	CCN OAQ Broadcast	ON/OFF		OAQBC	Off	60
→***BROD***→***G.S.B***	Global Schedule Broadcst	ON/OFF		GSBC	Off	60
→***BROD***→***B.ACK***	CCN Broadcast Ack'er	ON/OFF		CCNBCACK	Off	60
→***SC.OV***	CCN SCHEDULES-OVERRIDES					
→***SC.OV***→***SCH.N***	Schedule Number	0 - 99		SCHEDNUM	1	60
→***SC.OV***→***HOL.T***	Accept Global Holidays?	YES/NO		HOLIDAYT	No	60
→***SC.OV***→***O.T.L.***	Override Time Limit	0 - 4	HRS	OTL	1	60
→***SC.OV***→***OV.EX***	Timed Override Hours	0 - 4	HRS	OVR_EXT	0	60
→***SC.OV***→***SPT.O***	SPT Override Enabled ?	YES/NO		SPT_OVER	Yes	60
→***SC.OV***→***T58.O***	T58 Override Enabled ?	YES/NO		T58_OVER	Yes	60
→***SC.OV***→***GL.OV***	Global Sched. Override ?	YES/NO		GLBLOVER	No	60

MODE — CONFIGURATION (cont)

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
ALLM	ALERT LIMIT CONFIG.					
→*SP.L.O*	SPT lo alert limit/occ	−10-245	dF	SPLO	60	60
→*SP.H.O*	SPT hi alert limit/occ	−10-245	dF	SPHO	85	60
→*SP.L.U*	SPT lo alert limit/unocc	−10-245	dF	SPLU	45	60
→*SP.H.U*	SPT hi alert limit/unocc	−10-245	dF	SPHU	100	60
→*SA.L.O*	EDT lo alert limit/occ	−40-245	dF	SALO	40	61
→*SA.H.O*	EDT hi alert limit/occ	−40-245	dF	SAHO	100	61
→*SA.L.U*	EDT lo alert limit/unocc	−40-245	dF	SALU	40	61
→*SA.H.U*	EDT hi alert limit/unocc	−40-245	dF	SAHU	100	61
→*RA.L.O*	RAT lo alert limit/occ	−40-245	dF	RALO	60	61
→*RA.H.O*	RAT hi alert limit/occ	−40-245	dF	RAHO	90	61
→*RA.L.U*	RAT lo alert limit/unocc	−40-245	dF	RALU	40	61
→*RA.H.U*	RAT hi alert limit/unocc	−40-245	dF	RAHU	100	61
→*R.RH.L*	RARH low alert limit	0-100	%	RRHL	0	61
→*R.RH.H*	RARH high alert limit	0-100	%	RRHH	100	61
→*SP.L*	SP low alert limit	0-5	"H2O	SPL	0	61
→*SP.H*	SP high alert limit	0-5	"H2O	SPH	2	61
→*BP.L*	BP lo alert limit	−0.25-0.25	"H2O	BPL	-0.25	61
→*BP.H*	BP high alert limit	−0.25-0.25	"H2O	BPH	0.25	61
→*IAQ.H*	IAQ high alert limit	0-5000		IAQH	1200	61
TRIM	SENSOR TRIM CONFIG.					
→*SAT.T*	Air Temp Lvg SF Trim	−10 - 10	^F	SAT_TRIM	0	61
→*RAT.T*	RAT Trim	−10 - 10	^F	RAT_TRIM	0	61
→*OAT.T*	OAT Trim	−10 - 10	^F	OAT_TRIM	0	62
→*SPT.T*	SPT Trim	−10 - 10	^F	SPT_TRIM	0	62
→*CTA.T*	Cir A Sat.Cond.Temp Trim	−30 - 30	^F	SCTATRIM	0	62
→*CTB.T*	Cir B Sat.Cond.Temp Trim	−30 - 30	^F	SCTBTRIM	0	62
→*SP.A.T*	Suct.Press.Circ.A Trim	−50 - 50	PSIG	SPA_TRIM	0	62
→*SP.B.T*	Suct.Press.Circ.B Trim	−50 - 50	PSIG	SPB_TRIM	0	62
→*DP.A.T*	Dis.Press.Circ.A Trim	−50 - 50	PSIG	DPA_TRIM	0	62
→*DP.B.T*	Dis.Press.Circ.B Trim	−50 - 50	PSIG	DPB_TRIM	0	62
SW.LG	SWITCH LOGIC: NO / NC					
→*FTS.L*	Filter Status Inpt-Clean	Open/Close		FLTSLOGC	Open	62
→*IGC.L*	IGC Feedback - Off	Open/Close		GASFANLG	Open	62
→*RMI.L*	RemSw Off-Unoc-Strt-NoOv	Open/Close		RMTINLOG	Open	62
→*ECS.L*	Economizer Switch - No	Open/Close		ECOSWLOG	Open	62
→*SFS.L*	Fan Status Sw. - Off	Open/Close		SFSLOGIC	Open	62
→*DL1.L*	Dmd.Lmt.Sw.1 - Off	Open/Close		DMD_SW1L	Open	62
→*DL2.L*	Dmd.Lmt.Sw.2 - Off	Open/Close		DMD_SW2L	Open	62
→*IAQ.L*	IAQ Disc.Input - Low	Open/Close		IAQINLOG	Open	62
→*FSD.L*	Fire Shutdown - Off	Open/Close		FSDLOGIC	Open	62
→*PRS.L*	Pressurization Sw. - Off	Open/Close		PRESLOGC	Open	62
→*EVC.L*	Evacuation Sw. - Off	Open/Close		EVACLOGC	Open	62
→*PRG.L*	Smoke Purge Sw. - Off	Open/Close		PURGLOGC	Open	62
DISP	DISPLAY CONFIGURATION					
→*TEST*	Test Display LEDs	ON/OFF		TEST	Off	62
→*METR*	Metric Display	ON/OFF		DISPUNIT	Off	62
→*LANG*	Language Selection	0-1(multi-text strings)		LANGUAGE	0	62
→*PAS.E*	Password Enable	ENABLE/DISABLE		PASS_EBL	Enable	62
→*PASS*	Service Password	0000-9999		PASSWORD	1111	62

MODE — TIME CLOCK

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
TIME	TIME OF DAY					
→*HH.MM*	Hour and Minute	00:00		TIME		64
DATE	MONTH,DATE,DAY AND YEAR					
→*MNTH*	Month of Year	multi-text strings		MOY		64
→*DOM*	Day of Month	0-31		DOM		64
→*DAY*	Day of Week	multi-text strings		DOWDISP		64
→*YEAR*	Year	e.g. 2003		YOCDISP		64
SCH.L	LOCAL TIME SCHEDULE					
→*PER.1*	PERIOD 1					
→*PER.1→DAYS*	DAY FLAGS FOR PERIOD 1				Period 1 only	64
→*PER.1→DAYS→MON*	Monday in Period	YES/NO		PER1MON	Yes	64
→*PER.1→DAYS→TUE*	Tuesday in Period	YES/NO		PER1TUE	Yes	64
→*PER.1→DAYS→WED*	Wednesday in Period	YES/NO		PER1WED	Yes	64
→*PER.1→DAYS→THU*	Thursday in Period	YES/NO		PER1THU	Yes	64
→*PER.1→DAYS→FRI*	Friday in Period	YES/NO		PER1FRI	Yes	64
→*PER.1→DAYS→SAT*	Saturday in Period	YES/NO		PER1SAT	Yes	64
→*PER.1→DAYS→SUN*	Sunday in Period	YES/NO		PER1SUN	Yes	64
→*PER.1→DAYS→HOL*	Holiday in Period	YES/NO		PER1HOL	Yes	65
→*PER.1→OCC*	Occupied from	00:00		PER1_OCC	00:00	65
→*PER.1→UNC*	Occupied to	00:00		PER1_UNC	24:00	65
Repeated for periods 2-8………..						
HOL.L	LOCAL HOLIDAY SCHEDULES					
→*HD.01*	HOLIDAY SCHEDULE 01					
→*HD.01→MON*	Holiday Start Month	0-12		HOL_MON1		65
→*HD.01→DAY*	Start Day	0-31		HOL_DAY1		65
→*HD.01→LEN*	Duration (Days)	0-99		HOL_LEN1		65

MODE — TIME CLOCK (cont)

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	DEFAULT	PAGE NO.
Repeated for holidays 2-30…….						
DAY.S	DAYLIGHT SAVINGS TIME					
DS.ST	DAYLIGHT SAVINGS START					
DS.ST→ST.MN	Month	1 - 12		STARTM	4	65
DS.ST→ST.WK	Week	1 - 5		STARTW	1	65
DS.ST→ST.DY	Day	1 - 7		STARTD	7	65
DS.ST→MIN.A	Minutes to Add	0 - 90		MINADD	60	65
DS.SP	DAYLIGHTS SAVINGS STOP					
DS.SP→SP.MN	Month	1 - 12		STOPM	10	65
DS.SP→SP.WK	Week	1 - 5		STOPW	5	65
DS.SP→SP.DY	Day	1 - 7		STOPD	7	65
DS.SP→MIN.S	Minutes to Subtract	0 - 90		MINSUB	60	65

MODE — OPERATING MODES

ITEM	EXPANSION	RANGE	UNITS	CCN POINT
SYS.M	ascii string spelling out the system mode			string
HVAC	ascii string spelling out the hvac modes			string
CTRL	ascii string spelling out the "control type"			string
MODE	MODES CONTROLLING UNIT			
→OCC	Currently Occupied	ON/OFF		MODEOCCP
→T.OVR	Timed Override in Effect	ON/OFF		MODETOVR
→DCV	DCV Resetting Min Pos	ON/OFF		MODEADCV
→SA.R	Supply Air Reset	ON/OFF		MODESARS
→DMD.L	Demand Limit in Effect	ON/OFF		MODEDMLT
→T.C.ST	Temp.Compensated Start	ON/OFF		MODETCST
→IAQ.P	IAQ Pre-Occ Purge Active	ON/OFF		MODEIQPG
→LINK	Linkage Active - CCN	ON/OFF		MODELINK
→LOCK	Mech.Cooling Locked Out	ON/OFF		MODELOCK

MODE — ALARMS

ITEM	EXPANSION	RANGE	UNITS	CCN POINT	WRITE STATUS
CURR	CURRENTLY ACTIVE ALARMS				
	this is a dynamic list of active alarms			strings	
R.CUR	Reset All Current Alarms	YES/NO		ALRESET	ram config
HIST	ALARM HISTORY				
	this is a record of the last 20 alarms			strings	
R.HIS	Reset Alarm History	YES/NO		ALHISCLR	ram config

APPENDIX B — CCN TABLES

All A series units with *Comfort*Link™ controls have a port for interface with the Carrier Comfort Network (CCN). On TB3 there is a J11 jack which can be used for temporary connection to the CCN network or to computers equipped with CCN software like the Service Tool. Also on TB3 there are screw connections that can be used for more permanent CCN connections.

In the following tables the structure of the tables which are used with the Service Tool as well as the names and data that are included in each table are shown. As a reference the equivalent Scrolling Marquee tables and names are included. There are several CCN variables that are not displayed through the Scrolling Marquee and are used for more extensive diagnostics and system evaluations.

STATUS DISPLAY TABLES

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
COOLING					
	HVAC Mode…………..:	ascii text strings			
	Control Mode………..:	ascii text strings			
	Current Running Capacity		%	CAPTOTAL	
	Cooling Control Point		dF	COOLCPNT	
	Evaporator Discharge Tmp		dF	EDT	
	Mixed Air Temperature		dF	MAT	
COOL_A					
	Compressor A1 Relay			CMPA1	
	Compressor A1 Feedback			CSB_A1	
	Compressor A1 Timeguard			CMPA1_TG	
	Compressor A2 Relay			CMPA2	
	Compressor A2 Feedback			CSB_A2	
	Compressor A2 Timeguard			CMPA2_TG	
	Minimum Load Valve			MLV	
	Cir A Discharge Pressure		PSIG	DP_A	
	Cir A Suction Pressure		PSIG	SP_A	
	Cir A Sat.Condensing Tmp		dF	SCTA	
	Cir A Sat.Suction Temp.		dF	SSTA	

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
COOL_B	Compressor B1 Relay			CMPB1	
	Compressor B1 Feedback			CSB_B1	
	Compressor B1 Timeguard			CMPB1_TG	
	Compressor B2 Relay			CMPB2	
	Compressor B2 Feedback			CSB_B2	
	Compressor B2 Timeguard			CMPB2_TG	
	Cir B Discharge Pressure		PSIG	DP_B	
	Cir B Suction Pressure		PSIG	SP_B	
	Cir B Sat.Condensing Tmp		dF	SCTB	
	Cir B Sat.Suction Temp.		dF	SSTB	
ECONDIAG	Economizer Active ?	Yes/No		ECACTIVE	
	Conditions which prevent economizer being active:				
	Econ Act. Unavailable?	Yes/No		ECONUNAV	
	Remote Econ. Disabled ?	Yes/No		ECONDISA	
	DBC - OAT lockout?	Yes/No		DBC_STAT	
	DEW - OA Dewpt. lockout?	Yes/No		DEW_STAT	
	DDBC- OAT > RAT lockout?	Yes/No		DDBCSTAT	
	OAEC- OA Enth Lockout?	Yes/No		OAECSTAT	
	DEC - Diff.Enth.Lockout?	Yes/No		DEC_STAT	
	EDT Sensor Bad ?	Yes/No		EDT_STAT	
	OAT Sensor Bad ?	Yes/No		OAT_STAT	
	Economizer forced ?	Yes/No		ECONFORC	
	Supply Fan not on 30s ?	Yes/No		SFONSTAT	
	Cool Mode not in effect?	Yes/No		COOL_OFF	
	OAQ lockout in effect ?	Yes/No		OAQLOCKD	
	Econ recovery hold off?	Yes/No		ECONHELD	
ECONOMZR	Economizer Act.Curr.Pos.		%	ECONOPOS	
	Economizer Act.Cmd.Pos.		%	ECONOCMD	forcible
	Economizer Active ?			ECACTIVE	
	Economizer Control Point		dF	ECONCPNT	
	Outside Air Temperature		dF	OAT	forcible
	Evaporator Discharge Tmp		dF	EDT	
	Controlling Return Temp		dF	RETURN_T	forcible
GENERAL	Occupied ?	Yes/No		OCCUPIED	forcible
	Static Pressure		"H2O	SP	
	Building Pressure		"H2O	BP	
	Outside Air Rel.Humidity		%	OARH	forcible
	Return Air Rel.Humidity		%	RARH	forcible
	Space Temperature Offset		^F	SPTO	forcible
	Supply Air Setpnt. Reset		^F	SASPRSET	forcible
	Static Pressure Reset			SPRESET	forcible
	IAQ - PPM Return CO2			IAQ	forcible
	OAQ - PPM Return CO2			OAQ	forcible
	IAQ Min.Pos.Override		%	IAQMINOV	forcible
GENERIC	20 points dependent upon the configuration of the "generics" table in the Service-Config section on page 128.				

