



**48NP  
50NB,NP**

## Single-Package Heating/Cooling Units With Product Integrated Controls



# Controls, Operation, and Troubleshooting

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Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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## SAFETY CONSIDERATIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components; and equipment location (roof, elevated structures, etc.). Only trained, qualified installers and service mechanics should install, start up, and service this equipment.

When working on this equipment, observe precautions in the literature; on tags, stickers, and labels attached to the equipment, and any other safety precautions that apply. Follow all safety codes. Wear safety glasses and work gloves. Use care in handling, rigging, and setting this equipment, and in handling all electrical components.

### ⚠ WARNING

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation and service. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

### ⚠ WARNING

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.

## GENERAL

### Carrier Comfort Network System Architecture (Fig. 1)

**IMPORTANT:** This literature contains controls, operation, and troubleshooting data for 48NP and 50NB,NP rooftop units. Use this guide in conjunction with the separate Installation Instructions literature packaged with the unit.

Precise control is provided for stand-alone operation of HVAC (Heating, Ventilation, and Air Conditioning) equipment by factory-installed processor and relay modules. An accessory keypad and display module is also required. Carrier NB,NP units contain factory-installed Product Integrated Controls (PIC). Sensors that monitor equipment operation and conditions in the occupied spaces are connected to the standard processor module in the unit, and outputs from the standard processor module serve to control unit operation. Each PIC-equipped unit is shipped from the factory with all applicable control hardware and software installed and ready for start-up.

The same standard modules can be applied to equipment in the field. A FID (field-installed device) is a UT203 controller for use with HVAC equipment built by manufacturers other than Carrier.

HVAC and other building equipment being controlled by PICs or FIDs have the inherent ability to 'talk' on a common communications bus or network. The configuration of the communications bus with 2 or more PIC- or FID-controlled pieces of equipment is referred to as a Carrier Comfort Network (CCN) system. The CCN communications bus conveys commands, data, and alarms between all elements of the system. Any system element connected to the bus may communicate with any other system element, regardless of their physical locations. The communications bus consists of a field-supplied, shielded, 3-conductor cable connected in daisy-chain fashion. The PICs, FIDs, and optional network products can be added at any time to the network.

The main human interface with the CCN system is the Building Supervisor. The Building Supervisor consists of an IBM PC compatible computer equipped with Carrier controls software that allows it to connect to the communications bus and 'talk' directly with any equipment connected to the network. An operator working at a Building Supervisor can command, monitor, configure, or modify any portion of the system. More than one Building Supervisor can be used. The Building Supervisor, in conjunction with optional network products, can generate a wide variety of managerial reports which reflect the operational characteristics of one or more buildings.

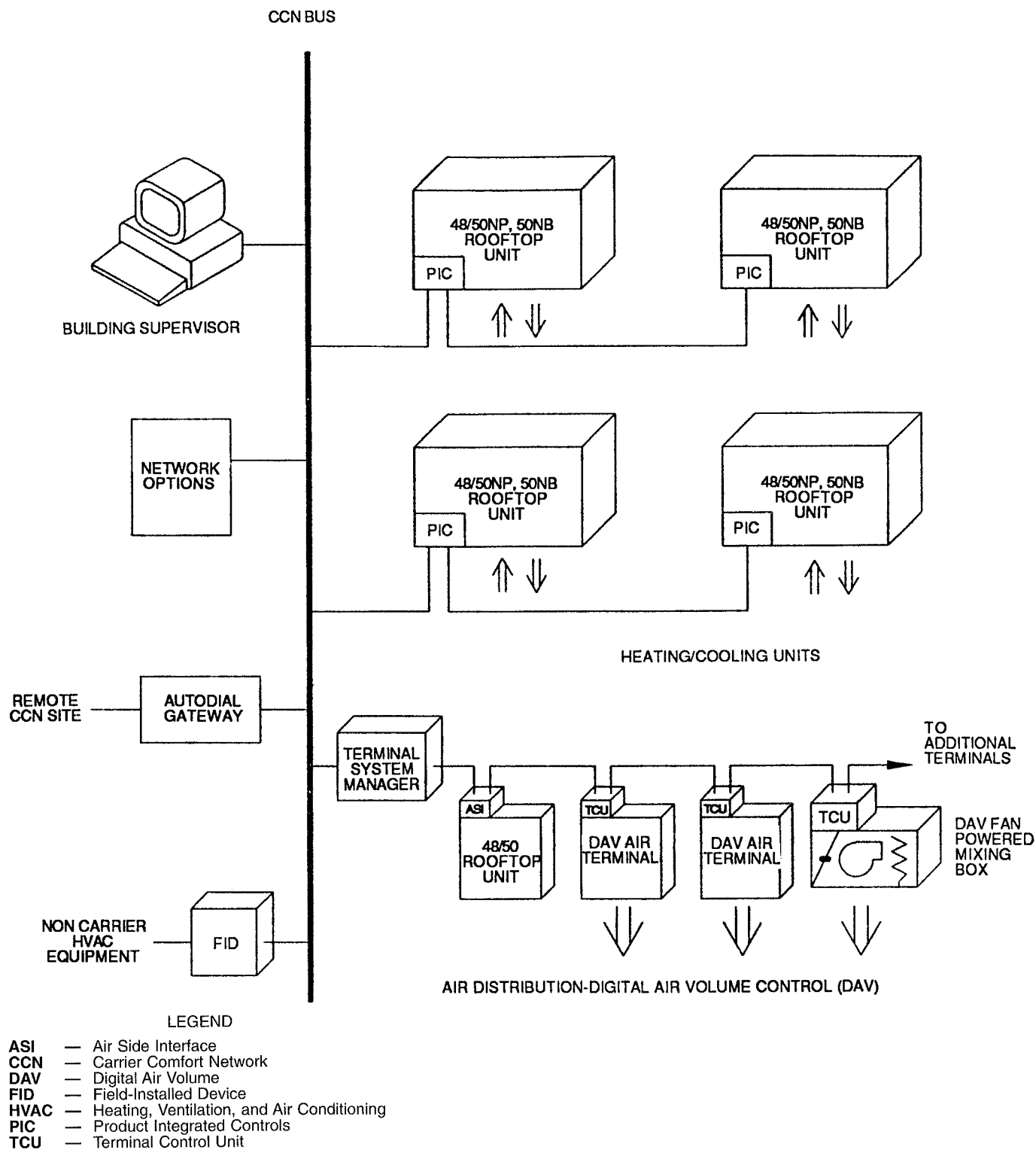


**Fig. 1 — CCN System Architecture**

To take further advantage of the network, accessory or optional control options module that performs specialized functions can be added to the communications bus at any time to enhance the CCN system's capabilities. Each control options module consists of a standard hardware module with special purpose algorithms and communications software that provide an advanced control function for the entire CCN system or a designated portion of the system. Data collection, remote communications, demand limiting, and tenant billing are a few examples of the network options available to give the building owner increased system performance and superior building management capabilities.

Zoned systems meet the zone temperature control needs for many commercial applications. These systems utilize a microelectronic thermostat as a basis for individual zone control and typically build multiple-zone systems with constant volume (CV) or variable-air volume (VAV) units. Zoned systems can provide complete control of heating and cooling equipment and zone dampers in many types of HVAC systems.

### PIC Rooftop Information

The PIC rooftop controls cycle evaporator-fan motor, compressors, and unloaders to maintain the proper temperature conditions. The controls also cycle condenser fans to maintain suitable head pressure. Safeties are continuously monitored to prevent the unit from operating under abnormal conditions. The controls cycle heat as required and provide control of economizer, power exhaust, and inlet guide vane actuators or variable frequency drives.

A scheduling function, programmed by the user, controls the unit occupied/unoccupied schedule. The controls also allow the service person to operate a 'quick test' so that all the controlled components can be checked for proper operation.

The PIC controls are modular and use a processor module (PSIO), 2 relay modules (DSIO1 and DSIO2), a control option module (optional/accessory PSIO2), and a keypad and display module (accessory HSIO or LID).

## MAJOR CONTROL COMPONENTS

**General** — The control system consists of the following components (see Fig. 2):

- standard processor module (PSIO 8088 or PSIO1)
- accessory/optional control options module (PSIO 8052 or PSIO2)
- two standard high-voltage relay modules (DSIO1 and DSIO2)
- accessory keypad and display module (HSIO or LID)
- enthalpy sensor
- thermistors
- pressure transducers
- accessory humidity sensors
- space temperature sensors (standard T55 and accessory T56)
- supply-air fan status switch
- check filter switch

### Features

**PROCESSOR MODULE NO. 1 (Standard)** — The PSIO1 module contains the factory-loaded software that monitors and processes the following inputs, outputs, and system information:

#### INPUTS:

- transducers
- thermistors
- switches

#### OUTPUTS:

- condenser-fan contactors
- optional integrated economizer motor (4-20 mA)
- optional inlet guide vanes or variable frequency drive motor (4-20 mA)
- optional modulating power exhaust dampers motor (4-20 mA)
- heat stages 1 and 2 operation

### ⚠ CAUTION

The PSIO1 module contains a specially-designed battery that provides power to maintain the module software in the event of unit power failure. DO NOT remove this battery, or system software will be lost if there is a unit power failure.

#### SYSTEM INFORMATION:

- generates alert and alarm information (via transducer, thermistor, and sensor inputs)
- supports level II communications
- supports digital air volume (DAV) interface

**NOTE:** The correct module address for the PSIO1 is 01 (S1 set at 0; S2 set at 1).

**CONTROL OPTIONS MODULE (Option or Accessory)** — The PSIO2 can be purchased on its own (as a field-installed accessory) or as part of the factory-installed control option module. The PSIO2 module does not contain software. Through input and output channels on the hardware, it supports the sensors used for:

- humidity control
- outdoor-air cfm
- indoor-air quality (IAQ)
- smoke control
- superheat monitoring (only when PSIO2 is factory-installed as part of the optional control options module)

In addition, the PSIO2 supplies the outputs (4-20 mA signal) for humidity and hydronic heating coil control and a discrete output (4-20 mA signal) with timed clock control (for outdoor building or parking lot lights).

**NOTE:** The correct module address for the PSIO2 is 31 (S1 set at 3; S2 set at 1). See Fig. 2 for PSIO2 location.

**HIGH-VOLTAGE RELAY MODULES (DSIO1 and DSIO2)** — The DSIO modules close contacts to energize evaporator and condenser fan contactors. The modules also control compressor unloaders, compressor contactors, compressor crank-case heaters, heat interlock relay, power exhaust contactor, and heat stages 3 through 5 (50NB,NP only). The compressor status through the compressor lockout (CLO) relays and high-pressure switches (safety circuits) are the inputs to these modules.

**NOTE:** The correct module addresses for the DSIO1 and DSIO2 modules are 19 and 49, respectively. Set the switch closest to the mounting plate at 1 (DSIO1) or 4 (DSIO2), and the other switch at 9 (both modules). See Fig. 2 for DSIO locations.

# LEGEND

|       |                                     |
|-------|-------------------------------------|
| C     | Contactor                           |
| CB    | Circuit Breaker                     |
| CCB   | Control Circuit Breaker             |
| CLO   | Compressor Lockout                  |
| COM   | Common                              |
| COMM  | Communication Plug Module           |
| DSIO  | High-Voltage Relay Module           |
| DU    | Dummy Terminal                      |
| ECON  | Economizer                          |
| EQUIP | Equipment                           |
| FU    | Fuse                                |
| GND   | Ground                              |
| HR    | Heat Interlock Relay                |
| HR    | Heater Relay                        |
| HSIO  | Keypad and Display Module           |
| IDC   | Induced-Draft Contactor (48NP Only) |
| IFC   | Indoor (Evaporator)                 |
| IFCB  | Fan Contactor                       |
| IGV   | Indoor (Evaporator)                 |
| MM    | Fan Circuit Breaker                 |
| NC    | Inlet Guide Vane                    |
| NEC   | Head Pressure Control               |
| NO    | Device                              |
| OFC   | Normally Closed                     |
| PEDM  | Normally Open                       |
| PL    | Fan Contactor                       |
| PL    | Power Exhaust Damper                |
| PL    | Motor                               |
| PL    | Plug Assembly                       |
| PL    | Processor Module                    |
| PWR   | Power                               |
| RFM   | Return Fan Motor                    |
| SEC   | Secondary                           |
| TB    | Terminal Block                      |
| TRAN  | Transformer                         |

## COMPONENT ARRANGEMENT-MAIN CONTROL BOX

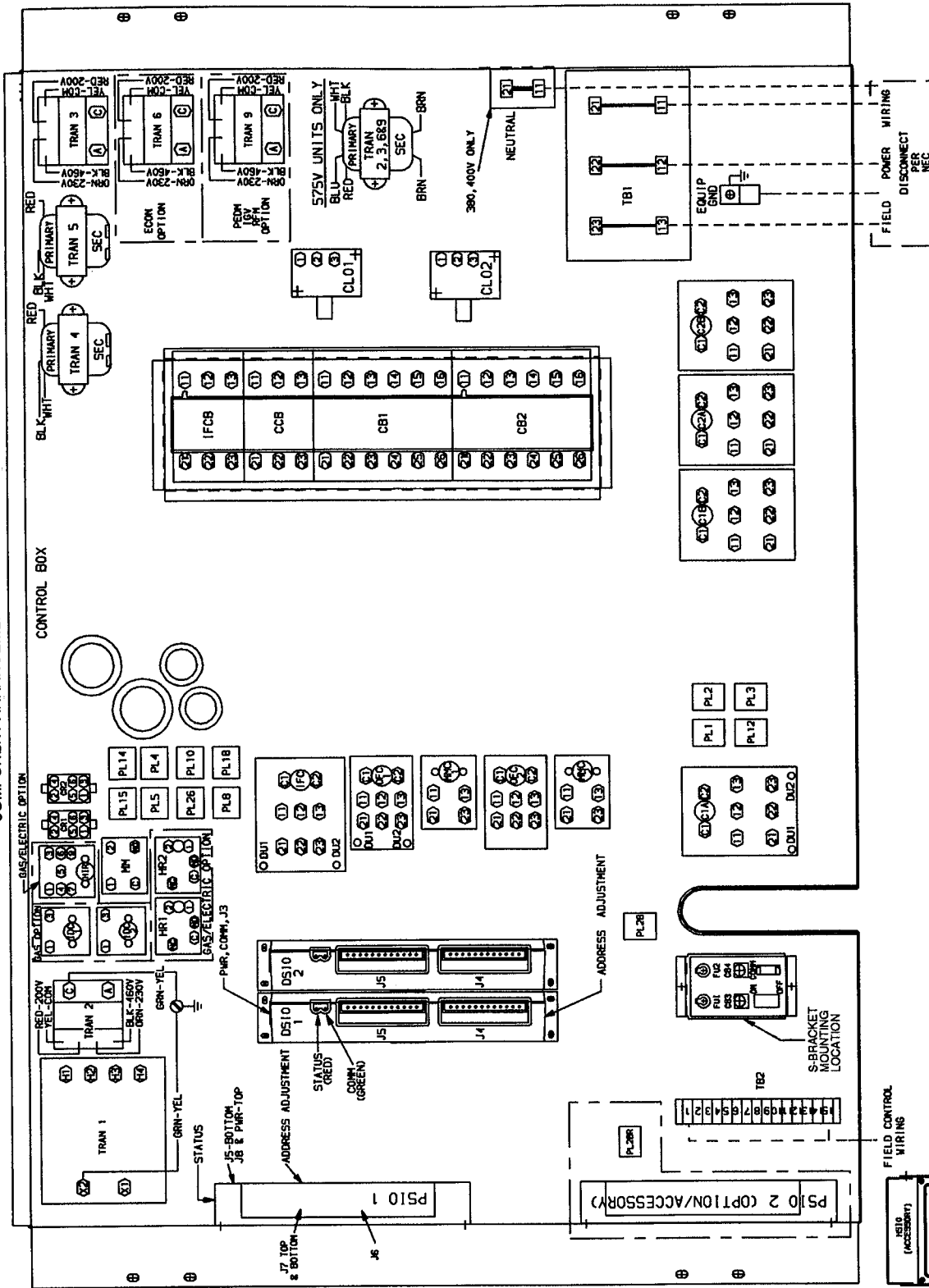


Fig. 2 — Major Control Components in Control Box (054-074 Shown)

**KEYPAD AND DISPLAY MODULE (HSIO OR LID)** — This device consists of a keypad with 6 function keys, 5 operative keys, 12 numeric keys, and an alpha-numeric 8-character LCD (liquid crystal display). Key usage is explained in Keypad and Display Module section on page 12.

**ECONOMIZER, POWER EXHAUST, AND INLET GUIDE VANE ACTUATORS** — The PIC controls output a 4–20 mA signal to each of the actuators in the unit to modulate them as required by the control algorithm. All dampers are spring-return type to allow automatic closing of the damper on power loss. The actuators have a maximum rotation of 160 degrees, and contain a series of DIP (dual, in-line package) switches so that the maximum rotation can be tailored for the damper that is being controlled.

**VARIABLE FREQUENCY DRIVES** — If a variable frequency drive (VFD) is preferred for evaporator-fan control, the PSIO1 output that normally controls the variable inlet guide vanes may be used to control the VFD. Either a factory-installed optional VFD or a field-supplied VFD may be used.

**THERMISTORS AND REFRIGERANT PRESSURE TRANSDUCERS** — The NB,NP control system gathers information from the sensors to control the operation of the unit. The NB,NP units use 6 standard and 2 additional accessory or optional thermistors and up to 7 accessory pressure transducers to monitor various temperatures and pressures at selected points throughout the system.

## DIGITAL AIR VOLUME (DAV) LINKAGE

Carrier rooftop units with PIC may also have a communication linkage with the VAV terminal units in a particular application. This linkage is called the DAV linkage. In order for this linkage to be possible, the individual VAV air terminals must be equipped with Carrier PIC controls and the air terminals must be linked by a Terminal System Manager (TSM). The TSM acts as the communication link between the VAV air terminal PICs and the rooftop unit. When the TSM is fully programmed and begins communication, the rooftop control begins using inputs from the TSM for rooftop unit control operation. This is automatic, and does not require a configuration change to the standard rooftop unit PIC.

**Linkage Data and Operation** — The values from the TSM which are used as linkage data by the rooftop PIC control are found in Table 1.

**Table 1 — TSM Linkage Codes**

| ITEM     | DEFINITION                        |
|----------|-----------------------------------|
| AOCS     | Average Occupied Cool Set Point   |
| AOHS     | Average Occupied Heat Set Point   |
| AOZT     | Average Occupied Zone Temperature |
| AUCS     | Average Unoccupied Cool Set Point |
| AUHS     | Average Unoccupied Heat Set Point |
| AZT      | Average Zone Temperature          |
| NEXTOCDD | Next Occupied Day                 |
| NEXTOCCT | Next Occupied Time                |
| NEXTUNOD | Next Unoccupied Day               |
| NEXTUNOT | Next Unoccupied Time              |
| OCCSTAT  | Occupancy Status                  |
| PREVUNOD | Previous Unoccupied Day           |
| PREVUNOT | Previous Unoccupied Time          |

**Cooling/Heating Routines** — When the rooftop unit PIC is part of a DAV system, the rooftop unit PIC utilizes

information supplied by the TSM to control cooling, heating, and economizer routines instead of using its own return air and space temperature sensors. The AOHS, AOCS, AUHS, and AUCS from the TSM are used instead of the rooftop unit PIC configured set points. The rooftop unit uses the occupancy status information through the communication linkage, such as NEXTOCCT and NEXTUNOT, instead of its internal occupancy schedule.

**VAV Systems** — During occupied and biased occupied periods on VAV systems, the rooftop unit PIC uses the AOZT from the TSM to replace the rooftop unit PIC return-air temperature sensor value. During unoccupied periods, the rooftop unit PIC uses the AZT from the TSM instead of the rooftop unit PIC space temperature and return-air temperature sensor values.

**Optimal Start Routine** — The following TSM points are used in the optimal start portion of the rooftop unit PIC adaptive optimal start/stop routine (AOSS). The rooftop PIC uses the AZT, NEXTOCCT, NEXTOCDD, PREVUNOT, and PREVUNOD from the TSM to compute optimal start. The rooftop PIC uses this information to calculate a bias time that is then used by both the rooftop PIC and the TSM. When the current time of day is greater than the biased start time, the rooftop PIC uses the AOZT from the TSM to determine when the occupied set point has been achieved.

**Nighttime Free Cooling** — When the nighttime free cooling is configured, the rooftop PIC uses the AZT from the TSM instead of the space temperature to determine if nighttime free cooling should operate.

**Cold Deck Reset** — When cold deck reset is configured, the rooftop unit PIC uses the AOZT and the AOCS from the TSM instead of the space temperature to determine the amount of reset required.

**Linkage Alarms** — If the rooftop unit PIC which had previously been operating as part of a DAV system detects a communication failure between the rooftop unit and the TSM, the rooftop unit PIC continues to operate for 5 minutes using the last information it received from the TSM. If communication resumes within the 5 minute period, normal system operation continues. If the communication failure persists beyond 5 minutes, the rooftop unit PIC generates a linkage failure alarm. At that time, the rooftop unit PIC will return to stand-alone operation using its own sensors and set points.

If the internal occupancy schedule for the rooftop unit PIC has not been configured, the controls will maintain the same occupancy state as prior to the linkage failure. If the occupancy schedule is configured on the rooftop unit PIC, the controls will maintain the same occupancy state as prior to the linkage failure until the next scheduled occupancy transition. At that time, the rooftop unit PIC will revert to its own internal occupancy schedule.

If communication is restored, normal DAV system operation resumes, and the rooftop unit PIC generates a linkage return-to-normal message.

## COOLING CONTROL

**Cooling Master Control Loop** — In order for the cooling algorithms to run, the rooftop unit evaporator fan must be running. Cooling control operates as detailed in the following sections. See Table 2 for cooling control operation definitions.

**Table 2 — Cooling Control Operation Definitions**

| ITEM     | DEFINITION                                                    |
|----------|---------------------------------------------------------------|
| CCSR     | Cooling Control Submaster Reference                           |
| CV       | Constant Volume                                               |
| LIMIT    | Reset Limit                                                   |
| OCSP     | Occupied Cooling Set Point (Space Set Point)                  |
| OHSP     | Occupied Heating Set Point (Space Set Point)                  |
| PID      | Proportional, Integral, Derivative Controls                   |
| RESET    | Cold Deck Reset Value (Based on Space Temperature)            |
| RTIO     | Reset Ratio                                                   |
| SASP     | Supply Air Set Point                                          |
| SAT      | Supply Air Temperature                                        |
| SATRESET | Cold Deck Reset Value (Based on 2 to 10 v Input)              |
| SATRV    | Input Voltage to Control Reset (VAV) or Offset (CV)           |
| SPT      | Space Temperature                                             |
| STO      | Space Temperature Offset                                      |
| SUM      | Proportional PID Parameter Based on Temperature               |
| VAV      | Variable Air Volume                                           |
| Z        | Calculated Integral Limit Based on Temperature Rise Per Stage |

**BASIC COOLING OPERATION** — The cooling control loop is used to calculate the desired supply air temperature needed to satisfy the space temperature (CV) or the supply air set point (VAV). The calculated CCSR is then used by the capacity algorithm (cooling submaster loop) to control the required number of cooling stages.

**UNIT CONFIGURED FOR CV OPERATION** — For CV operation, the master loop calculates a CCSR as follows:

$$\text{CCSR} = \text{PID calculation based on OCSP} + \text{STO} - \text{SPT}$$

The result of the PID calculation is additionally modified by an overall PID loop gain.

**UNIT CONFIGURED FOR VAV OPERATION** — For VAV operation, the master loop calculates a cooling submaster reference (modified SASP) as follows:

$$\text{CCSR} = \text{SASP} + \text{RESET}$$

**RESET OF SUPPLY AIR TEMPERATURE, VAV UNITS** — Reset of the supply air temperature can be accomplished by configuring the control to reset based on either space temperature or on a 2 to 10 vdc signal from an energy management system. Reset operates as follows:

$$1. \text{ RESET} = \text{RTIO} \times (\text{OCSP} - \text{PT})$$

The calculated reset value is compared to the LIMIT. If the reset value is greater than the LIMIT, the sequence will use the LIMIT as the reset value.

$$2. \text{ SATRESET} = 20^\circ \text{ F} \times (\text{SATRV} - 2) \div 8$$

Reset based on space temperature must be configured as ON to operate. Reset based on external input operates whenever the jumper on channel 42 is removed. If both space temperature reset and reset based on external input are active, the control will use the greater value of reset.

**SPACE TEMPERATURE OFFSET, CV UNITS** — The space temperature set point for CV units may be offset by the use of the T56 space sensor with the slide offset control, or by use of a 2 to 10 vdc signal from an energy management system. The T56 offset has a range of  $\pm 5^\circ \text{ F}$  from the space temperature set point. The external offset control operates as follows:

$$\text{OFFSET (Heat)} = \text{OHSP} - (\text{SATRV} - 2) \div 8 \times 20$$

$$\text{OFFSET (Cool)} = \text{OCSP} + (\text{SATRV} - 2) \div 8 \times 20$$

**Cooling Submaster Control Loop** — The cooling submaster control loop is capable of controlling 6 stages of cooling (2 compressors and 4 unloaders). The control maintains the supply air temperature at the value calculated by the master control algorithm. Both supply- and return-air sensors are used to adjust the cycling deadband to match the

actual load. The logic for determining when to add or subtract a stage is a time-based integration of the deviation from the set point plus the rate of change of the supply-air temperature.

**STAGED COOLING SUBMASTER** — The staged cooling submaster algorithm calculates the following 2 functions:

**SUM** = PID control factor based on deviation from modified SASP and rate of change of supply air temperature.

**Z** = Adjustable integrated limit based on temperature rise per stage.

If the supply air temperature is above the set point and the rate of change of SAT is positive, SUM will increase. If the next capacity stage is a compressor, when SUM becomes greater than Z, a stage of capacity is added, and SUM is set to zero. If the next stage of capacity is an unloader, when SUM becomes greater than  $0.6 \times Z$ , a stage of capacity is added, and SUM is set to zero.

If the SAT is below the set point, and the rate of change of SAT is negative, SUM will decrease. Under these conditions, compression will unload using the same method as the load up description above. See Table 3 for configuration information.

## HEATING CONTROL

**Heating Master Control Loop** — When reading the heating information below, keep in mind that:

- Whenever any heat stages are energized, the heat interlock relay (HIR) will be energized.
- If the unit has electric heat and any compressors are energized, the heat stages will be set to zero.
- Morning warmup in a VAV unit occurs when the adaptive optimal start algorithm calculates a biased occupied start time, and the unit has a heating demand (i.e.,  $\text{RAT} < \text{heating set point}$ ). Warmup will continue into the occupied period as long as there is a call for heat; even if occupied heating is disabled.
- When hydronic heat is used, the SAT sensor needs to be located downstream of the field-installed hydronic coil.
- In order for the heating algorithms to run, the rooftop unit evaporator fan must be running. Heating control operates as detailed in the following sections. See Table 4 for heating control operation definitions.

**BASIC HEATING OPERATION** — The heating control loop is used to calculate the desired supply air temperature needed to satisfy the space temperature (CV) or the return air (VAV) set point. The calculated HSR is then used by the capacity algorithm (heating submaster loop) to control the required number of heating stages or valve position for the hydronic coil.

**UNIT CONFIGURED FOR CV OPERATION** — For CV operation, the master loop calculates an HSR as follows:

$$\text{HSR} = \text{PID calculation based on OHSP} + \text{STO} - \text{SPT}$$

**UNIT CONFIGURED FOR VAV OPERATION** — For units configured as VAV, a preliminary heat check is performed before the true PID calculation is performed. First, the following equation must be true:

$$\text{RAT} < \text{OHSP} - \text{SATRESET}$$

In addition, one of the following must be true:

- Unit is in unoccupied state
- Unit is performing warmup (warmup may be started during optimal start mode and continue until the set point is satisfied)
- OHEN option is enabled
- For VAV operation, the master loop calculates a heating submaster reference as follows:

$$\text{HSR} = \text{PID calculation based on OHSP} - \text{SATRESET} - \text{RAT}$$

**Table 3 — Cooling Control and Reset Configuring**

| SET POINT | DESCRIPTION                | HOW TO CONFIGURE                                                                                                     | RANGE          |
|-----------|----------------------------|----------------------------------------------------------------------------------------------------------------------|----------------|
| LIMIT     | Reset Limit                | Bldg Supv or <input type="text" value="1"/> <input type="text" value="4"/> <input type="text" value="SRVC"/> on HSIO | 0 to 20 F      |
| OCSP      | Occupied Cooling Set Point | Bldg Supv or <input type="text" value="1"/> <input type="text" value="SET"/> on HSIO                                 | 55 to 80 F     |
| RSEN      | Supply Air Reset           | <input type="text" value="6"/> <input type="text" value="SRVC"/> on HSIO only                                        | Enable/Disable |
| RTIO      | Reset Ratio                | Bldg Supv or <input type="text" value="1"/> <input type="text" value="4"/> <input type="text" value="SRVC"/> on HSIO | 0 to 10 F      |
| SASP      | Supply Air Set Point       | Bldg Supv or <input type="text" value="1"/> <input type="text" value="SET"/> on HSIO                                 | 45 to 70 F     |
| TYPE      | Unit Type                  | <input type="text" value="3"/> <input type="text" value="SRVC"/> on HSIO only                                        | CV/VAV         |

**LEGEND**

Bldg Supv — Building Supervisor    HSIO — Keypad and Display Module  
CV — Constant Volume    VAV — Variable Air Volume

**Table 4 – Heating Control Operation Definitions**

| ITEM      | DEFINITION                                                         |
|-----------|--------------------------------------------------------------------|
| CV        | Constant Volume                                                    |
| ECSO      | Economizer Set Point Offset                                        |
| HCSCV     | Heating Coil Submaster Center Value                                |
| HCSMG     | Heating Coil Submaster Gain                                        |
| HD        | Heat Demand (Degrees F for Staged Heat and Percent for Modulating) |
| HS        | Heating Stages                                                     |
| HSR       | Heating Submaster Reference                                        |
| IAQ       | Indoor Air Quality Function                                        |
| IAQRR     | Indoor Air Quality Reheat Reference                                |
| OAT       | Outdoor Air Temperature                                            |
| OHEN      | Occupied Heat Enable/Disable                                       |
| OHSP      | Occupied Heating Set Point (Space Set Point)                       |
| PID       | Proportional, Integral, Derivative Controls                        |
| RAT       | Return Air Temperature                                             |
| RESET     | Cold Deck Reset Value                                              |
| SASP      | Supply Air Set Point                                               |
| SAT       | Supply Air Temperature                                             |
| SAT-RESET | Cold Deck Reset Value (Based on 2 to 10 v Input)                   |
| SHSMG     | Staged Heating Submaster Gain                                      |
| SPT       | Space Temperature                                                  |
| STO       | Space Temperature Offset (CV Only)                                 |
| VAV       | Variable Air Volume                                                |

**VAV RESET WHEN IN IAQ MODE** — In addition to the heating functions above, this control can provide reheat when the unit is operating in the IAQ mode. When IAQ is active, IAQ reheat is active and will output a 4-20 mA signal when a call for heating exists, even if the unit is not configured for heating operation.

IF                    IAQ is active and OAT < SASP  
THEN                IAQRR = SASP + RESET – ECSO – 5  
OTHERWISE        IAQRR = 0

**Heating Submaster Control Loop** — The heating submaster loop uses the HSR that is calculated by the heating master loop algorithm. The submaster algorithm that is used by the control depends on whether unit is configured for staged heat or modulating heat output.

**STAGED HEAT OUTPUT** — The control can provide up to 5 stages of heating (only 2 stages are used in these units). The following equations describe the staged heating control:

HD (F) = HSR – SAT  
IF                    – SHSMG < HD < + SHSMG,  
THEN HS will not change  
IF                    – SHSMG > HD > + SHSMG,  
THEN HS = HD ÷ SHSMG

The new HS value is rounded and clamped between zero and the configured maximum heat stages. If the new HS value is different from the current heat stages, the algorithm will switch to a 5-second reschedule time and add or remove a heat stage every 5 seconds until the required number of stages is on. Then the algorithm shall return to its original 2-second reschedule interval.

**MODULATING HEAT SUBMASTER** — The control can provide modulating (4-20 mA) heating control for a field-installed hydronic coil. The following equation describes the modulating heat control:

HD (percentage) = HCSMG x (HSR – SAT) + HCSCV

See Table 5 for more information on configuring heating control.

## DEHUMIDIFICATION AND REHEAT

When the rooftop unit is configured for electric heat, both compression and heat cannot operate at once. This is because the unit wiring is not sized for simultaneous compression and electric heat.

Dehumidification and reheat will work when unit is configured for either gas or analog heat (water/steam valve) output.

Reheat may operate simultaneously with dehumidification.

**Dehumidification Sequence of Operation** — If the evaporator fan is off, the submaster routine is set to the highest cooling coil submaster value. If the evaporator fan is on, the system checks for a humidity sensor.

If the system has a humidity sensor, the call for dehumidification is checked by comparing humidity value with high humidity override (HHOR) set point. If the humidity exceeds the HHOR set point, the sequence will output the lowest reference value to the submaster loop.

The unit will then normally stage up compression to full unit capacity.

**Reheat Sequence of Operation** — If the evaporator fan is off, all stages of heat are turned off. If the evaporator fan is on, the control checks for whether the unit is in CV or VAV operation.

If the system is operating in CV mode, the call for heating is checked by comparing the space temperature to the OHSP (occupied heating set point). If the space temperature is less than the OHSP, the control will compute a submaster reference value and output it to the submaster loop.

If the system is operating in VAV mode, occupied heating must configured to on. The call for heating is checked by comparing the return air temperature to OHSP. If the return air temperature is less than the OHSP, the control will compute a submaster reference value and output it to the submaster loop.

**Table 5 — Heating Control and Reset Configuring**

| SET POINT | DESCRIPTION                                                         | HOW TO CONFIGURE                                                                                                     | RANGE          |
|-----------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------|
| HEAT      | Heat Type<br>0 = None<br>1 = Water/Steam<br>2 = Electric<br>3 = Gas | <input type="text" value="3"/> <input type="text" value="SRVC"/> on HSIO only                                        | 0 to 3         |
| OHEN      | Occupied Heating Enable/Disable                                     | <input type="text" value="6"/> <input type="text" value="SRVC"/> on HSIO only                                        | Enable/Disable |
| OHSP      | Supply Air Reset                                                    | <input type="text" value="6"/> <input type="text" value="SRVC"/> on HSIO only                                        | Enable/Disable |
| RTIO      | Reset Ratio                                                         | Bldg Supv or <input type="text" value="1"/> <input type="text" value="4"/> <input type="text" value="SRVC"/> on HSIO | 0 to 10 F      |
| SASP      | Supply Air Set Point                                                | Bldg Supv or <input type="text" value="1"/> <input type="text" value="SET"/> on HSIO                                 | 45 to 70 F     |
| TYPE      | Unit Type                                                           | <input type="text" value="3"/> <input type="text" value="SRVC"/> on HSIO only                                        | CV/VAV         |

**LEGEND**

**Bldg Supv** — Building Supervisor  
**CV** — Constant Volume  
**HSIO** — Keypad and Display Module  
**VAV** — Variable Air Volume

For both CV and VAV modes, the submaster loop will use the submaster reference compared to the actual supply air temperature to compute the number of stages required. If the type of heat is set at electric and the compressors are energized, the number of heat stages will be set to zero.

**INDOOR-AIR QUALITY (IAQ) AND OUTDOOR-AIR CFM (OAC) CONTROL**

In order for the IAQ/OAC algorithms to run, the rooftop unit evaporator fan must be running. The IAQ and OAC functions set the minimum position for the outdoor-air damper and work in conjunction with economizer minimum damper set point as described in the following sections. See Table 6 for IAQ and OAC definitions.

**NOTE:** The economizer and nighttime free cooling functions may set the damper position further open than the IAQ and OAC functions.

**IAQ and OAC Operation** — The IAQ algorithm calculates IAQ and OAC damper position values and compares these values with the user-configured MDP to determine the IQMP used by the system. The IQMP is determined based on the VENT option and IAQP priority as follows:

For IAQ priority level = 1 (High) or 2 (Medium):

- If VENT = 0, then IQMP = MDP
- If VENT = 1, then IQMP = MDP or IAQ (whichever is greater)
- If VENT = 2, then IQMP = MDP or OAC (whichever is greater)
- If VENT = 3, then IQMP = MDP, IAQ, or OAC (whichever is greater)

For IAQ priority level = 3 (Low), the IAQ minimum position will not be calculated and is ignored in the logic presented above.

If the final IQMP value is less than the IAQ purge minimum position, IQMP will be set to the purge minimum position value. If VENT option is set to either 1 or 3, the indoor-air quality alarm will be generated if the IAQ set point is configured outside of the sensor range

The damper position is calculated using the following equations:

$$\text{IAQ Damper} = \text{ECONDP} + 100 \times \text{IAQGAIN} \times (\text{IAQS} - \text{IAQSEN}) \div \text{IAQS}$$

$$\text{OAC Damper} = \text{ECONDP} + 100 \times \text{OACGAIN} \times (\text{OACS} - \text{OACSEN}) \div \text{OACS}$$

**NOTE:** IAQ damper is not allowed to exceed IAQMAXP, and OAC damper is not allowed to exceed OACMAXP

**IAQ Comfort Overrides** — When IAQ damper position is being calculated and IAQ priority level = 2, the following comfort overrides are in effect:

- Space temperature override  
 IF  $\text{SPT} > (\text{OCSP} + \text{SPLO}) \div 2$  or  $\text{SPT} < (\text{OHSP} + \text{SPLO}) \div 2$ ,  
 THEN IAQ damper position = 0 (closed)  
 Once space temperature override has been set, it will be removed when  $\text{OCSP} > \text{SPT} > \text{OHSP}$
- Supply air temperature override (VAV units)  
 IF  $\text{SAT} < \text{SASP} - 8$  or  $\text{SAT} > \text{SASP} + 5$  for more than 4 minutes,  
 THEN IAQ damper position = 0
- High humidity override  
 IF system has humidity sensor and  $\text{RH} > \text{HHOR}$   
 THEN IAQ damper position = 0 (closed)

**To Configure IAQ/OAC Control** — Refer to Table 7 for details.

**Table 6 — IAQ/OAC Definitions**

| ITEM    | DEFINITION                                   |
|---------|----------------------------------------------|
| ECONDP  | Current Economizer Damper Position           |
| HHOR    | High Humidity Override Set Point             |
| IAQ     | Indoor-Air Quality                           |
| IAQGAIN | Indoor Air Quality Gain                      |
| IAQMAXP | IAQ Maximum Damper Position                  |
| IAQP    | Indoor Air Quality Priority Level            |
| IAQS    | Indoor Air Quality Set Point                 |
| IAQSEN  | Indoor Air Quality Sensor Reading            |
| IQMP    | Final Minimum Damper Position                |
| MDP     | Economizer Minimum Damper Position           |
| OAC     | Constant Outdoor-Air Cfm                     |
| OACGAIN | Constant Outdoor Air Cfm Gain                |
| OACMAXP | OAC Maximum Damper Position                  |
| OACS    | Constant Outdoor Air Cfm Set Point           |
| OACSEN  | Constant Outdoor Air Cfm Sensor Reading      |
| OCSP    | Occupied Cooling Set Point (Space Set Point) |
| OHSP    | Occupied Heating Set Point (Space Set Point) |
| RH      | Space Relative Humidity                      |
| SASP    | Supply Air Set Point (VAV)                   |
| SAT     | Supply Air Temperature                       |
| SPLO    | Space Temperature Low Alert Limit (Occupied) |
| SPT     | Space Temperature                            |
| VAV     | Variable Air Volume                          |
| VENT    | Ventilation Mode Setting                     |

**Table 7 — Configuring IAQ/OAC Control**

| SET POINT | DESCRIPTION                                       | HOW TO CONFIGURE                                                      | RANGE            |
|-----------|---------------------------------------------------|-----------------------------------------------------------------------|------------------|
| IAQMAXP   | IAQ Maximum Damper Position                       | Building Supervisor only                                              | 0 to 100 percent |
| IAQP      | IAQ Priority<br>1 = High<br>2 = Medium<br>3 = Low | Building Supervisor only                                              | 1 to 3           |
| IAQS      | IAQ Set Point                                     | Building Supervisor only                                              | 1 to 5000 ppm    |
| OACMAXP   | OAC Maximum Damper Position                       | Building Supervisor only                                              | 0 to 100 percent |
| OCS       | Outdoor Air Cfm Set Point                         | Building Supervisor only                                              | 1 to 50,000 cfm  |
| PURG      | IAQ Purge                                         | <input type="checkbox"/> 6 <input type="checkbox"/> SRVC on HSIO only | Enable/Disable   |
| VENT      | Ventilation Mode                                  | Building Supervisor only                                              | 0 to 3           |

**LEGEND**

HSIO — Keypad and Display Module  
 IAQ — Indoor Air Quality  
 OAC — Outdoor Air Cfm Control

**ECONOMIZER OPERATION**

The supply fan must be on for the economizer algorithm to run. In addition, there must be a call for cooling and the enthalpy switch must be closed indicating outdoor air is of acceptable quality for cooling. See Table 8 for economizer operation definitions.

**Table 8 — Economizer Operation Definitions**

| ITEM | DEFINITION                                 |
|------|--------------------------------------------|
| CV   | Constant Volume                            |
| DPSP | Damper Position Set Point                  |
| ECSP | Economizer Offset, VAV Only                |
| NTLO | Nighttime Free Cooling Lockout             |
| OAT  | Outdoor-Air Temperature                    |
| OCSP | Occupied Cooling Set Point                 |
| OHSP | Occupied Heating Set Point                 |
| SASP | Supply Air Set Point Temperature, VAV Only |
| VAV  | Variable Air Volume                        |

**VAV Economizer Operation** — With the rooftop unit configured for VAV operation, the unit in cooling mode, and enthalpy control enabling the economizer, the following equation is true:

$$DPSP = SASP - ECSP$$

**CV Economizer Operation** — With the unit configured for CV operation, the unit in cooling mode, and enthalpy control enabling economizer, the following are true:

When  $OAT < NTLO$ :

$$DPSP = OCSP - 1\text{ F}$$

When  $NTLO < OAT < 68\text{ F}$ :

$$DPSP = OHSP + (OCSP - OHSP) \div 2$$

When  $OAT > 68\text{ F}$ :

$$DPSP = OHSP + 1\text{ F}$$

These algorithms are designed to maximize free cooling using outdoor air while minimizing the risk of overcooling the space.

**Mechanical Cooling Interface** — Mechanical cooling cannot be activated until the economizer is at least 90% open (enthalpy switch must be closed). When mechanical cooling is on, the control set point is:

$$VAV = SASP \text{ (unless reset governs)}$$

$$CV = OCSP$$

**Configuring Economizer Operation** — See Tables 9 and 10 for economizer configuring under both CV and VAV conditions.

**Table 9 — CV Unit Economizer Configuring**

| SET POINT | DESCRIPTION                     | HOW TO CONFIGURE                                                              | RANGE      |
|-----------|---------------------------------|-------------------------------------------------------------------------------|------------|
| ECON      | Econ Config (0 = None, 1 = Air) | Bldg Supv or <input type="checkbox"/> 3 <input type="checkbox"/> SRVC on HSIO | 0 to 3*    |
| SASP      | Supply Air Set Point            | Bldg Supv or <input type="checkbox"/> 1 <input type="checkbox"/> SET on HSIO  | 45 to 70 F |
| ECSP      | Economizer Set Point Offset     | Building Supervisor only                                                      | 1 to 10 F  |

**LEGEND**

BLDG — Building  
 CONFIG — Configuration  
 ECON — Economizer  
 HSIO — Keypad and Display Module  
 SUPV — Supervisor

\*Settings 2 and 3 are not applicable to these units

**Table 10 — VAV Unit Economizer Configuring**

| SET POINT | DESCRIPTION                     | HOW TO CONFIGURE                                                                                         | RANGE      |
|-----------|---------------------------------|----------------------------------------------------------------------------------------------------------|------------|
| ECON      | Econ Config (0 = None; 1 = Air) | Bldg Supv or <input type="checkbox"/> 3 <input type="checkbox"/> SRVC on HSIO                            | 0 to 3*    |
| NTLO      | Nighttime Free Cooling Lockout  | Bldg Supv or <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> SRVC on HSIO | 40 to 70 F |
| OCSP      | Occupied Cooling Set Point      | Bldg Supv or <input type="checkbox"/> 1 <input type="checkbox"/> SET on HSIO                             | 55 to 80 F |
| OHSP      | Occupied Heating Set Point      | Bldg Supv or <input type="checkbox"/> 1 <input type="checkbox"/> SET on HSIO                             | 55 to 80 F |

**LEGEND**

BLDG — Building  
 CONFIG — Configuration  
 ECON — Economizer  
 HSIO — Keypad and Display Module  
 SUPV — Supervisor

\*Settings 2 and 3 are not applicable to these units

## MODULATING RETURN FANS AND MODULATING POWER EXHAUST FANS

The supply fan must be on for the modulating return or power exhaust fan routine to operate. See Table 11 for fan operation definitions.

**Table 11 — Modulating Return and Power Exhaust Fan Operation Definitions**

| ITEM | DEFINITION                            |
|------|---------------------------------------|
| BP   | Actual Space Pressure                 |
| BPSO | Building Pressure Set Point Offset    |
| BPSP | Building Pressure Set Point           |
| BPSR | Building Pressure Submaster Reference |
| EFRF | Discrete Output to Cycle Fan          |
| FANT | Fan Type Configuration Choice         |
| PED  | Analog Damper Output                  |

**Return Fan (054-074 Only) Sequence of Operation** — If FANT is set at 'return,' the return fan will be energized on the EFRF output channel (channel 28 on DSIO1) when the evaporator fan is turned on. The BPSR will be calculated. The BPSR value will be used to modulate the discharge damper by outputting a 4–20 mA signal on the PED output channel (channel 15 on PSIO1).

**Power Exhaust Sequence of Operation** — If the FANT is set at 'modulating,' the following logic applies when the evaporator fan is turned on:

If BP is greater than BPSP, the exhaust fan will be energized on the EFRF output channel (channel 28 on DSIO1), and BPSR will be calculated.

If the power exhaust fan is energized, the BPSR value will be used to modulate the discharge damper by outputting a

4–20 mA signal on the PED output channel (channel 15 on PSIO1).

If BP is less than BPSP - BPSO for 4 to 6 minutes, the exhaust fan will be turned off and the BPSR will be set to its minimum value. See Table 12 for how to configure modulating return or power exhaust fan.

NOTE: Power exhaust has a 2-minute minimum off-time to minimize cycling.

## UNOCCUPIED HEATING AND COOLING INITIATION AND COMPLETION

In order for the unoccupied cooling or heating algorithms to run, the rooftop unit evaporator fan must be running. The following sections describe how the evaporator fan starts and stops. See Table 13 for unoccupied heating and cooling initiation and completion definitions.

**Starting Evaporator Fan During Unoccupied Mode** — The evaporator fan is started any time SPT is less than UHSP or SPT is greater than UCSP. When either of these conditions exist, the evaporator fan starts and the cooling or heating algorithm begins calculating as appropriate.

**Stopping Evaporator Fan During Unoccupied Mode** — The evaporator fan will turn off during unoccupied mode when either of the following equations is true:

$$SPT < UCSP - UCDB \text{ (for cooling operation)}$$

$$SPT > UHSP + UHDB \text{ (for heating operation)}$$

## Configuring Unoccupied Cooling and Heating

— See Table 14 for details on configuring unoccupied cooling and heating.

**Table 12 — Configuring Modulating Return and Power Exhaust**

| SET POINT | DESCRIPTION                                                                                         | HOW TO CONFIGURE                                                                                                     | RANGE          |
|-----------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------|
| FANT      | Fan Type<br>0 = No Fan<br>1 = Not Used<br>2 = Modulating Power Exhaust<br>3 = Modulating Return Fan | <input type="text" value="3"/> <input type="text" value="SRVC"/> on HSIO only                                        | 0 to 3         |
| BPSP      | Building Pressure Set Point                                                                         | Bldg Supv or <input type="text" value="1"/> <input type="text" value="8"/> <input type="text" value="SRVC"/> on HSIO | 0 to 0.5 in wg |
| BPSO      | Building Pressure Set Point Offset                                                                  | Bldg Supv or <input type="text" value="1"/> <input type="text" value="8"/> <input type="text" value="SRVC"/> on HSIO | 0 to 0.5 in wg |

### LEGEND

BLDG — Building SUPV — Supervisor HSIO — Keypad and Display Module

**Table 13 — Unoccupied Heating and Cooling Definitions**

| ITEM | DEFINITION                   |
|------|------------------------------|
| UCDB | Unoccupied Cooling Deadband  |
| UCSP | Unoccupied Cooling Set Point |
| UHDB | Unoccupied Heating Deadband  |
| UHSP | Unoccupied Heating Set Point |
| SPT  | Space Temperature            |

**Table 14 — Configuring Unoccupied Cooling and Heating**

| SET POINT | DESCRIPTION                  | HOW TO CONFIGURE                                                                     | RANGE           |
|-----------|------------------------------|--------------------------------------------------------------------------------------|-----------------|
| UCDB      | Unoccupied Cooling Deadband  | Bldg Supv only                                                                       | 0 to 10 degrees |
| UCSP      | Unoccupied Cooling Set Point | Bldg Supv or <input type="text" value="1"/> <input type="text" value="SE1"/> on HSIO | 75 to 95 F      |
| UHDB      | Unoccupied Heating Deadband  | Bldg Supv only                                                                       | 0 to 10 degrees |
| UHSP      | Unoccupied Heating Set Point | Bldg Supv or <input type="text" value="1"/> <input type="text" value="SET"/> on HSIO | 40 to 80 F      |

### LEGEND

BLDG — Building SUPV — Supervisor HSIO — Keypad and Display Module

## ACCESSING CONTROL FEATURES THROUGH HSIO

### Keypad and Display Module (HSIO)

**IMPORTANT:** The accessory HSIO (human sensor input/output) keypad and display module is required for initial start-up of these units. All units are shipped in standby mode, and the accessory HSIO must be used to change the unit to run mode. Once the unit is in run mode, the HSIO is not required for normal operation.

The keypad and display module (local interface device or LID) is a field-installed accessory, and provides unit function information at the unit. See Fig. 3. The module consists of a keypad with 6 function keys, 5 operative keys, 10 numeric keys (0 through 9), and an alphanumeric 8-character liquid crystal display (LCD). Key usage is explained in Table 15. Each function has one or more subfunctions as shown in Table 16. Those functions are described in greater detail in the Keypad (HSIO) Operation section on page 12-35.

The HSIO keypad and display module is installed by connecting the power and communication plugs and can be easily moved from one unit to another. Because of this flexibility, one HSIO can be used for several units.

Unit operation is controlled by the status of the run/standby mode on the HSIO. To access the mode, press **1** **1** **STAT** on the HSIO keypad, and then press **↓**. The HSIO will display either STBY YES or STBY NO. To enable the unit, press **CLR** or **•** and press **ENTR** while at the STBY YES display. To disable the unit, press **1** **ENTR** while at the STBY NO display. Clearing an alarm that has stopped unit operation is accomplished by entering the STBY YES mode.

**IMPORTANT:** Use the STBY YES mode when servicing the unit or running the quick test feature.

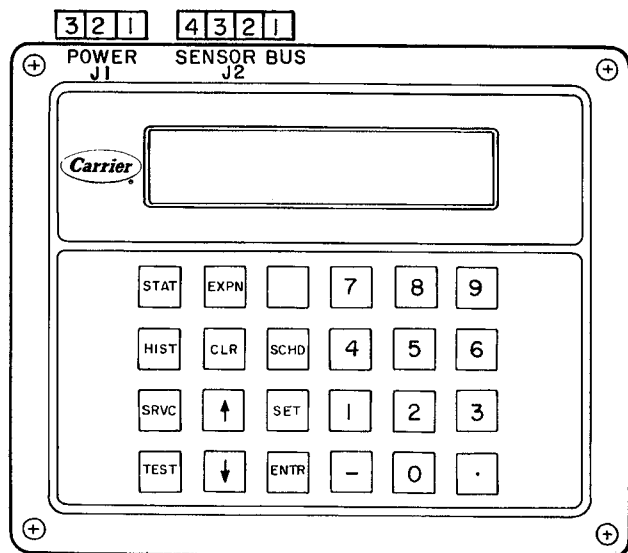


Fig. 3 — Keypad and Display Module

Table 15 — HSIO Keypad Key Usage

| FUNCTION KEYS  | USE                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------|
| <b>STAT</b>    | Status — To display diagnostic codes and current operating information about the unit             |
| <b>TEST</b>    | Quick Test — To check inputs and outputs for proper operation                                     |
| <b>HIST</b>    | History — To check most recent alarms                                                             |
| <b>SRVC</b>    | Service — To enter specific unit configuration information.                                       |
| <b>SET</b>     | Set Point — To enter operating set points and day/time information                                |
| <b>SCHD</b>    | Schedule — To enter occupied/unoccupied schedules for unit operation                              |
| OPERATIVE KEYS | USE                                                                                               |
| <b>EXPN</b>    | Expand Display — To display a non-abbreviated expansion of the display.                           |
| <b>CLR</b>     | Clear — To clear the screen and return to previous display. Also used to enter data value of zero |
| <b>↑</b>       | Up Arrow — To return to previous display position.                                                |
| <b>↓</b>       | Down Arrow — To advance to next display position.                                                 |
| <b>ENTR</b>    | To enter data                                                                                     |

### KEYPAD (HSIO) OPERATION

**Accessing Functions and Subfunctions —** See Table 17. Refer also to Table 16, which shows the functions (identified by name) and the subfunctions (identified by number). Table 18 shows the sequence of all of the elements in the subfunctions.

#### Functions

**SUMMARY DISPLAY —** Whenever the keypad has not been used for 10 minutes, the display will automatically switch to an alternating summary display. This display has 5 parts, shown below, which alternate in continuous rotating sequence.

| Display                                              | Expansion (Press <b>EXPN</b> )                                                                                          |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| TUE 12:45<br>MODE 23<br>COOL 1<br>HEAT 1<br>2 ALARMS | TODAY IS TUE, TIME IS 12:45 PM<br>MODE IS UNOCCUPIED HEAT<br>COOLING STAGES 1<br>HEATING STAGES 1<br>THERE ARE 2 ALARMS |

**STATUS FUNCTION —** This function shows the current status of the alarm and alert codes, operating modes, capacity stages, operating set point, all measured system temperatures and pressures, superheat and saturated condensing temperature values, pressure switch positions, analog inputs, switch inputs, system component status, and unit standby/run (disable/enable) capability.

**1 STAT (Alarms) —** Alarms are signals sent by the processor that one or more faults have been detected. Each fault is assigned a code number which is reported as an alarm code. Refer to NB,NP Diagnostic Alarm Codes and Possible Causes section on page 36 for specific alarm information. These codes indicate a failure that causes the unit to shut down, terminate an option, or results in the use of a default value as a set point.

Up to 10 alarms can be stored at once. To view them, press **1** **STAT** to enter the alarm displays and then press **↓** to move to the individual alarm displays. Press **EXPN** after a code has been displayed to expand the code into a full definition.

**Table 16 — HSIO Keypad and Display Module Functions and Subfunctions**

| SUB<br>FUNCTION<br>NO. | FUNCTIONS                    |                   |                                |                             |                       |                  |
|------------------------|------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|------------------|
|                        | Status<br>[STAT]             | History<br>[HIST] | Schedule<br>[SCID]             | Service<br>[SRVC]           | Set Point<br>[SET]    | Test<br>[TEST]   |
| 1                      | Current Alarms               | Alarms            | Occupied Mode Override (Unit)  | Log on and Log off          | System Set Point      | Test of Inputs   |
| 2                      | Current Alerts               | Maintenance       | Period 1 (Unit)                | Software Version            | Demand Limit          | Analog Outputs   |
| 3                      | Current Operating Modes      | ---               | Period 2 (Unit)                | Factory Configuration       | Current Time          | Discrete Outputs |
| 4                      | Capacity Stages              | ---               | Period 3 (Unit)                | Bus Address                 | Daylight Savings Time | Test Compressors |
| 5                      | Current Operating Set Points | ---               | Period 4 (Unit)                | Units of Measure            | Configure Holiday     | Test Heat        |
| 6                      | System Temperatures          | ---               | Period 5 (Unit)                | User Configuration          | ---                   | Exit Test        |
| 7                      | System Pressures             | ---               | Period 6 (Unit)                | Heating Coil                | ---                   | ---              |
| 8                      | Inputs                       | ---               | Period 7 (Unit)                | Cooling                     | ---                   | ---              |
| 9                      | Analog Outputs               | ---               | Period 8 (Unit)                | Duct Pressure               | ---                   | ---              |
| 10                     | Discrete Outputs             | ---               | Occupied Mode 2 Override (TDO) | Economizer                  | ---                   | ---              |
| 11                     | Run/ Standby                 | ---               | Period 1 (TDO)                 | Staged Heat                 | ---                   | ---              |
| 12                     | ---                          | ---               | Period 2 (TDO)                 | Night Time Free Cool        | ---                   | ---              |
| 13                     | ---                          | ---               | Period 3 (TDO)                 | Adaptive Optimal Start/Stop | ---                   | ---              |
| 14                     | ---                          | ---               | Period 4 (TDO)                 | Temperature Reset           | ---                   | ---              |
| 15                     | ---                          | ---               | Period 5 (TDO)                 | Configure Loadshed          | ---                   | ---              |
| 16                     | ---                          | ---               | Period 6 (TDO)                 | Configure IAQ               | ---                   | ---              |
| 17                     | ---                          | ---               | Period 7 (TDO)                 | Configure Humidity          | ---                   | ---              |
| 18                     | ---                          | ---               | Period 8 (TDO)                 | Building Pressure           | ---                   | ---              |
| 19                     | ---                          | ---               | ---                            | Alert Limits                | ---                   | ---              |
| 20                     | ---                          | ---               | ---                            | Service History             | ---                   | ---              |
| 21                     | ---                          | ---               | ---                            | Service Maintenance Alarm   | ---                   | ---              |
| 22                     | ---                          | ---               | ---                            | Override History            | ---                   | ---              |

LEGEND  
 IAQ — Indoor-Air Quality  
 TDO — Timed Discrete Output

When a diagnostic code is stored in the display and the unit automatically resets, the code is entered into the alarm history. Codes for safeties, which do not automatically reset, are not deleted until the problem is corrected and the machine is switched to standby, and then back to run mode.

The controls provide an alarm history of the last 9 alarms generated in the order of their occurrence. The alarm history deletes the first alarm displayed (oldest) once the tenth alarm is generated. This information is available by pressing **[1] [HIST]**.

**[2] [STAT]** (Alerts) — There are 23 input channels of alerts which are compared against their configured alert limits. If any channel is detected outside of these limits, the corresponding alert number will be displayed after pressing **[2] [STAT]** to determine if any alerts are present. The **[↓]** will display the first alert. Press **[EXPN]** after a code has been displayed to expand the code into a full definition.