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
HEATING					
	HVAC Mode..............:	ascii text strings			
	Control Mode...........:	ascii text strings			
	Heat Control Type......:	ascii text strings			
	Heating Mode...........:	ascii text strings			
	Current Heat Stage			HT_STAGE	
	Heating Control Point		dF	HEATCPNT	
	Heat Relay 1			HS1	
	Heat Relay 2			HS2	
	Relay 3 W1 Gas Valve 2			HS3	
	Relay 4 W2 Gas Valve 2			HS4	
	Relay 5 W1 Gas Valve 3			HS5	
	Relay 6 W2 Gas Valve 3			HS6	
	Heat Interlock Relay			HIR	forcible
	Heat Stage 1 Timeguard			HS1_TG	
	Heat Stage 2 Timeguard			HS2_TG	
	Heat Stage 3 Timeguard			HS3_TG	
	Heat Stage 4 Timeguard			HS4_TG	
	Heat Stage 5 Timeguard			HS5_TG	
	Heat Stage 6 Timeguard			HS6_TG	
MODEDISP					
	System Mode............:	ascii text strings			
	HVAC Mode..............:	ascii text strings			
	Control Mode...........:	ascii text strings			
	Currently Occupied	On/Off		MODEOCCP	
	Timed Override in effect	On/Off		MODETOVR	
	DCV resetting min pos	On/Off		MODEADCV	
	Supply Air Reset	On/Off		MODESARS	
	Demand Limit in Effect	On/Off		MODEDMLT	
	Temp.Compensated Start	On/Off		MODETCST	
	IAQ pre-occ purge active	On/Off		MODEIQPG	
	Linkage Active - DAV	On/Off		MODELINK	
	Mech.Cooling Locked Out	On/Off		MODELOCK	
MODETRIP					
	Unoccup. Cool Mode Start			UCCLSTRT	
	Unoccup. Cool Mode End			UCCL_END	
	Occupied Cool Mode Start			OCCLSTRT	
	Occupied Cool Mode End			OCCL_END	
	Ctl.Temp RAT,SPT or Zone			CTRLTEMP	
	Occupied Heat Mode End			OCHT_END	
	Occupied Heat Mode Start			OCHTSTRT	
	Unoccup. Heat Mode End			UCHT_END	
	Unoccup. Heat Mode Start			UCHTSTRT	
	HVAC Mode..............:	ascii text strings		string	
TEMPCTRL					
	Evaporator Discharge Tmp		dF	EDT	
	Leaving Air Temperature		dF	LAT	
	Mixed Air Temperature		dF	MAT	
	Controlling Return Temp		dF	RETURN_T	forcible
	Controlling Space Temp		dF	SPACE_T	forcible
TEMPS					
	Air Temp Lvg Supply Fan		dF	SAT	
	Return Air Temperature		dF	RAT	forcible
	Outside Air Temperature		dF	OAT	forcible
	Space Temperature		dF	SPT	forcible
	Space Temperature Offset		^F	SPTO	forcible
	Staged Gas LAT Sum		dF	LAT_SGAS	
	Staged Gas LAT 1		dF	LAT1SGAS	
	Staged Gas LAT 2		dF	LAT2SGAS	
	Staged Gas LAT 3		dF	LAT23SGAS	
	Staged Gas Limit Sw.Temp		dF	LIMSWTMP	
	Cir A Sat.Condensing Tmp		dF	SCTA	
	Cir B Sat.Condensing Tmp		dF	SCTB	
	Cir A Sat.Suction Temp.		dF	SSTA	
	Cir B Sat.Suction Temp.		dF	SSTB	
TSTAT					
	Control Mode...........:	ascii text strings			
	Thermostat Y1 Input	On/Off		Y1	forcible
	Thermostat Y2 Input	On/Off		Y2	forcible
	Thermostat W1 Input	On/Off		W1	forcible
	Thermostat W2 Input	On/Off		W2	forcible
	Thermostat G Input	On/Off		G	forcible

STATUS DISPLAY TABLES (cont)

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
UINPUTS					
	Filter Status Input	Dirty/Clean		FLTS	forcible
	Fan request from IGC	On/Off		IGCFAN	
	Fire Shutdown Switch	Alarm/Normal		FSD	forcible
	Thermostat G Input	On/Off		G	forcible
	Thermostat W2 Input	On/Off		W2	forcible
	Thermostat W1 Input	On/Off		W1	forcible
	Thermostat Y2 Input	On/Off		Y2	forcible
	Thermostat Y1 Input	On/Off		Y1	forcible
	Economizer Control Input	On/Off		ECOSW	forcible
	Remote Economizer Enable	Yes/No		ECONENBL	forcible
	Econo Position Override	Yes/No		ECOORIDE	forcible
	Remote Input State	On/Off		RMTIN	forcible
	Supply Fan Status Switch	On/Off		SFS	forcible
	Demand Limit Switch 1	On/Off		DMD_SW1	forcible
	Demand Limit Switch 2	On/Off		DMD_SW2	forcible
	Pressurization Input	Alarm/Normal		PRES	forcible
	Evacuation Input	Alarm/Normal		EVAC	forcible
	Smoke Purge Input	Alarm/Normal		PURG	forcible
	IAQ - Discrete Input	High/Low		IAQIN	forcible
UOUTPUTS					
	FANS				
	Supply Fan Relay	On/Off		SFAN_RLY	
	Supply Fan VFD Speed	0-100	%	SFAN_VFD	
	Supply Fan Request	Yes/No		SFANFORC	forcible
	Power Exhaust Relay A	On/Off		PE_A	
	Power Exhaust Relay B	On/Off		PE_B	
	Power Exhaust Relay C	On/Off		PE_C	
	Condenser Fan A	On/Off		CONDFANA	
	Condenser Fan B	On/Off		CONDFANB	
	COOLING				
	Compressor A1 Relay	On/Off		CMPA1	
	Compressor A2 Relay	On/Off		CMPA2	
	Minimum Load Valve	On/Off		MLV	
	Compressor B1 Relay	On/Off		CMPB1	
	Compressor B2 Relay	On/Off		CMPB2	
	HEATING				
	Heat Relay 1	On/Off		HS1	
	Heat Relay 2	On/Off		HS2	
	Relay 3 W1 Gas Valve 2	On/Off		HS3	
	Relay 4 W2 Gas Valve 2	On/Off		HS4	
	Relay 5 W1 Gas Valve 3	On/Off		HS5	
	Relay 6 W2 Gas Valve 3	On/Off		HS6	
	Heat Interlock Relay	On/Off		HIR	forcible
	ECONOMIZER				
	Economizer Act.Curr.Pos.	0-100	%	ECONOPOS	
	Economizer Act.Cmd.Pos.	0-100	%	ECONOCMD	forcible
	Economizer Pwner Relay	On/Off		ECON_PWR	forcible
	GENERAL OUTPUTS				
	Remote Alarm Relay	On/Off		ALRM	

SET POINT TABLE

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
SET_PNT					
	Occupied Heat Setpoint	55-80	dF	OHSP	68
	Occupied Cool Setpoint	55-80	dF	OCSP	75
	Unoccupied Heat Setpoint	40-80	dF	UHSP	55
	Unoccupied Cool Setpoint	75-95	dF	UCSP	90
	Heat-Cool Setpoint Gap	2-10	deltaF	HCSP_GAP	5
	VAV Occ. Cool On Delta	0-25	deltaF	VAVOCON	3.5
	VAV Occ. Cool Off Delta	1-25	deltaF	VAVOCOFF	2
	Supply Air Setpoint	45-75	dF	SASP	55
	Supply Air Setpoint Hi	45-75	dF	SASP_HI	55
	Supply Air Setpoint Lo	45-75	dF	SASP_LO	60
	Heating Supply Air Setpt	90-145	dF	SASPHEAT	85
	Tempering Purge SASP	−20-80	dF	TEMPPURG	50
	Tempering in Cool SASP	5-75	dF	TEMPCOOL	5
	Tempering in Vent Occ SASP	−20-80	dF	TEMPVOCC	65
	Tempering Vent Unocc. SASP	−20-80	dF	TEMPVUNC	50

CONFIG TABLES

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
ALARMDEF					
	Alarm Routing Control	00000000-11111111		ALRM_CNT	11000000
	Equipment Priority	0 - 7		EQP_TYPE	5
	Comm Failure Retry Time	1 - 240	min	RETRY_TM	10
	Re-Alarm Time	1 - 255	min	RE-ALARM	30
	Alarm System Name	up to 8 alphanum		ALRM_NAM	A-SERIES

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
BRODEFS	CCN Time/Date Broadcast	Off/On		CCNBC	Off
	CCN OAT Broadcast	Off/On		OATBC	Off
	CCN OARH Broadcast	Off/On		OARHBC	Off
	CCN OAQ Broadcast	Off/On		OAQBC	Off
	Global Schedule Broadcst	Off/On		GSBC	Off
	Daylight Savings Start:				
	Month	1 - 12		STARTM	4
	Week	1 - 5		STARTW	1
	Day	1 - 7		STARTD	7
	Minutes to Add	0 - 90		MINADD	60
	Daylight Savings Stop:				
	Month	1 - 12		STOPM	10
	Week	1 - 5		STOPW	5
	Day	1 - 7		STOPD	7
	Minutes to Subtract	0 - 90		MINSUB	60
Ctlr-ID	Device Name:	A-Series			
	Description:	A Series Rooftop			
	Location:				
	Software Part Number:	CESR131343-XX-XX			
	Model Number:				
	Serial Number:				
	Reference Number:				
HOLIDAY	Broadcast Supervisory				
HOLDY01S	Holiday Start Month	1-12		HOL-MON	0
to	Start Day	1-31		HOL-DAY	0
HOLDY30S	Duration (days)	1-99		HOL-LEN	0
OCCDEFCS	Occupancy Supervisory				
	Timed Override Hours	0		OVR-EXT	
	Period 1 DOW (MTWTFSSH)	00000000		DOW1	
	Occupied From	0:00		OCCTOD1	
	Occupied To	0:00		UNOCTOD1	
	Period 2 DOW (MTWTFSSH)	00000000		DOW2	
	Occupied From	0:00		OCCTOD2	
	Occupied To	0:00		UNOCTOD2	
	Period 3 DOW (MTWTFSSH)	00000000		DOW3	
	Occupied From	0:00		OCCTOD3	
	Occupied To	0:00		UNOCTOD3	
	Period 4 DOW (MTWTFSSH)	00000000		DOW4	
	Occupied From	0:00		OCCTOD4	
	Occupied To	0:00		UNOCTOD4	
	Period 5 DOW (MTWTFSSH)	00000000		DOW5	
	Occupied From	0:00		OCCTOD5	
	Occupied To	0:00		UNOCTOD5	
	Period 6 DOW (MTWTFSSH)	00000000		DOW6	
	Occupied From	0:00		OCCTOD6	
	Occupied To	0:00		UNOCTOD6	
	Period 7 DOW (MTWTFSSH)	00000000		DOW7	
	Occupied From	0:00		OCCTOD7	
	Occupied To	0:00		UNOCTOD7	
	Period 8 DOW (MTWTFSSH)	00000000		DOW8	
	Occupied From	0:00		OCCTOD8	
	Occupied To	0:00		UNOCTOD8	
SCHEDOVR	Schedule Number	0-99		SCHEDNUM	0
	Accept Global Holidays?	Yes/No		HOLIDAYT	No
	Override Time Limit	0-4	hours	OTL	1
	Timed Override Hours	0-4	hours	OVR_EXT	0
	Accepting an Override:				
	SPT Override Enabled ?	Yes/No		SPT_OVER	Yes
	T58 Override Enabled ?	Yes/No		T58_OVER	Yes
	Allowed to Broadcast a				
	Global Sched. Override ?	Yes/No		GLBLOVER	No
SET_PNT	Occupied Heat Setpoint	55-80	dF	OHSP	68
	Occupied Cool Setpoint	55-80	dF	OCSP	75
	Unoccupied Heat Setpoint	40-80	dF	UHSP	55
	Unoccupied Cool Setpoint	75-95	dF	UCSP	90
	Heat-Cool Setpoint Gap	2-10	deltaF	HCSP_GAP	5
	VAV Occ. Cool On Delta	0-25	deltaF	VAVOCON	3.5
	VAV Occ. Cool Off Delta	1-25	deltaF	VAVOCOFF	2
	Supply Air Setpoint	45-75	dF	SASP	55
	Supply Air Setpoint Hi	45-75	dF	SASP_HI	55
	Supply Air Setpoint Lo	45-75	dF	SASP_LO	60
	Heating Supply Air Setpt	90-145	dF	SASPHEAT	85
	Tempering Purge SASP	−20-80	dF	TEMPPURG	50
	Tempering in Cool SASP	5-75	dF	TEMPCOOL	5
	Tempering in Vent Occ SASP	−20-80	dF	TEMPVOCC	65
	Tempering Vent Unocc. SASP	−20-80	dF	TEMPVUNC	50