Press **[1] [9] [SRVC]** on the keypad to determine a configured alert limit. Then access the **[STAT]** subfunction per

Table 19 to determine the actual value being monitored. Table 19 also indicates the acceptable high and low limits (both occupied and unoccupied modes) for the configured alerts and defines the factory preset default values. The alert will return to normal once the alert channel meets the criteria. The criteria for return to normal is the high limit minus a constant or the low limit plus a constant. See Table 20 for the list of constants. Items having no constant return to normal as soon as the unit returns to the acceptable range (between low and high limits).

Certain analog alerts are only generated when the unit is in the occupied mode. These alerts are SP (static pressure), RH (relative humidity), and BP (building pressure). Alerts will not be generated when the controls are in the unoccupied mode, even if the sensor value is outside the configured limits.

The OAT (outdoor-air temperature) and OARH (outdoor-air relative humidity) analog alerts are monitored at all times and generate alerts whenever the sensor value exceeds the corresponding alert limits.

**Table 17 — Accessing Functions and Subfunctions**

| OPERATION                                                                                                                                                                                                                              | KEYPAD ENTRY                                                     | DISPLAY                                                                                          | DESCRIPTION                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| To access a function, press the subfunction number and the function name key. The display will show the subfunction group<br><br>To move to the other elements, scroll up or down using the arrow keys                                 | 4 STAT<br>↓<br>↓<br>↓<br>↓<br>↓                                  | STAGES<br><br>COOL X<br><br>CPC X<br><br>HEAT X<br><br>HPC X<br><br>SMZ X                        | Current stages<br><br>Cooling stages<br><br>Cooling percent capacity<br><br>Heating stages<br><br>Heating percent capacity<br><br>SUM/Z ratio                             |
| When the last element in a subfunction has been displayed, the subfunction group name will be repeated                                                                                                                                 | ↓                                                                | STAGES                                                                                           | Current stages                                                                                                                                                            |
| To move to the next subfunction, it is not necessary to use the subfunction number, pressing the function name key will advance the display through all subfunctions within a function and then back to the first.                     | STAT<br><br>STAT<br><br>STAT<br><br>STAT<br><br>STAT<br><br>STAT | SETPOINT<br><br>TEMPS<br><br>PRESSURE<br><br>INPUTS<br><br>ANLGOUT<br><br>OUTPUTS<br><br>STANDBY | Current operating set point<br><br>System temperatures<br><br>System pressures<br><br>System inputs<br><br>Analog outputs<br><br>Discrete outputs<br><br>Standby/run mode |
| To move to another function, either press the function name key for the desired function (display will show the first subfunction)<br>or<br>Access a particular subfunction by using the subfunction number and the function name key. | HIST<br><br>2 HIST                                               | ALRMHST<br><br>MTN/HIS                                                                           | Alarm history<br><br>Maintenance history                                                                                                                                  |

The SAT (supply-air temperature), SPT (space temperature), RAT (return-air temperature), SP, and RH have alert limits for both the occupied and unoccupied modes (see Table 19). A 30-minute delay is used when changing from unoccupied to occupied mode for these alerts. If an alert condition exists in the unoccupied mode, no alert will be generated. If the alert condition still exists 30 minutes after unit enters occupied mode, an alert will be generated at that time.

**3 STAT (Modes)**— The operating mode codes are displayed to indicate the operating status of the unit at a given time. To enter the modes subfunction, press **3 STAT** and use the **↓** to determine if more than 1 mode is in effect. See Table 21 for a list of the modes and mode names. The current operating modes are.

**Space Temperature Reset (21) (VAV) only** — This mode uses temperature reset to adjust the supply-air set point upward. The unit controls to the modified supply-air temperature set point. The set point is modified based on the space temperature, occupied cooling set point, and user-defined reset ratio and limit.

**Demand Limit (22)** — Demand limit is only available on units connected to the CCN. Initially, the capacity of the unit is limited by the demand limit control redline alert command, and demand limit is in effect. When demand limit is in effect, the unit may not be able to produce the desired leaving-air temperature. A loadshed command is received, and the capacity of the system is reduced to the loadshed set point.

**Unoccupied Heating (23)** — This mode indicates that the space temperature is below the unoccupied heating set point (or the morning warm-up set point, if applicable) and the heat is on. When the space temperature rises above the set point, the heat stages and the unit are turned off. The economizer will remain closed during unoccupied heating.

**Unoccupied Cooling (24)** — This mode indicates that the space temperature is above the unoccupied cooling set point and the unit is on. When the space temperature falls below the set point, the unit is turned off and the economizer will remain closed.

**Standby (25)** — Standby mode indicates that the unit is being held in an inoperative mode by the user. This is the case when the run/standby mode is configured to standby.

**Optimal Start (26)** — This mode allows cooling or heating to be used to bring space temperature up or down to the occupied set point in time for the occupied period.

NOTE: Morning warmup will initiate both mode 26 (optimal start) and mode 23 (unoccupied heating).

**Unoccupied (27)** — This mode indicates the period when the time schedule that has been input has the unit in an unoccupied mode.

**IAQ Purge (28)** — Purge mode directs the economizer dampers to full open and operates the supply-air fan for a user-configured purge duration starting 2 hours prior to the occupied start time.

NOTE: DO NOT use this feature in conjunction with a hot water or steam coil.

**Optimal Stop (29)** — This mode allows space temperature to drift to an expanded occupied set point during the last portion of the current occupied period (CV applications only).

**Occupied Heating (30)** — Occupied heat mode initiates heating stages to provide supply-air temperature required to satisfy heating set point during occupied time period. The economizer is at the minimum position.

**Occupied Cooling (31)** — Occupied cool mode provides supply-air temperature required to satisfy cooling set point during occupied time period using economizer operation (if the outdoor-air enthalpy is suitable); and then adds stages of cooling as needed.

**Occupied (32)** — Portion of inputted time schedule when unit is programmed to run and cool and heat modes are not operating according to occupied control set points. This applies to both CV and VAV applications.

NOTE: When unit is in mode 32, economizer will operate if unit is programmed for CV operation. If unit is programmed for VAV operation, both modes 31 and 32 must be in effect for economizer operation to occur.

Table 18 — Keypad Directory

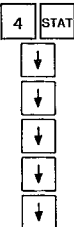
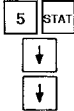
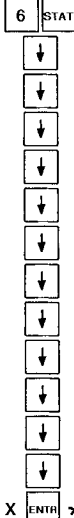
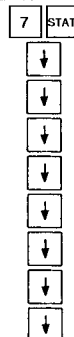
| STATUS      |                                                                                                                                                                     |          |                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------|
| Subfunction | Keypad Entry                                                                                                                                                        | Display  | Expansion (Press  key) |
| 1<br>ALARMS |   | ALARMS   | CURRENT ALARMS                                                                                            |
|             |                                                                                    | ALARM 51 | COMPRESSOR A1 FAULT                                                                                       |
|             |                                                                                    | ALARM 53 | COMPRESSOR A1 STATUS                                                                                      |
|             |                                                                                    | ALARM 55 | COMPRESSOR B1 FAULT                                                                                       |
|             |                                                                                    | ALARM 57 | COMPRESSOR B1 STATUS                                                                                      |
|             |                                                                                    | ALARM 59 | THERMISTOR FAILURE SUPPLY AIR                                                                             |
|             |                                                                                    | ALARM 60 | THERMISTOR FAILURE RETURN AIR                                                                             |
|             |                                                                                    | ALARM 61 | OUTSIDE AIR THERMISTOR FAILURE                                                                            |
|             |                                                                                    | ALARM 62 | CIRCUIT A CONDENSER THERMISTOR FAILURE                                                                    |
|             |                                                                                    | ALARM 63 | CIRCUIT B CONDENSER THERMISTOR FAILURE                                                                    |
|             |                                                                                    | ALARM 64 | COMPRESSOR A1 THERMISTOR FAILURE                                                                          |
|             |                                                                                    | ALARM 65 | COMPRESSOR B1 THERMISTOR FAILURE                                                                          |
|             |                                                                                    | ALARM 66 | SPACE THERMISTOR FAILURE                                                                                  |
|             |                                                                                    | ALARM 67 | CIRCUIT A DISCHARGE TRANSDUCER FAILURE                                                                    |
|             |                                                                                    | ALARM 68 | CIRCUIT B DISCHARGE TRANSDUCER FAILURE                                                                    |
|             |                                                                                    | ALARM 69 | CIRCUIT A SUCTION TRANSDUCER FAILURE                                                                      |
|             |                                                                                    | ALARM 70 | CIRCUIT B SUCTION TRANSDUCER FAILURE                                                                      |
|             |                                                                                    | ALARM 71 | LOSS OF COMMUNICATION WITH DSIO1                                                                          |
|             |                                                                                    | ALARM 72 | LOSS OF COMMUNICATION WITH DSIO2                                                                          |
|             |                                                                                    | ALARM 73 | LOSS OF COMMUNICATION WITH OPTION BOARD 1 (PSIO2)                                                         |
|             |                                                                                    | ALARM 74 | LOW PRESSURE CIRCUIT A                                                                                    |
|             |                                                                                   | ALARM 75 | LOW PRESSURE CIRCUIT B                                                                                    |
|             |                                                                                  | ALARM 76 | HIGH PRESSURE CIRCUIT A                                                                                   |
|             |                                                                                  | ALARM 77 | HIGH PRESSURE CIRCUIT B                                                                                   |
|             |                                                                                  | ALARM 78 | SUPPLY FAN FAILURE                                                                                        |
|             |                                                                                  | ALARM 80 | LOW CIRCUIT A SATURATED SUCTION TEMP                                                                      |
|             |                                                                                  | ALARM 81 | LOW CIRCUIT B SATURATED SUCTION TEMP                                                                      |
|             |                                                                                  | ALARM 82 | HIGH CIRCUIT A SUCTION SUPERHEAT                                                                          |
|             |                                                                                  | ALARM 83 | HIGH CIRCUIT B SUCTION SUPERHEAT                                                                          |
|             |                                                                                  | ALARM 84 | LOW CIRCUIT A SUCTION SUPERHEAT                                                                           |
|             |                                                                                  | ALARM 85 | LOW CIRCUIT B SUCTION SUPERHEAT                                                                           |
|             |                                                                                  | ALARM 86 | ILLEGAL CONFIGURATION                                                                                     |
|             |                                                                                  | ALARM 88 | HYDRONIC COIL FREEZE STAT                                                                                 |
|             |                                                                                  | ALARM 89 | PRESSURIZATION                                                                                            |
|             |                                                                                  | ALARM 90 | EVACUATION                                                                                                |
|             |                                                                                  | ALARM 91 | SMOKE PURGE                                                                                               |
|             |                                                                                  | ALARM 92 | FIRE SHUTDOWN                                                                                             |
|             |                                                                                  | ALARM 93 | LINKAGE FAILURE                                                                                           |
|             |                                                                                  | ALARM 94 | BUILDING PRESSURE                                                                                         |
|             |                                                                                  | ALARM 95 | DUCT STATIC PRESSURE                                                                                      |
|             |                                                                                  | ALARM 97 | IAQ SET POINT MISCONFIGURED                                                                               |

See legend and notes on page 17

Table 18 — Keypad Directory (cont)

| STATUS (cont) |                                                                                     |           |                                                                                                           |
|---------------|-------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------|
| Subfunction   | Keypad Entry                                                                        | Display   | Expansion (Press  key) |
| 2 ALERTS      |    | ALERTS    | CURRENT ALERTS                                                                                            |
|               |    | ALERT 150 | SUPPLY AIR TEMP LOW LIMIT                                                                                 |
|               |    | ALERT 151 | SUPPLY AIR TEMP HIGH LIMIT                                                                                |
|               |    | ALERT 152 | RETURN AIR TEMP LOW LIMIT                                                                                 |
|               |    | ALERT 153 | RETURN AIR TEMP HIGH LIMIT                                                                                |
|               |    | ALERT 154 | OUTSIDE AIR TEMP LOW LIMIT                                                                                |
|               |    | ALERT 155 | OUTSIDE AIR TEMP HIGH LIMIT                                                                               |
|               |    | ALERT 156 | SPACE TEMP LOW LIMIT                                                                                      |
|               |    | ALERT 157 | SPACE TEMP HIGH LIMIT                                                                                     |
|               |    | ALERT 158 | STATIC PRESSURE LOW LIMIT                                                                                 |
|               |    | ALERT 159 | STATIC PRESSURE HIGH LIMIT                                                                                |
|               |    | ALERT 160 | RELATIVE HUMIDITY LOW LIMIT                                                                               |
|               |    | ALERT 161 | RELATIVE HUMIDITY HIGH LIMIT                                                                              |
|               |    | ALERT 162 | OUTSIDE AIR RELATIVE HUMIDITY LOW LIMIT                                                                   |
|               |    | ALERT 163 | OUTSIDE AIR RELATIVE HUMIDITY HIGH LIMIT                                                                  |
|               |    | ALERT 164 | FILTER STATUS                                                                                             |
|               |    | ALERT 165 | BUILDING PRESSURE LOW LIMIT                                                                               |
|               |    | ALERT 166 | BUILDING PRESSURE HIGH LIMIT                                                                              |
|               |    | ALERT 167 | OUTSIDE AIR CFM LOW LIMIT                                                                                 |
|               |    | ALERT 168 | OUTSIDE AIR CFM HIGH LIMIT                                                                                |
| 3 MODES       |  | MODES     | CURRENT OPERATING MODES                                                                                   |
|               |  | MODE 21   | MODE IS SPACE TEMP RESET                                                                                  |
|               |  | MODE 22   | MODE IS DEMAND LIMIT                                                                                      |
|               |  | MODE 23   | MODE IS UNOCCUPIED HEAT                                                                                   |
|               |  | MODE 24   | MODE IS UNOCCUPIED COOL                                                                                   |
|               |  | MODE 25   | MODE IS STANDBY                                                                                           |
|               |  | MODE 26   | MODE IS OPTIMAL START                                                                                     |
|               |  | MODE 27   | MODE IS UNOCCUPIED                                                                                        |
|               |  | MODE 28   | MODE IS IAQ PURGE                                                                                         |
|               |  | MODE 29   | MODE IS OPTIMAL STOP                                                                                      |
|               |  | MODE 30   | MODE IS OCCUPIED HEAT                                                                                     |
|               |  | MODE 31   | MODE IS OCCUPIED COOL                                                                                     |
|               |  | MODE 32   | MODE IS OCCUPIED                                                                                          |
|               |  | MODE 33   | MODE IS NIGHT TIME FREE COOL                                                                              |
|               |  | MODE 34   | MODE IS PRESSURIZATION                                                                                    |
|               |  | MODE 35   | MODE IS EVACUATION                                                                                        |
|               |  | MODE 36   | MODE IS SMOKE PURGE                                                                                       |
|               |  | MODE 37   | MODE IS FIRE SHUTDOWN                                                                                     |
|               |  | MODE 38   | MODE IS TIMED OVERRIDE                                                                                    |
|               |  | MODE 39   | MODE IS DAV CONTROL                                                                                       |
|               |  | MODE 40   | MODE IS FACTORY-FIELD TEST                                                                                |
|               |  | MODE 41   | MODE IS HIGH HUMIDITY OVERRIDE                                                                            |

Table 18 — Keypad Directory (cont)

| STATUS (cont) |                                                                                     |                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subfunction   | Keypad Entry                                                                        | Display                                                                                                                        | Expansion (Press  key)                                                                                                                                                                                                                                                                                                                      |
| 4 STAGES      |    | STAGES<br>COOL X<br>CPC X<br>HEAT X<br>HPC X<br>SMZ X                                                                          | CURRENT STAGES<br>COOLING STAGES X<br>COOLING PERCENT CAPACITY X<br>HEATING STAGES X<br>HEATING PERCENT CAPACITY X<br>SUM/Z RATIO X                                                                                                                                                                                                                                                                                            |
| 5 SET POINT   |    | SETPOINT<br>CLSP X<br>CLTP X                                                                                                   | CURRENT OPERATING SETPOINT<br>CONTROL SETPOINT X<br>CONTROL TEMP X                                                                                                                                                                                                                                                                                                                                                             |
| 6 TEMPERATURE |   | TEMPS<br>SCTA X<br>STA X<br>SSTA X<br>SHA X<br>SCTB X<br>STB X<br>SSTB X<br>SHB X<br>SAT X<br>RAT X<br>SPT X<br>OAT X<br>OAT X | SYSTEM TEMPERATURES<br>CIRCUIT A SATURATED CONDENSING TEMP X<br>CIRCUIT A SUCTION TEMP X<br>CIRCUIT A SATURATED SUCTION TEMP X<br>CIRCUIT A SUCTION SUPERHEAT<br>CIRCUIT B SATURATED CONDENSING TEMP X<br>CIRCUIT B SUCTION TEMP X<br>CIRCUIT B SATURATED SUCTION TEMP X<br>CIRCUIT B SUCTION SUPERHEAT<br>SUPPLY AIR TEMP X<br>RETURN AIR TEMP X<br>SPACE TEMP X<br>OUTSIDE AIR TEMP X<br>OUTSIDE AIR TEMP X (-40 F to 245 F) |
| 7 PRESSURE    |  | PRESSURE<br>DPA X<br>SPA X<br>LPA X<br>DPB X<br>SPB X<br>LPB X<br>BP X<br>SP X                                                 | SYSTEM PRESSURES<br>CIRCUIT A DISCHARGE PRESSURE SENSOR X<br>CIRCUIT A SUCTION PRESSURE SENSOR X<br>CIRCUIT A LOW PRESSURE SWITCH X<br>CIRCUIT B DISCHARGE PRESSURE SENSOR X<br>CIRCUIT B SUCTION PRESSURE SENSOR X<br>CIRCUIT B LOW PRESSURE SWITCH X<br>BUILDING PRESSURE X<br>STATIC PRESSURE X                                                                                                                             |

LEGEND

|                                           |                                       |                                      |
|-------------------------------------------|---------------------------------------|--------------------------------------|
| <b>AOSS</b> — Adaptive Optimal Start/Stop | <b>HH</b> — Hour                      | <b>NTFC</b> — Nighttime Free Cooling |
| <b>CONT</b> — Continuous                  | <b>IAQ</b> — Indoor-Air Quality       | <b>OAC</b> — Outdoor-Air Cfm Control |
| <b>CV</b> — Constant Volume               | <b>MAINT</b> — Maintenance            | <b>OVRD</b> — Override               |
| <b>DAV</b> — Digital Air Volume           | <b>MDP</b> — Minimum Damper Position  | <b>RTN</b> — Return                  |
| <b>DD</b> — Day                           | <b>MIN</b> — Minimum                  | <b>STAT</b> — Status                 |
| <b>DTCC</b> — Discrete Time Clock Control | <b>MM</b> — Month                     | <b>TEMP</b> — Temperature            |
| <b>DUR</b> — Duration                     | <b>MOD</b> — Modulating               | <b>VAV</b> — Variable-Air Volume     |
| <b>EXH</b> — Exhaust                      | <b>MPD</b> — Modulating Power Dampers |                                      |

\*An "X  " in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing . The valid force ranges are listed in the Expansion column.

†See page 50-51 for details on correct operation of these tests.

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions.

††Compressors are energized for 10 seconds.

|| Controls set point for economizer.

NOTES:

1 Alarm no. will only be displayed if ALARM is present.

2 Alert no. will only be displayed if ALERT is present.

3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values.

Table 18 — Keypad Directory (cont)

| STATUS (cont) |                                                                                         |         |                                                                                                           |
|---------------|-----------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------|
| Subfunction   | Keypad Entry                                                                            | Display | Expansion (Press  key) |
| 8 INPUTS      |        | INPUTS  | SYSTEM INPUTS                                                                                             |
|               |        | CSA1 X  | COMPRESSOR A1 STATUS X                                                                                    |
|               |        | CSB1 X  | COMPRESSOR B1 STATUS X                                                                                    |
|               |        | CFA1 X  | COMPRESSOR A1 SAFETY X                                                                                    |
|               |        | CFB1 X  | COMPRESSOR B1 SAFETY X                                                                                    |
|               |        | OAC X   | OUTSIDE AIR CFM X                                                                                         |
|               |        | IAQ X   | INDOOR AIR QUALITY X                                                                                      |
|               |        | SFS X   | SUPPLY FAN STATUS X                                                                                       |
|               |        | ENT X   | ENTHALPY SWITCH X                                                                                         |
|               | X  *   | ENT X   | ENTHALPY SWITCH X (0 = High, 1 = Low)                                                                     |
|               |        | RH X    | RELATIVE HUMIDITY X                                                                                       |
|               | X  *   | RH X    | RELATIVE HUMIDITY X (0 to 100%)                                                                           |
|               |        | FRZ X   | FREEZE STAT X                                                                                             |
|               |        | OARH X  | OUTSIDE AIR RELATIVE HUMIDITY X                                                                           |
|               | X  *   | OARH X  | OUTSIDE AIR RELATIVE HUMIDITY X (0 to 100%)                                                               |
|               |        | FLTS X  | FILTER STATUS X                                                                                           |
|               | X  *   | FLTS X  | FILTER STATUS X (0 = Clean, 1 = Dirty)                                                                    |
|               |       | STO X   | SPACE TEMP OFFSET X                                                                                       |
|               |      | EVAC X  | EVACUATION X                                                                                              |
| 9 ANALOG      |      | ANALOG  | ANALOG OUTPUTS                                                                                            |
|               |      | IGV X   | INLET GUIDE VANES X                                                                                       |
|               |      | ECON X  | ECONOMIZER X                                                                                              |
|               |      | HCV X   | HEATING COIL VALVE X                                                                                      |
|               | X  * | HCV X   | HEATING COIL VALVE X (0 to 100%)                                                                          |
|               |      | PERD X  | POWER EXHAUST/RETURN DAMPER X                                                                             |
|               | X  * | HUM X   | HUMIDIFIER 4-20 X                                                                                         |
|               |                                                                                         | HUM X   | HUMIDIFIER 4-20 X (0 to 100%)                                                                             |

Table 18 — Keypad Directory (cont)

| STATUS (cont) |                                                                                                                                                                                                                                                             |         |                                                                                                           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------|
| Subfunction   | Keypad Entry                                                                                                                                                                                                                                                | Display | Expansion (Press  key) |
| 10<br>OUTPUTS |          | OUTPUTS | DISCRETE OUTPUTS                                                                                          |
|               |                                                                                                                                                                            | SF X    | SUPPLY FAN X                                                                                              |
|               | X  *                                                                                                                                                                       | SF X    | SUPPLY FAN X (0 = On, 1 = Off)                                                                            |
|               |                                                                                                                                                                            | EC2P X  | ECONOMIZER 2 POSITION X                                                                                   |
|               | X  *                                                                                                                                                                       | EC2P X  | ECONOMIZER 2 POSITION X (0 = Open, 1 = Closed)                                                            |
|               |                                                                                                                                                                            | MM X    | MOTOR MASTER/FAN STAGE 1 X                                                                                |
|               |                                                                                                                                                                            | FR2 X   | OUTDOOR FAN 2 X                                                                                           |
|               |                                                                                                                                                                            | FR3 X   | OUTDOOR FAN 3 X                                                                                           |
|               |                                                                                                                                                                            | SF2S X  | 2 SPEED SUPPLY FAN X                                                                                      |
|               |                                                                                                                                                                            | EFRF X  | EXHAUST/RETURN FAN X                                                                                      |
|               |                                                                                                                                                                            | CPA1 X  | COMPRESSOR A1 X                                                                                           |
|               |                                                                                                                                                                            | CPB1 X  | COMPRESSOR B1 X                                                                                           |
|               |                                                                                                                                                                            | ULA1 X  | UNLOADER A1 X                                                                                             |
|               |                                                                                                                                                                            | ULB1 X  | UNLOADER B1 X                                                                                             |
|               |                                                                                                                                                                            | ULA2 X  | UNLOADER A2 X                                                                                             |
|               |                                                                                                                                                                            | ULB2 X  | UNLOADER B2 X                                                                                             |
|               |                                                                                                                                                                            | HS1 X   | HEAT STAGE 1 X                                                                                            |
|               |                                                                                                                                                                            | HS2 X   | HEAT STAGE 2 X                                                                                            |
|               |                                                                                                                                                                           | HS3 X   | HEAT STAGE 3 X                                                                                            |
|               |                                                                                                                                                                          | HS4 X   | HEAT STAGE 4 X                                                                                            |
|               |                                                                                                                                                                          | HS5 X   | HEAT STAGE 5 X                                                                                            |
|               |                                                                                                                                                                          | HIR X   | HEAT INTERLOCK RELAY                                                                                      |
| 11<br>STANDBY |                                                                                                                                                                          | HUM1 X  | HUMIDIFIER 1ST STAGE X                                                                                    |
|               | X  *                                                                                                                                                                     | HUM1 X  | HUMIDIFIER 1ST STAGE X (0 = On, 1 = Off)                                                                  |
|               |                                                                                                                                                                          | DTCC X  | DISCRETE TIME CLOCK CONTROL X                                                                             |
|               | X  *                                                                                                                                                                     | DTCC X  | DISCRETE TIME CLOCK CONTROL X (0 = On, 1 = Off)                                                           |
|               |                                                                                                                                                                          | PERD X  | POWER EXHAUST/RETURN DAMPER X                                                                             |
|               |                                                                                                                                                                          |         |                                                                                                           |
|               |                                                                                                                                                                          |         |                                                                                                           |
| 11<br>STANDBY |    | STANDBY | STANDBY/RUN MODE (0 = Run, 1 = Standby)                                                                   |
|               |                                                                                                                                                                          | STBY X  | UNIT IN STANDBY X                                                                                         |
|               |                                                                                                                                                                          | EXT X   | EXTERNAL CLOCK INPUT (Remote on/off) X (0 = On, 1 = Off)                                                  |

LEGEND

|                                           |                                       |                                      |
|-------------------------------------------|---------------------------------------|--------------------------------------|
| <b>AOSS</b> — Adaptive Optimal Start/Stop | <b>HH</b> — Hour                      | <b>NTFC</b> — Nighttime Free Cooling |
| <b>CONT</b> — Continuous                  | <b>IAQ</b> — Indoor-Air Quality       | <b>OAC</b> — Outdoor-Air Cfm Control |
| <b>CV</b> — Constant Volume               | <b>MAINT</b> — Maintenance            | <b>OVRD</b> — Override               |
| <b>DAV</b> — Digital Air Volume           | <b>MDP</b> — Minimum Damper Position  | <b>RTN</b> — Return                  |
| <b>DD</b> — Day                           | <b>MIN</b> — Minimum                  | <b>STAT</b> — Status                 |
| <b>DTCC</b> — Discrete Time Clock Control | <b>MM</b> — Month                     | <b>TEMP</b> — Temperature            |
| <b>DUR</b> — Duration                     | <b>MOD</b> — Modulating               | <b>VAV</b> — Variable-Air Volume     |
| <b>EXH</b> — Exhaust                      | <b>MPD</b> — Modulating Power Dampers |                                      |

\*An "X  " in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing . The valid force ranges are listed in the Expansion column.

†See page 50-51 for details on correct operation of these tests

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions

††Compressors are energized for 10 seconds

|| Controls set point for economizer

NOTES:

- 1 Alarm no. will only be displayed if ALARM is present
- 2 Alert no. will only be displayed if ALERT is present
- 3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values

Table 18 — Keypad Directory (cont)

| Subfunction | Keypad Entry                                                                                                                                                        | TEST    |                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------|
|             |                                                                                                                                                                     | Display | Expansion (Press  key) |
| 1 INPUTS    |   | INPUTS  | FACTORY/FIELD TEST OF INPUTS                                                                              |
|             |                                                                                    | CSA1 X  | COMPRESSOR A1 STATUS X                                                                                    |
|             |                                                                                    | CSB1 X  | COMPRESSOR B1 STATUS X                                                                                    |
|             |                                                                                    | CFA1 X  | COMPRESSOR A1 SAFETY X                                                                                    |
|             |                                                                                    | CFB1 X  | COMPRESSOR B1 SAFETY X                                                                                    |
|             |                                                                                    | IAQ X   | INDOOR AIR QUALITY X                                                                                      |
|             |                                                                                    | OAC X   | OUTSIDE AIR CFM X                                                                                         |
|             |                                                                                    | SFS X   | SUPPLY FAN STATUS X                                                                                       |
|             |                                                                                    | ENT X   | ENTHALPY SWITCH X                                                                                         |
|             |                                                                                    | RH X    | RELATIVE HUMIDITY X                                                                                       |
|             |                                                                                    | FRZ X   | FREEZE STAT X                                                                                             |
|             |                                                                                    | OARH X  | OUTSIDE AIR RELATIVE HUMIDITY X                                                                           |
|             |                                                                                    | FLTS X  | FILTER STATUS X                                                                                           |
|             |                                                                                    | EVAC X  | EVACUATION X                                                                                              |
|             |                                                                                    | PRES X  | PRESSURIZATION X                                                                                          |
|             |                                                                                    | PURG X  | SMOKE PURGE X                                                                                             |
|             |                                                                                    | FSD X   | FIRE SHUTDOWN X                                                                                           |
|             |                                                                                    | SCTA X  | CIRCUIT A SATURATED CONDENSING TEMP X                                                                     |
|             |                                                                                   | STA X   | CIRCUIT A SUCTION TEMP X                                                                                  |
|             |                                                                                  | SSTA X  | CIRCUIT A SATURATED SUCTION TEMP X                                                                        |
|             |                                                                                  | SHA X   | CIRCUIT A SUCTION SUPERHEAT                                                                               |
|             |                                                                                  | SCTB X  | CIRCUIT B SATURATED CONDENSING TEMP X                                                                     |
|             |                                                                                  | STB X   | CIRCUIT B SUCTION TEMP X                                                                                  |
|             |                                                                                  | SSTB X  | CIRCUIT B SATURATED SUCTION TEMP X                                                                        |
|             |                                                                                  | SHB X   | CIRCUIT B SUCTION SUPERHEAT                                                                               |
|             |                                                                                  | SAT X   | SUPPLY AIR TEMP X                                                                                         |
|             |                                                                                  | RAT X   | RETURN AIR TEMP X                                                                                         |
|             |                                                                                  | SPT X   | SPACE TEMP X                                                                                              |
|             |                                                                                  | STO X   | SPACE TEMPERATURE OFFSET X                                                                                |
|             |                                                                                  | OAT X   | OUTSIDE AIR TEMP X                                                                                        |
|             |                                                                                  | CEWT X  | CONDENSER ENT WATER TEMP X                                                                                |
|             |                                                                                  | DPA X   | CIRCUIT A DISCHARGE PRESSURE SENSOR X                                                                     |
|             |                                                                                  | SPA X   | CIRCUIT A SUCTION PRESSURE SENSOR X                                                                       |
|             |                                                                                  | LPA X   | CIRCUIT A LOW PRESSURE SWITCH X                                                                           |
|             |                                                                                  | DPB X   | CIRCUIT B DISCHARGE PRESSURE SENSOR X                                                                     |
|             |                                                                                  | SPB X   | CIRCUIT B SUCTION PRESSURE SENSOR X                                                                       |
|             |                                                                                  | LPB X   | CIRCUIT B LOW PRESSURE SWITCH X                                                                           |
|             |                                                                                  | BP X    | BUILDING PRESSURE X                                                                                       |
|             |                                                                                  | SP X    | STATIC PRESSURE X                                                                                         |

\*An "X"  in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing . The valid force ranges are listed in the Expansion column

†See page 50-51 for details on correct operation of these tests

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions

††Compressors are energized for 10 seconds

|| Controls set point for economizer

Table 18 — Keypad Directory (cont)

| TEST (cont)              |                                                                                     |           |                                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------|
| Subfunction              | Keypad Entry                                                                        | Display   | Expansion (Press  key) |
| 2<br>ANALOG<br>OUTPUTS   |    | ANLGOUT   | FACTORY/FIELD TEST OF ANALOG OUTPUTS                                                                      |
|                          |    | IGV       | INLET GUIDE VANES TEST                                                                                    |
|                          |    | IGV TST   | TESTING INLET GUIDE VANES                                                                                 |
|                          |    | ECON      | ECONOMIZER TEST                                                                                           |
|                          |    | ECON TST  | TESTING ECONOMIZER                                                                                        |
|                          |    | HCV       | HEATING COIL VALVE TEST                                                                                   |
|                          |    | HCV TST   | TESTING HEATING COIL VALVE                                                                                |
|                          |    | PERD      | POWER EXHAUST/RETURN DAMPER TEST                                                                          |
|                          |    | PERD TST  | TESTING EXHAUST/RETURN DAMPER                                                                             |
|                          |    | HUM       | HUMIDIFIER 4-20 TEST                                                                                      |
|                          |    | HUM TST   | TESTING HUMIDIFIER 4-20                                                                                   |
| 3<br>DISCRETE<br>OUTPUTS |    | DISCOUT   | FACTORY/FIELD TEST OF DISCRETE OUTPUTS                                                                    |
|                          |    | SF        | SUPPLY FAN                                                                                                |
|                          |    | SF TEST   | TESTING SUPPLY FAN                                                                                        |
|                          |    | EC2P      | ECONOMIZER 2 POSITION TEST                                                                                |
|                          |    | EC2P TEST | TESTING ECONOMIZER 2 POSITION                                                                             |
|                          |    | MM        | MOTOR MASTER TESTS                                                                                        |
|                          |    | MM TEST   | TESTING MOTOR MASTER                                                                                      |
|                          |   | FR2       | OUTDOOR FAN 2 TEST                                                                                        |
|                          |  | FR2 TEST  | TESTING OUTDOOR FAN 2                                                                                     |
|                          |  | FR3       | OUTDOOR FAN 3 TEST                                                                                        |
|                          |  | FR3 TEST  | TESTING OUTDOOR FAN 3                                                                                     |
|                          |  | SF2S      | 2 SPEED SUPPLY FAN TEST                                                                                   |
|                          |  | SF2S TST  | TESTING 2 SPEED SUPPLY FAN                                                                                |
|                          |  | EFRF      | EXHAUST/RETURN FAN TEST                                                                                   |
|                          |  | EFRF TST  | TESTING EXHAUST/RETURN FAN                                                                                |
|                          |  | ULA1      | UNLOADER A1 TEST                                                                                          |
|                          |  | ULA1 TST  | TESTING UNLOADER A1                                                                                       |
|                          |  | ULB1      | UNLOADER B1 TEST                                                                                          |
|                          |  | ULB1 TST  | TESTING UNLOADER B1                                                                                       |
|                          |  | ULA2      | UNLOADER A2 TEST                                                                                          |
|                          |  | ULA2 TST  | TESTING UNLOADER A2                                                                                       |
|                          |  | ULB2      | UNLOADER B2 TEST                                                                                          |
|                          |  | ULB2 TST  | TESTING UNLOADER B2                                                                                       |
|                          |  | HUM1      | HUMIDIFIER 1ST STAGE TEST                                                                                 |
|                          |  | HUM1 TST  | TESTING HUMIDIFIER 1ST STAGE                                                                              |
|                          |  | DTCC      | DISCRETE TIME CLOCK CONTROL TEST                                                                          |
|                          |  | DTCC TST  | TESTING DISCRETE TIME CLOCK CONTROL                                                                       |
|                          |  | PERD      | POWER EXHAUST/RETURN DAMPER TEST                                                                          |
|                          |  | PERD TST  | TESTING EXHAUST/RETURN DAMPER                                                                             |

**Table 18 — Keypad Directory (cont)**

| TEST (cont)                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                           |                                                                                                                                                                                                                                        |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subfunction                       | Keypad Entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Display                                                                                                   | Expansion (Press  key)                                                                                                                              |
| <b>4<br/>COMPRESSOR<br/>TESTS</b> |  <br><br><br><br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | COMPRSR<br><br>CPA1**<br>CPA1 TST<br>CPB1<br>CPB1 TST                                                     | FACTORY/FIELD TEST OF COMPRESSOR<br><br>COMPRESSOR A1 TEST<br>TESTING COMPRESSOR A1††<br>COMPRESSOR B1<br>TESTING COMPRESSOR B1††                                                                                                      |
| <b>5<br/>HEAT<br/>STAGES</b>      |  <br><br><br><br><br><br><br><br><br><br> | HEAT<br><br>HS1**<br>STG1 TST<br>HS2<br>STG2 TST<br>HS3<br>STG3 TST<br>HS4<br>STG4 TST<br>HS5<br>STG5 TST | FACTORY/FIELD TEST OF HEAT<br><br>STAGE 1 TEST<br>TESTING HEAT STAGE 1<br>STAGE 2 TEST<br>TESTING HEAT STAGE 2<br>STAGE 3 TEST<br>TESTING HEAT STAGE 3<br>STAGE 4 TEST<br>TESTING HEAT STAGE 4<br>STAGE 5 TEST<br>TESTING HEAT STAGE 5 |
| <b>6<br/>EXIT TEST</b>            |  <br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | EXIT TST<br>TST CMPL                                                                                      | EXIT FACTORY/FIELD TEST<br>TEST COMPLETE                                                                                                                                                                                               |

| HISTORY                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                      |                                                                                                                                                                                                                                                 |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subfunction                          | Keypad Entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Display                                                                                              | Comment                                                                                                                                                                                                                                         |
| <b>1<br/>ALARM<br/>HISTORY</b>       |  <br><br><br><br><br><br><br><br> | ALRMHIST<br><br>ALARM X<br>ALARM X<br>ALARM X<br>ALARM X<br>ALARM X<br>ALARM X<br>ALARM X<br>ALARM X | Alarm history<br><br>Latest alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion<br>Previous alarm expansion |
| <b>2<br/>MAINTENANCE<br/>HISTORY</b> |  <br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | MTN/HIS<br><br>mm dd yy                                                                              | Maintenance history<br><br>Latest service date                                                                                                                                                                                                  |

**LEGEND**

|                                           |                                       |                                      |
|-------------------------------------------|---------------------------------------|--------------------------------------|
| <b>AOSS</b> — Adaptive Optimal Start/Stop | <b>HH</b> — Hour                      | <b>NTFC</b> — Nighttime Free Cooling |
| <b>CONT</b> — Continuous                  | <b>IAQ</b> — Indoor-Air Quality       | <b>OAC</b> — Outdoor-Air Cfm Control |
| <b>CV</b> — Constant Volume               | <b>MAINT</b> — Maintenance            | <b>OVRD</b> — Override               |
| <b>DAV</b> — Digital Air Volume           | <b>MDP</b> — Minimum Damper Position  | <b>RTN</b> — Return                  |
| <b>DD</b> — Day                           | <b>MIN</b> — Minimum                  | <b>STAT</b> — Status                 |
| <b>DTCC</b> — Discrete Time Clock Control | <b>MM</b> — Month                     | <b>TEMP</b> — Temperature            |
| <b>DUR</b> — Duration                     | <b>MOD</b> — Modulating               | <b>VAV</b> — Variable-Air Volume     |
| <b>EXH</b> — Exhaust                      | <b>MPD</b> — Modulating Power Dampers |                                      |

\*An "X"  in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing . The valid force ranges are listed in the Expansion column.

†See page 50-51 for details on correct operation of these tests.

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions.

††Compressors are energized for 10 seconds.

‡Controls set point for economizer.

**NOTES:**

- 1 Alarm no. will only be displayed if ALARM is present.
- 2 Alert no. will only be displayed if ALERT is present.
- 3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values.

Table 18 — Keypad Directory (cont)

| SET POINT               |              |           |                             |
|-------------------------|--------------|-----------|-----------------------------|
| Subfunction             | Keypad Entry | Display   | Comment                     |
| 1 SET POINTS            | 1 SET        | SET POINT | System set points           |
|                         | ↓            | OHSP X    | Occupied heat set point X   |
|                         | ↓            | OCSP X    | Occupied cool set point X   |
|                         | ↓            | UHSP X    | Unoccupied heat set point X |
|                         | ↓            | UCSP X    | Unoccupied cool set point X |
|                         | ↓            | SPSP X    | Static pressure set point X |
|                         | ↓            | SASP X    | Supply air set point X      |
|                         | ↓            | HUSP X    | Humidity set point X        |
| 2 DEMAND SET POINTS     | 2 SET        | DEMAND    | Demand limit set points     |
|                         | ↓            | LSP X     | Loadshed set point X        |
| 3 DATE AND TIME         | 3 SET        | TIME      | Current time                |
|                         | ↓            | dow hh mm | Day of Week and Time        |
|                         | ↓            | mm dd yy  | Month, Day and Year         |
| 4 DAYLIGHT SAVINGS TIME | 4 SET        | DAYLIGHT  | Daylight savings time       |
|                         | ↓            | ENM X     | Daylight enter month X      |
|                         | ↓            | END X     | Daylight enter day X        |
|                         | ↓            | ENT hh mm | Daylight enter time X       |
|                         | ↓            | LVM X     | Daylight leave month X      |
|                         | ↓            | LVD X     | Daylight leave day X        |
|                         | ↓            | LVT hh mm | Daylight leave time X       |
| 5 HOLIDAY TIMES         | 5 SET        | HOLIDAY   | Holiday configuration       |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd.dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd.dur | Holiday mm.dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd.dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd.dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |
|                         | ↓            | mm dd dur | Holiday mm dd dur days long |

Table 18 — Keypad Directory (cont)

| SERVICE                               |                                                                                                                                                                                                                              |                                                                                          |                                                                                          |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Subfunction                           | Keypad Entry                                                                                                                                                                                                                 | Display                                                                                  | Description                                                                              |
| <b>1</b><br>LOG ON/OFF                | <div>1</div> <div>1</div> <div>1</div> <div>1</div> <div>ENTR</div> <div>↓</div> <div>ENTR</div>                                                                                                                             | LOG ON                                                                                   | Enter password followed by <div>ENTR</div>                                               |
|                                       |                                                                                                                                                                                                                              | LOGGED ON                                                                                | Logged on ok                                                                             |
|                                       |                                                                                                                                                                                                                              | LOG OFF                                                                                  | Press <div>ENTR</div> to log off                                                         |
|                                       |                                                                                                                                                                                                                              | LOGD OFF                                                                                 | Logged off ok                                                                            |
|                                       |                                                                                                                                                                                                                              |                                                                                          |                                                                                          |
| <b>2</b><br>SOFTWARE<br>VERSION       | <div>2</div> <div>↓</div> <div>ENTR</div>                                                                                                                                                                                    | VERSION                                                                                  | Software version                                                                         |
|                                       |                                                                                                                                                                                                                              | 500054-XX                                                                                | Software version number                                                                  |
| <b>3</b><br>FACTORY<br>CONFIGURATION  | <div>3</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> | FACT CFG                                                                                 | Factory configuration                                                                    |
|                                       |                                                                                                                                                                                                                              | TYPE X                                                                                   | Unit type (0 = CV, 1 = VAV)                                                              |
|                                       |                                                                                                                                                                                                                              | SIZE X                                                                                   | Unit size (024-074)                                                                      |
|                                       |                                                                                                                                                                                                                              | ULOP X                                                                                   | Number of unloaders 2/3/4                                                                |
|                                       |                                                                                                                                                                                                                              | HPSP X                                                                                   | Head pressure set point (F)                                                              |
|                                       |                                                                                                                                                                                                                              | HEAT X                                                                                   | Heat type (0 = None, 1 = Water/Steam, 2 = Elec, 3 = Gas)                                 |
|                                       |                                                                                                                                                                                                                              | HTSG X                                                                                   | Number of heat stages (0 to 5)                                                           |
|                                       |                                                                                                                                                                                                                              | TRNS X                                                                                   | Transducer options (0 = No, 1 = Yes)                                                     |
|                                       |                                                                                                                                                                                                                              | SF2S X                                                                                   | Two-speed supply-air fan (0 = No, 1 = Yes)                                               |
|                                       |                                                                                                                                                                                                                              | ECON X                                                                                   | Economizer (0 = None, 1, 2 = Air, 3 = Two-Pos)                                           |
|                                       |                                                                                                                                                                                                                              | FANT X                                                                                   | Fan Type (0 = None, 1 = Exh, 2 = Mod Exh, 3 = Mod Rtn)                                   |
|                                       |                                                                                                                                                                                                                              | HUEN X                                                                                   | Humidifier control (0 = None, 1 = Analog, 2 = Discrete)                                  |
|                                       |                                                                                                                                                                                                                              | DTRS X                                                                                   | Data reset (0 = No, 1 = Yes) (Required to save edits)                                    |
|                                       |                                                                                                                                                                                                                              | DPA CALB                                                                                 | Calibrate discharge A pressure sensor                                                    |
|                                       |                                                                                                                                                                                                                              | DPB CALB                                                                                 | Calibrate discharge B pressure sensor                                                    |
|                                       |                                                                                                                                                                                                                              | SPA CALB                                                                                 | Calibrate suction A pressure sensor                                                      |
|                                       |                                                                                                                                                                                                                              | SPB CALB                                                                                 | Calibrate suction B pressure sensor                                                      |
| <b>4</b><br>ELEMENT<br>BUS<br>ADDRESS | <div>4</div> <div>↓</div> <div>↓</div>                                                                                                                                                                                       | BUS ADDR                                                                                 | Element bus address                                                                      |
|                                       |                                                                                                                                                                                                                              | BUS X                                                                                    | Bus number (factory default = 0)                                                         |
|                                       |                                                                                                                                                                                                                              | ADR X                                                                                    | Element address (factory default = 1)                                                    |
| <b>5</b><br>UNITS                     | <div>5</div> <div>↓</div> <div>ENTR</div>                                                                                                                                                                                    | UNITS X                                                                                  | English/metric system (0 = English, 1 = Metric)                                          |
| <b>6</b><br>USER<br>CONFIGURATION     | <div>6</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div> <div>↓</div>                                                                                                                                                | USER CFG                                                                                 | User configuration                                                                       |
|                                       |                                                                                                                                                                                                                              | HUSN X                                                                                   | Humidity sensors (0 = None, 1 = Differential [2 Sensors], 2 = Space Override [1 Sensor]) |
|                                       |                                                                                                                                                                                                                              | SUSN X                                                                                   | Suction sensors (0 = No, 1 = Yes)                                                        |
|                                       |                                                                                                                                                                                                                              | VENT  | Ventilation control (0 = MDP, 1 = IAQ, 2 = CFM, 3 = All)                                 |
|                                       |                                                                                                                                                                                                                              | MMAS X                                                                                   | Motormaster (0 = No, 1 = Yes)                                                            |
|                                       |                                                                                                                                                                                                                              | PURG X                                                                                   | Indoor-air quality (0 = Disable, 1 = Enable)                                             |
|                                       |                                                                                                                                                                                                                              | NTEN X                                                                                   | Nighttime free cool (0 = Disable, 1 = Enable)                                            |

AOSS — Adaptive Optimal Start/Stop  
CONT — Continuous  
CV — Constant Volume  
DAV — Digital Air Volume  
DD — Day  
DTCC — Discrete Time Clock Control

DUR — Duration  
EXH — Exhaust  
HH — Hour  
IAQ — Indoor-Air Quality  
MAINT — Maintenance  
MDP — Minimum Damper Position

## LEGEND

MIN — Minimum  
MM — Month  
MOD — Modulating  
MPD — Modulating Power Dampers  
NTFC — Nighttime Free Cooling  
OAC — Outdoor-Air Cfm Control

OVRD — Override  
RTN — Return  
STAT — Status  
TEMP — Temperature  
VAV — Variable-Air Volume

\*An "X" 

ENTR

 in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing 

ENTR

. The valid force ranges are listed in the Expansion column.

†See page 50-51 for details on correct operation of these tests

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions

††Compressors are energized for 10 seconds

|| Controls set point for economizer

## NOTES:

1 Alarm no. will only be displayed if ALARM is present

2 Alert no. will only be displayed if ALERT is present

3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values

Table 18 — Keypad Directory (cont)

| SERVICE (cont)                       |              |          |                                                         |
|--------------------------------------|--------------|----------|---------------------------------------------------------|
| Subfunction                          | Keypad Entry | Display  | Description                                             |
| 6<br>USER<br>CONFIGURATION<br>(cont) | ↓            | OSEN X   | Adaptive optimal start/stop (0 = Disable, 1 = Enable)   |
|                                      | ↓            | DLEN X   | Demand limit (0 = Disable, 1 = Enable)                  |
|                                      | ↓            | OHEN X   | Occupied heating (0 = Disable, 1 = Enable)              |
|                                      | ↓            | RSEN X   | Space temperature reset (0 = Disable, 1 = Enable)       |
|                                      | ↓            | DPEN X   | Duct pressure control (0 = Disable, 1 = Enable)         |
|                                      | ↓            | FANM X   | Fan mode auto/cont (0 = Auto, 1 = Cont)                 |
|                                      | ↓            | TSCH X   | Timed override schedules (1 = Unit, 2 = DTCC, 3 = Both) |
|                                      | ↓            | TOVR X   | Timed override value (0 to 4 hours)                     |
|                                      | ↓            | LLAG X   | Lead/Lag option (0 = Disable, 1 = Enable)               |
| 7<br>HEATING<br>COIL                 | 7 SRVC       | HEATCOIL | Configure heating coil                                  |
|                                      | ↓            | MLG X    | Master loop gain value                                  |
|                                      | ↓            | SMG X    | Submaster gain value                                    |
|                                      | ↓            | SCV X    | Submaster center value                                  |
|                                      | ↓            | FOV X    | Fan off value (F)                                       |
|                                      | ↓            | SMR X    | Submaster reference value                               |
|                                      | X ENTR *     | SMR X    | Submaster reference value forced (35 to 140 F)          |
| 8<br>COOLING                         | 8 SRVC       | COOLING  | Configure cooling parameters                            |
|                                      | ↓            | MLG X    | Master loop gain value                                  |
|                                      | ↓            | HHL X    | High humidity limit (0 to 99%)                          |
| 9<br>DUCT<br>PRESSURE                | 9 SRVC       | DUCTPRES | Configure duct pressure control                         |
|                                      | ↓            | MLG X    | Master loop gain value                                  |
|                                      | ↓            | SMG X    | Submaster gain value                                    |
|                                      | ↓            | SCV X    | Submaster center value                                  |
|                                      | ↓            | SMR X    | Submaster reference value                               |
|                                      | X ENTR *     | SMR X    | Submaster reference value forced (0.0 to 5.0 in wg)     |
| 10<br>ECONOMIZER                     | 1 0 SERV     | ECONMIZR | Configure economizer                                    |
|                                      | ↓            | MLG X    | Master loop gain value                                  |
|                                      | ↓            | SMG X    | Submaster gain value                                    |
|                                      | ↓            | SCV X    | Submaster center value                                  |
|                                      | ↓            | MDP X    | Minimum damper position (percent open)                  |
|                                      | ↓            | PES1 X   | Power exhaust set point 1                               |
|                                      | ↓            | PES2 X   | Power exhaust set point 2                               |
|                                      | ↓            | SMR X    | Submaster reference value                               |
|                                      | X ENTR *     | SMR X    | Submaster reference value forced (40 to 120)            |
|                                      | ↓            | DPSP X   | Damper set point (F)                                    |
|                                      | X ENTR *     | DPSP X   | Damper set point forced (45 to 80 F)                    |
|                                      | ↓            | OAE X    | Outdoor air enthalpy value                              |
|                                      | ↓            | RAE X    | Return air enthalpy value                               |
| 11<br>HEAT                           | 1 1 SERV     | HEAT     | Configure staged heat                                   |
|                                      | ↓            | MLG X    | Master loop gain value                                  |
|                                      | ↓            | SMG X    | Submaster gain value                                    |
|                                      | ↓            | SMR X    | Submaster reference value                               |
|                                      | X ENTR *     | SMR X    | Submaster reference value forced (35 to 140)            |
| 12<br>NTFC                           | 1 2 SERV     | NTFC     | Configure nighttime free cool (NTFC)                    |
|                                      | ↓            | NTLO X   | NTFC lockout temp (min. OAT to operate NTFC F)          |

**Table 18 — Keypad Directory (cont)**

| SERVICE (cont)                             |                               |          |                                                                 |
|--------------------------------------------|-------------------------------|----------|-----------------------------------------------------------------|
| Subfunction                                | Keypad Entry                  | Display  | Description                                                     |
| <b>13</b><br>AOSS                          | <b>1</b> <b>3</b> <b>SERV</b> | AOSS     | Configure adaptive optimal start/stop                           |
|                                            | ↓                             | BLDF X   | Building factor value (1 to 100; default = 10)                  |
|                                            | ↓                             | UOCF X   | 24-hour unoccupied factor (0 to 99; default = 15)               |
|                                            | ↓                             | SETB X   | Set point bias (0 to 10; default = 2)                           |
|                                            | ↓                             | OSMT X   | Maximum allowable stop time (10 to 120; default = 60)           |
| <b>14</b><br>SPACE<br>TEMPERATURE<br>RESET | <b>1</b> <b>4</b> <b>SERV</b> | SPCRESET | Configure space temperature reset                               |
|                                            | ↓                             | RTIO X   | Reset ratio (0 to 10; default = 3)                              |
|                                            | ↓                             | LIMIT X  | Reset limit (0 to 20; default = 10)                             |
| <b>15</b><br>LOADSHED                      | <b>1</b> <b>5</b> <b>SERV</b> | LOADSHED | Configure loadshed                                              |
|                                            | ↓                             | LSGP X   | Loadshed group number (1 to 16; default = 1)                    |
| <b>16</b><br>IAQ/CFM                       | <b>1</b> <b>6</b> <b>SERV</b> | IAQ      | Configure indoor-air quality                                    |
|                                            | ↓                             | LEVEL X  | IAQ priority level (1 = high, 2 = medium, 3 = low; default = 2) |
|                                            | ↓                             | IAQS X   | IAQ Set point (0 to 5000 ppm; default = 2000)                   |
|                                            | ↓                             | IAQG X   | IAQ gain (-2 to 2)                                              |
|                                            | ↓                             | OCS X    | Outdoor air cfm set point                                       |
|                                            | ↓                             | OACG X   | Outdoor air cfm gain (1 to 2.0)                                 |
|                                            | ↓                             | IVL X    | IAQ voltage low point                                           |
|                                            | ↓                             | IRL X    | IAQ reference low point                                         |
|                                            | ↓                             | IVH X    | IAQ voltage high point                                          |
|                                            | ↓                             | IRH X    | IAQ reference high point                                        |
|                                            | ↓                             | IQMX X   | IAQ maximum damper position (0 to 100%; default = 50%)          |
|                                            | ↓                             | OCMX X   | OAC maximum damper position (0 to 100%; default = 50%)          |
| <b>17</b><br>HUMIDITY                      | <b>1</b> <b>7</b> <b>SERV</b> | HUMIDITY | Configure humidity                                              |
|                                            | ↓                             | MLG X    | Master loop gain value                                          |
|                                            | ↓                             | SMG X    | Submaster gain value                                            |
|                                            | ↓                             | SCV X    | Submaster center value                                          |
|                                            | ↓                             | SMR X    | Submaster reference value                                       |
|                                            | <b>X</b> <b>ENTR</b> <b>★</b> | SMR X    | Submaster reference value forced (0 to 90)                      |

**LEGEND**

|                                           |                                       |                                      |
|-------------------------------------------|---------------------------------------|--------------------------------------|
| <b>AOSS</b> — Adaptive Optimal Start/Stop | <b>HH</b> — Hour                      | <b>NTFC</b> — Nighttime Free Cooling |
| <b>CONT</b> — Continuous                  | <b>IAQ</b> — Indoor-Air Quality       | <b>OAC</b> — Outdoor-Air Cfm Control |
| <b>CV</b> — Constant Volume               | <b>MAINT</b> — Maintenance            | <b>OVRD</b> — Override               |
| <b>DAV</b> — Digital Air Volume           | <b>MDP</b> — Minimum Damper Position  | <b>RTN</b> — Return                  |
| <b>DD</b> — Day                           | <b>MIN</b> — Minimum                  | <b>STAT</b> — Status                 |
| <b>DTCC</b> — Discrete Time Clock Control | <b>MM</b> — Month                     | <b>TEMP</b> — Temperature            |
| <b>DUR</b> — Duration                     | <b>MOD</b> — Modulating               | <b>VAV</b> — Variable-Air Volume     |
| <b>EXH</b> — Exhaust                      | <b>MPD</b> — Modulating Power Dampers |                                      |

\*An "X" **ENTR** in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing **ENTR**. The valid force ranges are listed in the Expansion column.

†See page 50-51 for details on correct operation of these tests.

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions.

††Compressors are energized for 10 seconds.

‡ Controls set point for economizer.

**NOTES:**

1 Alarm no. will only be displayed if ALARM is present.

2 Alert no. will only be displayed if ALERT is present.

3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values.