SERVICE-CONFIG TABLES

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
ALLM	SPT lo alert limit/occ	−10-245	dF	SPLO	60
	SPT hi alert limit/occ	−10-245	dF	SPHO	85
	SPT lo alert limit/unocc	−10-245	dF	SPLU	45
	SPT hi alert limit/unocc	−10-245	dF	SPHU	100
	EDT lo alert limit/occ	−40-245	dF	SALO	40
	EDT hi alert limit/occ	−40-245	dF	SAHO	100
	EDT lo alert limit/unocc	−40-245	dF	SALU	40
	EDT hi alert limit/unocc	−40-245	dF	SAHU	100
	RAT lo alert limit/occ	−40-245	dF	RALO	60
	RAT hi alert limit/occ	−40-245	dF	RAHO	90
	RAT lo alert limit/unocc	−40-245	dF	RALU	40
	RAT hi alert limit/unocc	−40-245	dF	RAHU	100
	RARH low alert limit	0-100	%	RRHL	0
	RARH high alert limit	0-100	%	RRHH	100
	SP low alert limit	0-5	"H2O	SPL	0
	SP high alert limit	0-5	"H2O	SPH	2
	BP lo alert limit	−0.25-0.25	"H2O	BPL	-0.25
	BP high alert limit	−0.25-0.25	"H2O	BPH	0.25
	IAQ high alert limit	0-5000		IAQH	1200
BP__	Building Press. Config	0-2		BLDG_CFG	0
	Power Exhaust Motors 0=None,1=4 Mtr, 2=6 Mtr	0-2		PWRM	1
	Building Pressure Sensor	Enable/Disable		BPSENS	Dsable
	Bldg Press (+/-) Range	0-1		BP_RANGE	0.25
	Building Pressure Setp.	−0.25 -> 0.25	"H2O	BPSP	0.05
	Power Exhaust On Setp.1	0-100	%	PES1	35
	Power Exhaust On Setp.2	0-100	%	PES2	75
	Modulating PE Alg. Slct.	1-3		BPSELECT	1
	BP PID Evaluation Time	0-10	min	BPPERIOD	1
	BP Threshold Adjustment	0.1-10		BPZ_GAIN	1
	High BP Level	0-1		BPHPLVL	0.05
	Low BP Level	0-1		BPLPLVL	0.04
COOL	Capacity Threshold Adjust	−10 -> 10		Z_GAIN	1
	Compressor Lockout Temp	−20 -> 55	dF	OATLCOMP	40
	Fan-off Delay, Mech Cool	0-600	sec	COOL_FOD	60
	Minimum Load Valve?	Yes/No		MLV_SEL	No
	Motor Master Control ?	Yes/No		MOTRMAST	No
	Head Pressure Setpoint	80-150	dF	HPSP	110
	Enable Compressor A1	Enable/Disable		CMPA1ENA	Enable
	Enable Compressor A2	Enable/Disable		CMPA2ENA	Enable
	Enable Compressor B1	Enable/Disable		CMPB1ENA	Enable
	Enable Compressor B2	Enable/Disable		CMPB2ENA	Enable
	CSB A1 Feedback Alarm	Enable/Disable		CSB_A1EN	Dsable
	CSB A2 Feedback Alarm	Enable/Disable		CSB_A2EN	Dsable
	CSB B1 Feedback Alarm	Enable/Disable		CSB_B1EN	Dsable
	CSB B2 Feedback Alarm	Enable/Disable		CSB_B2EN	Dsable
	Rev. Rotation Verified ?	Yes/No		REVR_VER	No
DISP	Metric Display	Off/On		DISPUNIT	Off
	Language Selection	0-1		LANGUAGE	0
	Password Enable	Enable/Disable		PASS_EBL	Enable
	Service Password	0000-9999		PASSWORD	1111
	Contrast Adjustment	−255 - 255		CNTR_ADJ	0
	Brightness Adjustment	−255 - 255		BRTS_ADJ	0
DLVT	Dmd Level Lo Heat On	−1 - 2	^F	DMDLHON	1.5
	Dmd Level(+) Hi Heat On	0.5 - 2.0	^F	DMDHHON	0.5
	Dmd Level(-) Lo Heat Off	0.5 - 2	^F	DMDLHOFF	1
	Dmd Level Lo Cool On	−1 - 2	^F	DMDLCON	1.5
	Dmd Level(+) Hi Cool On	0.5 - 2	^F	DMDHCON	0.5
	Dmd Level(-) Lo Cool Off	0.5 - 2	^F	DMDLCOFF	1
	Cool Trend Demand Level	0.1 - 5	^F	CTRENDLV	0.1
	Heat Trend Demand Level	0.1 - 5	^F	HTRENDLV	0.1
	Cool Trend Time	30 - 600	sec	CTRENDTM	120
	Heat Trend Time	30 - 600	sec	HTRENDTM	120
DMDL	Demand Limit Select	0 - 3		DMD_CTRL	0
	Demand Limit at 20 ma	0 - 100	%	DMT20MA	100
	Loadshed Group Number	0 - 99		SHED_NUM	0
	Loadshed Demand Delta	0 - 60	%	SHED_DEL	0
	Maximum Loadshed Time	0 - 120	min	SHED_TIM	60
	Demand Limit Sw.1 Setpt.	0 - 100	%	DLSWSP1	80
	Demand Limit Sw.2 Setpt.	0 - 100	%	DLSWSP2	50

SERVICE-CONFIG TABLES (cont)

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
ECON					
	Economizer Installed ?	Yes/No		ECON_ENA	Yes
	Economizer Min.Position	0 - 100	%	ECONOMIN	20
	Economizer Max.Position	0 - 100	%	ECONOMAX	98
	Economzr trim for sumZ ?	Yes/No		ECONTRIM	Yes
	Econ ChangeOver Select	0 - 3		ECON_SEL	1
	OA Enthalpy ChgOvr Selct	1 - 5		OAEC_SEL	2
	Outdr.Enth Compare Value	18 - 28		OAEN_CFG	24
	High OAT Lockout Temp	55 - 120	dF	OAT_LOCK	60
	OA Dewpoint Temp Limit	50 - 62	dF	OADEWCFG	55
	Outside Air RH Sensor	Enable/Disable		OARHSENS	Disable
	Economizer Control Type	1-3		ECON_CTL	1
	Economizer Switch Config	0-2		ECOSWCFG	0
	Economizer Prop.Gain	0.7 - 3.0		EC_PGAIN	1
	Economizer Range Adjust	0.5 - 5	^F	EC_RANGE	2.5
	Economizer Speed Adjust	0.1 - 10		EC_SPEED	0.75
	Economizer Deadband	0.1 - 2	^F	EC_DBAND	0.5
	Unoc Econ Free Cool Cfg	0-2		UEFC_CFG	0
	Unoc Econ Free Cool Time	0-720	min	UEFCTIME	120
	Un.Ec.Free Cool OAT Lock	40-70	dF	UEFCNTLO	50
EDTR					
	EDT Reset Configuration	0 - 3		EDRSTCFG	2
	Reset Ratio	0 - 10		RTIO	3
	Reset Limit	0 - 20	^F	LIMT	10
	EDT 4-20 ma Reset Input	Enable/Disable		EDTRSENS	Disable
HEAT					
	Heating Control Type	0 - 4		HEATTYPE	0
	Heating Supply Air Setpt	80-120	dF	SASPHEAT	85
	Occupied Heating Enabled	Yes/No		HTOCCENA	No
	MBB Sensor Heat Relocate	Yes/No		HTLATMON	No
	Fan-off Delay, Gas Heat	45-600		GAS_FOD	45
	Fan-off Delay, Elec Heat	10-600		ELEC_FOD	30
	Staged Gas Heat Type	0 - 4		HTSTGTYP	0
	Max Cap Change per Cycle	5 - 45		HTCAPMAX	45
	S.Gas DB min.dF/PID Rate	0 - 5		HT_MR_DB	0.5
	St.Gas Temp. Dead Band	0 - 5	^F	HT_SG_DB	2
	Heat Rise dF/sec Clamp	0.05 - 0.2		HTSGRISE	0.06
	LAT Limit Config	0 - 20	^F	HTLATLIM	10
	Heat Control Prop. Gain	0 - 1.5		HT_PGAIN	1
	Heat Control Derv. Gain	0 - 1.5		HT_DGAIN	1
	Heat PID Rate Config	60 - 300	sec	HTSGPIDR	90
IAQ_					
	Economizer Min.Position	0 - 100	%	ECONOMIN	5
	IAQ Demand Vent Min.Pos.	0 - 100	%	IAQMINP	0
	IAQ Analog Sensor Config	0 - 4		IAQANCFG	0
	IAQ 4-20 ma Fan Config	0 - 2		IAQANFAN	0
	IAQ Discrete Input Config	0 - 2		IAQINCFG	0
	IAQ Disc.In. Fan Config	0 - 2		IAQINFAN	0
	OAQ 4-20ma Sensor Config	0 - 2		OAQANCFG	0
	IAQ Econo Override Pos.	0 - 100	%	IAQOVPOS	100
	Diff.Air Quality LoLimit	0 - 1000		DAQ_LOW	100
	Diff. Air Quality HiLimit	100 - 2000		DAQ_HIGH	700
	DAQ PPM Fan Off Setpoint	0 - 2000		DAQFNOFF	200
	DAQ PPM Fan On Setpoint	0 - 2000		DAQFNON	400
	Diff. AQ Responsiveness	−5 - 5		IAQREACT	0
	OAQ Lockout Value	0 - 2000		OAQLOCK	0
	User determined OAQ	0-5000		OAQ_USER	400
	IAQ Low Reference	0 - 5000		IAQREFL	0
	IAQ High Reference	0 - 5000		IAQREFH	2000
	OAQ Low Reference	0 - 5000		OAQREFL	0
	OAQ High Reference	0 - 5000		OAQREFH	2000
	IAQ Purge	Yes/No		IAQPURGE	No
	IAQ Purge Duration	5-60	min	IAQPTIME	15
	IAQ Purge LoTemp Min Pos	0-100	%	IAQPLTMP	10
	IAQ Purge HiTemp Min Pos	0-100	%	IAQPHTMP	35
	IAQ Purge OAT Lockout	35-70	dF	IAQPNTLO	50
SP__					
	Static Pres.VFD Control?	No		STATICFG	No
	Static Pres.Fan Control?	Yes		STATPFAN	Yes
	Static Pressure Sensor	Enable/Disable		SPSENS	Disable
	Static Press. Low Range	−10 - 0		SP_LOW	0
	Static Press. High Range	0 - 10		SP_HIGH	5
	Static Pressure Setpoint	0 - 5	"H2O	SPSP	1.5
	VFD Minimum Speed	10 - 50	%	STATPMIN	20
	VFD Maximum Speed	50 - 100	%	STATPMAX	100
	VFD Fire Speed Override	0 - 100	%	STATPFSO	100
	Stat.Pres.PID Run Rate	1 - 200	sec	SPIDRATE	2
	Static Press. Prop. Gain	0 - 100		STATP_PG	20
	Static Pressure Intg. Gain	0 - 50		STATP_IG	2
	Static Pressure Derv. Gain	0 - 50		STATP_DG	0
	Static Press.System Gain	0 - 50		STATP_SG	1

SERVICE-CONFIG TABLES (cont)

TABLE	NAME	RANGE	UNITS	POINT NAME	DEFAULT
TRIM	Air Temp Lvg SF Trim	−10 - 10	^F	SAT_TRIM	0
	RAT Trim	−10 - 10	^F	RAT_TRIM	0
	OAT Trim	−10 - 10	^F	OAT_TRIM	0
	SPT Trim	−10 - 10	^F	SPT_TRIM	0
	Cir A Sat.Cond.Temp Trim	−30 - 30	^F	SCTATRIM	0
	Cir B Sat.Cond.Temp Trim	−30 - 30	^F	SCTBTRIM	0
	Suct.Press.Circ.A Trim	−50 - 50	PSI	SPA_TRIM	0
	Suct.Press.Circ.B Trim	−50 - 50	PSI	SPB_TRIM	0
	Dis.Press.Circ.A Trim	−50 - 50	PSI	DPA_TRIM	0
	Dis.Press.Circ.B Trim	−50 - 50	PSI	DPB_TRIM	0
	Static Press. Trim (ma)	−2 - 2		SPMATRIM	0
	Bldg. Pressure Trim (ma)	−2 - 2		BPMATRIM	0
SWLG	Filter Status Inpt-Clean	Open/Close		FLTSLOGC	Open
	IGC Feedback - Off	Open/Close		GASFANLG	Open
	RemSw Off-Unoc-Strt-NoOv	Open/Close		RMTINLOG	Open
	Economizer Switch - No	Open/Close		ECOSWLOG	Open
	Fan Status Sw. - Off	Open/Close		SFSLOGIC	Open
	Dmd.Lmt.Sw.1 - Off	Open/Close		DMD_SW1L	Open
	Dmd.Lmt.Sw.2 - Off	Open/Close		DMD_SW2L	Open
	IAQ Disc.Input - Low	Open/Close		IAQINLOG	Open
	Fire Shutdown - Off	Open/Close		FSDLOGIC	Open
	Press. Switch - Off	Open/Close		PRESLOGC	Open
	Evacuation Sw. - Off	Open/Close		EVACLOGC	Open
	Smoke Purge Sw. - Off	Open/Close		PURGLOGC	Open
UNIT	Machine Control Type	1-6		CTRLTYPE	4
	Fan Mode (0=auto, 1=cont)	0-1		FAN_MODE	1
	Remote Switch Config	0 -3		RMTINCFG	0
	CEM Module installed	Yes/No		CEM_BRD	No
	Temp.Cmp.Strt.Cool Factr	0-60	min	TCSTCOOL	0
	Temp.Cmp.Strt.Heat Factr	0-60	min	TCSTHEAT	0
	Fan fail shuts down unit	Yes/No		SFS_SHUT	No
	Fan Stat Monitoring Type	0-2		SFS_MON	0
	VAV Unocc.Fan Retry time	0-720	min	SAMPMINS	50
	Unit Size (20-60) 20,25,27,30,35,40,50,60	20-60	TONS	UNITSIZE	20
	Disch. Press. Transducer	Yes/No		DP_TRANS	No
	MAT Calc Config	Yes/No		MAT_SEL	Yes
	Reset MAT Table Entries?	Yes/No		MATRESET	No
	Altitude……..in feet:	0-60000		ALTITUDE	0
	Space Temp Sensor	Enable/Disable		SPTSENS	Disable
	Space Temp Offset Sensor	Enable/Disable		SPTOSENS	Disable
	Space Temp Offset Range	1 - 10	^F	SPTO_RNG	5
	Return Air RH Sensor	Enable/Disable		RARHSENS	Disable
	Filter Stat.Sw.Enabled ?	Enable/Disable		FLTS_ENA	Disable
	Stat. Pres. Reset Sensor	Enable/Disable		SPRSTSEN	Disable
generics	POINT_01 Definition	8 CHAR ASCII		POINT_01	
	POINT_02 Definition	8 CHAR ASCII		POINT_02	
	POINT_03 Definition	8 CHAR ASCII		POINT_03	
	POINT_04 Definition	8 CHAR ASCII		POINT_04	
	POINT_05 Definition	8 CHAR ASCII		POINT_05	
	POINT_06 Definition	8 CHAR ASCII		POINT_06	
	POINT_07 Definition	8 CHAR ASCII		POINT_07	
	POINT_08 Definition	8 CHAR ASCII		POINT_08	
	POINT_09 Definition	8 CHAR ASCII		POINT_09	
	POINT_10 Definition	8 CHAR ASCII		POINT_10	
	POINT_11 Definition	8 CHAR ASCII		POINT_11	
	POINT_12 Definition	8 CHAR ASCII		POINT_12	
	POINT_13 Definition	8 CHAR ASCII		POINT_13	
	POINT_14 Definition	8 CHAR ASCII		POINT_14	
	POINT_15 Definition	8 CHAR ASCII		POINT_15	
	POINT_16 Definition	8 CHAR ASCII		POINT_16	
	POINT_17 Definition	8 CHAR ASCII		POINT_17	
	POINT_18 Definition	8 CHAR ASCII		POINT_18	
	POINT_19 Definition	8 CHAR ASCII		POINT_19	
	POINT_20 Definition	8 CHAR ASCII		POINT_20	