**Table 18 — Keypad Directory (cont)**

| SERVICE (cont)                               |                               |          |                                                                   |
|----------------------------------------------|-------------------------------|----------|-------------------------------------------------------------------|
| Subfunction                                  | Keypad Entry                  | Display  | Description                                                       |
| <b>18<br/>BUILDING<br/>PRESSURE</b>          | <b>1</b> <b>8</b> <b>SERV</b> | BLD PRES | Configure building pressure                                       |
|                                              | ↓                             | MLG X    | Master loop gain value                                            |
|                                              | ↓                             | SMG X    | Submater gain value                                               |
|                                              | ↓                             | SCV X    | Submaster center value                                            |
|                                              | ↓                             | SMR X    | Submaster reference value                                         |
|                                              | X <b>ENTR</b> *               | SMR X    | Submaster reference value forced (0 0 to 0 5)                     |
|                                              | ↓                             | BPS X    | Building pressure set point (0 to 0 50; default = 0 05)           |
|                                              | ↓                             | BPSO X   | Building pressure set point offset (0 05 to 0 50; default = 0 05) |
| <b>19<br/>ALERT<br/>LIMITS</b>               | <b>1</b> <b>9</b> <b>SERV</b> | ALRTLMT  | Configure alert limits                                            |
|                                              | ↓                             | SPLO X   | Space temp low alert limit/occupied X                             |
|                                              | ↓                             | SPHO X   | Space temp high alert limit/occupied X                            |
|                                              | ↓                             | SPLU X   | Space temp low alert limit/unoccupied X                           |
|                                              | ↓                             | SPHU X   | Space temp high alert limit/unoccupied X                          |
|                                              | ↓                             | SALO X   | Supply air temp low alert limit/occupied X                        |
|                                              | ↓                             | SAHO X   | Supply air temp high alert limit/occupied X                       |
|                                              | ↓                             | SALU X   | Supply air temp low alert limit/unoccupied X                      |
|                                              | ↓                             | SAHU X   | Supply air temp high alert limit/unoccupied X                     |
|                                              | ↓                             | RALO X   | Return air temp low alert limit/occupied X                        |
|                                              | ↓                             | RAHO X   | Return air temp high alert limit/occupied X                       |
|                                              | ↓                             | RALU X   | Return air temp low alert limit/unoccupied X                      |
|                                              | ↓                             | RAHU X   | Return air temp high alert limit/unoccupied X                     |
|                                              | ↓                             | OATL X   | Outdoor air temp low alert limit X                                |
|                                              | ↓                             | OATH X   | Outdoor air temp high alert limit X                               |
|                                              | ↓                             | RHL X    | Relative humidity low alert limit X                               |
|                                              | ↓                             | RHH X    | Relative humidity high alert limit X                              |
|                                              | ↓                             | ORHL X   | Outdoor air relative humidity low alert limit X                   |
|                                              | ↓                             | ORHH X   | Outdoor air relative humidity high alert limit X                  |
|                                              | ↓                             | SPL X    | Static pressure low alert limit X                                 |
|                                              | ↓                             | SPH X    | Static pressure high alert limit X                                |
|                                              | ↓                             | BPL X    | Building pressure low alert limit X                               |
|                                              | ↓                             | BPH X    | Building pressure high alert limit X                              |
|                                              | ↓                             | OACL X   | Outdoor air cfm low alert limit X                                 |
|                                              | ↓                             | OACH X   | Outdoor air cfm high alert limit X                                |
|                                              | ↓                             | IAQL X   | Indoor-air quality low alert limit X                              |
|                                              | ↓                             | IAQH X   | Indoor-air quality high alert limit X                             |
| <b>20<br/>SERVICE<br/>HISTORY</b>            | <b>2</b> <b>0</b> <b>SERV</b> | SERVHIST | Service history                                                   |
|                                              | ↓                             | CAT X    | Circuit A run time                                                |
|                                              | ↓                             | CBT X    | Circuit B run time                                                |
|                                              | ↓                             | SFT X    | Supply-air fan run time                                           |
|                                              | ↓                             | CYC X    | Cycles stage 0 to stage 1                                         |
| <b>21<br/>SERVICE<br/>MAINTENANCE</b>        | <b>2</b> <b>1</b> <b>SERV</b> | SRV/MTN  | Service maintenance alert                                         |
|                                              | ↓                             | SMAL X   | Service/maintenance alert limit (X hrs x 1000)                    |
|                                              | ↓                             | SMEH X   | Service maintenance elapsed hours (X.X x 1000)                    |
| <b>22<br/>TIMED<br/>OVERRIDE<br/>HISTORY</b> | <b>2</b> <b>2</b> <b>SERV</b> | OVRDHIST | History of timed overrides                                        |
|                                              | ↓                             | OHR X    | Hours of timed overrides                                          |

**Table 18 — Keypad Directory (cont)**

| SCHEDULE                                       |                               |            |                                                           |
|------------------------------------------------|-------------------------------|------------|-----------------------------------------------------------|
| Subfunction                                    | Keypad Entry                  | Display    | Comments                                                  |
| <b>1 OVERRIDE</b>                              | <b>1</b> <b>SCHD</b>          | OVRD xHR   | Number of Override Hours (0 to 4 Hours); Schedule I       |
| <b>2 PERIOD 1</b>                              | <b>2</b> <b>SCHD</b>          | PERIOD 1   | Period 1; Time Schedule I                                 |
|                                                | ↓                             | OCC HH MM  | Occupied Time                                             |
|                                                | ↓                             | UNO HH MM  | Unoccupied Time                                           |
|                                                | ↓                             | MON X      | Monday Flag                                               |
|                                                | ↓                             | TUE X      | Tuesday Flag                                              |
|                                                | ↓                             | WED X      | Wednesday Flag                                            |
|                                                | ↓                             | THU X      | Thursday Flag                                             |
|                                                | ↓                             | FRI X      | Friday Flag                                               |
|                                                | ↓                             | SAT X      | Saturday Flag                                             |
|                                                | ↓                             | SUN X      | Sunday Flag                                               |
|                                                | ↓                             | HOL X      | Holiday Flag                                              |
| <b>3 PERIOD 2</b>                              | <b>3</b> <b>SCHD</b>          | PERIOD 2   | Period 2; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>4 PERIOD 3</b>                              | <b>4</b> <b>SCHD</b>          | PERIOD 3   | Period 3; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>5 PERIOD 4</b>                              | <b>5</b> <b>SCHD</b>          | PERIOD 4   | Period 4; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>6 PERIOD 5</b>                              | <b>6</b> <b>SCHD</b>          | PERIOD 5   | Period 5; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>7 PERIOD 6</b>                              | <b>7</b> <b>SCHD</b>          | PERIOD 6   | Period 6; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>8 PERIOD 7</b>                              | <b>8</b> <b>SCHD</b>          | PERIOD 7   | Period 7; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>9 PERIOD 8</b>                              | <b>9</b> <b>SCHD</b>          | PERIOD 8   | Period 8; Time Schedule I<br>Same as Period 1 Subfunction |
| <b>10 OVERRIDE</b>                             | <b>1</b> <b>0</b> <b>SCHD</b> | OVRD XHR   | Number of Override Hours (0 to 4 Hours); Schedule II      |
| <b>11 through 18 PERIOD 1 through PERIOD 8</b> | <b>1</b> <b>1</b> <b>SCHD</b> | PERIOD 1 — | Period 1 through Period 8; Time Schedule II               |
|                                                | <b>1</b> <b>8</b> <b>SCHD</b> | PERIOD 8   | Configure same as Period 1 subfunction, Time Schedule I   |

**LEGEND**

|                                           |                                       |                                      |
|-------------------------------------------|---------------------------------------|--------------------------------------|
| <b>AOSS</b> — Adaptive Optimal Start/Stop | <b>HH</b> — Hour                      | <b>NTFC</b> — Nighttime Free Cooling |
| <b>CONT</b> — Continuous                  | <b>IAQ</b> — Indoor-Air Quality       | <b>OAC</b> — Outdoor-Air Cfm Control |
| <b>CV</b> — Constant Volume               | <b>MAINT</b> — Maintenance            | <b>OVRD</b> — Override               |
| <b>DAV</b> — Digital Air Volume           | <b>MDP</b> — Minimum Damper Position  | <b>RTN</b> — Return                  |
| <b>DD</b> — Day                           | <b>MIN</b> — Minimum                  | <b>STAT</b> — Status                 |
| <b>DTCC</b> — Discrete Time Clock Control | <b>MM</b> — Month                     | <b>TEMP</b> — Temperature            |
| <b>DUR</b> — Duration                     | <b>MOD</b> — Modulating               | <b>VAV</b> — Variable-Air Volume     |
| <b>EXH</b> — Exhaust                      | <b>MPD</b> — Modulating Power Dampers |                                      |

\*An "X" **ENTR** in the Keypad Entry column indicates that the reading can be forced by entering a value and then pressing **ENTR**. The valid force ranges are listed in the Expansion column

†See page 50-51 for details on correct operation of these tests

\*\*The supply-air fan is energized at this point and remains on for the duration of the compressor/heat test functions.

††Compressors are energized for 10 seconds

‡ Controls set point for economizer.

**NOTES:**

- 1 Alarm no. will only be displayed if ALARM is present
- 2 Alert no. will only be displayed if ALERT is present
- 3 If unit is not configured for a certain subfunction, that subfunction will not show up when scrolling through values.

Table 19 — Sensor Set Point Alert Limits and Default Values

| NAME | DESCRIPTION                   | <div>STAT</div><br>SUBFUNCTION | OCCUPIED<br>SPACE STATUS | ALERT<br>DEFAULT<br>(LOW) | ALERT<br>DEFAULT<br>(HIGH) | LOW<br>LIMIT  | HIGH<br>LIMIT |
|------|-------------------------------|--------------------------------|--------------------------|---------------------------|----------------------------|---------------|---------------|
| BP   | Building pressure             | <div>7</div><br>Pressure       | Occupied                 | −0.25 in.<br>wg           | 0.25 in.<br>wg             | 0.0 in.<br>wg | 0.5 in.<br>wg |
| IAQ  | Indoor-Air Quality            | <div>8</div><br>Inputs         | Occupied                 | 0 ppm                     | 2000 ppm                   | 0 ppm         | 5000 ppm      |
| OAC  | Outdoor-Air Cfm               | <div>8</div><br>Inputs         | Occupied                 | 0 cfm                     | 50,000 cfm                 | 0 cfm         | 50,000 cfm    |
| OARH | Outdoor-Air Relative Humidity | <div>8</div><br>Inputs         | Occupied/<br>Unoccupied  | 0%                        | 100%                       | 0%            | 100%          |
| OAT  | Outdoor-Air Temp              | <div>6</div><br>Temps          | Occupied/<br>Unoccupied  | −40 F                     | 125 F                      | −40 F         | 245 F         |
| RAT* | Return-Air Temp               | <div>6</div><br>Temps          | Occupied                 | 60 F                      | 90 F                       | −40 F         | 245 F         |
|      |                               |                                | Unoccupied               | 35 F                      | 120 F                      | −40 F         | 245 F         |
| RH*  | Relative Humidity             | <div>8</div><br>Inputs         | Occupied                 | 0%                        | 100%                       | 0%            | 100%          |
| SAT* | Supply-Air Temp               | <div>6</div><br>Temps          | Occupied                 | 45 F                      | 180 F                      | −40 F         | 245 F         |
|      |                               |                                | Unoccupied               | 35 F                      | 180 F                      | −40 F         | 245 F         |
| SP*  | Static Pressure               | <div>7</div><br>Pressure       | Occupied                 | 0.0 in.<br>wg             | 5.0 in.<br>wg              | 0.0 in.<br>wg | 5.0 in.<br>wg |
| SPT* | Space Temperature             | <div>6</div><br>Temps          | Occupied                 | 65 F                      | 80 F                       | −10 F         | 245 F         |
|      |                               |                                | Unoccupied               | 45 F                      | 100 F                      | −10 F         | 245 F         |

ppm — parts per million

\*Once the unit changes from unoccupied to occupied mode, a programmed delay of 30 minutes takes place before any alert will be generated

Table 20 — Alert Criteria Reset Value for Return to Normal

| NAME | DESCRIPTION                   | CONSTANT VALUE |
|------|-------------------------------|----------------|
| BP   | Actual Space Pressure         | None           |
| IAQ  | Indoor-Air Quality            | None           |
| OAC  | Constant Outdoor-Air Cfm      | None           |
| OARH | Outdoor-Air Relative Humidity | 2%             |
| OAT  | Outdoor-Air Temperature       | 1 F            |
| RAT  | Return-Air Temperature        | 1 F            |
| RH   | Space Relative Humidity       | 2%             |
| SAT  | Supply-Air Temperature        | 2 F            |
| SP   | Static Pressure               | 0.2 in. wg     |
| SPT  | Space Temperature             | 1 F            |

*Nighttime Free Cooling (33)* — This mode starts the supply-air fan and uses the economizer (if outdoor air is satisfactory) to precool space during early morning unoccupied hours (3 to 7 a.m.).

*Building Pressurization (34)* — The intent of building pressurization is to keep smoke out of a zone. During building pressurization:

- The HIR is on
- the optional economizer dampers open (if equipped)
- the supply-air fan runs (the optional inlet guide vanes are open)
- the optional modulating power exhaust or return fan damper(s) is closed (if installed)
- the optional power exhaust or return fans are off (if installed)

This allows the space to be pressurized and smoke will not enter the space. See Table 22 for full details.

Table 21 — Mode Numbers and Names ( 

3

STAT

 )

| MODE NUMBER | MODE NAME                          |
|-------------|------------------------------------|
| 21          | Space Temperature Reset (VAV Only) |
| 22          | Demand Limit                       |
| 23          | Unoccupied Heating                 |
| 24          | Unoccupied Cooling                 |
| 25          | Standby                            |
| 26          | Optimal Start                      |
| 27          | Unoccupied                         |
| 28          | Indoor-Air Quality Purge           |
| 29          | Optimal Stop                       |
| 30          | Occupied Heating                   |
| 31          | Occupied Cooling                   |
| 32          | Occupied Fan Only                  |
| 33          | Nighttime Free Cooling             |
| 34          | Pressurization                     |
| 35          | Evacuation                         |
| 36          | Smoke Purge                        |
| 37          | Fire Shutdown                      |
| 38          | Timed Override                     |
| 39          | Digital Air Volume Control         |
| 40          | Quick Test                         |
| 41          | High Humidity Override             |

NOTES

1. Optimal start will initiate both mode 26 (optimal start) and mode 23 (unoccupied heating)
2. Do not use mode 28 (IAQ purge) in conjunction with a VAV hot water or steam coil.

**Table 22 — Operating Mode Details**

| MODE                                                          | PRESSURIZATION                             | EVACUATION | SMOKE PURGE                                | FIRE SHUTDOWN |
|---------------------------------------------------------------|--------------------------------------------|------------|--------------------------------------------|---------------|
| DISPLAY CODE (MODE)                                           | 34                                         | 35         | 36                                         | 37            |
| POWER EXHAUST OR RETURN FANS                                  | Off                                        | On         | On                                         | Off           |
| SUPPLY-AIR FAN                                                | On                                         | Off        | On                                         | Off           |
| ECONOMIZER DAMPER                                             | Open                                       | Open       | Open                                       | Close         |
| RETURN-AIR DAMPERS                                            | Close                                      | Close      | Close                                      | Open          |
| POWER EXHAUST OR RETURN DAMPER(S)                             | Close                                      | Open       | Open                                       | Close         |
| SUPPLY-AIR FAN INLET GUIDE VANES OR VARIABLE FREQUENCY DRIVES | Open, Control To Static Pressure Set Point | Close      | Open, Control To Static Pressure Set Point | Close         |
| HEAT INTERLOCK RELAY                                          | On                                         | Off        | On                                         | Off           |
| ELECTRIC HEAT — ALL STAGES                                    | Off                                        | Off        | Off                                        | Off           |
| HUMIDIFIER 1 AND 2                                            | Off                                        | Off        | Off                                        | Off           |

*Evacuation (35)* — This function allows the rooftop unit to remove smoke from the space. During evacuation:

- the HIR is off
- the economizer dampers are open
- the power exhaust or return fans are running
- the power exhaust or return fan damper(s) is open
- the supply-air fan is off

Note that the optional economizer and modulating power exhaust are required for the evacuation function. See Table 22 for full details.

*Smoke Purge (36)* — The smoke purge function allows the rooftop unit to remove smoke from the space. During smoke purge:

- HIR is on
- the economizer dampers are open
- the power exhaust or return fans are running
- the power exhaust or return fan damper(s) is open
- the supply-air fan is on

Note that the optional economizer and modulating power exhaust are required for the smoke purge function. See Table 22 for full details.

*Fire Shutdown (37)* — During the fire shutdown mode, the unit shuts off and all dampers except return-air dampers close. See Table 22 for full details.

*Timed Override (38)* — The timed override mode provides a one to 4 hour temporary override of the programmed schedule and forces the unit into the occupied mode. Override can be implemented from the HSIO keypad by pressing

**1** **SCHD** and entering the override hours desired. Override can also be implemented by pressing the button on T55 or T56 space temperature sensor(s) (when configured) in the occupied space. The duration of the current override is defined under the **6** **TRVC** timed override value (TOVR). Override expires after each use.

NOTE: Unit must go into an unoccupied mode before another override can begin.

*DAV Control (39)* — This mode indicates that the unit is being controlled through the CCN network and is connected

to a DAV system (VAV terminals with digital controls). Unit occupancy schedule and the space temperature reset are overridden by the DAV system.

*Factory/Field Test (40)* — This mode indicates that the unit is configured to display all inputs and exercise all output channels.

*High Humidity Override (41)* — This mode indicates that the humidity is above the high humidity override value and cooling is initiated. This can only be enabled for unit with gas, steam, or hot water heat.

**4** **STAT** (Stages) — This subfunction displays the information about the current stage. A capacity stage number, from 0 to 6 for cooling and 0 to 5 for heating is displayed to indicate the number of active stages. See Table 23 for compressor loading sequences. To access the cooling stages function, press **4** **STAT** and press **↓** to display the number of cooling stages in operation. Press **↓** to display the following:

1. Cooling Percent Capacity — Percent of total unit cooling capacity being utilized.
2. Heating Stages — The number of active heating stages
3. Heating Percent Capacity — Percent of total unit heating capacity being utilized.
4. Sum/Z Ratio — Load/unload factor is used to determine when compressors and unloaders will be staged. This factor indicates when the addition or subtraction of a step of capacity will occur.

**5** **STAT** (Set point) — This subfunction displays the operating set points that are currently in effect, either occupied or unoccupied. To access the control set point function, press **5** **STAT** and press **↓** to display the current control set point.

NOTE: If unit is programmed for CV operation, this will be the cooling submaster reference value for cooling and the heating set point for heating. For units programmed for VAV operation, this will be the MSAS (supply-air set point + reset) for cooling and the heating set point for heating.

**Table 23 — Compressor Loading and Unloading Sequences**

| 48NP/50NB,NP028-034,064,074 UNITS |              |       |       |             |       |       |                       |                          |
|-----------------------------------|--------------|-------|-------|-------------|-------|-------|-----------------------|--------------------------|
| COOLING STAGE                     | LEAD CIRCUIT |       |       | LAG CIRCUIT |       |       | ACTIVE COMP CYLINDERS | PERCENT CYLINDERS ACTIVE |
|                                   | COMP A1      | UL A1 | UL A2 | COMP B1     | UL B1 | UL B2 |                       |                          |
| 0                                 | OFF          | OFF   | OFF   | OFF         | OFF   | OFF   | 0                     | 0                        |
| 1                                 | ON           | ON    | ON    | OFF         | OFF   | OFF   | 2                     | 17                       |
| 2                                 | ON           | ON    | OFF   | OFF         | OFF   | OFF   | 4                     | 33                       |
| 3                                 | ON           | OFF   | OFF   | OFF         | OFF   | OFF   | 6                     | 50                       |
| 4                                 | ON           | OFF   | OFF   | ON          | ON    | ON    | 8                     | 66                       |
| 5                                 | ON           | OFF   | OFF   | ON          | ON    | OFF   | 10                    | 83                       |
| 6                                 | ON           | OFF   | OFF   | ON          | OFF   | OFF   | 12                    | 100                      |

| 48NP/50NB,NP044 UNITS |              |       |             |       |                       |                          |
|-----------------------|--------------|-------|-------------|-------|-----------------------|--------------------------|
| COOLING STAGE         | LEAD CIRCUIT |       | LAG CIRCUIT |       | ACTIVE COMP CYLINDERS | PERCENT CYLINDERS ACTIVE |
|                       | COMP A1      | UL A1 | COMP B1     | UL B1 |                       |                          |
| 0                     | OFF          | OFF   | OFF         | OFF   | 0                     | 0                        |
| 1                     | ON           | ON    | OFF         | OFF   | 2                     | 25                       |
| 2                     | ON           | OFF   | OFF         | OFF   | 4                     | 50                       |
| 3                     | ON           | OFF   | ON          | ON    | 6                     | 75                       |
| 4                     | ON           | OFF   | ON          | OFF   | 8                     | 100                      |

| 48NP/50NB,NP024,054 UNITS |              |       |       |             |       |                       |                          |
|---------------------------|--------------|-------|-------|-------------|-------|-----------------------|--------------------------|
| COOLING STAGE             | LEAD CIRCUIT |       |       | LAG CIRCUIT |       | ACTIVE COMP CYLINDERS | PERCENT CYLINDERS ACTIVE |
|                           | COMP A1      | UL A1 | UL A2 | COMP B1     | UL B1 |                       |                          |
| 0                         | OFF          | OFF   | OFF   | OFF         | OFF   | 0                     | 0                        |
| 1                         | ON           | ON    | ON    | OFF         | OFF   | 2                     | 20                       |
| 2                         | ON           | ON    | OFF   | OFF         | OFF   | 4                     | 40                       |
| 3                         | ON           | OFF   | OFF   | OFF         | OFF   | 6                     | 60                       |
| 4                         | ON           | OFF   | OFF   | ON          | ON    | 8                     | 80                       |
| 5                         | ON           | OFF   | OFF   | ON          | OFF   | 10                    | 100                      |

| 48NP/50NB,NP024,054 UNITS (cont) |             |       |       |              |       |                       |                          |
|----------------------------------|-------------|-------|-------|--------------|-------|-----------------------|--------------------------|
| COOLING STAGE                    | LAG CIRCUIT |       |       | LEAD CIRCUIT |       | ACTIVE COMP CYLINDERS | PERCENT CYLINDERS ACTIVE |
|                                  | COMP A1     | UL A1 | UL A2 | COMP B1      | UL B1 |                       |                          |
| 0                                | OFF         | OFF   | OFF   | OFF          | OFF   | 0                     | 0                        |
| 1                                | OFF         | OFF   | OFF   | ON           | ON    | 2                     | 20                       |
| 2                                | OFF         | OFF   | OFF   | ON           | OFF   | 4                     | 40                       |
| 3                                | ON          | ON    | ON    | ON           | OFF   | 6                     | 60                       |
| 4                                | ON          | ON    | OFF   | ON           | OFF   | 8                     | 80                       |
| 5                                | ON          | OFF   | OFF   | ON           | OFF   | 10                    | 100                      |

**COMP** — Compressor  
**UL** — Unloader

NOTE: ON means unloaded and OFF means loaded for unloaders

Press  to display the control temperature. This display is the actual supply-air temperature leaving the unit.

(Temperature) — The system temperature subfunction displays the readings at the temperature sensing thermistors. To read a temperature, press  , then scroll to the desired temperature reading by pressing .

(Pressure) — The system pressure subfunction displays suction, discharge, low-pressure switch status, building pressure, and static pressure.

(Inputs) — This subfunction displays the rest of the system inputs. Press  , then press . The compressor A1 status is displayed with either ON or OFF based on whether the compressor is running or not. Press  to access additional system inputs. Some inputs can be used forced by entering a value to replace the actual value. For example, press  until the ENT display appears. The display will show ENT LOW or ENT HGH,

indicating that the enthalpy is good (LOW) or bad (HGH). If the display is ENT HGH and the user wants to use outdoor air, pressing   will change the display to ENT LOW/FORCE 4; overriding or “forcing” the enthalpy status to be good. This allows economizer operation.

Refer to Table 18 for more information on “forcible” displays. To discontinue a forced command, press the  key. This removes the forced value and allows the unit to accept input from the controlling device.

The forced values are useful for problem diagnosis, and as a preliminary step before running the test function.

(Analog outputs) — This subfunction displays the status of the various analog outputs. Press  to access additional analog outputs. Some outputs can be user forced by entering a value for the output. For example, press  until the HCV display appears. The display will indicate an output value describing the heating coil valve percent open. If the display reads HEATING COIL VALVE 0 (valve closed) and the user wants to use the heating coil, pressing   will change the display to HEATING COIL VALVE

100/FORCE 4; overriding or forcing the heating coil valve to 100% open. This is useful for problem diagnosis and as a preliminary step before running the test function.

**1 0 STAT** (Outputs) — This subfunction displays the various system discrete outputs. These displays indicate the ability of the component or device to operate. It does not indicate that the component or device is functioning, but that the component or device has been energized by the control.

Press **↓** to access additional discrete outputs. Some outputs can be user forced.

**1 1 STAT** (Standby) — The standby/run mode indicates the current capability of the unit. Press **↓** to access standby. This displays either a STBY NO (unit is in the run configuration) or STBY YES (unit is in standby and is not capable of operating). To change from STBY YES to STBY NO, either press **CLR** or **• ENTR**. To change from STBY NO to STBY YES, press **1 ENTR**. This change to STBY YES will clear any alarms present on the unit.

Press **↓** to access external clock input function. This function (when set to 0) permits remote on-off control of unit from any switching source.

**TEST FUNCTION** — The test function operates the “quick test” diagnostic program. See Quick Test section on page 50 and Table 18 for full details.

**HISTORY FUNCTION** — The history function allows the user to look at unit operational information.

**1 HIST** (Alarm history) — This subfunction allows the user to view the last 9 alarm codes and their descriptions. The oldest alarm is listed first and is replaced when the tenth alarm is generated. The first alarm listed (the oldest) continues to be shifted out as new alarms are generated.

**2 HIST** (Maintenance history) — The maintenance history subfunction displays the latest service date. A service technician can enter a new service date through the HSIO keypad. The entry of a service date shall be password protected. See Service Function section below for more details. The last 2 service dates are displayed at the building supervisor.

**SERVICE FUNCTION** — The service function allows the user to view and modify the unit configuration files. Factory, field, and service configuration data may be viewed, changed, and/or entered through the keypad and display module.

**1 SRVC** (Log on/Log off) — The service function is password protected by a non-changeable password. To log on, press **1 SRVC** and the display will read LOG ON. Press **1 1 1 1 ENTR** and the display will change to LOGGED ON. At this time, configurations may be viewed or modified. To log out, press **1 SRVC ↓ ENTR** and the display will read LOGD OFF.

**2 SRVC** (Software version) — This subfunction allows the user to view information about the software, such as the version number and language options.

**3 SRVC** (Factory Configuration) — This subfunction allows for factory configuration of the unit size, type, and options. Under this subfunction, there are a minimum of 7 configuration fields that are configured at the factory.

**NOTE:** If a processor is replaced in the field, these configuration fields must be configured using the keypad at this subfunction.

To change a configuration:

1. Display present configuration field.
2. Enter the new configuration data.
3. Press **ENTR** (see Table 24 for more details).

**4 SRVC** (Element bus address) — The element bus address subfunction is used to identify the unit address assignment when using the CCN network. The default bus number is zero and is factory set. When more than one unit is connected to the CCN, the element address must be changed on all but one unit. The element address system default is 1, and element address numbers cannot be repeated. Element address must be changed at the HSIO keypad.

**5 SRVC** (Units of measure) — Measurements can be displayed in either English or SI Metric units. The default is English. To change units, press **5 SRVC**. The display will be UNIT 0 (English units). Press **1 ENTR** and the display will change to UNIT 1 (SI Metric units).

**6 SRVC** (User configuration) — After logging on, this subfunction allows the user to read or change the factory configuration of user options. Table 24 shows the particular factory and user configurations that are factory set

The majority of user configuration items are self-explanatory. However, the ventilation control requires the following information:

- 0 = economizer minimum position is controlled by minimum position entered.
- 1 = economizer minimum position is controlled by IAQ set point.
- 2 = economizer minimum position is controlled to maintain a constant outdoor-air cfm set point.
- 3 = economizer will use the largest of the minimum set points as stated in 0, 1, and 2 settings above.

**7 SRVC** (Heating coil) — This subfunction allows the user to view and modify the factory configuration of the heating coil.

The fan off value is the supply-air temperature that the hydronic heating coil valve will modulate open or closed to maintain during periods when the evaporator fan is off. This is designed to prevent coil freeze-up during off periods. This value can be set anywhere between 35 and 65 F, and the default value is 40 F

**8 SRVC** (Cooling coil) — This subfunction is used to read or change the configuration of the cooling coil parameters. The high humidity limit is the set point used when the cooling control will be overridden by the humidity control.

**9 SRVC** (Duct pressure) — This subfunction is used to read or change the configuration of duct pressure control.

**1 0 SRVC** (Economizer) — The economizer subfunction is used to read or change the configuration of the economizer.

**NOTE** The economizer dampers modulate to maintain a supply-air temperature equal to the damper set point (VAV only).

**1 1 SRVC** (Heat) — This subfunction is used to read or change the configuration of staged heat.



**IMPORTANT:** The Data Reset function should be performed any time one or more of the values is configured. See Note 2 above for more details

**Table 24 — Factory/Field Configuration Procedure (cont)**

| KEYPAD ENTRY         | DISPLAY  | COMMENTS                                                                                             |
|----------------------|----------|------------------------------------------------------------------------------------------------------|
| <b>6</b> <b>SRVC</b> | USER CFG | User configuration                                                                                   |
| ↓                    | HUSN 0   | Humidity sensors; Default = No (0 = No, 1 = Differential [2 sensors], 2 = Space Override [1 sensor]) |
| ↓                    | SUSN 0   | Suction sensors (Enter value)                                                                        |
| <b>ENTR</b>          | SUSN X   | 0 = No, 1 = Yes                                                                                      |
| ↓                    | VENT 0   | Ventilation control (Enter value)                                                                    |
| <b>ENTR</b>          | VENT X   | 0 = SPT, 1 = IAQ, 2 = CFM, 3 = All                                                                   |
| ↓                    | MMAS 0   | Head pressure control function (Enter value)                                                         |
| <b>ENTR</b>          | MMAS X   | 0 = No, 1 = Yes                                                                                      |
| ↓                    | PURG DIS | IAQ purge enable; Default = Disable (0 = Disable, 1 = Enable)                                        |
| ↓                    | NTEN DIS | NTFC enable; Default = Disable (0 = Disable, 1 = Enable)                                             |
| ↓                    | OSEN DIS | AOSS enable; Default = Disable (0 = Disable, 1 = Enable)                                             |
| ↓                    | DLEN DIS | Demand limit enable; Default = Disable (0 = Disable, 1 = Enable)                                     |
| ↓                    | OHEN DIS | Occupied heating enable; Default = Disable (0 = Disable, 1 = Enable)                                 |
| ↓ *                  | RSEN DIS | Space temperature reset enable; Default = Disable (0 = Disable, 1 = Enable)                          |
| ↓                    | DPEN 0   | Duct pressure control (Enter value)                                                                  |
| <b>ENTR</b> *        | DPEN X   | 0 = Disable, 1 = Enable                                                                              |
| ↓                    | FANM 0   | Fan Mode (Enter value)                                                                               |
| <b>ENTR</b> *        | FANM X   | 0 = Automatic, 1 = Continuous                                                                        |
| ↓                    | TSCH 1   | Timed Override Schedules (Enter value)                                                               |
| <b>ENTR</b>          | TSCH X   | 1 = Unit, 2 = DTCC, 3 = Both                                                                         |
| ↓                    | TOVR 0   | Timed Override Hours (Enter value)                                                                   |
| <b>ENTR</b>          | TOVR X   | 0, 1, 2, 3, or 4                                                                                     |
| ↓                    | LLAG     | Lead/Lag Option; Enter 0 = No or 1 = Yes                                                             |

**AOSS** — Adaptive Optimal Start/Stop  
**CV** — Constant Volume  
**DTCC** — Discrete Time Clock Control  
**ELEC** — Electric  
**IAQ** — Indoor-Air Quality  
**MDP** — Minimum Damper Position  
**MOD** — Modulating  
**NTFC** — Nighttime Free Cool  
**SPT** — Space Temperature  
**VAV** — Variable-Air Volume

\*Alarm 86, illegal configuration, will result if value is not inputted correctly

**NOTES:**

- Calibration of the pressure transducers is not required unless problems with the transducers occur or the standard PSIO is replaced. To calibrate pressure transducers:
  - Disconnect from system
  - Hang in the atmosphere

c Read pressure Pressures before calibration must be in the range of  $\pm 3$  psig (atmosphere)

d Press **ENTR**

e Reattach to system

- Upon completion of the factory/field configuration step, move to the DTRS (Data Reset) subfunction Press **1** **ENTR**, and all revised inputs will be loaded This procedure takes approximately 40 seconds The display returns to the default rotating display

**IMPORTANT:** The Data Reset function should be performed any time one or more of the values is configured See Note 2 above for more details.