MAINTENANCE DISPLAY TABLES

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
ALARMS01					
	Active Alarm -----------------------	ascii ascii		ALARM_01	
	Active Alarm -----------------------	ascii ascii		ALARM_02	
	Active Alarm -----------------------	ascii ascii		ALARM_03	
	Active Alarm -----------------------	ascii ascii		ALARM_04	
follow same format for… **ALARMS02** **ALARMS03** **ALARMS04** **ALARMS05**					
COMPRESR					
	Compressor A1 Relay	On/Off		CMPA1	
	Compressor A1 Feedback	On/Off		CSB_A1	
	Curr.Sens.Brd. A1 Status	ascii		CSBA1ASC	
	CSB A1 Feedback Alarm	Enable/Disable		CSB_A1EN	config
	Comp A1 Locked Out ?	Yes/No		CMPA1LOK	
	Compressor A1 Strikes			CMPA1STR	
	Enable Compressor A1	Enable/Disable		CMPA1ENA	config
	Compressor A2 Relay	On/Off		CMPA2	
	Compressor A2 Feedback	On/Off		CSB_A2	
	Curr.Sens.Brd. A2 Status	ascii		CSBA2ASC	
	CSB A2 Feedback Alarm	Enable/Disable		CSB_A2EN	config
	Comp A2 Locked Out ?	Yes/No		CMPA2LOK	
	Compressor A2 Strikes			CMPA2STR	
	Enable Compressor A2	Enable/Disable		CMPA2ENA	config
	Compressor B1 Relay	On/Off		CMPB1	
	Compressor B1 Feedback	On/Off		CSB_B1	
	Curr.Sens.Brd. B1 Status	ascii		CSBB1ASC	
	CSB B1 Feedback Alarm	Enable/Disable		CSB_B1EN	config
	Comp B1 Locked Out ?	Yes/No		CMPB1LOK	
	Compressor B1 Strikes			CMPB1STR	
	Enable Compressor B1	Enable/Disable		CMPB1ENA	config
	Compressor B2 Relay	On/Off		CMPB2	
	Compressor B2 Feedback	On/Off		CSB_B2	
	Curr.Sens.Brd. B2 Status	ascii		CSBB2ASC	
	CSB B2 Feedback Alarm	Enable/Disable		CSB_B2EN	config
	Comp B2 Locked Out ?	Yes/No		CMPB2LOK	
	Compressor B2 Strikes			CMPB2STR	
	Enable Compressor B2	Enable/Disable		CMPB2ENA	config
DMANDLIM					
	Active Demand Limit	0-100	%	DEM_LIM	forcible
	Percent Total Capacity	0-100	%	CAPTOTAL	
	Demand Limit Select	0-3		DMD_CTRL	config
	Demand Limit Switch 1	On/Off		DMD_SW1	forcible
	Demand Limit Switch 2	On/Off		DMD_SW2	forcible
	Demand Limit Sw.1 Setpt.	0-100	%	DLSWSP1	config
	Demand Limit Sw.2 Setpt.	0-100	%	DLSWSP2	config
	4-20 ma Demand Signal	4-20	ma	DMDLMTMA	forcible
	Demand Limit at 20 ma	0-100	%	DMT20MA	config
	CCN Loadshed Signal	0-99		DL_STAT	
	Loadshed Group Number	0-99		SHED_NUM	config
	Loadshed Demand Delta	0-60	%	SHED_DEL	config
	Maximum Loadshed Time	0-120	min	SHED_TIM	config

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
ECON_MIN					
	Econo Damper Command Pos		%	ECONOCMD	forcible
	Econo Damper Current Pos		%	ECONOPOS	
	Econo Current Min. Pos.		%	ECMINPOS	
	Diff.Air Quality in PPM			DAQ	
	Econo Position Override			ECOORIDE	forcible
	IAQ Min.Pos.Override		%	IAQMINOV	forcible
	Econ Remote 10K Pot Val.			ECON_POT	forcible
	IAQ - PPM Return CO2			IAQ	forcible
	OAQ - PPM Return CO2			OAQ	forcible
	IAQ - Discrete Input			IAQIN	forcible
	IAQ Demand Vent Min.Pos.		%	IAQMINP	config
	Economizer Min.Position		%	ECONOMIN	config
	IAQ Analog Sensor Config			IAQANCFG	config
	IAQ 4-20 ma Fan Config			IAQANFAN	config
	IAQ Discrete Input Confg			IAQINCFG	config
	IAQ Disc.In. Fan Config			IAQINFAN	config
	IAQ Econo Override Pos.		%	IAQOVPOS	config
	Diff.Air Quality LoLimit			DAQ_LOW	config
	Diff.Air Quality HiLimit			DAQ_HIGH	config
	DAQ PPM Fan Off Setpoint			DAQFNOFF	config
	DAQ PPM Fan On Setpoint			DAQFNON	config
	Diff. AQ Responsiveness			IAQREACT	config
	IAQ Low Reference			IAQREFL	config
	IAQ High Reference			IAQREFH	config
	OAQ Lockout Value			OAQLOCK	config
	OAQ 4-20ma Sensor Config		ma	OAQANCFG	config
	IAQ milliamps		ma	IAQ_MA	
	OAQ milliamps			OAQ_MA	
EC_DIAG					
	Economizer Active ?	Yes/No		ECACTIVE	
	Conditions which prevent economizer being active:				
	Econ Act. Unavailable?	Yes/No		ECONUNAV	
	Remote Econ. Disabled ?	Yes/No		ECONDISA	
	DBC - OAT lockout?	Yes/No		DBC_STAT	
	DEW - OA Dewpt. lockout?	Yes/No		DEW_STAT	
	DDBC- OAT > RAT lockout?	Yes/No		DDBCSTAT	
	OAEC- OA Enth Lockout?	Yes/No		OAECSTAT	
	DEC - Diff.Enth.Lockout?	Yes/No		DEC_STAT	
	EDT Sensor Bad ?	Yes/No		EDT_STAT	
	OAT Sensor Bad ?	Yes/No		OAT_STAT	
	Economizer forced ?	Yes/No		ECONFORC	
	Supply Fan not on 30s ?	Yes/No		SFONSTAT	
	Cool Mode not in effect?	Yes/No		COOL_OFF	
	OAQ lockout in effect ?	Yes/No		OAQLOCKD	
	Econ recovery hold off?	Yes/No		ECONHELD	
	Outside Air Temperature		dF	OAT	forcible
	OutsideAir DewPoint Temp		dF	OADEWTMP	
	Outside Air Rel.Humidity		%	OARH	forcible
	Outdoor Air Enthalpy			OAE	
	Return Air Temperature		dF	RAT	forcible
	Return Air Rel.Humidity		%	RARH	forcible
	Return Air Enthalpy			RAE	
	High OAT Lockout Temp		dF	OAT_LOCK	config
	Econ ChangeOver Select			ECON_SEL	config
	OA Enthalpy ChgOvr Selct			OAEC_SEL	config
	Outdr.Enth Compare Value			OAEN_CFG	config
	OA Dewpoint Temp Limit		dF	OADEWCFG	config
	Supply Fan State			SFAN	
	Economizer Act.Cmd.Pos.		%	ECONOCMD	forcible
	Economizer Act.Curr.Pos.		%	ECONOPOS	
	Evaporator Discharge Tmp		dF	EDT	
	Economizer Control Point		dF	ECONCPNT	
	EDT Trend in degF/minute		^F	EDTTREND	
	Economizer Prop.Gain			EC_PGAIN	config
	Economizer Range Adjust		^F	EC_RANGE	config
	Economizer Speed Adjust			EC_SPEED	config
	Economizer Deadband		^F	EC_DBAND	config
	Economizer Timer		sec	ERATETMR	config

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
ENTHALPY					
	Outdoor Air Enthalpy			OAE	
	Outside Air Temperature		dF	OAT	forcible
	Outside Air Rel.Humidity		%	OARH	forcible
	Outside Air RH Sensor			OARHSENS	config
	OA Dewpoint Temp Limit		dF	OADEWCFG	config
	OutsideAir DewPoint Temp		dF	OADEWTMP	
	OutsideAir Humidty Ratio			OA_HUMR	
	OA H2O Vapor Sat.Pressur		"Hg	OA_PWS	
	OA H2O Partial.Press.Vap		"Hg	OA_PWS	
	Return Air Enthalpy			RAE	
	Return Air Temperature		dF	RAT	forcible
	Controlling Return Temp		dF	RETURN_T	forcible
	Return Air Rel.Humidity		%	RARH	forcible
	Return Air Temp Sensor			RATSENS	config
	Return Air RH Sensor			RARHSENS	config
	Altitude……..in feet:			ALTITUDE	config
	Atmospheric Pressure		"Hg	ATMOPRES	config
LINKDATA					
	Supervisory Element #			SUPE-ADR	
	Supervisory Bus			SUPE-BUS	
	Supervisory Block Number			BLOCKNUM	
	Average Occup. Heat Stp.		dF	AOHS	
	Average Occup. Cool Stp.		dF	AOCS	
	Average Unocc. Heat Stp.		dF	AUHS	
	Average Unocc. Cool Stp.		dF	AUCS	
	Average Zone Temperature		dF	AZT	
	Average Occup. Zone Temp		dF	AOZT	
	Linkage System Occupied?			LOCC	
	Next Occupied Day			LNEXTOCD	
	Next Occupied Time			LNEXTOCC	
	Next Unoccupied Day			LNEXTUOD	
	Next Unoccupied Time			LNEXTUNC	
	Last Unoccupied Day			LLASTUOD	
	Last Unoccupied Time			LLASTUNC	
MILLIAMP					
	IAQ milliamps		ma	IAQ_MA	
	OAQ milliamps		ma	OAQ_MA	
	SP Reset milliamps		ma	SPRST_MA	
	4-20 ma Demand Signal		ma	DMDLMTMA	forcible
	EDT Reset milliamps		ma	EDTRESMA	
	OARH milliamps		ma	OARH_MA	
	RARH milliamps		ma	RARH_MA	
	BP milliamps		ma	BP_MA	
	SP milliamps		ma	SP_MA	
MODES					
	System Mode………….:	ascii text strings			
	HVAC Mode…………..:	ascii text strings			
	Control Mode………..:	ascii text strings			
	Currently Occupied	On/Off		MODEOCCP	
	Timed Override in effect	On/Off		MODETOVR	
	DCV resetting min pos	On/Off		MODEADCV	
	Supply Air Reset	On/Off		MODESARS	
	Demand Limit in Effect	On/Off		MODEDMLT	
	Temp.Compensated Start	On/Off		MODETCST	
	IAQ pre-occ purge active	On/Off		MODEIQPG	
	Linkage Active - DAV	On/Off		MODELINK	
	Mech.Cooling Locked Out	On/Off		MODELOCK	
OCCDEFME					
	Current Day, Time & Date:	ascii date & time		TIMEDATE	
	Occupancy Controlled By:	ascii text		OCDFTXT1	
		ascii text		OCDFTXT2	
		ascii text		OCDFTXT3	
	Currently Occupied	Yes/No		MODE_OCC	
	Current Occupied Time			STRTTIME	
	Current Unoccupied Time			ENDTIME	
	Next Occupied Day & Time			NXTOC_DT	
	Next Unocc. Day & Time			NXTUN_DT	
	Last Unocc. Day & Time			PRVUN_DT	
	Current Occup. Period #			PER_NO	
	Timed-Override in Effect	Yes/No		OVERLAST	
	Timed-Override Duration		hours	OVR_HRS	

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
PRESBLDG					
	Building Pressure		"H2O	BP	
	Econo Damper Current Pos		%	ECONOPOS	
	Power Exhaust Stage A			PE_A	
	Power Exhaust Stage B			PE_B	
	Power Exhaust Stage C			PE_C	
	BP Load Factor			BPSMZ	
	BP Rise Per Stage			BPRISE	
	BP PID/Integral Term			BPINT	config
	BP PID Threshold			BPZ	config
	BP Deadband			BPY	config
	Building Pressure Error			BPERROR	config
	Rate of Chng of BPERROR			BPRATE	config
	High BP Override			BPHPOVRD	config
	Low BP Override			BPLPOVRD	config
PRESDUCT					
	Static Pressure		"H2O	SP	
	Supply Fan VFD Speed		%	SFAN_VFD	
	Static Pressure Setpoint		"H2O	SPSP	config
	Static Pressure Reset			SPRESET	forcible
STAGEGAS					
	Heating Mode………..:				
	Requested Heat Stage			HT_STAGE	
	Heating Control Point			HEATCPNT	
	Staged Gas LAT Sum		dF	LAT_SGAS	
	Staged Gas LAT 1		dF	LAT1SGAS	
	Staged Gas LAT 2		dF	LAT2SGAS	
	Staged Gas LAT 3		dF	LAT3SGAS	
	Staged Gas Limit Sw.Temp		dF	LIMSWTMP	
	Heat PID Timer		sec	HTSGTIMR	
	Staged Gas Capacity Calc		%	HTSGCALC	
	Current Running Capacity		%	HTSG_CAP	
	Proportional Cap. Change			HTSG_P	
	Derivative Cap. Change			HTSG_D	
	Maximum Heat Stages			HTMAXSTG	
	Hi Limit Switch Tmp Mode			LIMTMODE	
	LAT Cutoff Mode			LATCMODE	
	Capacity Clamp Mode			CAPMODE	
STRTHOUR					
	Compressor A1 Run Hours		hours	HR_A1	config
	Compressor A2 Run Hours		hours	HR_A2	config
	Compressor B1 Run Hours		hours	HR_B1	config
	Compressor B2 Run Hours		hours	HR_B2	config
	Compressor A1 Starts			CY_A1	config
	Compressor A2 Starts			CY_A2	config
	Compressor B1 Starts			CY_B1	config
	Compressor B2 Starts			CY_B2	config
SUMZ					
	Cooling Control Point		dF	COOLCPNT	
	Mixed Air Temperature		dF	MAT	
	Evaporator Discharge Tmp		dF	EDT	
	Return Air Temperature		dF	RAT	
	Outside Air Temperature		dF	OAT	
	Econo Damper Current Pos		%	ECONOPOS	
	Capacity Threshold Adjst			Z_GAIN	
	Capacity Load Factor			SMZ	
	Next Stage EDT Decrease			ADDRISE	
	Next Stage EDT Increase			SUBRISE	
	Rise Per Percent Capacity			RISE_PCT	
	Cap Deadband Subtracting			Y_MINUS	
	Cap Deadband Adding			Y_PLUS	
	Cap Threshold Subtracting			Z_MINUS	
	Cap Threshold Adding			Z_PLUS	
	High Temp Cap Override	On/Off		HI_TEMP	
	Low Temp Cap Override	On/Off		LOW_TEMP	
	Pull Down Cap Override	On/Off		PULLDOWN	
	Slow Change Cap Override	On/Off		SLO_CHNG	
SYSTEM					
	Reset All Current Alarms	Yes/No		ALRESET	config
	Reset Alarm History	Yes/No		ALHISCLR	config
	Reset the Device	Yes/No		RESETDEV	config
	Local Machine Disable	Yes/No		UNITSTOP	config
	Soft Stop Request	Yes/No		SOFTSTOP	forcible
	Emergency Stop	Enable/Disable		EMSTOP	forcible

MAINTENANCE DISPLAY TABLES (cont)

TABLE	DISPLAY NAME	RANGE	UNITS	POINT NAME	WRITE STATUS
TESTCOOL					
	Compressor A1 Relay	ON/OFF		CMPA1TST	test
	Compressor A2 Relay	ON/OFF		CMPA2TST	test
	Min. Load Valve (HGBP)	ON/OFF		MLV_TST	test
	Compressor B1 Relay	ON/OFF		CMPB1TST	test
	Compressor B2 Relay	ON/OFF		CMPB2TST	test
TESTFANS					
	Supply Fan Relay	ON/OFF		SFAN_TST	test
	Supply Fan VFD Speed	0-100	%	SGVFDTST	test
	Condenser Fan Circuit A	ON/OFF		CNDA_TST	test
	Condenser Fan Circuit B	ON/OFF		CNDB_TST	test
TESTHEAT					
	Heat Relay 1	ON/OFF		HS1_TST	test
	Heat Relay 2	ON/OFF		HS2_TST	test
	Relay 3 W1 Gas Valve 2	ON/OFF		HS3_TST	test
	Relay 4 W2 Gas Valve 2	ON/OFF		HS4_TST	test
	Relay 5 W1 Gas Valve 3	ON/OFF		HS5_TST	test
	Relay 6 W2 Gas Valve 3	ON/OFF		HS6_TST	test
TESTINDP					
	Economizer Position Test			ECONCTST	test
	Economizer Power Test			ECONPTST	test
	Calibrate the Economizer?			ECON_CAL	test
	Power Exhaust Relay A			PE_A_TST	test
	Power Exhaust Relay B			PE_B_TST	test
	Power Exhaust Relay C			PE_C_TST	test
	Heat Interlock Relay	ON/OFF		HIR_TST	test
	Remote Alarm Relay	ON/OFF		ALRM_TST	test
VERSIONS					
	MBB CESR131334-	ascii version#		MBB_SW	
	ECB1 CESR131249-	ascii version#		ECB1_SW	
	ECB2 CESR131249-	ascii version#		ECB2_SW	
	SCB CESR131226-	ascii version#		SCB_SW	
	CEM CESR131174-	ascii version#		CEM_SW	
	MARQUEE CESR131171-	ascii version#		MARQ_SW	
	NAVIGATOR CESR130227-	ascii version#		NAVI_SW	

TIME SCHEDULE CONFIG TABLE

Allowable Entries: Day not selected = 0 Day selected = 1

	DAY FLAGS MTWTFSSH	OCCUPIED TIME	UNOCCUPIED TIME
Period 1:	00000000	00:00	00:00
Period 2:	00000000	00:00	00:00
Period 3:	00000000	00:00	00:00
Period 4:	00000000	00:00	00:00
Period 5:	00000000	00:00	00:00
Period 6:	00000000	00:00	00:00
Period 7:	00000000	00:00	00:00
Period 8:	00000000	00:00	00:00

APPENDIX C — VFD INFORMATION

On variable air volume units with optional VFD, the supply fan speed is controlled by a 3-phase VFD. The VFD is located in the supply fan section behind a removable panel. The VFD speed is controlled directly by the *Comfort*Link™ controls through a 4 to 20 mA signal based on a supply duct pressure sensor. The VFD has a display, which can be used for service diagnostics, but setup of the building pressure and control loop factors should be done through the Scrolling Marquee display. The VFD is powered during normal operation to prevent condensation from forming on the boards during the off mode and is stopped by driving the speed to 0 (by sending a 4 mA signal to the VFD).

The A series units use ABB VFDs. The interface wiring for the VFDs is shown in Fig. A. The VFD connects through an isolation board to the 4 to 20 mA RCB board. Terminal designations are shown in Table A. Configurations are shown in Table B.

Table A — VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three-Phase Main Circuit Input Power Supply
U2 V2 W2	Three-Phase AC Output to Motor, 0 V to Maximum Input Voltage Level
X1-11 (GND) X1-12 (COMMON)	Factory-supplied jumper
X1-10 (24 VDC) X1-13 (DI-1)	Run (factory-supplied jumper)
X1-10 (24 VDC) X1-16 (DI-4)	Start Enable 1 (Factory-supplied jumper). When opened the drive goes to emergency stop.
X1-2 (AI-1) X1-3 (AGND)	Factory wired for 4 to 20 mA remote input

Fig. A — VFD Wiring

Table B — VFD Configurations

PARAMETER GROUP	PARAMETER TITLE	PARAMETER INDEX	CARRIER DEFAULT
	LANGUAGE	9901	ENGLISH
	APPLIC MACRO	9902	USER 1
	MOTOR CTRL MODE	9904	SCALAR: FREQ
Start-Up Data	MOTOR NOM VOLT	9905	460v
	MOTOR NOM CURR	9906	*TBD*
	MOTOR NOM FREQ	9907	60 Hz
	MOTOR NOM SPEED	9908	1750 rpm
Start/Stop/Dir	EXT1 COMMANDS	1001	DI-1
	DIRECTION	1003	REVERSE
Analog Inputs	MINIMUM AI1	1301	20.0 %
	MAXIMUM AI1	1302	100.0 %
	RELAY OUTPUT 1	1401	STARTED
Relay Outputs	RELAY OUTPUT 2	1402	RUN
	RELAY OUTPUT 3	1403	FAULT (-1)
System Controls	RUN ENABLE	1601	NOT SELECTED
	START ENABLE 1	1608	DI-4
	OVERRIDE SEL	1701	DI-3
	OVERRIDE FREQ	1702	60 Hz
OVER RIDE	OVERRIDE SPEED	1703	1750 rpm
	OVER PASS CODE	1704	ENTERED
	OVERRIDE	1705	ON
	STOP FUNCTION	2102	RAMP
Accel/Decel	ACCELER TIME 1	2202	30.0s
	DECELER TIME 1	2203	30.0s
MOTOR	SWITCHING FREQ	2606	8 kHz

VFD Operation — The VFD keypad is shown in Fig. B. The function of SOFT KEYS 1 and 2 change depending on what is displayed on the screen. The function of SOFT KEY 1 matches the word in the lower left-hand box on the display screen. The function of SOFT KEY 2 matches the word in the lower right-hand box on the display screen. If the box is empty, then the SOFT KEY does not have a function on that specific screen. The UP and DOWN keys are used to navigate through the menus. The OFF key is used to turn off the VFD. The AUTO key is used to change control of the drive to automatic control. The HAND key is used to change control of the drive to local (hand held) control. The HELP button is used to access the help screens.
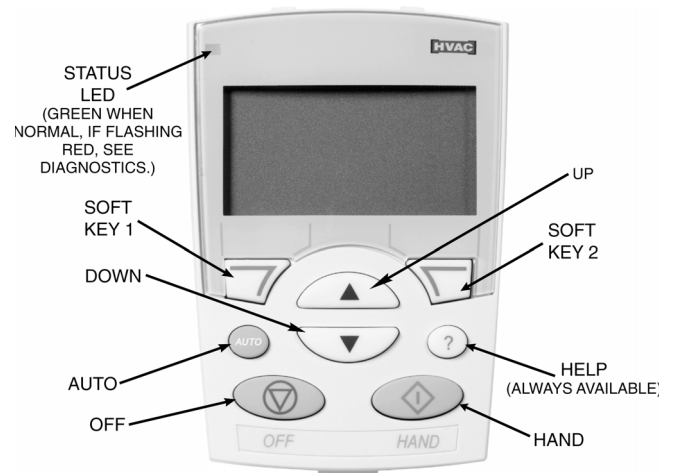
Fig. B — VFD Keypad

START UP WITH ASSISTANT — Initial start-up has been performed at the factory. To start up the VFD with the Start-Up Assistant or reset the VFD with the Carrier defaults, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight ASSISTANTS on the display screen and press ENTER (SOFT KEY 2).

3. Use the UP or DOWN keys to highlight Carrier Assistant and press SEL (SOFT KEY 2).

4. The Carrier Assistant will ask questions to determine the correct parameters for the VFD. Select the desired values and press SAVE (SOFT KEY 2) after every change. The process will continue until all the parameters are set.

   a. The Carrier Assistant will ask "Is this an Air Handler or Rooftop?" Select "Rooftop."

   b. The Carrier Assistant will ask "Is this a High E or Premium E motor?" Select the correct efficiency type.

   c. If the VFD can be used with two different size (HP) motors, then the Carrier Assistant will ask the user to choose the proper HP. Select the correct motor horsepower.

START UP BY CHANGING PARAMETERS INDIVIDU-ALLY — Initial start-up is performed at the factory. To start up the VFD with by changing individual parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight PARAMETERS on the display screen and press ENTER (SOFT KEY 2).

3. Use the UP or DOWN keys to highlight the desired parameter group and press SEL (SOFT KEY 2).

4. Use the UP or DOWN keys to highlight the desired parameter and press EDIT (SOFT KEY 2).

5. Use the UP or DOWN keys to change the value of the parameter.

6. Press SAVE (SOFT KEY 2) to store the modified value. Press CANCEL (SOFTKEY 1) to keep the previous value. Any modifications that are not saved will not be changed.

7. Choose another parameter or press EXIT (SOFT KEY 1) to return to the listing of parameter groups. Continue until all the parameters have been configured and then press EXIT (SOFT KEY 1) to return to the main menu.

NOTE: The current parameter value appears above the high-light parameter. To view the default parameter value, press the UP and DOWN keys simultaneously. To restore the default factory settings, select the application macro "HVAC Default."

VFD Modes — The VFD has several different modes for configuring, operating, and diagnosing the VFD. The modes are:

- Standard Display mode — shows drive status information and operates the drive
- Parameters mode — edits parameter values individually
- Start-up Assistant mode — guides the start up and configuration
- Changed Parameters mode — shows all changed parameters
- Drive Parameter Backup mode — stores or uploads the parameters
- Clock Set mode — sets the time and date for the drive
- I/O Settings mode — checks and edits the I/O settings

STANDARD DISPLAY MODE — Use the standard display mode to read information on the drive status and operate the drive. To reach the standard display mode, press EXIT until the LCD display shows status information as described below. See Fig. C.

The top line of the LCD display shows the basic status information of the drive. The HAND icon indicates that the drive control is local from the control panel. The AUTO icon indicates that the drive is in remote control mode, such as the basic I/O (X1) or field bus.

The arrow icon indicates the drive and motor rotation status. A rotating arrow (clockwise or counterclockwise) indicates that the drive is running and at set point and the shaft direction is forward or reverse. A rotating blinking arrow indicates that the drive is running but not at set point. A stationary arrow indicates that the drive is stopped. For Carrier rooftop units, the correct rotation is counterclockwise.

The upper right corner shows the frequency set point that the drive will maintain.

Using parameter group 34, the middle of the LCD display can be configured to display 3 parameter values. The default display shows parameters 0103 (OUTPUT FREQ) in percentages, 0104 (CURRENT) in amperes, and 0120 (AI1) in milliamperes.

The bottom corners of the LCD display show the functions currently assigned to the two soft keys. The lower middle displays the current time (if configured to show the time).

The first time the drive is powered up, it is in the OFF mode. To switch to local hand-held control and control the drive using the control panel, press and hold the HAND button. Pressing the HAND button switches the drive to hand control while keeping the drive running. Press the AUTO button to switch to remote input control. To start the drive press the HAND or AUTO buttons, to stop the drive press the OFF button.

To adjust the speed in HAND mode, press the UP or DOWN buttons (the reference changes immediately). The reference can be modified in the local control (HAND) mode, and can be parameterized (using Group 11 reference select) to also allow modification in the remote control mode.

PARAMETERS MODE — The Parameters mode is used to change the parameters on the drive. To change parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight PARAMETERS on the display screen and press ENTER (SOFT KEY 2).

3. Use the UP or DOWN keys to highlight the desired parameter group and press SEL (SOFT KEY 2).

4. Use the UP or DOWN keys to highlight the desired parameter and press EDIT (SOFT KEY 2).

5. Use the UP or DOWN keys to change the value of the parameter.

6. Press SAVE (SOFT KEY 2) to store the modified value. Press CANCEL (SOFT KEY 1) to keep the previous value. Any modifications that are not saved will not be changed.

7. Choose another parameter or press EXIT (SOFT KEY 1) to return to the listing of parameter groups. Continue until all the parameters have been configured and then press EXIT (SOFT KEY 1) to return to the main menu.

NOTE: The current parameter value appears above the high-light parameter. To view the default parameter value, press the UP and DOWN keys simultaneously. To restore the default factory settings, select the Carrier application macro.
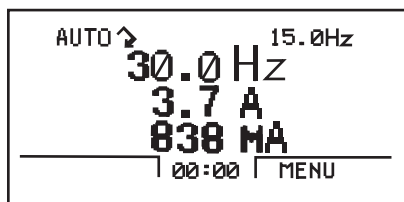
Fig. C — Standard Display Example

START-UP ASSISTANT MODE — To use the Start-Up Assistant, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight ASSISTANTS on the display screen and press ENTER (SOFT KEY 2).

3. Use the UP or DOWN keys to highlight Commission Drive and press SEL (SOFT KEY 2).

4. The Start-Up Assistant will display the parameters that need to be configured. Select the desired values and press SAVE (SOFT KEY 2) after every change. The process will continue until all the parameters are set. The assistant checks to make sure that entered values are in range.

The assistant is divided into separate tasks. The user can activate the tasks one after the other or independently. The tasks are typically done in this order: Application, References 1 and 2, Start/Stop Control, Protections, Constant Speeds, PID Control, Low Noise Setup, Panel Display, Timed Functions, and Outputs.

CHANGED PARAMETERS MODE — The Changed Parameters mode is used to view and edit recently changed parameters on the drive. To view the changed parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight CHANGED PAR on the display screen and press ENTER (SOFT KEY 2). A list of the recently changed parameters will be displayed.

3. Use the UP or DOWN keys to highlight the desired parameter group and press EDIT (SOFT KEY 2) to change the parameter if desired.

4. Press EXIT (SOFT KEY 1) to exit the Changed Parameters mode.

DRIVE PARAMETER BACKUP MODE — The drive parameter back up mode is used to export the parameters from one drive to another. The parameters can be uploaded from a VFD to the removable control panel. The control panel can then be transferred to another drive and the parameters downloaded into memory.

Depending on the motor and application, there are two options available. The first option is to download all parameters. This copies both application and motor parameters to the drive from the control panel. This is recommended when using the same application for drives of the same size. This can also be used to create a backup of the parameters group for the drive.

The second option downloads only the application parameters to the drive. This is recommended when using the same application for drives of different sizes. Parameters 9905, 9906, 9907, 9908, 9909, 1605, 1607, 5201, and group 51 parameters and internal motor parameters are not copied.

Upload All Parameters — To upload and store parameters in the control panel from the VFD, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).

3. Use the UP or DOWN keys to highlight UPLOAD TO PANEL and press SEL (SOFT KEY 2).

4. The text "Copying Parameters" will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).

5. When the upload is complete, the text "Parameter upload successful" will be displayed.

6. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.

7. The control panel can now be disconnected from the drive.

Download All Parameters — To download all parameters from the control panel to the VFD, perform the following procedure:

1. Install the control panel with the correct parameters onto the VFD.

2. Select MENU (SOFT KEY 2). The Main menu will be displayed.

3. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).

4. Use the UP or DOWN keys to highlight DOWNLOAD TO DRIVE ALL and press SEL (SOFT KEY 2).

5. The text "Restoring Parameters" will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).

6. When the download is complete, the text "Parameter download successful" will be displayed.

7. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.

8. The control panel can now be disconnected from the drive.

Download Application Parameters — To download application parameters only to the control panel from the VFD, perform the following procedure:

1. Install the control panel with the correct parameters onto the VFD.

2. Select MENU (SOFT KEY 2). The Main menu will be displayed.

3. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).

4. Use the UP or DOWN keys to highlight DOWNLOAD APPLICATION and press SEL (SOFT KEY 2).

5. The text "Downloading Parameters (partial)" will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).

6. When the download is complete, the text "Parameter download successful" will be displayed.

7. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.

8. The control panel can now be disconnected from the drive.

CLOCK SET MODE — The clock set mode is used for setting the date and time for the internal clock of the VFD. In order to use the timer functions of the VFD control, the internal clock must be set. The date is used to determine weekdays and is visible in the fault logs.

To set the clock, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight CLOCK SET on the display screen and press ENTER (SOFT KEY 2). The clock set parameter list will be displayed.