**1** **2** **SRVC** (Nighttime free cooling) — This subfunction is used to read or change the configuration of the nighttime free cooling option.

**1** **3** **SRVC** (Adaptive optimal start/stop) — This subfunction is used to read or change the configuration of the adaptive optimal start/stop option. Refer to Carrier Comfort Network product literature for more information on configurations.

**1** **4** **SRVC** (Space temperature reset) — This subfunction is used to read or change the configuration of the space temperature reset Refer to the Space Temperature Reset section on page 14 and Space Temperature Averaging section on page 41 for more information.

**1** **5** **SRVC** (Loadshed) — This subfunction is used to read or change the configuration of loadshed. Loadshed is used to

define the CCN groups for redline and loadshed functions. Groups 1 through 16 are acceptable values.

**1** **6** **SRVC** (Indoor-air quality) — This subfunction is used to read or change the configuration of the indoor-air quality option. Refer to the Indoor-Air Quality section on page 72 for more details.

**1** **7** **SRVC** (Humidity) — This subfunction is used to read or change the configuration of the humidity option.

**1** **8** **SRVC** (Building pressure) — This subfunction is used to read or change the configuration of the building pressure option.

**1** **9** **SRVC** (Alert limits) — This is used to read or change the configuration of the alert limits.

**2 0 SRVC** (Service history) — This subfunction is used to read the unit service history.

**2 1 SRVC** (Service/Maintenance alert) — This is used to read or change the configuration of the service maintenance alert option.

NOTE: When the number of hours the supply-air fan has been energized reaches the alert limit, alert no. 173 is generated and SMEH 0.0 is displayed, resetting the supply-air fan's run time to 0 hours. The supply-air fan cumulative time energized can also be reset by pressing **2 HST** and entering a new service date. This function can be used to monitor standard service practices, such as lubrication of bearings and changing or cleaning filters.

**2 2 SRVC** (Override history) — This subfunction is used to read the status of the timed override history. This value is cumulative for the current 24-hour period (beginning at midnight).

NOTE: This subfunction is a "read only" option.

**SET POINT FUNCTION** — The set point function allows the user to view current set point values and to make changes as necessary. See Adjusting Set Points section on page 66 and Table 18 for details.

**SCHEDULE FUNCTION** — Two schedules are provided with the unit controls. Refer to Program Time Sequences section on page 69 and Table 18 for details.

## TROUBLESHOOTING

By using the keypad and display module and the status function, actual operating conditions of the unit are displayed while it is running. Test function allows proper operation of compressors, compressor unloaders, fans, and other components to be checked while unit is stopped. Service function displays how configurable items are configured. If an operating fault is detected, an alarm is generated and an alarm code(s) is displayed under the subfunction **1 STAT**, along with an explanation of the fault. Up to 10 current alarm codes are stored under this subfunction. For checking specific items, see Tables 16 and 18.

**Checking Display Codes** — To determine how the unit has been programmed to operate, check diagnostic information (**1 STAT** and **2 STAT**) and operating mode displays (**3 STAT**). If no display appears, follow procedures in Control Modules section on page 47. If display is working, continue as follows:

1. Note all alarm and alert codes displayed, **1 STAT** and **2 STAT**.
2. Note all operating mode codes displayed, **3 STAT**.
3. Note control temperature set point in effect and current control temperature, **5 STAT**.

If unit is running, compare the "in effect" control set point with current temperature. Remember, if reset is in effect, the values may be different because machine is operating to the modified leaving air set point. Check the programming of schedule function to see if occupied or unoccupied set point should be in effect.

**Unit Shutoff** — To place the unit in standby mode, use the HSIO and press **1 1 STAT**. Press **↓** until the display

reads STBY YES or STBY NO. If display reads STBY NO, press **1 ENTR** to place the unit in standby mode. If display reads STBY YES, the unit is already in the standby mode. To remove the unit from standby mode, press **• ENTR**.

Any compressors and condenser fans which are operating will take several seconds to shut down once the unit is placed in standby mode. The evaporator fan will take approximately 15 seconds to shut down.

NOTE: When unit is in standby mode (display reads STBY YES), no commands will be accepted from the CCN communications bus.

**Complete Unit Stoppage** — If the unit is off, there are several conditions that can cause this situation to occur:

1. Cooling load satisfied.
2. Programmed schedule.
3. General power failure.
4. Blown fuse in the control power feed.
5. Open control circuit fuse.
6. Unit ON/OFF switch moved to OFF position.
7. Loss of communications between the processor module and other control modules.
8. Operation of the unit blocked by the demand limit function.
9. Unit is in standby mode.
10. Unit is turned off through the CCN network.
11. Unit supply-air temperature (SAT) thermistor failure.
12. Supply-air fan is not operating.
13. High duct static pressure.
14. Remote on-off circuit open (off).

**Single Circuit Stoppage** — If a single circuit stops, there are several potential causes.

1. Open contacts in the compressor high-pressure switch.
2. Low refrigerant pressure.
3. Thermistor failure.
4. Transducer failure.
5. High suction superheat.
6. Low suction superheat.
7. Unit supply-air temperature thermistor (SAT) failure.
8. Compressor circuit breaker trip.
9. Operation of the circuit blocked by the demand limit function.
10. Loss of communications between the processor module and DSIO1 module.

**Restart Procedure** — Before attempting to restart the machine, check the alarms and alerts subfunctions to determine the cause of the shutdown. If the unit, circuit, or compressor stops more than once as a result of a safety device, determine and correct the cause before attempting to start the unit again.

After the cause of the shutdown has been corrected, unit restart may be automatic or manual depending upon the fault. A manual reset requires the standby mode be reenabled to STBY NO display. Manual reset conditions may also be cleared through the building supervisor or service tool by selecting modify, controller, configuration and downloading "Unit Reset YES" from the configuration screen. All of the fault conditions are described in the NB,NP Diagnostic Alarm Codes And Possible Causes section on page 36.

**Alarm Codes and Problem Identification** — The NB,NP unit controls have many features to aid service personnel in troubleshooting. By using the keypad and display module and the status function, actual operating conditions of the system are displayed while the unit is running. The test function allows proper operation of the compressors, compressor unloaders, fans, and other components to be checked while the unit is stopped. The service function displays how configurable items are currently configured. If an operating fault is detected, an alarm is generated and an alarm code(s) is displayed under the subfunction **1** **STAT** along with an explanation of the fault. All current alarms are stored in this subfunction.

To determine how a unit is operating, check the diagnostic information available ( **6** **STAT** through **10** **STAT** ) and the operating mode displays ( **3** **STAT** ). If no display appears, see Control Modules section on page 47. If the display is working:

1. Note all alarm codes displayed under **1** **STAT** .
2. Note all operating mode codes displayed under **3** **STAT** .
3. Note the modified supply-air set point in effect and the current supply-air temperature under **5** **STAT** .
  - a. If reset is in effect, the modified set point may be different from the supply-air set point because the space temperature is below the reset set point.
  - b. If demand limit is in effect, the unit may be incapable of producing the desired supply-air set point due to the decreased capacity of the unit.
  - c. Check the programming of the schedule function to see if occupied or unoccupied set point should be in effect.

NOTE: To disable unit operation, press **1** **1** **STAT** and put the unit in standby mode.

**NB,NP DIAGNOSTIC ALARM CODES AND POSSIBLE CAUSES** (See Table 25):

**Alarm Codes 51 and 55 (Compressor Fault)** — Alarm code 51 is for a fault on compressor A1, and alarm code 55 is for a fault on compressor B1. If the DSIO1 relay module fails or a compressor safety circuit switch opens during the operation of the compressor, the microprocessor detects this fault, stops the compressor, signals the alarm, and deenergizes the DSIO1 relay to lock the compressor off. To reset the alarm, use the manual method. The possible causes are:

1. High-pressure switch open (code 51 or 55, then code 76 and/or 77 if pressure transducers are installed) The high-pressure switch is wired in series with the 24-v supply that energizes the load side of the DSIO1 module. If the high-pressure switch opens during compressor operation, the compressor stops, and the stop is detected by the DSIO1, terminal strip J3.
2. Wiring error A wiring error in the control safety circuit will cause the modules to malfunction, and an error will be indicated.

To check out alarm codes 51 or 55:

1. Scroll through the subfunction **4** **TEST** to the proper compressor number using the **↓** key.
2. Energize the step (press **ENTR** ). If the compressor does not start, the cause is most likely related to one of the following: HPS (high-pressure switch) open, tripped compressor circuit breaker or incorrect wiring in either the safety circuit or compressor contactor coil circuit. To follow the circuit alarm, see the unit wiring diagram.

If the compressor starts, verify that all stages of condenser fans are operational using **3** **TEST** and **ENTR** for MM, FR2 and FR3.

Return unit to run mode and observe compressor operation to verify that compressor lock-out circuit is working and condenser fans are energized after compressor starts.

NOTE: With head pressure control option enabled ( **6** **SWG** , MMAS = YES), a short delay will occur before the first stage of condenser fan(s) is energized. Check location of SCT on condenser coil or pressure transducer wiring and pressure (if equipped) if condenser fans do not start.

**Alarm Codes 53 and 57 (Compressor Status)** — If the commanded state of the compressor does not match compressor status for 3 seconds, the corresponding compressor stops and the proper alarm trips. This alarm will detect circuit breaker failures, and failure of the compressor contactor to be energized. If a compressor circuit breaker trips due to compressor overcurrent or a short or ground between the circuit breaker and compressor, an alarm for that compressor will be indicated. This will only affect that circuit; the other circuit will continue to operate. The microprocessor is also programmed to indicate a compressor failure if the CLO (cooling lockout) circuit to the DSIO1, terminal J3, receives a voltage when a compressor is not supposed to be operating. Other possible causes include a failed contactor or DSIO1 module.

**Alarm Code 59 (Supply-Air Thermistor Failure)** — If the temperature measured by this thermistor is outside the range of -40 to 245 F (-40 to 118 C), heating, cooling, and economizer use are disabled. Reset of this alarm is automatic once the problem is corrected. Start-up follows the normal sequence. The cause of the alarm is usually a bad thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

**Alarm Code 60 (Return-Air Thermistor Failure)** — If the temperature measured by this thermistor is outside the range of -40 to 245 F (-40 to 118 C), the cooling capacity algorithm will use a default of 8° F per stage drop. Heating and economizer will be disabled. Reset of this alarm is automatic once the problem is corrected. Start-up follows the normal sequence. The cause of the alarm is usually a bad thermistor, a shorted or open thermistor caused by a wiring error, or a loose connection.

**Alarm Code 61 (Outdoor-Air Thermistor Failure)** — If the temperature measured by this thermistor is outside the range of -40 to 245 F (-40 to 118 C), the economizer routine will use enthalpy input only. If the unit is equipped with humidity sensors, then the enthalpy will also be considered bad and the economizer will close the dampers. Nighttime free cooling will also be disabled. Reset of this alarm is automatic once the problem is corrected. Start-up follows the normal sequence. The cause of the alarm is usually a bad thermistor, a wiring error, or a loose connection.

**Alarm Codes 62 and 63 (Saturated Condensing Thermistor Failure)** — If the SCT fails (temperature is out of the range of -40 F to 245 F), the alarm will trip and the appropriate circuit will shut off. Reset of this alarm is automatic once the problem is corrected. The unit performs a complete restart when the SCT sensor resets. The cause of the alarm is usually a bad thermistor, a wiring error, or a loose connection.

NOTE: This alarm is only valid when the unit has saturated condensing thermistors.

**Table 25 — Alarm Codes**

| DISPLAY | DESCRIPTION                                         | ACTION TAKEN BY CONTROL                                                                                        | RESET METHOD        | PROBABLE CAUSE                                                                                                                                                                                                                                                    |
|---------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 51      | Compressor A1 Failure                               | Compressor A1 shut down                                                                                        | Manual              | High-pressure switch open<br>Wiring error                                                                                                                                                                                                                         |
| 52      | Not Used                                            | —                                                                                                              | —                   | —                                                                                                                                                                                                                                                                 |
| 53      | Compressor A1 Status Failure                        | Compressor A1 shut down                                                                                        | Manual              | Voltage on DSIO1 J3 when compressor off.<br>Failed contactor.<br>Failed DSIO module.<br>Circuit breaker tripped                                                                                                                                                   |
| 54      | Not used                                            | —                                                                                                              | —                   | —                                                                                                                                                                                                                                                                 |
| 55      | Compressor B1 Failure                               | Compressor B1 shut down                                                                                        | Manual              | High-pressure switch open<br>Wiring error                                                                                                                                                                                                                         |
| 56      | Not Used                                            | —                                                                                                              | —                   | —                                                                                                                                                                                                                                                                 |
| 57      | Compressor B1 Status Failure                        | Compressor B1 shut down                                                                                        | Manual              | Voltage on DSIO1 J3 when compressor off<br>Failed contactor<br>Failed DSIO module<br>Circuit breaker tripped                                                                                                                                                      |
| 58      | Not Used                                            | —                                                                                                              | —                   | —                                                                                                                                                                                                                                                                 |
| 59      | Supply-Air Thermistor Failure                       | Heating, cooling, and economizer disabled                                                                      | Automatic           | Bad, shorted, or open thermistor caused by a wiring error or loose connection                                                                                                                                                                                     |
| 60      | Return-Air Thermistor Failure                       | Heating and economizer disabled                                                                                | Automatic           | Bad, shorted, or open thermistor caused by a wiring error or loose connection                                                                                                                                                                                     |
| 61      | Outdoor-Air Thermistor Failure                      | NTFC disabled and economizer uses enthalpy input only. If unit has humidity sensors, economizer dampers close. | Automatic           | Bad thermistor, wiring error, or loose connection.                                                                                                                                                                                                                |
| 62      | Saturated Condensing Thermistor Failure, Circuit A  | Circuit A shut down                                                                                            | Automatic           | Bad thermistor, wiring error, or loose connection<br>This alarm is only valid when unit does not have pressure transducers                                                                                                                                        |
| 63      | Saturated Condensing Thermistor Failure, Circuit B  | Circuit B shut down                                                                                            | Automatic           | Bad thermistor, wiring error, or loose connection.<br>This alarm is only valid when unit does not have pressure transducers                                                                                                                                       |
| 64      | Suction Thermistor Failure, Circuit A               | Superheat alarms disabled<br>Unit will operate as if there are no suction sensors.                             | Automatic           | Bad thermistor, wiring error, or loose connection<br>This alarm is only valid when unit is configured for suction sensors                                                                                                                                         |
| 65      | Suction Thermistor Failure, Circuit B               | Superheat alarms disabled<br>Unit will operate as if there are no suction sensors                              | Automatic           | Bad thermistor, wiring error, or loose connection<br>This alarm is only valid when unit is configured for suction sensors.                                                                                                                                        |
| 66      | Space Thermistor Failure                            | Temperature reset, NTFC, cooling and heating functions disabled (CV applications only)                         | Automatic           | Bad thermistor, wiring error, or loose connection                                                                                                                                                                                                                 |
| 67      | Compressor A1 Discharge Pressure Transducer Failure | Compressor A1 shuts down                                                                                       | Automatic           | Bad transducer, bad 5-v power supply, or a wiring error                                                                                                                                                                                                           |
| 68      | Compressor B1 Discharge Pressure Transducer Failure | Compressor B1 shuts down                                                                                       | Automatic           | Bad transducer, bad 5-v power supply, or a wiring error                                                                                                                                                                                                           |
| 69      | Compressor A1 Suction Pressure Transducer Failure   | Compressor A1 shuts down                                                                                       | Automatic           | Bad transducer, bad 5-v power supply, or a wiring error                                                                                                                                                                                                           |
| 70      | Compressor B1 Suction Pressure Transducer Failure   | Compressor B1 shuts down                                                                                       | Automatic           | Bad transducer, bad 5-v power supply, or a wiring error                                                                                                                                                                                                           |
| 71      | Loss of Communications with DSIO1                   | All DSIO1 outputs turned off                                                                                   | Automatic           | Faulty or improperly connected plug, faulty DSIO1 module, or wiring error                                                                                                                                                                                         |
| 72      | Loss of Communications with DSIO2                   | All DSIO2 outputs turned off                                                                                   | Automatic           | Faulty or improperly connected plug, faulty DSIO2 module, or wiring error                                                                                                                                                                                         |
| 73      | Loss of Communications with PSIO2                   | All PSIO2 outputs turned off                                                                                   | Automatic           | Faulty or improperly connected plug, faulty PSIO2 module, or wiring error.                                                                                                                                                                                        |
| 74      | Low Pressure, Circuit A                             | Circuit A compressor(s) shut down                                                                              | Automatic or Manual | Low refrigerant charge, dirty filters, evaporator fan turning backwards, inlet guide vanes not opening properly, plugged filter drier, or faulty transducer                                                                                                       |
| 75      | Low Pressure, Circuit B                             | Circuit B compressor(s) shut down                                                                              | Automatic or Manual | Low refrigerant charge, dirty filters, evaporator fan turning backwards, inlet guide vanes not opening properly, plugged filter drier, or faulty transducer.                                                                                                      |
| 76      | High Pressure, Circuit A                            | Circuit A compressor(s) shut down                                                                              | Manual              | An overcharged system, high outdoor ambient temperature coupled with a dirty outdoor coil, plugged filter drier, partially closed liquid line service valve, or a faulty transducer. This alarm is only valid when the unit has refrigerant pressure transducers. |

**LEGEND**

CCN — Carrier Comfort Network  
DSIO — High-Voltage Relay Module  
IAQ — Indoor-Air Quality  
NTFC — Nighttime Free Cool  
PSIO — Processor Module  
TSM — Terminal System Manager  
TXV — Thermal Expansion Valve

**NOTE** Alarms 89-92 are level zero on the CCN Network. All other alarms are level 2

**Table 25 — Alarm Codes (cont)**

| DISPLAY | DESCRIPTION                                  | ACTION TAKEN BY CONTROL                                                                | RESET METHOD | PROBABLE CAUSE                                                                                                                                                                                                                                                                     |
|---------|----------------------------------------------|----------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 77      | High Pressure, Circuit B                     | Circuit B compressor(s) shut down                                                      | Manual       | An overcharged system, high outdoor ambient temperature coupled with a dirty outdoor coil, plugged filter drier, partially closed liquid line service valve, or a faulty transducer. This alarm is only valid when the unit has refrigerant pressure transducers                   |
| 78      | Supply-Air Fan State and Status              | All unit outputs (except supply fan) turned off. Supply fan output remains energized   | Automatic    | Fan status switch failure, tubing not properly connected, or fan status switch set incorrectly                                                                                                                                                                                     |
| 79      | Not used                                     | —                                                                                      | —            | —                                                                                                                                                                                                                                                                                  |
| 80      | Low Saturated Suction Temperature, Circuit A | Circuit A shut down                                                                    | Manual       | Low entering outdoor-air temperature, low evaporator-fan cfm, low refrigerant charge, plugged filter drier, partially closed liquid line service valve, or pressure transducer failure                                                                                             |
| 81      | Low Saturated Suction Temperature, Circuit B | Circuit B shut down                                                                    | Manual       | Low entering outdoor-air temperature, low evaporator-fan cfm, low refrigerant charge, plugged filter drier, partially closed liquid line service valve, or pressure transducer failure                                                                                             |
| 82      | High Suction Superheat, Circuit A            | Circuit A shut down                                                                    | Manual       | Low refrigerant charge, plugged filter drier, partially closed liquid line service valve, or a faulty thermistor or transducer.                                                                                                                                                    |
| 83      | High Suction Superheat, Circuit B            | Circuit B shut down                                                                    | Manual       | Low refrigerant charge, plugged filter drier, partially closed liquid line service valve, or a faulty thermistor or transducer                                                                                                                                                     |
| 84      | Low Suction Superheat, Circuit A             | Circuit A shut down                                                                    | Manual       | Faulty TXV, thermistor, or transducer                                                                                                                                                                                                                                              |
| 85      | Low Suction Superheat, Circuit B             | Circuit B shut down                                                                    | Manual       | Faulty TXV, thermistor, or transducer                                                                                                                                                                                                                                              |
| 86      | Illegal Configuration                        | Unit will not start                                                                    | Manual       | Configuration code error                                                                                                                                                                                                                                                           |
| 87      | Not used                                     | —                                                                                      | —            | —                                                                                                                                                                                                                                                                                  |
| 88      | Hydronic Coil Freeze Stat                    | Economizer at minimum position, heating coil valve fully open, supply-air fan shut off | Automatic    | Low temperature outdoor-air used with minimum airflow<br>Unit is in IAQ purge mode with low temperature outdoor air<br>Outdoor-air damper is jammed open.                                                                                                                          |
| 89      | Pressurization                               | Initializes pressurization mode. See Table 22 for hardware state details               | Automatic    | Pressurization alarm tripped. Space being over-pressurized to prevent smoke from entering zones                                                                                                                                                                                    |
| 90      | Evacuation                                   | Initializes evacuation mode. See Table 22 for hardware state details                   | Automatic    | Smoke alarm tripped. Power exhaust/return-air fans clear smoke from space                                                                                                                                                                                                          |
| 91      | Smoke Purge                                  | Initializes smoke purge mode. See Table 22 for hardware state details                  | Automatic    | Purge alarm tripped. Outdoor air is being supplied and return air is being exhausted                                                                                                                                                                                               |
| 92      | Fire Shutdown                                | Unit shuts down. See Table 22 for hardware state details                               | Automatic    | Fire alarm tripped                                                                                                                                                                                                                                                                 |
| 93      | Linkage Failure                              | Unit returns to stand-alone operation                                                  | Automatic    | Loose connection, a broken wire, or a loss of communication with the TSM                                                                                                                                                                                                           |
| 94      | Building Pressure                            | Alarm generated                                                                        | Automatic    | Power exhaust fan failure in either the 1/4-in. plastic tubing routed to the area to be controlled or the tubing routed to the atmosphere from the building pressure control. This alarm is only valid when the unit is configured for modulating power exhaust or return-air fan. |
| 95      | Duct Static Pressure                         | The supply-air fan shuts off for 5 minutes                                             | Automatic    | Inlet guide vane actuator motor failure;<br>A leak or obstruction in the 1/4-in. plastic tubing routed from the inlet guide vane duct pressure control to the ductwork connection. All the terminals are closed                                                                    |
| 96      | Not used                                     | —                                                                                      | —            | —                                                                                                                                                                                                                                                                                  |
| 97      | Indoor-Air Quality Failure                   | Alarm generated                                                                        | Automatic    | IAQ set point is less than the IAQ low reference generated, or the IAQ priority is configured as low and the IAQ sensor reading exceeds the IAQ set point                                                                                                                          |

**LEGEND**

CCN — Carrier Comfort Network  
DSIO — High-Voltage Relay Module  
IAQ — Indoor-Air Quality  
NTFC — Nighttime Free Cool  
PSIO — Processor Module  
TSM — Terminal System Manager  
TXV — Thermostatic Expansion Valve

NOTE Alarms 89-92 are level zero on the CCN Network. All other alarms are level 2

**Alarm Codes 64 and 65 (Suction Thermistor Failure)** — If the temperature measured by this thermistor is outside the range of  $-40$  to  $245$  F ( $-40$  to  $118$  C), the high and low superheat alarms will be disabled and the head pressure algorithm will operate as if the unit did not have suction sensors. Reset of this alarm is automatic once the problem is corrected. Start-up follows the normal sequence. The cause of the alarm is usually a bad thermistor, a wiring error, or a loose connection.

**Alarm Code 66 (Space Thermistor Failure)** — This alarm applies to all units. If the temperature measured by this thermistor is outside the range of  $-10$  to  $245$  F ( $-23$  to  $118$  C), the temperature reset, nighttime free cooling, and cooling and heating (CV applications only) functions are disabled. Reset of this alarm is automatic once the problem is corrected, and the reset function will be enabled. The cause of the alarm is usually a bad thermistor, a wiring error, or a loose connection.

**Alarm Codes 67 through 70 (Transducer Failure)** — If the voltage ratio of a transducer is less than 2% or greater than 98% for 3 seconds, the transducer has failed and the affected circuit shuts down.

- Code 67** — Compressor A1 Discharge Pressure Transducer Failure
- Code 68** — Compressor B1 Discharge Pressure Transducer Failure
- Code 69** — Compressor A1 Suction Pressure Transducer Failure
- Code 70** — Compressor B1 Suction Pressure Transducer Failure

The reset of this alarm is automatic if the voltage ratio returns within range. Start-up of this circuit follows a normal sequence. The cause of this error is usually a bad transducer, a bad 5-v power supply, or a wiring error. The failed transducer should be recalibrated by the control using the service function before the transducer is considered bad.

**Alarm Code 71 (Loss of Communications With DSIO1)** — If communication is lost with the DSIO1 module, all outputs controlled by this module will be turned off. This alarm will reset automatically when the communication is restored. The outputs will turn on normally after the alarm condition has been reset. The probable cause for this condition is a faulty or improperly connected plug, a wiring error, or a faulty module.

**Alarm Code 72 (Loss of Communications With DSIO2)** — If communication is lost with the DSIO2 module, all outputs controlled by this module will be turned off. This alarm will reset automatically once the communication is restored. The outputs will turn on normally after the alarm condition has been reset. The probable cause for this condition is a faulty or improperly connected plug, a wiring error, or a faulty module.

**Alarm Code 73 (Loss of Communications With Control Option Board [PSIO2])** — If communication is lost with the PSIO2 module, all outputs controlled by this module will be turned off. Reset of this alarm is automatic when the communication is restored.

Start-up after this alarm has been remedied follows a normal sequence. The probable cause for this condition is a faulty or improperly connected plug, a wiring error, or a faulty module.

**Alarm Codes 74 and 75 (Low Pressure Circuit A or B)**

**With low-pressure switches installed** — If a circuit is on and the low-pressure switch is open (opens at  $27$  psig  $\pm 4$  psig) for 15 seconds, the compressor in that circuit will stop and the alarm will trip.

NOTE: During initial start-up of a circuit, the low pressure input will be ignored for 2 minutes.

**With a suction transducer installed** — If a circuit is on and the suction pressure drops below 28 psig for 15 seconds, the compressor in that circuit will stop and the alarm will trip.

Alarm code 74 signals a circuit A failure, and code 75 signals a circuit B failure. The reset for this alarm can be automatic if the pressure reaches  $67 \pm 7$  psig (switch) or 65 psig (transducer) within 5 minutes after the alarm has tripped. The circuit will not be reset if it trips again after 3 consecutive failures. The possible causes for the alarm are low refrigerant charge, dirty filters, evaporator fan turning backwards, inlet guide vanes not opening properly, plugged filter drier, or faulty transducer.

**Alarm Codes 76 and 77 (High Pressure Circuit A or B)** — If a compressor trips on compressor fault alarm 51 or 55 and the discharge pressure for that circuit is greater than 410 psig, then the high pressure alarm will trip. If the discharge pressure ever exceeds 440 psig, then the alarm will trip and the appropriate circuit will be shut off.

Alarm code 76 signals a circuit A failure, and alarm code 77 signals a circuit B failure.

Reset of this alarm is manual. The circuit will start normally after the alarm condition has been corrected. Possible causes for this alarm are an overcharged system, high outdoor ambient temperature coupled with a dirty outdoor coil, plugged filter drier, partially closed liquid line service valve, or a faulty transducer.

NOTE: This alarm is only valid when the unit has refrigerant pressure transducers.

**Alarm Code 78 (Supply-Air Fan)** — If the commanded state and status of the supply-air fan do not match for 60 seconds, the alarm trips. (The control circuit does not detect circuit breaker failures due to motor overcurrent, shorts or grounds between the evaporator-fan circuit breaker and motor, circuit breaker trips, or broken belts.) Other possible causes are fan status switch failure, tubing not properly connected, or switch set improperly. All other unit outputs except the supply-air fan are turned off when this alarm is generated. The supply-air fan output remains energized.

Reset of this alarm is automatic once the problem is corrected.

**Alarm Codes 80 and 81 (Low Saturated Suction Temperature)** — If the saturated suction temperature is less than  $20$  F ( $-6.7$  C) for 5 minutes, the alarm trips and the circuit shuts off.

If the unit is configured for 2-speed fan operation, the fan must be on high speed for this alarm to be generated. If the fan is at low speed, the speed will be set to high and the 5 minute timer will be restarted. The fan will be locked on high speed until the saturated suction temperature exceeds  $65$  F.

Alarm code 80 signals a circuit A failure, and alarm code 81 signals a circuit B failure. Reset is manual, and start-up of the circuit is normal after the alarm has been cleared. Possible causes of the fault condition are a combination of low entering outdoor-air temperature, low evaporator-fan cfm, low refrigerant charge, plugged filter drier, partially closed liquid line service valve, or pressure transducer failure.

NOTE: This alarm is valid only when the unit has refrigerant pressure transducers.

**Alarm Codes 82 and 83 (High Suction Superheat)** — This alarm is valid only when unit is configured for pressure transducers and suction sensors (thermistors), and mechanical cooling is on.