3. Use the UP or DOWN keys to highlight CLOCK VISI-BILITY and press SEL (SOFT KEY 2). This parameter is used to display or hide the clock on the screen. Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

4. Use the UP or DOWN keys to highlight SET TIME and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the hours and minutes. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

5. Use the UP or DOWN keys to highlight TIME FORMAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

6. Use the UP or DOWN keys to highlight SET DATE and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the day, month, and year. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

7. Use the UP or DOWN keys to highlight DATE FOR-MAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.

8. Press EXIT (SOFT KEY 1) twice to return to the main menu.

I/O SETTINGS MODE — The I/O Settings mode is used for viewing and editing the I/O settings.

To configure the I/O settings, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.

2. Use the UP or DOWN keys to highlight I/O SETTINGS on the display screen and press ENTER (SOFT KEY 2). The I/O Settings parameter list will be displayed.

3. Use the UP or DOWN keys to highlight the desired I/O setting and press SEL (SOFT KEY 2).

4. Use the UP or DOWN keys to select the parameter to view. Press OK (SOFT KEY 2).

5. Use the UP or DOWN keys to change the parameter setting. Press SAVE (SOFT KEY 2) to save the configuration. Press CANCEL (SOFT KEY 1) to keep the previous value. Any modifications that are not saved will not be changed.

6. Press EXIT (SOFT KEY 1) twice to return to the main menu.

Third Party Controls — For conversion to third party control of the VFD, perform the following procedure:

1. Remove the factory-installed jumper between X1-10 and X1-13 (control of VFD start/stop).

2. Remove the factory-installed jumper between X1-10 and X1-16 and replace with a normally closed safety contact for control of VFD start enable.

3. Install speed signal wires to AI-1 and AGND. This input is set at the factory for a 4 to 20 mA signal. If a 0 to 10 vdc signal is required, change DIP switch J1 (located above the VFD control terminal strip) to OFF (right position to left position) and change parameter 1301 to 0% from 20%.

VFD Diagnostics — The drive detects error situations and reports them using:

• the green and red LEDs on the body of the drive (located under the keypad)
• the status LED on the control panel
• the control panel display
• the Fault Word and Alarm Word parameter bits (parameters 0305 to 0309)

The form of the display depends on the severity of the error. The user can specify the severity for many errors by directing the drive to ignore the error situation, report the situation as an alarm, or report the situation as a fault.

FAULTS (RED LED LIT) — The VFD signals that it has detected a severe error, or fault, by:

• enabling the red LED on the drive (LED is either steady or flashing)
• setting an appropriate bit in a Fault Word parameter (0305 to 0307)
• overriding the control panel display with the display of a fault code
• stopping the motor (if it was on)
• sets an appropriate bit in Fault Word parameter 0305-0307.

The fault code on the control panel display is temporary. Pressing the MENU, ENTER, UP button or DOWN buttons removes the fault message. The message reappears after a few seconds if the control panel is not touched and the fault is still active.

ALARMS (GREEN LED FLASHING) — For less severe errors, called alarms, the diagnostic display is advisory. For these situations, the drive is simply reporting that it had detected something unusual. In these situations, the drive:

• flashes the green LED on the drive (does not apply to alarms that arise from control panel operation errors)
• sets an appropriate bit in an Alarm Word parameter (0308 or 0309)
• overrides the control panel display with the display of an alarm code and/or name

Alarm messages disappear from the control panel display after a few seconds. The message returns periodically as long as the alarm condition exists.

CORRECTING FAULTS — The recommended corrective action for faults is shown in the Fault Listing Table C. The VFD can also be reset to remove the fault. If an external source for a start command is selected and is active, the VFD may start immediately after fault reset.

Table C — Fault Codes

FAULT CODE	FAULT NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
1	OVERCURRENT	Output current is excessive. Check for excessive motor load, insufficient acceleration time (parameters 2202 ACCELER TIME 1, default 30 seconds), or faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for static or transient over voltages in the input power supply, insufficient deceleration time (parameters 2203 DECELER TIME 1, default 30 seconds), or undersized brake chopper (if present).
3	DEV OVERTEMP	Drive heat sink is overheated. Temperature is at or above 115 C (239 F). Check for fan failure, obstructions in the air flow, dirt or dust coating on the heat sink, excessive ambient temperature, or excessive motor load.
4	SHORT CIRC	Fault current. Check for short-circuit in the motor cable(s) or motor or supply disturbances.
5	OVERLOAD	Inverter overload condition. The drive output current exceeds the ratings.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for missing phase in the input power supply, blown fuse, or under voltage on main circuit.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FLT LIMIT (3021). Check source and connection for analog input and parameter settings for AI1 FLT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FLT LIMIT (3022). Check source and connection for analog input and parameter settings for AI2 FLT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, as estimated by the drive. Check for overloaded motor. Adjust the parameters used for the estimate (3005 through 3009). Check the temperature sensors and Group 35 parameters.
10	PANEL LOSS	Panel communication is lost and either drive is in local control mode (the control panel displays LOC), or drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check the communication lines and connections. Check parameter 3002 PANEL COMM ERROR, parameters in Group 10: Command Inputs and Group 11:Reference Select (if drive operation is REM).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check motor connections.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for excessive load or insufficient motor power. Check parameters 3010 through 3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	The load on the input power system is out of balance. Check for faults in the motor or motor cable. Verify that motor cable does not exceed maximum specified length.
17	UNDERLOAD	Motor load is lower than expected. Check for disconnected load. Check parameters 3013 UNDERLOAD FUNCTION through 3015 UNDERLOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact Carrier.
19	OPEX LINK	Internal fault. A communication-related problem has been detected between the OMIO and OINT boards. Contact Carrier.
20	OPEX PWR	Internal fault. Low voltage condition detected on the OINT board. Contact Carrier.
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact Carrier.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for missing main phase or blown fuse.
23	RESERVED	Not used.
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED parameters. Check parameter settings for 2001 and 2002. Check adequacy of motor braking torque. Check applicability of torque control. Check brake chopper and resistor.
25	RESERVED	Not used.
26	DRIVE ID	Internal fault. Configuration block drive ID is not valid.
27	CONFIG FILE	Internal configuration file has an error. Contact Carrier.
28	SERIAL 1 ERR	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
29	EFB CON FILE	Error in reading the configuration file for the field bus adapter.
30	FORCE TRIP	Fault trip forced by the field bus. See the field bus reference literature.
31	EFB 1	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
32	EFB 2	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
33	EFB 3	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for motor fault, motor cable fault, thermal relay fault (if used), or internal fault.
35	OUTP WIRING	Error in power wiring suspected. Check that input power wired to drive output. Check for ground faults.
101-105	SYSTEM ERROR	Error internal to the drive. Contact Carrier and report the error number.
201-206	SYSTEM ERROR	Error internal to the drive. Contact Carrier and report the error number.
1000	PAR HZRPM	Parameter values are inconsistent. Check for any of the following: 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: -128/+128 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: -128/+128 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: - 128/+128 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: - 128/+128
1001	PAR PFA REFNG	Parameter values are inconsistent. Check that 2007 MINIMUM FREQ is negative, when 8123 PFA ENABLE is active.
1002	PAR PFA IOCNF	Parameter values are inconsistent. The number of programmed PFA relays does not match with Interlock configuration, when 8123 PFA ENABLE is active. Check consistency of RELAY OUTPUT parameters 1401 through 1403, and 1410 through 1412. Check 8117 NR OF AUX MOTORS, 8118 AUTOCHANGE INTERV, and 8120 INTERLOCKS.
1003	PAR AI SCALE	Parameter values are inconsistent. Check that parameter 1301 AI 1 MIN > 1302 AI 1 MAX and that parameter 1304 AI 2 MIN > 1305 AI 2 MAX.
1004	PAR AO SCALE	Parameter values are inconsistent. Check that parameter 1504 AO 1 MIN > 1505 AO 1 MAX and that parameter 1510 AO 2 MIN > 1511 AO 2 MAX.
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check the following parameters: 1.1 < (9906 MOTOR NOM CURR * 9905 MOTOR NOM VOLT * 1.73 / PN) < 2.6 Where: PN = 1000 * 9909 MOTOR NOM POWER (if units are kW) or PN = 746 * 9909 MOTOR NOM POWER (if units are HP, e.g., in US)
1006	PAR EXT RO	Parameter values are inconsistent. Check the extension relay module for connection and 1410 through 1412 RELAY OUTPUTS 4 through 6 have non-zero values.
1007	PAR FBUS	Parameter values are inconsistent. Check that a parameter is set for field bus control (e.g., 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFA MODE	Parameter values are inconsistent. The 9904 MOTOR CTRL MODE must be = 3 (SCALAR SPEED), when 8123 PFA ENABLE is activated.
1009	PAR PCU 1	Parameter values for power control are inconsistent or improper motor nominal frequency or speed. Check for both of the following: 1 < (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED < 16 0.8 < 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor poles) < 0.992
1010	OVERRIDE/PFA CONFLICT	Override mode is enabled and PFA is activated at the same time. This cannot be done because PFA interlocks cannot be observed in the override mode.

To reset a fault indicated by a flashing red LED, turn off the power for 5 minutes. To reset a fault indicated by a red LED (not flashing), press RESET from the control panel or turn off the power for 5 minutes. Depending on the value of parameter 1604 (FAULT RESET SELECT), digital input or serial communication could also be used to reset the drive. When the fault has been corrected, the motor can be started.

HISTORY — For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402 through 0411) to aid in troubleshooting a problem. For example, a parameter 0404 stores the motor speed at the time of the fault. To clear the fault history (all of Group 04, Fault History parameters), follow these steps:

1. In the control panel, Parameters mode, select parameter 0401.
2. Press EDIT.
3. Press the UP and DOWN buttons simultaneously.
4. Press SAVE.

CORRECTING ALARMS — To correct alarms, first determine if the Alarm requires any corrective action (action is not always required). Use Table D below to find and address the root cause of the problem.

Table D — Alarm Codes

ALARM CODE	ALARM NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
2001	—	Reserved
2002	—	Reserved
2003	—	Reserved
2004	DIR LOCK	The change in direction being attempted is not allowed. Do not attempt to change the direction of motor rotation, or Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	I/O COMM	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check input source and connections. Check the parameter that sets the minimum (3021) and the parameter that sets the Alarm/Fault operation (3001).
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check input source and connections. Check parameter that sets the minimum (3022) and the parameter that sets the Alarm/Fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either the VFD is in local control mode (the control panel displays HAND), or the VFD is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct, check the communication lines and connections, Parameter 3002 PANEL LOSS, and parameters in groups 10 COMMAND INPUTS and 11 REFERENCE SELECT (if drive operation is REM).
2009	—	Reserved
2010	MOT OVERTEMP	Motor is hot, based on either the VFD estimate or on temperature feedback. This alarm warns that a Motor Overload fault trip may be near. Check for overloaded motor. Adjust the parameters used for the estimate (3005 through 3009). Check the temperature sensors and Group 35 parameters.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check that the motor and drive ratings match (motor is NOT undersized for the drive). Check the settings on parameters 3013 to 3015.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013*	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. To control automatic reset, use parameter group 31 (AUTOMATIC RESET).
2014*	AUTOCHANGE	This alarm warns that the PFA autochange function is active. To control PFA, use parameter group 81 (PFA) and the Pump Alternation macro.
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start any motor (when Autochange is used), or a speed regulated motor (when Autochange is not used).
2016	—	Reserved
2017*	OFF BUTTON	This alarm indicates that the OFF button has been pressed.
2018*	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. To control PID sleep, use parameters 4022 through 4026 or 4122 through 4126.
2019	ID RUN	The VFD is performing an ID run.
2020	OVERRIDE	Override mode is activated.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. To control Start Enable 1 function, use parameter 1608. To correct, check the digital input configuration and the communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. To control Start Enable 2 function, use parameter 1609. To correct, check the digital input configuration and the communication settings.
2023	EMERGENCY STOP	Emergency stop is activated.

*This alarm is not indicated by a relay output, even when the relay output is configured to indicate alarm conditions (parameter 1401 RELAY OUTPUT = 5 (ALARM) or 16 (FLT/ALARM).

If diagnostics troubleshooting has determined that the drive is defective during the warranty period, contact ABB Automation Inc., at 1-800-435-7365, option 4, option 3. A qualified technician will review the problem with the caller and make a determination regarding how to proceed. This may involve dispatching a designated service station (DSS) representative from an authorized station, dispatching a replacement unit, or advising return for repair.

VFD Maintenance — If installed in an appropriate environment, the VFD requires very little maintenance.

Table E lists the routine maintenance intervals recommended by Carrier.

Table E — Maintenance Intervals

MAINTENANCE	INTERVAL
Heat Sink Temperature Check and Cleaning	Every 6 to 12 months (depending on the dustiness of the environment)
Main Cooling Fan Replacement	Every five years
Internal Enclosure Cooling Fan Replacement	Every three years
Capacitor Change (Frame Size R5 and R6)	Every ten years
HVAC Control Panel Battery Change	Every ten years

HEAT SINK — The heat sink fins accumulate dust from the cooling air. Since a dusty sink is less efficient at cooling the drive, overtemperature faults become more likely. In a normal environment check the heat sink annually, in a dusty environment check more often.

Check the heat sink as follows (when necessary):

1. Remove power from drive.
2. Remove the cooling fan.
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust. If there a risk of the dust entering adjoining equipment, perform the cleaning in another room.
4. Replace the cooling fan.
5. Restore power.

MAIN FAN REPLACEMENT — The main cooling fan of the VFD has a life span of about 60,000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 18 F drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heat sink temperature in spite of heat sink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from Carrier.

To replace the main fan for frame sizes R1 through R4, perform the following (see Fig. D):

1. Remove power from drive.
2. Remove drive cover.
3. For frame sizes R1 and R2, press together the retaining clips on the fan cover and lift. For frame sizes R3 and R4, press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Install the new fan by reversing steps 2 to 4.
6. Restore power.

To replace the main fan for frame sizes R5 and R6, perform the following (see Fig. E):

1. Remove power from drive.
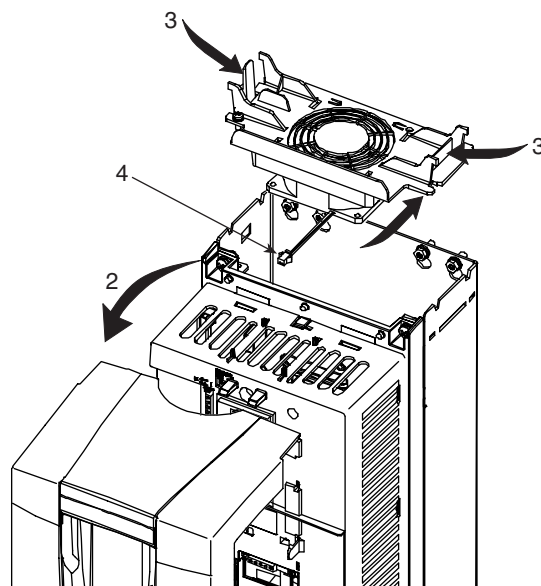
Fig. D — Main Fan Replacement (Frame Sizes R1-R4)

Bottom View (R5)

Bottom View (R6)
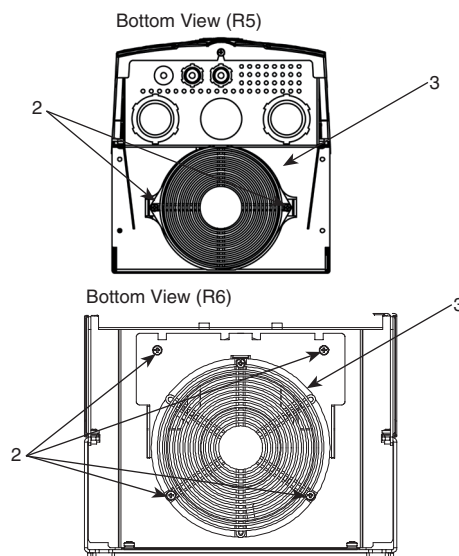
Fig. E — Main Fan Replacement (Frame Sizes R5 and R6)

2. Remove the screws attaching the fan.
3. Disconnect the fan cable.
4. Install the fan in reverse order.
5. Restore power.

INTERNAL ENCLOSURE FAN REPLACEMENT — The VFD IP 54 / UL Type 12 enclosures have an additional internal fan to circulate air inside the enclosure.

To replace the internal enclosure fan for frame sizes R1 to R4, perform the following (see Fig. F):

1. Remove power from drive.
2. Remove the front cover.
3. The housing that holds the fan in place has barbed retaining clips at each corner. Press all four clips toward the center to release the barbs.
4. When the clips/barbs are free, pull the housing up to remove from the drive.
5. Disconnect the fan cable.

6. Install the fan in reverse order, noting the following: the fan airflow is up (refer to arrow on fan); the fan wire harness is toward the front; the notched housing barb is located in the right-rear corner; and the fan cable connects just forward of the fan at the top of the drive.

To replace the internal enclosure fan for frame sizes R5 or R6, perform the following:

1. Remove power from drive.
2. Remove the front cover.
3. Lift the fan out and disconnect the cable.
4. Install the fan in reverse order.
5. Restore power.

CONTROL PANEL CLEANING — Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

BATTERY REPLACEMENT — A battery is only used in assistant control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions. The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.
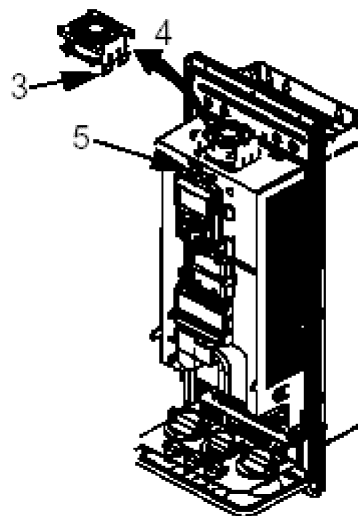
Fig. F — Internal Enclosure Fan Replacement

APPENDIX D — Mode Selection Process

If the System Mode is OFF:

{

    If the fire shut down input (***Inputs→FIRE→FSD***) is in "alarm":

        HVAC mode: **("Fire Shut Down ")** OFF

    Else

        HVAC mode: **("Disabled ")** OFF

}

    Else If: The rooftop is not in "factory test" and a fire smoke-control mode is "alarming":

{

    If the pressurization input (***Inputs→FIRE→PRES***) is in "alarm":

        HVAC mode: **("Pressurization ")**

    Else If the evacuation input (***Inputs→FIRE→EVAC***) is in "alarm":

        HVAC mode: **("Evacuation ")**

    Else If the smoke purge input (***Inputs→FIRE→PURG***) is in "alarm":

        HVAC mode: **("Smoke Purge ")**

}

    Else If: Someone changed the machine's control type (***Configuration→UNIT→C.TYP***) during run time, a 15 second delay is called out:

{

        HVAC mode: **("Disabled ")** OFF

}

    Else If: The System Mode is TEST:

{

        HVAC mode: **("Test ")**

}

    Else If: The "soft stop" command (***Service Test→S.STP)*** is forced to *YES*:

{

        HVAC mode: **("SoftStop Request")**

}

    Else If: The remote switch config (***Configuration→UNIT→RM.CF***)=2; "start/stop", and the remote input state (***Inputs→GEN.I→REMT***)=ON:

{

        HVAC mode: **("Rem. Sw. Disable")** OFF

}

    Else If: Configured for static pressure control (***Configuration→SP→SP.CF = 1,2***) and the static pressure sensor (***Pressures→AIR.P→SP***) fails:

{

        HVAC mode: **("Static Pres.Fail")** OFF

}

    Else If: Configured for supply fan status monitoring (***Configuration→UNIT→SFS.M = 1,2***) and configured to shut the unit down on fan status fail (***Configuration→UNIT→SFS.S = YES***)

{

        HVAC mode: **("Fan Status Fail ")** OFF

    Else If: The unit is just waking up from a power reset

{

        HVAC mode: **("Starting Up ")** OFF

}

Else If: A compressor is diagnosed as being "Stuck On"

{

HVAC mode: ("Comp. Stuck On ")

Else   The control is free to select the normal heating/ cooling HVAC modes:

{

HVAC mode: ("Off   ")

—   The unit is off and no operating modes are active.

HVAC mode: ("Tempering Vent ")

—   The economizer is at minimum vent position but the supply air temperature has dropped below the tempering vent set point. Gas heat is used to temper the ventilation air.

HVAC mode: ("Tempering LoCool")

—   The economizer is at minimum vent position but the combination of the outside-air temperature and the economizer position has dropped the supply-air temperature below the tempering cool set point. Gas heat is used to temper the ventilation air.

HVAC mode: ("Tempering HiCool")

—   The economizer is at minimum vent position but the combination of the outside air temperature and the economizer position has dropped the supply air temperature below the tempering cool set point. Gas heat is used to temper the ventilation air.

HVAC mode: ("Vent   ")

—   This is a normal operation mode where no heating or cooling is required and outside air is being delivered to the space to control IAQ levels.

HVAC mode: ("Low Cool   ")

—   This is a normal cooling mode when a low cooling demand exists.

HVAC mode: ("High Cool   ")

—   This is a normal cooling mode when a high cooling demand exists.

HVAC mode: ("Low Heat   ")

—   This is a normal heating mode when a low heating demand exists.

HVAC mode: ("High Heat   ")

—   This is a normal heating mode when a low heating demand exists.

HVAC mode: ("Unocc. Free Cool")

—   In this mode the unit will operate in cooling but will be using the economizer for free cooling. Entering this mode will depend on the status of the outside air. The unit can be configured for outside air changeover, differential dry bulb changeover, outside air enthalpy changeover, differential enthalpy changeover, or a custom arrangement of enthalpy/dewpoint and dry bulb. See the Economizer section for further details.

}

NOTE: There is also a transitional mode whereby the machine may be waiting for relay timeguards to expire before shutting the machine completely down:

HVAC mode: ("Shutting Down ")

INDEX

CONTROLS SET POINT AND CONFIGURATION LOG

MODEL NUMBER: _____

SERIAL NUMBER: _____

DATE: _____

TECHNICIAN: _____

Software Version

MBB	CESR131292--
RCB	CESR131249--
ECB	CESR131249--
NAVI	CESR131227--
SCB	CESR131226--
CEM	CESR131174--
MARQ	CESR131171--

ITEM	EXPANSION	RANGE	DEFAULT	ENTRY
UNIT	UNIT CONFIGURATION			
→*C.TYP*	Machine Control Type	1 - 6 (multi-text strings)	4	
→*CV.FN*	Fan Mode (0=Auto, 1=Cont)	0 - 1 (multi-text strings)	1	
→*RM.CF*	Remote Switch Config	0 - 3 (multi-text strings)	0	
→*CEM*	CEM Module Installed	Yes/No	No	
→*TCS.C*	Temp.Cmp.Strt.Cool Factr	0 - 60 min	0	
→*TCS.H*	Temp.Cmp.Strt.Heat Factr	0 - 60 min	0	
→*SFS.S*	Fan Fail Shuts Down Unit	Yes/No	No	
→*SFS.M*	Fan Stat Monitoring Type	0 - 2 (multi-text strings)	0	
→*VAV.S*	VAV Unocc.Fan Retry Time	0 - 720 min	50	
→*SIZE*	Unit Size (20-60)	20 - 60	20	
→*DP.XR*	Disch.Press. Transducers	Yes/No	No	
→*MAT.S*	MAT Calc Config	0 - 1 (multi-text strings)	1	
→*MAT.R*	Reset MAT Table Entries?	Yes/No	No	
→*ALTI*	Altitude……..in feet:	0 - 60000	0	
→*SENS*	INPUT SENSOR CONFIG			
→*SENS→SPT.S*	Space Temp Sensor	Enable/Disable	Disable	
→*SENS→SP.O.S*	Space Temp Offset Sensor	Enable/Disable	Disable	
→*SENS→SP.O.R*	Space Temp Offset Range	1 - 10	5	
→*SENS→RRH.S*	Return Air RH Sensor	Enable/Disable	Disable	
→*SENS→FLT.S*	Filter Stat.Sw.Enabled ?	Enable/Disable	Disable	
→*SENS→SP.RS*	Stat. Pres. Reset Sensor	Enable/Disable	Disable	
COOL	COOLING CONFIGURATION			
→*Z.GN*	Capacity Threshold Adjst	−10→ 10	1	
→*MC.LO*	Compressor Lockout Temp	−20 → 40 dF	40	
→*C.FOD*	Fan-Off Delay, Mech Cool	0 → 600 sec	60	
→*MLV*	Min. Load Valve? (HGBP)	Yes/No	No	
→*M.M.*	Motor Master Control	Yes/No	No	
→*HPSP*	Head Pressure Setpoint	80 - 150 dF	113	
→*A1.EN*	Enable Compressor A1	Enable/Disable	Enable	
→*A2.EN*	Enable Compressor A2	Enable/Disable	Enable	
→*B1.EN*	Enable Compressor B1	Enable/Disable	Enable	
→*B2.EN*	Enable Compressor B2	Enable/Disable	Enable	
→*CS.A1*	CSB A1 Feedback Alarm	Enable/Disable	Enable	
→*CS.A2*	CSB A2 Feedback Alarm	Enable/Disable	Enable	
→*CS.B1*	CSB B1 Feedback Alarm	Enable/Disable	Enable	
→*CS.B2*	CSB B2 Feedback Alarm	Enable/Disable	Enable	
→*REV.R*	Rev Rotation Verified ?	Yes/No	No	
EDT.R	EVAP.DISCHRGE TEMP RESET			
→*RS.CF*	EDT Reset Configuration	0 - 3 (multi-text strings)	2	
→*RTIO*	Reset Ratio	0 - 10	2	
→*LIMT*	Reset Limit	0 - 20 ^F	10	
→*RES.S*	EDT 4-20 ma Reset Input	Enable/Disable	Disable	

ITEM	EXPANSION	RANGE	DEFAULT	ENTRY
HEAT	HEATING CONFIGURATION			
→*HT.CF*	Heating Control Type	0 - 4	0	
→*HT.SP*	Heating Supply Air Setpt	80 - 120 dF	85	
→*OC.EN*	Occupied Heating Enabled	Yes/No	No	
→*LAT.M*	MBB Sensor Heat Relocate	Yes/No	No	
→*G.FOD*	Fan-Off Delay, Gas Heat	45-600	45	
→*E.FOD*	Fan-Off Delay, Elec Heat	10-600	30	
→*SG.CF*	STAGED GAS CONFIGS			
→*SG.CF*→*HT.ST*	Staged Gas Heat Type	0 - 4	0	
→*SG.CF*→*CAP.M*	Max Cap Change per Cycle	5 - 45	45	
→*SG.CF*→*M.R.DB*	S.Gas DB min.dF/PID Rate	0 - 5	0.5	
→*SG.CF*→*S.G.DB*	St.Gas Temp. Dead Band	0 - 5 ^F	2	
→*SG.CF*→*RISE*	Heat Rise dF/sec Clamp	0.05 - 0.2	0.06	
→*SG.CF*→*LAT.L*	LAT Limit Config	0 - 20 ^F	10	
→*SG.CF*→*LIM.M*	Limit Switch Monitoring?	Yes/No	No	
→*SG.CF*→*SW.H.T*	Limit Switch High Temp	110 - 180 dF	170	
→*SG.CF*→*SW.L.T*	Limit Switch Low Temp	100 - 170 dF	160	
→*SG.CF*→*HT.P*	Heat Control Prop. Gain	0 - 1.5	1	
→*SG.CF*→*HT.D*	Heat Control Derv. Gain	0 - 1.5	1	
→*SG.CF*→*HT.TM*	Heat PID Rate Config	60 - 300 sec	90	
SP	SUPPLY STATIC PRESS.CFG.			
→*SP.CF*	Static Pressure Config	0 - 1 (multi-text strings)	No	
→*SP.FN*	Static Pres.Fan Control?	Yes	Yes	
→*SP.S*	Static Pressure Sensor	Enable/Disable	Disable	
→*SP.LO*	Static Press. Low Range	-10 - 0	0	
→*SP.HI*	Static Press. High Range	0 - 10	5	
→*SP.SP*	Static Pressure Setpoint	0 - 5 "H2O	1.5	
→*SP.MN*	VFD Minimum Speed	10 - 50 %	20	
→*SP.MX*	VFD Maximum Speed	50 - 100 %	100	
→*SP.FS*	VFD Fire Speed Override	0 - 100	100	
→*S.PID*	STAT.PRESS.PID CONFIGS			
→*S.PID->SP.TM*	Stat.Pres.PID Run Rate	1 - 200 sec	2	
→*S.PID->SP.P*	Static Press. Prop. Gain	0 - 100	20	
→*S.PID->SP.I*	Static Pressure Intg. Gain	0 - 50	2	
→*S.PID->SP.D*	Static Pressure Derv. Gain	0 - 50	0	
→*S.PID->SP.SG*	Static Press.System Gain	0 - 50	1	
ECON	ECONOMIZER CONFIGURATION			
→*EC.EN*	Economizer Installed?	Yes/No	Yes	
→*EC.MN*	Economizer Min.Position	0 - 100 %	5	
→*EC.MX*	Economizer Max.Position	0 - 100 %	98	
→*E.TRM*	Economzr Trim For SumZ ?	Yes/No	Yes	
→*E.SEL*	Econ ChangeOver Select	0 - 3 (multi-text strings)	1	
→*OA.E.C*	OA Enthalpy ChgOvr Selct	1 - 5 (multi-text strings)	4	
→*OA.EN*	Outdr.Enth Compare Value	18 - 28	24	
→*OAT.L*	High OAT Lockout Temp	–40 - 120 dF	60	
→*O.DEW*	OA Dewpoint Temp Limit	50 - 62 dF	55	
→*ORH.S*	Outside Air RH Sensor	Enable/Disable	Disable	
→*E.TYP*	Economizer Control Type	1-3 (multi-text strings)	1	
→*EC.SW*	Economizer Switch Config	0 - 2 (multi-text strings)	0	
→*E.CFG*	ECON.OPERATION CONFIGS			
→*E.CFG->E.P.GN*	Economizer Prop.Gain	0.7 - 3.0	1	
→*E.CFG->E.RNG*	Economizer Range Adjust	0.5 - 5.0 ^F	2.5	
→*E.CFG->E.SPD*	Economizer Speed Adjust	0.1 - 10.0	0.75	
→*E.CFG->E.DBD*	Economizer Deadband	0.1 - 2.0 ^F	0.5	
→*UEFC*	UNOCC.ECON.FREE COOLING			
→*UEFC->FC.CF*	Unoc Econ Free Cool Cfg	0-2 (multi-text strings)	0	
→*UEFC->FC.TM*	Unoc Econ Free Cool Time	0 - 720 min	120	
→*UEFC->FC.L.O*	Un.Ec.Free Cool OAT Lock	40 - 70 dF	50	