If the suction superheat is greater than  $45$  F ( $7$  C) for more than five minutes, the alarm trips and the circuit shuts down. Alarm code 82 signals a circuit A failure, and alarm code 83 signals a circuit B failure. Reset of this alarm is manual. The circuit will start normally after the alarm condition has been corrected. Possible causes for this alarm are low refrigerant

charge, plugged filter drier, partially closed liquid line service valve, or a faulty thermistor or transducer.

**Alarm Codes 84 and 85 (Low Suction Superheat)** — This alarm is valid only when the unit is configured for pressure transducers and suction sensors (thermistors), and mechanical cooling is on.

If the suction superheat is less than 3 F (–16 C) for more than five minutes, the alarm trips and the affected circuit shuts down. Alarm code 84 signals a circuit A failure, and alarm code 85 signals a circuit B failure. Reset of this alarm is manual. Start-up of the circuit is normal after the alarm has been corrected. Possible causes of the alarm include a faulty thermostatic expansion valve (TXV), thermistor, or transducer.

**Alarm Code 86 (Illegal Configuration)** — This fault indicates a configuration code error, and the unit is not allowed to start. Refer to Table 16 and   on page 32 for factory configuration values and   on page 32 for user configuration variables. Check all configuration codes and set points and correct any errors.

**Alarm Code 88 (Hydronic Coil Freeze Stat)** — The hydronic coil freeze stat alarm requires a field supplied, normally open, temperature actuated switch connected to PSIO2 at plug J7 (bottom). The alarm is activated by a 24-v signal generated by the switch when it closes. The economizer will be set at minimum position, heating coil valve will be fully open, and supply-air fan will be shut off. This may be caused by low temperature outdoor-air used with minimum airflow, during IAQ purge mode with low temperature outdoor air, or because the outdoor-air damper is jammed open.

Reset of this alarm is automatic once the problem is corrected.

**Alarm Code 89 through 92 (Pressurization, Evacuation, Smoke Purge, and Fire Shutdown, respectively)** — When the unit is equipped with an optional smoke control and a fire system is installed, these 4 modes are provided to control smoke within areas serviced by the unit. The unit must be equipped with an economizer, power exhaust or return-air fan options, and the control option module to support these modes. The building fire alarm system closes field supplied, normally open, dry contacts connected to PSIO2 at plug J7 (bottom) to activate the alarms

Reset of this alarm is automatic once the problem is corrected.

**Alarm Code 93 (Linkage Failure — DAV System Only)** — A linkage failure alarm is generated when the linkage has stopped updating the TSM linkage tables within the last 5 minutes.

NOTE: This alarm can only be generated after linkage has updated the table at least one time since initialization.

The unit controls enter the linkage default mode if the linkage is enabled, but the communications link has been lost. With the controls having reverted back to stand-alone operation, the existing sensors, previously overridden by linkage, will be used. This may be caused by a loose connection or a broken wire.

Reset of this alarm is automatic once the problem is corrected.

**Alarm Code 94 (Building Pressure)** — If the building pressure is greater than the building pressure set point plus 0.25 in. wg for 30 seconds, the alarm will be generated. This may be caused by a power exhaust fan failure or a leak or obstruction in either the 1/4-in. plastic tubing routed to the area to be controlled or the tubing routed to atmosphere from the building pressure control. This alarm is valid only when the unit is configured for modulating power exhaust or return-air fan.

Reset of this alarm is automatic once the problem is corrected.

**Alarm Code 95 (Duct Static Pressure)** — If the duct pressure is greater than the static pressure set point plus 1.0 in. wg for 30 seconds, or equal to or greater than 5.0 in. wg for 15 seconds, then the alarm will trip, and the supply-air fan will shut off for 5 minutes. This may be caused by variable frequency drive (VFD) or IGV actuator motor failure or a leak or obstruction in the 1/4-in. plastic tubing routed from the VFD or IGV duct pressure control to the ductwork connection, or all the terminals are closed.

Reset of this alarm is automatic once the problem is corrected

**Alarm Mode 97 (Indoor-Air Quality Failure)** — This alarm is valid only when the unit is configured with the PSIO2 control option module, the unit is equipped with field-supplied IAQ sensors, and the VENT option is set at either “1” or “3”.

If the IAQ set point (IAQS) is less than the IAQ low reference value or greater than the high reference value, an alarm will be generated. An alarm will also occur when the IAQ priority is configured as low and the IAQ sensor reading exceeds the IAQ set point.

Reset of this alarm is automatic once the problem is corrected

**Head Pressure Control** — The microprocessor controls the condenser fans to maintain the lowest condensing temperature and the highest operating efficiency possible. The condenser fan stages are configured to react to either saturated condensing temperatures (SCT) or refrigerant pressure sensors, or can be controlled by the lead compressor.

Unit sizes 024-034 have 2 stages of fan control. The stage 2 fan relay (FR2) will cycle in response to the higher SCT of the 2 circuits. Unit sizes 044-074 have 3 fan stages. Fan relays 2 and 3 will respond to their associated circuit SCT.

A low ambient head pressure control option is also included standard on all NB,NP units as an additional feature to allow fan cycling on the first stage. The first stage of head pressure control is cycled in the same manner as the Motor-master® II control. See Table 26.

The highest SCT is used to control the condenser (outdoor) fan motor(s) (OFM) controlled by the head pressure control relay (MMR). See Table 27 for fan control points. If FR2 or FR3 is energized in addition to MMR, then MMR will be locked in the energized mode.

The 2 other stages of head pressure control are controlled by the SCT on standard units, or the SCT and suction transducers on units equipped with suction pressure transducers and suction sensors. Table 27 shows the fan configurations and lists the on and off points for FR2 and FR3.

Table 27 also describes the fan sequence of operation and defines the particular fans controlled by stage. The OFM no. 1 is always the condenser fan on the left when viewing the unit from the compressor end.

## Space Temperature Sensors

**STANDARD SPACE TEMPERATURE SENSOR (T55)** — The T55 (part no. HH51BX001) sensor is a wall-mounted device used to measure space temperature and for unoccupied heating and cooling operation. It should be installed as a wall-mounted thermostat would be (in the conditioned space where it will not be subjected to either a cooling or heating source or direct exposure to sunlight, and 4 to 5 ft above the floor). It can also be used to override the occupancy schedule in the unit by pushing the button on the front. Refer to Space Temperature Sensor (T55) section on page 56 for wiring details.

**ACCESSORY SPACE TEMPERATURE SENSOR (T56)** — This device operates the same as the standard T55 sensor but has an additional feature of allowing the user to change the set point  $\pm 5^\circ\text{F}$  from the space. The T56 sensor is (part no. HH51BX004) applicable to CV applications only. A slide potentiometer is used to provide the space temperature offset and is located on the face of the device. The sensor is a wall-mounted device and should be installed as a wall-mounted thermostat would be (in the conditioned space where it will not be subjected to either a cooling or heating source or direct exposure to sunlight, and 4 to 5 ft above the floor). It can also be used to override the occupancy schedule in the unit by pushing the button on the front.

**SPACE TEMPERATURE AVERAGING** — Applications that require averaging using multiple space temperature sensors

can be satisfied using either 4 or 9 sensors as shown in Fig. 4. Single space temperature reset wiring is discussed in detail in Space Temperature Sensor sections on page 40.

**NOTE** Only Carrier sensors may be used for standard T55 space temperature averaging. Sensors must be used in multiples of 1, 4 and 9 only, with total sensor wiring not to exceed 1000 ft. However, space temperature reset can be accomplished with only one sensor (provided standard with unit).

**NOTE:** Do not use T56 sensor for space temperature averaging because  $5^\circ\text{F}$  offset function will not work in a multiple sensor application.

**Table 26 — Fan Relay Operation**

| FAN RELAY (FR) OUTPUT<br>(FAN STAGE NO.)      | CONFIGURATION                                                                                | OFM ON POINT                            | OFM OFF POINT                                                    |
|-----------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------|
| <b>MM</b><br>(Head Pressure Control Function) | Lead Fan Control (MMAS = NO)                                                                 | Mechanical Cooling On                   | Mechanical Cooling Off                                           |
|                                               | Head Pressure Control w/SCT Sensors (MMAS = YES, Pressure Transducers = NO)                  | SCT > Head Pressure Set Point - 15 F    | SCT < Head Pressure Set Point - 37 F For 90 Seconds              |
|                                               | Head Pressure Control w/Pressure Transducers (MMAS = YES, Pressure Transducers = YES)        | SCT > 138 F OR Head Pressure > 330 psig |                                                                  |
| <b>FR2 / FR3</b>                              | Unit with either SCT Sensors OR Pressure Transducers (MMAS = YES, Pressure Transducers = NO) | SCT > Head Pressure Set Point           | SCT < Head Pressure Set Point - 35 F for 2 Minutes               |
|                                               | Optional Suction Transducers AND Sensors Installed (MMAS = YES, Pressure Transducers = YES)  |                                         | SCT < Head Pressure Set Point and Superheat > 30 F For 2 Minutes |

**FR** — Fan Relay  
**OFM** — Outdoor (Condenser) Fan Motor  
**SCT** — Saturated Condensing Temperature

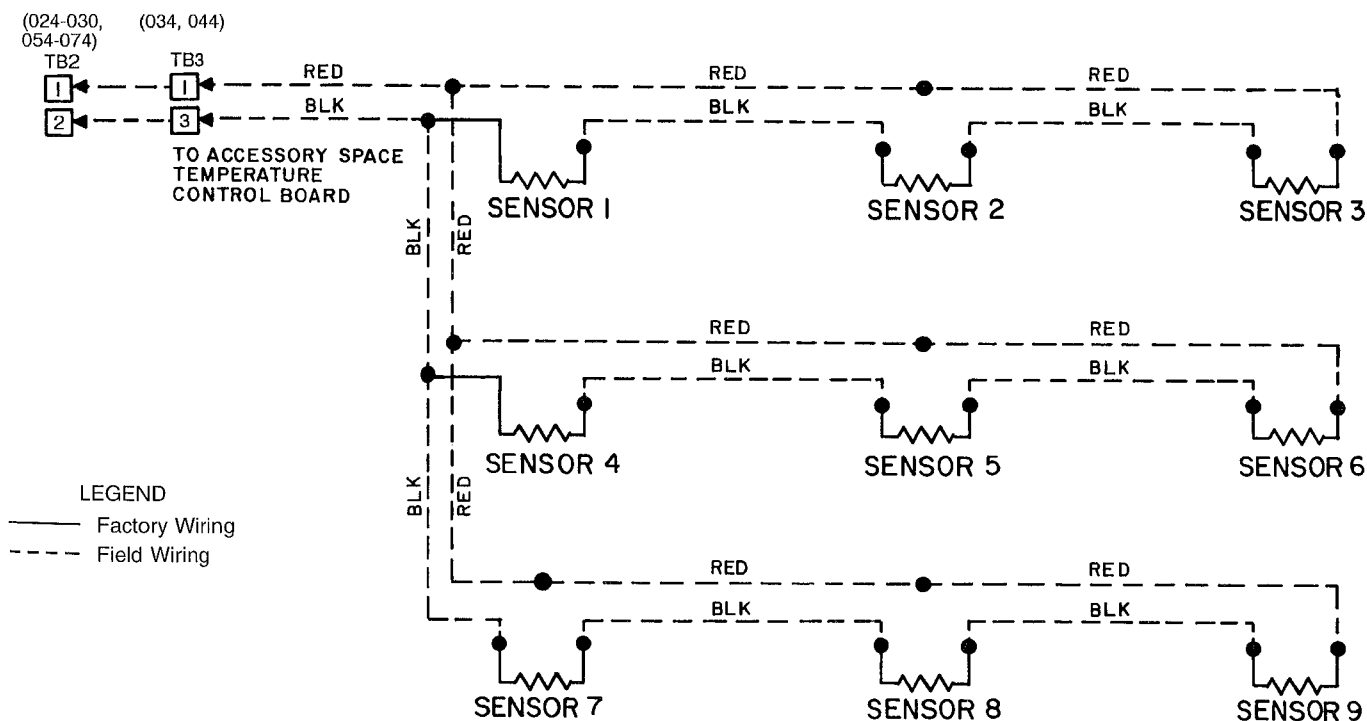
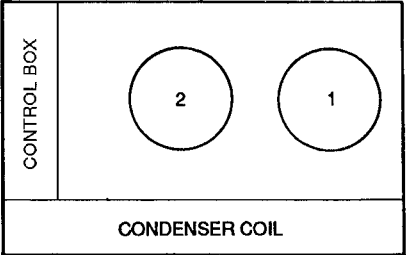
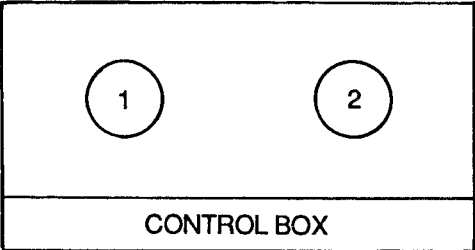
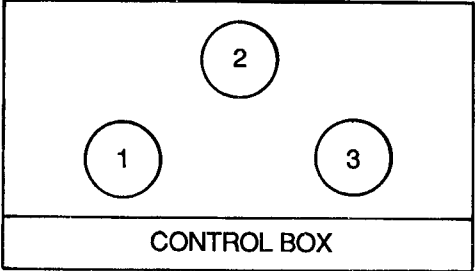
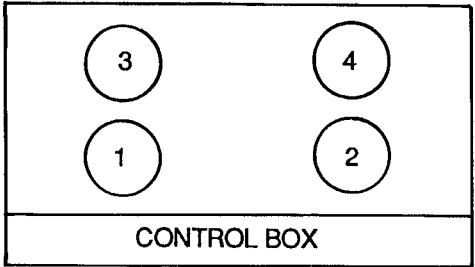
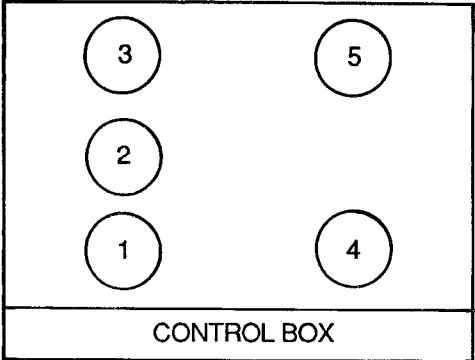


**Fig. 4 — Space Temperature Averaging**

Table 27 — Fan Sequence of Operation

| CONDENSER FAN CONFIGURATION                                                                                 |                                  |                 |            |
|-------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------|------------|
| Fan Arrangement                                                                                             | Fan Relay Output (Fan Stage No.) | Load Controlled | Fan(s) ON  |
| <b>024-030 Units</b><br>   | 1 (MM)                           | MMC             | OFM1       |
| <b>034 Unit</b><br>        | FR2                              | OFC1            | OFM2       |
| <b>044 Unit</b><br>       | 1 (MM)                           | MMC             | OFM2       |
|                                                                                                             | FR2                              | OFC1            | OFM1       |
|                                                                                                             | FR3                              | OFC2            | OFM3       |
| <b>054,064 Units</b><br> | 1 (MM)                           | MMC1, MMC2      | OFM3, OFM4 |
|                                                                                                             | FR2                              | OFC1            | OFM1       |
|                                                                                                             | FR3                              | OFC2            | OFM2       |
| <b>074 Unit</b><br>      | 1 (MM)                           | MMC1, MMC2      | OFM3, OFM5 |
|                                                                                                             | FR2                              | OFC1            | OFM1       |
|                                                                                                             | FR3                              | OFC2            | OFM2, OFM4 |

**FR** — Fan Relay  
**MM** — Head Pressure Control Function  
**MMC** — Head Pressure Control Function Contactor  
**OFC** — Outdoor (Condenser) Fan Contactor  
**OFM** — Outdoor (Condenser) Fan Motor

## Humidity Sensors

### RELATIVE HUMIDITY (RH) SENSOR (Wall Mounted) —

The accessory field-installed, wall-mounted type RH sensor (part no. HL39ZZ001) measures the relative humidity of the air within the occupied space. Use a junction box to accommodate the wiring when sensor is mounted in the occupied space. Sensor must be mounted with terminals ACIN and OUT+ located at the top of the sensor. There are factory-supplied provisions for locating this sensor on the back of the auxiliary control box, so that this sensor can be used to measure return-air humidity. Supply 24 vac to this sensor from an isolated power supply.

### RELATIVE HUMIDITY (RH) SENSOR (Duct Mounted) —

The accessory field-installed, duct-mounted RH sensor (part no. HL39ZZ002) can be installed either in the return-air ductwork or the outdoor-air ductwork. If 2 relative humidity sensors are ordered for differential enthalpy control, then the sensors will be installed in the conditioned space (CV applications) or the return air (VAV applications) and outdoor airstream. If the sensor is to be used for control of a humidifier, install the sensor in the return-air duct. Supply 24 vac to this sensor from an isolated power supply.

**THERMISTOR TROUBLESHOOTING** — The NB,NP control system uses thermistors to measure temperatures of the supply and return air, outdoor air and space temperature, and the saturated condensing and suction temperatures of the refrigerant circuits. See Table 28 and Fig. 5-8 for thermistor locations.

The resistance versus temperature and electrical characteristics for thermistors in the system (except space temperature) are identical. To obtain an accurate reading, a high-impedance meter (such as a digital meter) must be used.

Thermistors in the NB,NP control system have a 5-vdc signal applied across them any time the unit control circuit is energized. The voltage drop across the thermistor is directly proportional to the temperature and resistance of the thermistor.

To determine temperatures at the various thermistor locations:

1. Disconnect the thermistor from the processor board.
2. Measure the resistance across the appropriate thermistor using a high quality digital ohmmeter.
3. Use the resistance reading to determine the thermistor temperature using Tables 29 and 30.

The microprocessor has been programmed to check the operation of the thermistors. If the measured temperature is outside the range of -40 to 245 F (-40 to 118.3 C) and 168,250 to 203.75 ohms (outdoor-air temperature, supply-air temperature, saturated condensing temperature, suction gas temperature, and return-air temperature only), it will be treated as a sensor failure and a diagnostic code will be displayed. It is also possible to check the operation of the thermistors using the test function.

To check the thermistors:

1. Use the temperature subfunction of the status function ( ☐ 6 ☐ STAT ) to determine if the thermistors are reading correctly.
2. Check the thermistor calibration at a known temperature by measuring actual resistance and comparing the value measured with the values listed in the thermistor tables (Tables 29 and 30).
3. Make sure that the thermistor leads are connected to the proper pin terminals at the PSIO1 and PSIO2 terminal strip J7 on the processor boards, and that the thermistors are properly located in the refrigerant circuit.

If a thermistor has failed or the wire is damaged, replace the complete assembly. Do not attempt to splice the wires or repair the assembly.

**Table 28 — Thermistors and Unit Operation Control Pressure Transducers**

| SENSOR                                      | LOCATION AND FUNCTION                                                                                                                                                          | PART NO.                  |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Unit Operation Control Pressure Transducers |                                                                                                                                                                                |                           |
| DPT1*                                       | Compressor A1 located at the discharge service valve — Senses discharge pressure (replaces T3)                                                                                 | HK05ZG002                 |
| SPT1*                                       | Compressor A1 located at the LPS connection on the compressor instead of LPS1 (low-pressure switch) — Senses suction pressure                                                  |                           |
| DPT2*                                       | Compressor B1 located at the discharge service valve — Senses discharge pressure (replaces T4)                                                                                 |                           |
| SPT2*                                       | Compressor B1 located at the LPS connection on compressor instead of LPS2 — Senses suction pressure                                                                            |                           |
| Thermistors                                 |                                                                                                                                                                                |                           |
| T1                                          | Located in the fan housing (024-030 vertical discharge units) or in supply-air section (all other units) — Senses supply-air temperature (SAT)                                 | HH79NZ014†                |
| T2                                          | Located in the return-air section (024-030) or in filter section, mid-unit (all other units) — Senses return-air temperature (RAT)                                             | HH79NZ026**               |
| T3                                          | Located in condenser coil circuit no. 1 at the return bend end (034,044 units); or at the header end (024-030, 054-074 units) — Senses saturated condensing temperature (SCT1) | HH79NZ013                 |
| T4                                          | Located in condenser coil circuit no. 2 at the return bend end (034,044 units); or at the header end (054-074 units) — Senses saturated condensing temperature (SCT2)          |                           |
| T5                                          | Coiled at the corner post (034,044) or below main control box (054-074) — Senses outdoor-air temperature (OAT)                                                                 | HH79NZ014†<br>HH79NZ026** |
| T6                                          | Located in compressor A suction service valve — Senses suction gas temperature (SGT1)                                                                                          | HH79NZ026                 |
| T7                                          | Located in compressor B suction service valve — Senses suction gas temperature (SGT2)                                                                                          |                           |

\*Optional sensors which are included in control option module.

†Unit sizes 024-044

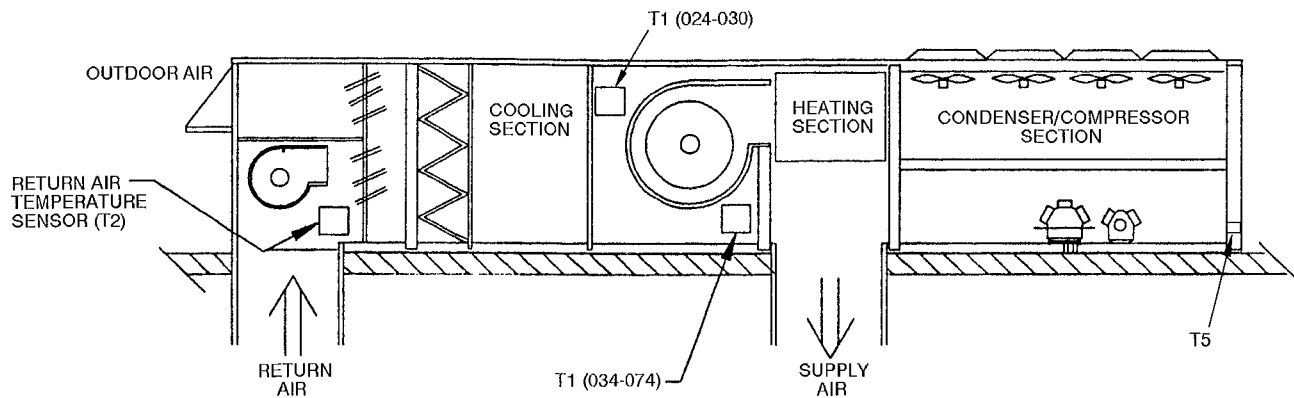
\*\*Unit sizes 054-074.

**Table 29 — Thermistor Resistance vs Temperature Values for Thermistors T1-T7 (5 K at 25 C Resistors)**

| TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) |
|-------------|----------------------|-------------|----------------------|-------------|----------------------|-------------|----------------------|
| -25         | 98010                | 74          | 5361                 | 125         | 1715                 | 176         | 602                  |
| -20         | 82627                | 75          | 5229                 | 126         | 1680                 | 177         | 591                  |
| -15         | 69790                | 76          | 5101                 | 127         | 1647                 | 178         | 581                  |
| -10         | 59081                | 77          | 4976                 | 128         | 1614                 | 179         | 570                  |
| -5          | 50143                | 78          | 4855                 | 129         | 1582                 | 180         | 560                  |
| 0           | 42678                | 79          | 4737                 | 130         | 1550                 | 181         | 551                  |
| 5           | 36435                | 80          | 4622                 | 131         | 1519                 | 182         | 542                  |
| 10          | 31201                | 81          | 4511                 | 132         | 1489                 | 183         | 533                  |
| 15          | 26804                | 82          | 4403                 | 133         | 1459                 | 184         | 524                  |
| 20          | 23096                | 83          | 4298                 | 134         | 1430                 | 185         | 516                  |
| 25          | 19960                | 84          | 4195                 | 135         | 1401                 | 186         | 508                  |
| 30          | 17297                | 85          | 4096                 | 136         | 1373                 | 187         | 501                  |
| 35          | 15027                | 86          | 4000                 | 137         | 1345                 | 188         | 494                  |
| 36          | 14614                | 87          | 3906                 | 138         | 1318                 | 189         | 487                  |
| 37          | 14214                | 88          | 3814                 | 139         | 1291                 | 190         | 480                  |
| 38          | 13833                | 89          | 3726                 | 140         | 1265                 | 191         | 473                  |
| 39          | 13449                | 90          | 3640                 | 141         | 1239                 | 192         | 467                  |
| 40          | 13084                | 91          | 3556                 | 142         | 1214                 | 193         | 461                  |
| 41          | 12730                | 92          | 3474                 | 143         | 1189                 | 194         | 456                  |
| 42          | 12387                | 93          | 3395                 | 144         | 1165                 | 195         | 450                  |
| 43          | 12053                | 94          | 3318                 | 145         | 1141                 | 196         | 444                  |
| 44          | 11730                | 95          | 3243                 | 146         | 1118                 | 197         | 439                  |
| 45          | 11416                | 96          | 3170                 | 147         | 1095                 | 198         | 434                  |
| 46          | 11111                | 97          | 3099                 | 148         | 1072                 | 199         | 429                  |
| 47          | 10816                | 98          | 3031                 | 149         | 1050                 | 200         | 424                  |
| 48          | 10529                | 99          | 2964                 | 150         | 1028                 | 201         | 419                  |
| 49          | 10250                | 100         | 2898                 | 151         | 1007                 | 202         | 415                  |
| 50          | 9979                 | 101         | 2835                 | 152         | 986                  | 203         | 410                  |
| 51          | 9717                 | 102         | 2774                 | 153         | 965                  | 204         | 405                  |
| 52          | 9461                 | 103         | 2713                 | 154         | 945                  | 205         | 401                  |
| 53          | 9213                 | 104         | 2655                 | 155         | 925                  | 206         | 396                  |
| 54          | 8973                 | 105         | 2598                 | 156         | 906                  | 207         | 391                  |
| 55          | 8739                 | 106         | 2542                 | 157         | 887                  | 208         | 386                  |
| 56          | 8511                 | 107         | 2488                 | 158         | 868                  | 209         | 382                  |
| 57          | 8291                 | 108         | 2436                 | 159         | 850                  | 210         | 377                  |
| 58          | 8076                 | 109         | 2385                 | 160         | 832                  | 211         | 372                  |
| 59          | 7868                 | 110         | 2335                 | 161         | 815                  | 212         | 366                  |
| 60          | 7665                 | 111         | 2286                 | 162         | 798                  | 213         | 361                  |
| 61          | 7468                 | 112         | 2238                 | 163         | 782                  | 214         | 356                  |
| 62          | 7277                 | 113         | 2192                 | 164         | 765                  | 215         | 350                  |
| 63          | 7091                 | 114         | 2147                 | 165         | 749                  | 216         | 344                  |
| 64          | 6911                 | 115         | 2103                 | 166         | 734                  | 217         | 338                  |
| 65          | 6735                 | 116         | 2060                 | 167         | 719                  | 218         | 332                  |
| 66          | 6564                 | 117         | 2018                 | 168         | 705                  | 219         | 325                  |
| 67          | 6399                 | 118         | 1977                 | 169         | 690                  | 220         | 318                  |
| 68          | 6237                 | 119         | 1937                 | 170         | 677                  | 221         | 311                  |
| 69          | 6081                 | 120         | 1898                 | 171         | 663                  | 222         | 304                  |
| 70          | 5929                 | 121         | 1860                 | 172         | 650                  | 223         | 297                  |
| 71          | 5781                 | 122         | 1822                 | 173         | 638                  | 224         | 289                  |
| 72          | 5637                 | 123         | 1786                 | 174         | 626                  | 225         | 282                  |
| 73          | 5497                 | 124         | 1750                 | 175         | 614                  |             |                      |

**Table 30 — Thermistor Resistance vs Temperature Values for Space Temperature Thermistors T55 and T56 (10 K at 25 C Resistors)**

| TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) | TEMP<br>(F) | RESISTANCE<br>(Ohms) |
|-------------|----------------------|-------------|----------------------|-------------|----------------------|-------------|----------------------|
| 40          | 24051                | 62          | 14101                | 84          | 8563                 | 106         | 5369                 |
| 41          | 23456                | 63          | 13775                | 85          | 8378                 | 107         | 5260                 |
| 42          | 22877                | 64          | 13457                | 86          | 8197                 | 108         | 5154                 |
| 43          | 22313                | 65          | 13148                | 87          | 8021                 | 109         | 5050                 |
| 44          | 21766                | 66          | 12846                | 88          | 7849                 | 110         | 4948                 |
| 45          | 21234                | 67          | 12553                | 89          | 7681                 | 111         | 4849                 |
| 46          | 20716                | 68          | 12267                | 90          | 7517                 | 112         | 4752                 |
| 47          | 20212                | 69          | 11988                | 91          | 7357                 | 113         | 4657                 |
| 48          | 19722                | 70          | 11717                | 92          | 7201                 | 114         | 4564                 |
| 49          | 19246                | 71          | 11452                | 93          | 7049                 | 115         | 4474                 |
| 50          | 18782                | 72          | 11194                | 94          | 6900                 | 116         | 4385                 |
| 51          | 18332                | 73          | 10943                | 95          | 6755                 | 117         | 4299                 |
| 52          | 17893                | 74          | 10698                | 96          | 6613                 | 118         | 4214                 |
| 53          | 17466                | 75          | 10459                | 97          | 6475                 | 119         | 4132                 |
| 54          | 17050                | 76          | 10227                | 98          | 6340                 | 120         | 4051                 |
| 55          | 16646                | 77          | 10000                | 99          | 6209                 | 121         | 3972                 |
| 56          | 16253                | 78          | 9779                 | 100         | 6080                 | 122         | 3895                 |
| 57          | 15870                | 79          | 9563                 | 101         | 5954                 | 123         | 3819                 |
| 58          | 15497                | 80          | 9353                 | 102         | 5832                 | 124         | 3745                 |
| 59          | 15134                | 81          | 9148                 | 103         | 5712                 | 125         | 3673                 |
| 60          | 14780                | 82          | 8948                 | 104         | 5595                 |             |                      |
| 61          | 14436                | 83          | 8754                 | 105         | 5481                 |             |                      |



NOTE: Thermistors T6 and T7 are located in the compressor suction service valves. Sufficient detail is not shown in this figure to include their precise locations.