ITEM	EXPANSION	RANGE	DEFAULT	ENTRY
BP	BUILDING PRESS. CONFIG			
→*BP.CF*	Building Press. Config	0-2	0	
→*BP.MT*	Power Exhaust Motors	1-2	1	
→*BP.S*	Building Pressure Sensor	Enable/Dsable	Dsable	
→*BP.R*	Bldg Press (+/-) Range	0 - 1.00	0.25	
→*BP.SP*	Building Pressure Setp.	−0.25 → 0.25 "H2O	0.05	
→*BP.P1*	Power Exhaust On Setp.1	0 - 100 %	35	
→*BP.P2*	Power Exhaust On Setp.2	0 - 100 %	75	
→*B.CFG*	BP ALGORITHM CONFIGS			
→*B.CFG*→*BP.SL*	Modulating PE Alg. Slct.	1-3	1	
→*B.CFG*→*BP.TM*	BP PID Evaluation Time	0 - 10 min	1	
→*B.CFG*→*BP.ZG*	BP Threshold Adjustment	0.1 - 10.0	1	
→*B.CFG*→*BP.HP*	High BP Level	0 - 1.000	0.05	
→*B.CFG*→*BP.LP*	Low BP Level	0 - 1.000	0.04	
D.LV.T	COOL/HEAT SETPT. OFFSETS			
→*L.H.ON*	Dmd Level Lo Heat On	−1 - 2 ^F	1.5	
→*H.H.ON*	Dmd Level(+) Hi Heat On	0.5 - 2.0 ^F	0.5	
→*L.H.OF*	Dmd Level(-) Lo Heat Off	0.5 - 2 ^F	1	
→*L.C.ON*	Dmd Level Lo Cool On	−1 - 2 ^F	1.5	
→*H.C.ON*	Dmd Level(+) Hi Cool On	0.5 - 2 ^F	0.5	
→*L.C.OF*	Dmd Level(-) Lo Cool Off	0.5 - 2 ^F	1	
→*C.T.LV*	Cool Trend Demand Level	0.1 - 5 ^F	0.1	
→*H.T.LV*	Heat Trend Demand Level	0.1 - 5 ^F	0.1	
→*C.T.TM*	Cool Trend Time	30 - 600 sec	120	
→*H.T.TM*	Heat Trend Time	30 - 600 sec	120	
DMD.L	DEMAND LIMIT CONFIG.			
→*DM.L.S*	Demand Limit Select	0 - 3 (multi-text strings)	0	
→*D.L.20*	Demand Limit at 20 ma	0 - 100 %	100	
→*SH.NM*	Loadshed Group Number	0 - 99	0	
→*SH.DL*	Loadshed Demand Delta	0 - 60 %	0	
→*SH.TM*	Maximum Loadshed Time	0 - 120 min	60	
→*D.L.S1*	Demand Limit Sw.1 Setpt.	0 - 100 %	80	
→*D.L.S2*	Demand Limit Sw.2 Setpt.	0 - 100 %	50	
IAQ	INDOOR AIR QUALITY CFG.			
→*DCV.C*	DCV ECONOMIZER SETPOINTS			
→*DCV.C*→*EC.MN*	Economizer Min.Position	0 - 100 %	5	
→*DCV.C*→*IAQ.M*	IAQ Demand Vent Min.Pos.	0 - 100 %	0	
→*AQ.CF*	AIR QUALITY CONFIGS			
→*AQ.CF*→*IQ.A.C*	IAQ Analog Sensor Config	0 - 4 (multi-text strings)	0	
→*AQ.CF*→*IQ.A.F*	IAQ 4-20 ma Fan Config	0 - 2 (multi-text strings)	0	
→*AQ.CF*→*IQ.I.C*	IAQ Discrete Input Config	0 - 2 (multi-text strings)	0	
→*AQ.CF*→*IQ.I.F*	IAQ Disc.In. Fan Config	0 - 2 (multi-text strings)	0	
→*AQ.CF*→*OQ.A.C*	OAQ 4-20ma Sensor Config	0 - 2 (multi-text strings)	0	
→*AQ.SP*	AIR QUALITY SETPOINTS			
→*AQ.SP*→*IQ.O.P*	IAQ Econ Override Pos.	0 - 100 %	100	
→*AQ.SP*→*DAQ.L*	Diff.Air Quality LoLimit	0 - 1000	100	
→*AQ.SP*→*DAQ.H*	Diff.Air Quality HiLimit	100 - 2000	700	
→*AQ.SP*→*D.F.OF*	DAQ PPM Fan Off Setpoint	0 - 2000	200	
→*AQ.SP*→*D.F.ON*	DAQ PPM Fan On Setpoint	0 - 2000	400	
→*AQ.SP*→*IAQ.R*	Diff. AQ Responsiveness	−5 - 5	0	
→*AQ.SP*→*OAQ.L*	OAQ Lockout Value	0 - 2000	0	
→*AQ.SP*→*OAQ.U*	User Determined OAQ	0 - 5000	400	
→*AQ.S.R*	AIR QUALITY SENSOR RANGE			
→*AQ.S.R*→*IQ.R.L*	IAQ Low Reference	0 - 5000	0	
→*AQ.S.R*→*IQ.R.H*	IAQ High Reference	0 - 5000	2000	
→*AQ.S.R*→*OQ.R.L*	OAQ Low Reference	0 - 5000	0	
→*AQ.S.R*→*OQ.R.H*	OAQ High Reference	0 - 5000	2000	
→*IAQ.P*	IAQ PRE-OCCUPIED PURGE			
→*IAQ.P*→*IQ.PG*	IAQ Purge	Yes/No	No	
→*IAQ.P*→*IQ.P.T*	IAQ Purge Duration	5-60 min	15	
→*IAQ.P*→*IQ.P.L*	IAQ Purge LoTemp Min Pos	0-100 %	10	
→*IAQ.P*→*IQ.P.H*	IAQ Purge HiTemp Min Pos	0-100 %	35	
→*IAQ.P*→*IQ.L.O*	IAQ Purge OAT Lockout	35-70 dF	50	

ITEM	EXPANSION	RANGE	DEFAULT	ENTRY
CCN	CCN CONFIGURATION			
→*CCNA*	CCN Address	1 - 239	1	
→*CCNB*	CCN Bus Number	0 - 239	0	
→*BAUD*	CCN Baud Rate	1 - 5 (multi-text strings)	3	
→*BROD*	CCN BROADCST DEFINITIONS			
→*BROD*→*TM.DT*	CCN Time/Date Broadcast	ON/OFF	On	
→*BROD*→*OAT.B*	CCN OAT Broadcast	ON/OFF	Off	
→*BROD*→*ORH.B*	CCN OARH Broadcast	ON/OFF	Off	
→*BROD*→*OAQ.B*	CCN OAQ Broadcast	ON/OFF	Off	
→*BROD*→*G.S.B*	Global Schedule Broadcst	ON/OFF	Off	
→*BROD*→*B.ACK*	CCN Broadcast Ack'er	ON/OFF	Off	
→*SC.OV*	CCN SCHEDULES-OVERRIDES			
→*SC.OV*→*SCH.N*	Schedule Number	0 - 99	1	
→*SC.OV*→*HOL.T*	Accept Global Holidays?	YES/NO	No	
→*SC.OV*→*O.T.L.*	Override Time Limit	0 - 4 HRS	1	
→*SC.OV*→*OV.EX*	Timed Override Hours	0 - 4 HRS	0	
→*SC.OV*→*SPT.O*	SPT Override Enabled ?	YES/NO	Yes	
→*SC.OV*→*T58.O*	T58 Override Enabled ?	YES/NO	Yes	
→*SC.OV*→*GL.OV*	Global Sched. Override ?	YES/NO	No	
ALLM	ALERT LIMIT CONFIG.			
→*SP.L.O*	SPT lo alert limit/occ	−10-245 dF	60	
→*SP.H.O*	SPT hi alert limit/occ	−10-245 dF	85	
→*SP.L.U*	SPT lo alert limit/unocc	−10-245 dF	45	
→*SP.H.U*	SPT hi alert limit/unocc	−10-245 dF	100	
→*SA.L.O*	EDT lo alert limit/occ	−40-245 dF	40	
→*SA.H.O*	EDT hi alert limit/occ	−40-245 dF	100	
→*SA.L.U*	EDT lo alert limit/unocc	−40-245 dF	40	
→*SA.H.U*	EDT hi alert limit/unocc	−40-245 dF	100	
→*RA.L.O*	RAT lo alert limit/occ	−40-245 dF	60	
→*RA.H.O*	RAT hi alert limit/occ	−40-245 dF	90	
→*RA.L.U*	RAT lo alert limit/unocc	−40-245 dF	40	
→*RA.H.U*	RAT hi alert limit/unocc	−40-245 dF	100	
→*R.RH.L*	RARH low alert limit	0-100 %	0	
→*R.RH.H*	RARH high alert limit	0-100 %	100	
→*SP.L*	SP low alert limit	0-5 "H2O	0	
→*SP.H*	SP high alert limit	0-5 "H2O	2	
→*BP.L*	BP lo alert limit	−0.25-0.25 "H2O	-0.25	
→*BP.H*	BP high alert limit	−0.25-0.25 "H2O	0.25	
→*IAQ.H*	IAQ high alert limit	0-5000	1200	
TRIM	SENSOR TRIM CONFIG.			
→*SAT.T*	Air Temp Lvg SF Trim	−10 - 10 ^F	0	
→*RAT.T*	RAT Trim	−10 - 10 ^F	0	
→*OAT.T*	OAT Trim	−10 - 10 ^F	0	
→*SPT.T*	SPT Trim	−10 - 10 ^F	0	
→*CTA.T*	Cir A Sat.Cond.Temp Trim	−30 - 30 ^F	0	
→*CTB.T*	Cir B Sat.Cond.Temp Trim	−30 - 30 ^F	0	
→*SP.A.T*	Suct.Press.Circ.A Trim	−50 - 50 PSIG	0	
→*SP.B.T*	Suct.Press.Circ.B Trim	−50 - 50 PSIG	0	
→*DP.A.T*	Dis.Press.Circ.A Trim	−50 - 50 PSIG	0	
→*DP.B.T*	Dis.Press.Circ.B Trim	−50 - 50 PSIG	0	
SW.LG	SWITCH LOGIC: NO / NC			
→*FTS.L*	Filter Status Inpt-Clean	Open/Close	Open	
→*IGC.L*	IGC Feedback - Off	Open/Close	Open	
→*RMI.L*	RemSw Off-Unoc-Strt-NoOv	Open/Close	Open	
→*ECS.L*	Economizer Switch - No	Open/Close	Open	
→*SFS.L*	Fan Status Sw. - Off	Open/Close	Open	
→*DL1.L*	Dmd.Lmt.Sw.1 - Off	Open/Close	Open	
→*DL2.L*	Dmd.Lmt.Sw.2 - Off	Open/Close	Open	
→*IAQ.L*	IAQ Disc.Input - Low	Open/Close	Open	
→*FSD.L*	Fire Shutdown - Off	Open/Close	Open	
→*PRS.L*	Pressurization Sw. - Off	Open/Close	Open	
→*EVC.L*	Evacuation Sw. - Off	Open/Close	Open	
→*PRG.L*	Smoke Purge Sw. - Off	Open/Close	Open	
DISP	DISPLAY CONFIGURATION			
→*TEST*	Test Display LEDs	ON/OFF	Off	
→*METR*	Metric Display	ON/OFF	Off	
→*LANG*	Language Selection	0-1(multi-text strings)	0	
→*PAS.E*	Password Enable	ENABLE/DISABLE	Enable	
→*PASS*	Service Password	0000-9999	1111	

CL-4

UNIT START-UP CHECKLIST

MODEL NO.: _____   SERIAL NO.: _____

SOFTWARE VERSION _____   TECHNICIAN: _____

DATE: _____

PRE-START-UP:

☐ VERIFY THAT DIP SWITCH SETTINGS ARE CORRECT

☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT

☐ REMOVE ALL COMPRESSOR SHIPPING HOLDDOWN BOLTS AND BRACKETS PER INSTRUCTIONS

☐ VERIFY INSTALLATION OF ECONOMIZER HOOD

☐ VERIFY INSTALLATION OF ALL OPTIONS AND ACCESSORIES

☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT

☐ CHECK GAS PIPING FOR LEAKS (48A ONLY)

☐ CHECK THAT RETURN-AIR FILTER AND OUTDOOR-AIR FILTERS ARE CLEAN AND IN PLACE

☐ VERIFY THAT UNIT IS LEVEL WITHIN TOLERANCES FOR PROPER CONDENSATE DRAINAGE

☐ CHECK FAN WHEELS AND PROPELLERS FOR LOCATION IN HOUSING/ORIFICE, AND SETSCREW IS TIGHT

☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED

☐ VERIFY THAT SUCTION, DISCHARGE, AND LIQUID SERVICE VALVES ON EACH CIRCUIT ARE OPEN

☐ VERIFY THAT CRANKCASE HEATERS HAVE BEEN ON 24 HOURS BEFORE START-UP.

START-UP:

ELECTRICAL

SUPPLY VOLTAGE   L1-L2 _____   L2-L3 _____   L3-L1 _____

COMPRESSOR AMPS — COMPRESSOR NO. 1   L1 _____   L2 _____   L3 _____

COMPRESSOR AMPS — COMPRESSOR NO. 2   L1 _____   L2 _____   L3 _____

SUPPLY FANS AMPS   (CV) _____   EXHAUST FAN AMPS _____

(VAV) _____ *

*VAV fan supply amps reading must be taken with a true RMS meter for accurate readings.

TEMPERATURES

OUTDOOR-AIR TEMPERATURE   _____ F DB (Dry Bulb)

RETURN-AIR TEMPERATURE   _____ F DB_____ F WB (Wet Bulb)

COOLING SUPPLY AIR   _____ F

GAS HEAT SUPPLY AIR   _____ F (48A ONLY)

ELECTRIC HEAT SUPPLY AIR   _____ F (50A ONLY, IF EQUIPPED)

PRESSURES

GAS INLET PRESSURE   _____ IN. WG (48A ONLY)

GAS MANIFOLD PRESSURE   STAGE NO. 1 _____ IN. WG   STAGE NO. 2 _____IN. WG (48A ONLY)

REFRIGERANT SUCTION   CIRCUIT NO. 1 _____PSIG   CIRCUIT NO. 2_____ PSIG

REFRIGERANT DISCHARGE   CIRCUIT NO. 2 _____ PSIG   CIRCUIT NO. 2_____ PSIG

☐ _____ VERIFY REFRIGERANT CHARGE.

CUT ALONG DOTTED LINE

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