**Fig. 5 — Thermistor T1, T2, and T5 Locations**

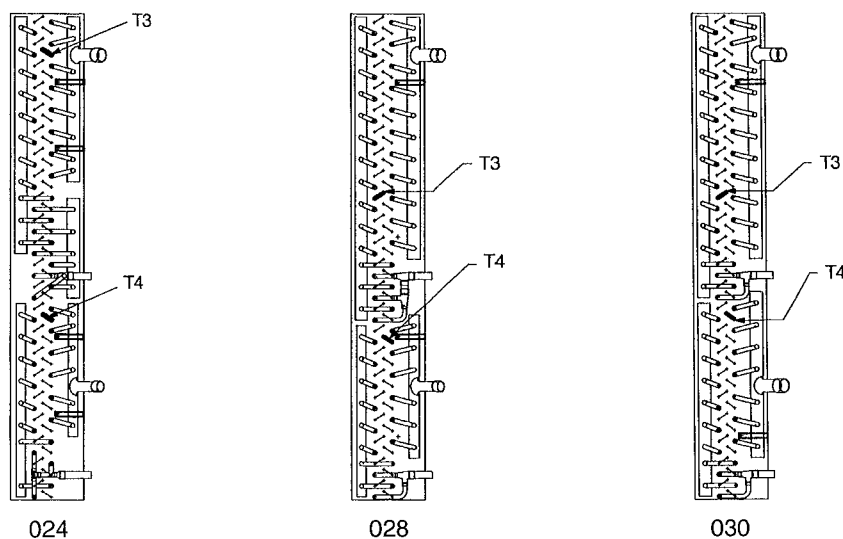


**Fig. 6 — Thermistor T3 and T4 Locations, 024-030 Units, Header End of Coil**

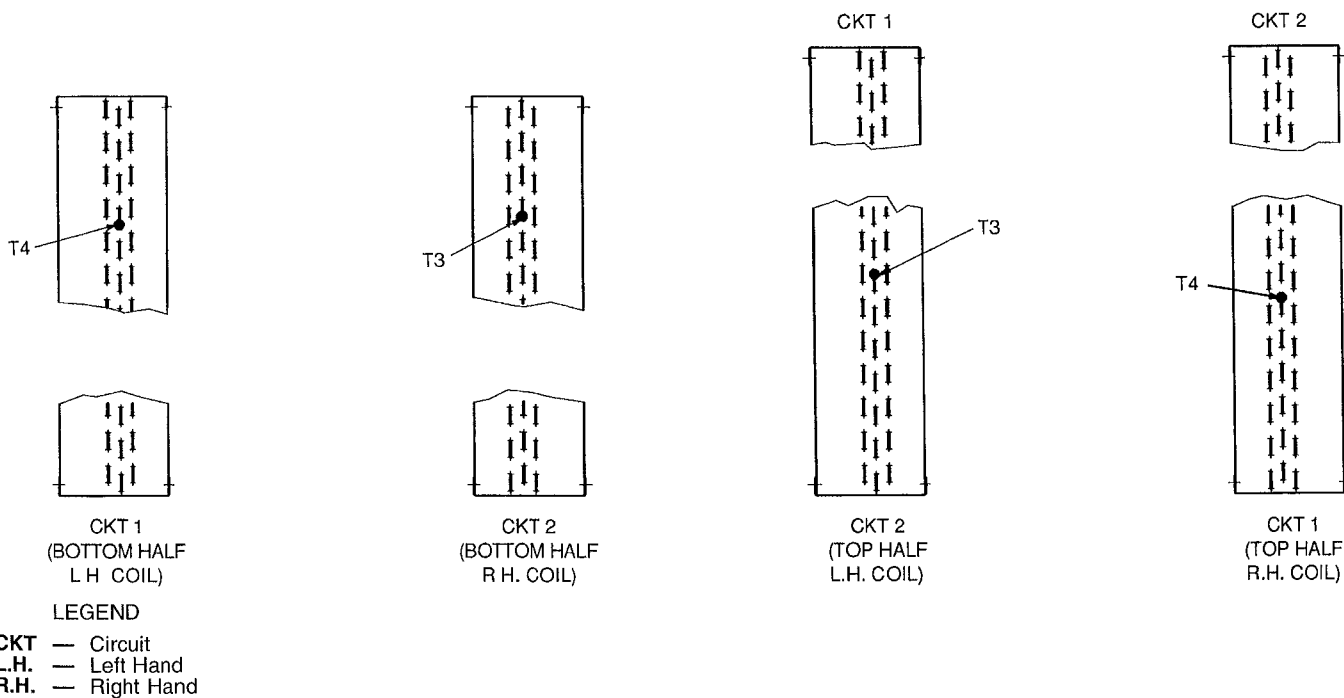
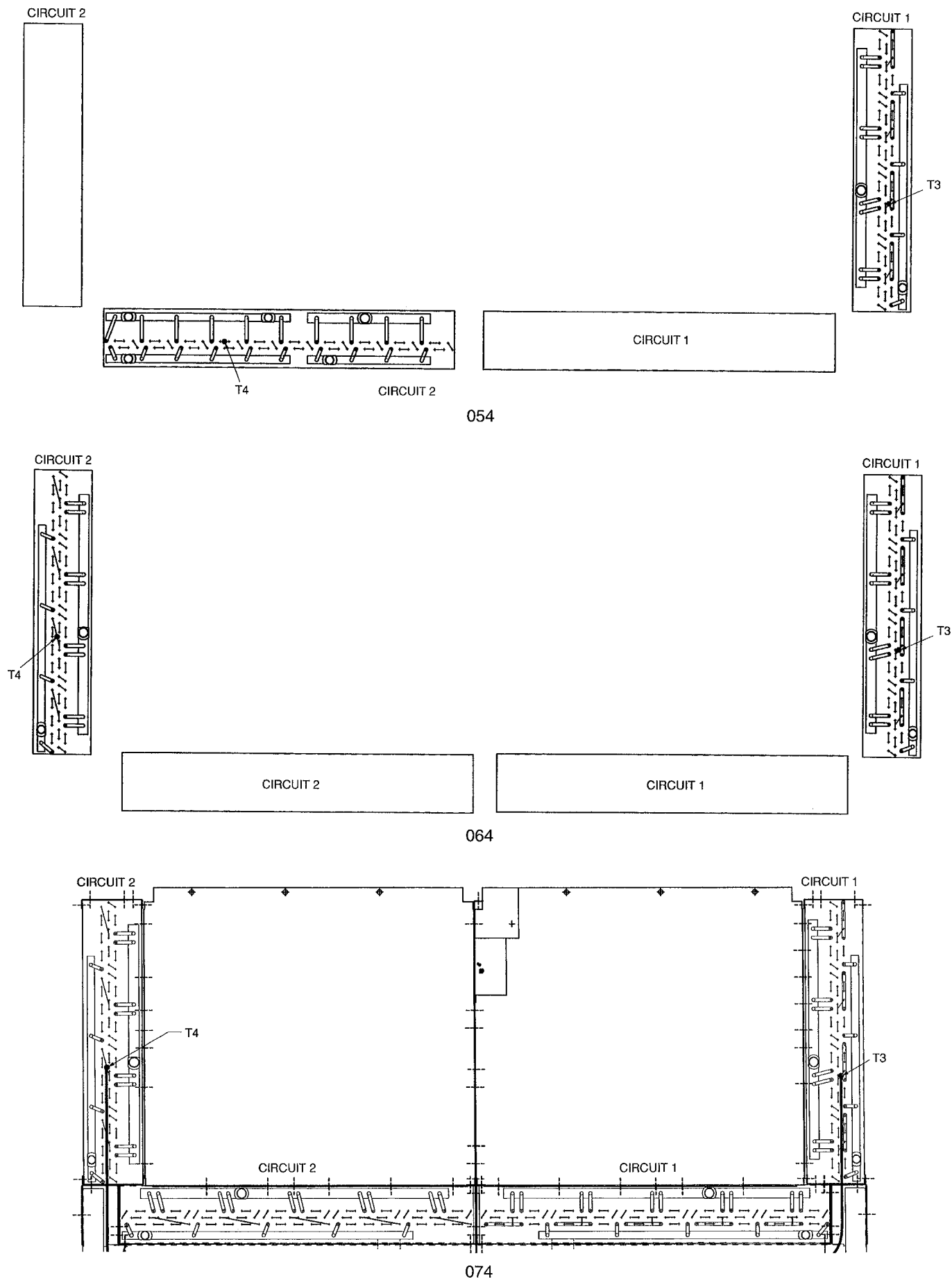


**Fig. 7 — Thermistor T3 and T4 Locations, 034 and 044 Units; Return Bend End of Coil**



NOTE Blank coils are included on 054, 064 units only for relative position Detail is provided for coils where thermistors are located.

**Fig. 8 — Thermistor T3 and T4 Locations, 054-074 Units; Header End of Coil**

**TRANSDUCER TROUBLESHOOTING** — The NB,NP control system uses transducers to measure pressures around the system. See Table 28 for pressure transducer locations and Fig. 9 for typical refrigerant pressure transducer. If a transducer is suspected of being faulty, check the voltage to the transducer. The refrigerant pressure transducer supply voltage should be 5 vdc  $\pm$  0.2 v. These transducers convert the measured refrigerant pressure to a voltage. This voltage is then evaluated as a ratio to the 5 vdc  $\pm$  0.2 v supply voltage. Read the voltage on channel 12. If the check filter switch is open, then 5 v is used for the ratio. All other transducers (BP, SP, and OAC) require 24 vac. If the supply voltage is correct, compare the pressure reading displayed on the HSIO keypad and the pressure obtained on a calibrated pressure gage.

**NOTE:** A 24-vac isolation transformer is required for proper operation of field-installed IAQ and humidity sensors, and one transformer is required for each sensor to avoid damage to refrigerant pressure transducers.

**IMPORTANT:** Compressor service valves shut off the pressure port when backseated. Be sure that service valves with transducers installed on the pressure port are not backseated to ensure proper transducer operation.

To check the transducers:

1. Use the pressure subfunction of the status function ( **7** **STAT** and **8** **STAT** ) to determine if the pressure transducers are reading correctly. Connect a calibrated gage to the lead compressor suction or discharge pressure connection to check transducer reading.
2. Make sure that the transducer leads are properly connected in the junction box and to the PSIO. Check the transformer TRAN3 output. Check the transducer supply voltage from PS1. It should be 5 vdc  $\pm$  0.2 v. Check the supply voltage to PSIO channel 12.

**Refrigerant Pressure Transducer Replacement and Calibration** — Remove the transducers from the compressor and allow them to be exposed to atmospheric pressure. Refrigerant ports under transducers have Schrader-type ports. Follow the steps in Table 31 to calibrate (zero) the transducers.

After calibration, the results may be checked by following the steps outlined in Table 32. Pressure readings other than 0.0 psig indicate that the calibration was unsuccessful. Repeat the calibration procedure for any value that is greater than  $\pm$  1.0 psig.

After satisfactory calibration of the transducers, reinstall them on the compressors.

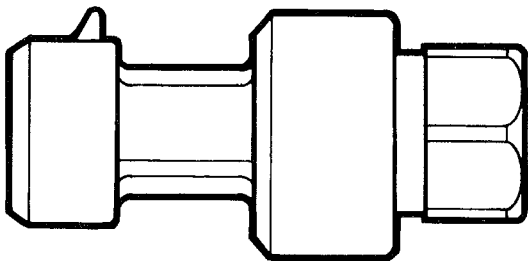


**Fig. 9 — Refrigerant Pressure Transducer**

**Table 31 — Refrigerant Pressure Transducer Configuration**

| HSIO ENTRY                                      | KEYPAD DISPLAY | ACTION BEING TAKEN                   |
|-------------------------------------------------|----------------|--------------------------------------|
| <b>1</b> <b>SRVC</b>                            | LOG ON         | Enter login function                 |
| <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>ENTR</b> | LOGGED ON      | Logging in                           |
| <b>3</b> <b>SRVC</b>                            | FACT CFG       | Enter factory configuration function |
| <b>↑</b>                                        | SPB CALB       |                                      |
| <b>1</b> <b>ENTR</b>                            | SPB CALB       | Calibrate SPB transducer             |
| <b>↑</b>                                        | SPA CALB       |                                      |
| <b>1</b> <b>ENTR</b>                            | SPA CALB       | Calibrate SPA transducer             |
| <b>↑</b>                                        | DPB CALB       |                                      |
| <b>1</b> <b>ENTR</b>                            | DPB CALB       | Calibrate DPB transducer             |
| <b>↑</b>                                        | DPA CALB       |                                      |
| <b>1</b> <b>ENTR</b>                            | DPA CALB       | Calibrate DPA transducer             |

**Table 32 — Verification of Refrigerant Pressure Transducer Calibration**

| HSIO ENTRY           | KEYPAD DISPLAY | READING NAME (EXPECTED DISPLAY)          |
|----------------------|----------------|------------------------------------------|
| <b>7</b> <b>STAT</b> | PRESSURE       | System pressures                         |
| <b>↓</b>             | DPA X          | Discharge pressure, circuit A (0.0 psig) |
| <b>↓</b>             | SPA X          | Suction pressure, circuit A (0.0 psig)   |
| <b>↓</b>             | DPB X          | Discharge pressure, circuit B (0.0 psig) |
| <b>↓</b>             | SPB X          | Suction pressure, circuit B (0.0 psig)   |

## Control Modules

### ⚠ CAUTION

Turn controller power off before servicing controls. This ensures safety and prevents damage to controller.

**PROCESSOR MODULE (PSIO1), CONTROL OPTION MODULE (PSIO2), AND HIGH-VOLTAGE RELAY MODULES (DSIO1 AND DSIO2)** — The PSIO and DSIO modules all perform continuous diagnostic evaluations of the condition of the hardware. Proper operation of these modules is indicated by LEDs (light-emitting diodes) on the front surface of the DSIOs, and on the top horizontal surface of the PSIOs.

**RED LED** — If the red LED is blinking continuously at a 3- to 5-second rate, it indicates proper operation. If it is lighted continuously, there is a problem requiring replacement of module. If it is off continuously, power should be checked. If there is no input power, check fuses. If fuse is bad, check for shorted secondary of transformer or for bad module. On the PSIO1 module, if the light is blinking at a rate of twice per second, the module should be replaced.

**GREEN LED** — On the PSIOs, this is the green LED closest to COMM connectors. The other green LED on the module indicates external communications, when used. Green LED

should always be blinking when power is on. It indicates modules are communicating properly. If green LED is not-blinking, check red LED. If red LED is normal, check module address switches. See Fig. 10. Proper addresses are:

- PSIO1 (Processor Module) — 01 (different when CCN connected)
- DSIO1 (High-Voltage Relay Module) — 19
- DSIO2 (High-Voltage Relay Module) — 49
- PSIO2 (Optional/Accessory Control Options Module) — 31

If *all* modules indicate communication failure, check COMM plug on PSIO1 module for proper seating. If a good connection is assured and condition persists, replace PSIO1 module.

If only DSIO(s) or PSIO2 module indicates communication failure, check COMM plug on that module for proper seating. If a good connection is assured and condition persists, replace DSIO or PSIO2 module(s).

All system operating intelligence rests in PSIO1 module, the module that controls unit. This module monitors conditions through input and output ports and through DSIO modules.

The machine operator communicates with microprocessor through keypad and display module (HSIO). Communication between PSIO1 and other modules is accomplished by a 3-wire sensor bus. These 3 wires run in parallel from module to module.

On sensor bus terminal strips, terminal 1 of PSIO1 module is connected to terminal 1 of each of the other modules. Terminals 2 and 3 are connected in the same manner. See Fig. 11. If a terminal 2 wire is connected to terminal 1, system does not work.

Internal communications between control modules in the rooftop unit is carried out through the COMM3 communications bus. A 3-wire bus is routed between the COMM3 plugs of each module.

The COMM1 communications bus (Fig 12) is for external communications to other equipment on the bus or to a computer running Building Supervisor or Service Tool software. A connection is usually made between the PSIO1 COMM1 plug on the rooftop unit, the air terminals, and the other rooftop units. A plug is provided in the control panel for connecting the external bus to the NB,NP rooftop units. The external connection plug is factory wired to the PSIO1 COMM1 plug.

The PSIO1, DSIO1, and HSIO are all powered from a common 21-vac power source which connects to terminals 1 and 2 of power input strip on each module. A separate source of 21-vac power is used to power the DSIO2 module and PSIO2 options module through terminals 1 and 2 on power input strip.

#### PROCESSOR MODULE (PSIO1) (Fig. 13)

**Inputs** — Each input channel has 3 terminals; only 2 of the terminals are used. Unit application determines which terminals are used. Always refer to individual unit wiring for terminal numbers.

**Outputs** — Output is 24 vdc. There are 3 terminals, only 2 of which are used, depending on application. Refer to unit wiring diagram

NOTE: Address switches (see Fig. 13) must be set at 01 (different when CCN connected).

#### HIGH-VOLTAGE RELAY MODULES (DSIO1 and 2) (Fig. 14)

**Inputs** — Inputs on strip J3 are discrete inputs (ON/OFF). When 24-vac power is applied across the 2 terminals in a channel it reads as an on signal. Zero v reads as an off signal.

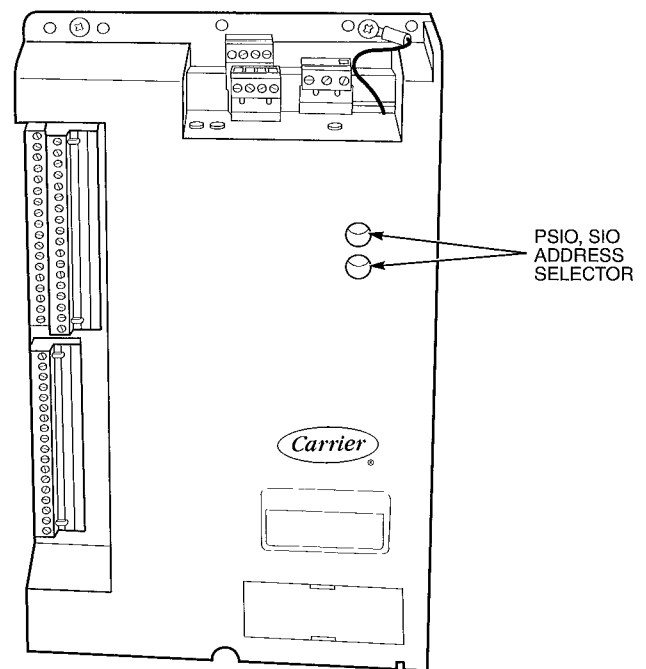
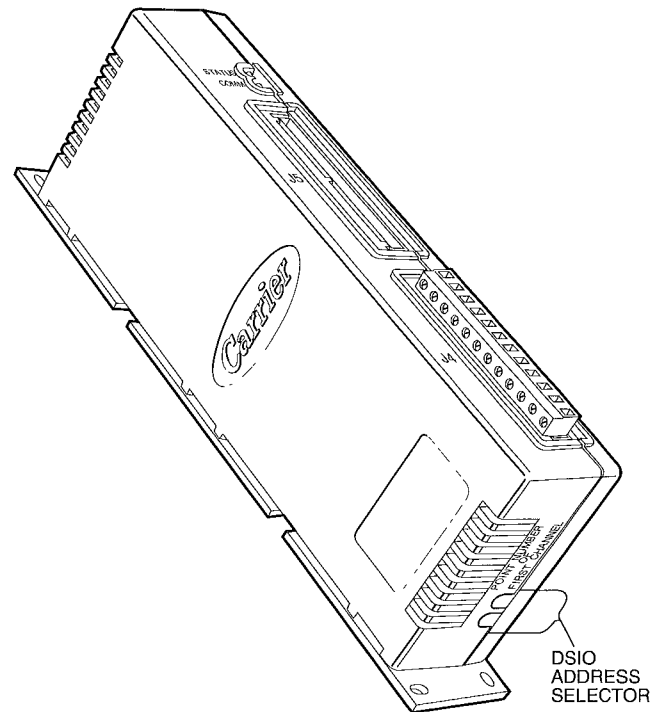
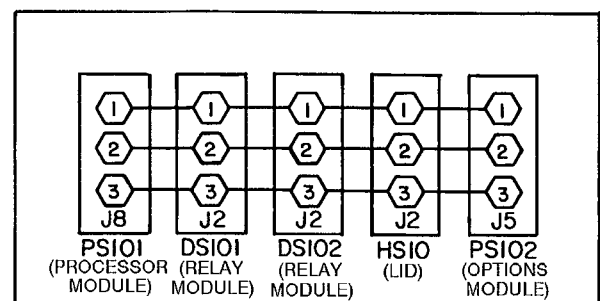
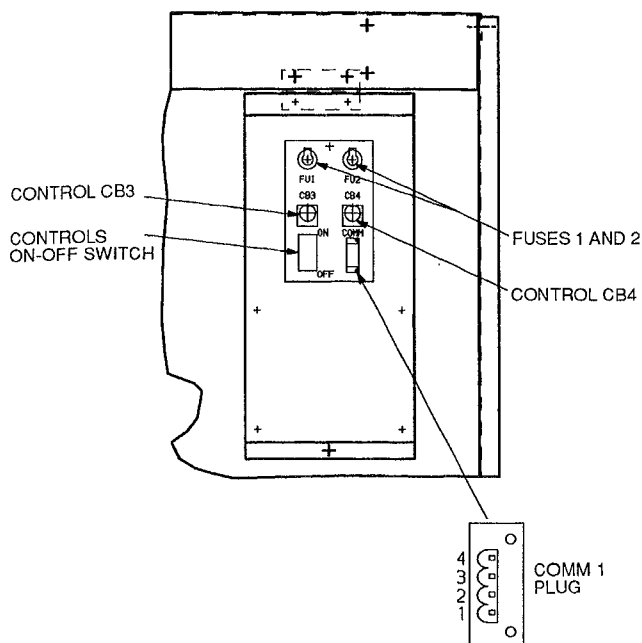


**Fig. 10 — Module Address Selector Switch Locations**

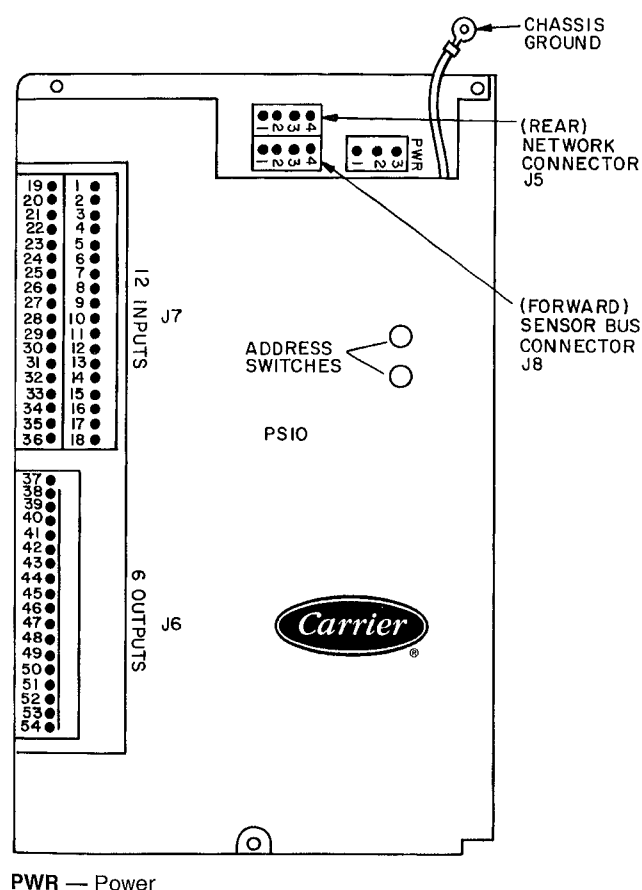


**HSIO (LID) — Keypad and Display Module (Local Interface Device)**  
**Fig. 11 — Sensor Bus Wiring (Communications)**



CB — Circuit Breaker

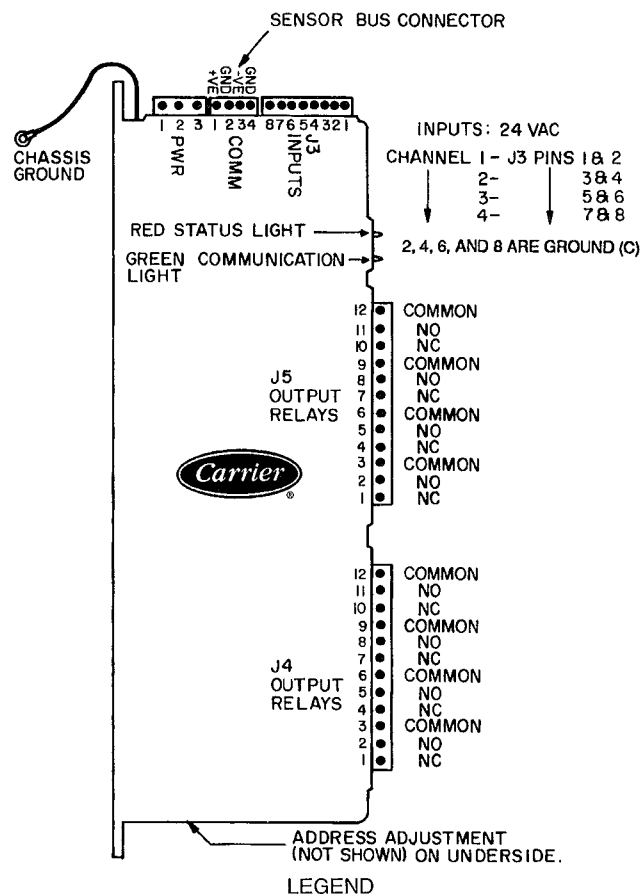
**Fig. 12 — COMM1 Communications Bus Plug**



PWR — Power

**Fig. 13 — Processor Module (PSIO1)**

**Outputs** — Terminal strips J4 and J5 are internal relays whose coils are powered-up and powered-off by a signal from microprocessor. The relays switch the circuit to which they are connected. No power is supplied to these connections by DSIO modules.



COMM — Communications Bus  
NC — Normally Closed  
NO — Normally Open  
PWR — Power

**Fig. 14 — High-Voltage Relay Modules (DSIO1 and 2)**

**CONTROL OPTIONS MODULE (PSIO2)** — See Fig. 15. The options module allows the following features to be utilized:

1. Relative humidity sensor. This feature requires a field-supplied, 4-wire, 2 to 10 v RH (relative humidity) sensor.
2. Outdoor-air cfm sensor. This feature requires a 4-wire, field-supplied, mass flow sensor to input a 2 to 10 v signal.
3. Indoor-air quality. This feature uses a field-supplied, 4-wire, carbon-dioxide sensor to input a 2 to 10 v signal.
4. Fire and smoke routines. This is accomplished through a field-supplied remote switch input.
5. Humidifier function. This feature provides control of a field-installed humidifier.
6. Discrete timer output. This output permits control of timed functions such as parking lot lights.
7. Hydronic valve control. The PSIO2 module provides outputs to control a field-installed hydronic coil valve.

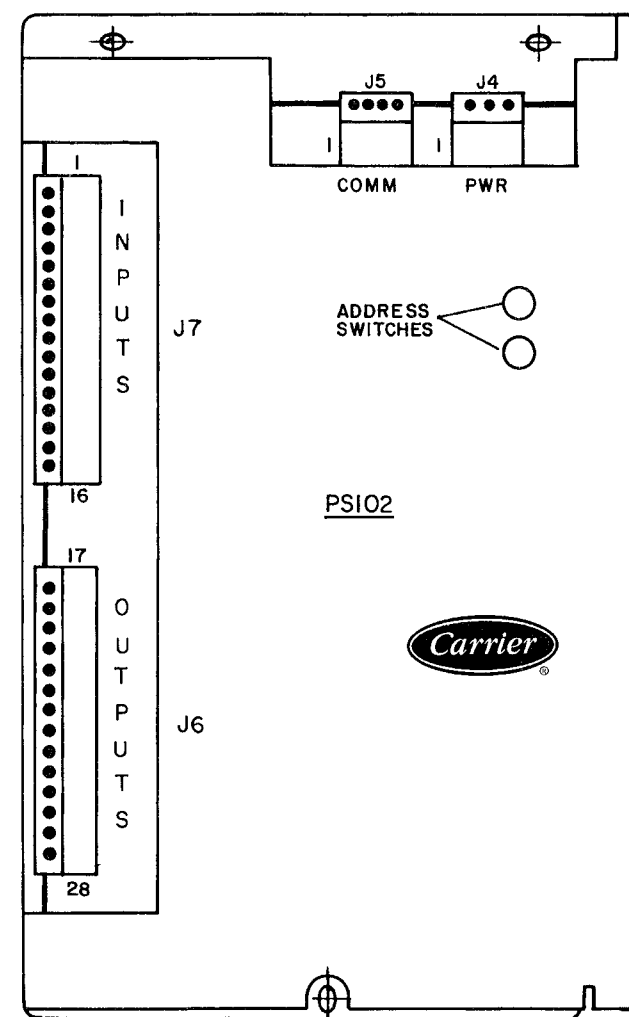
**ACTUATORS** — The actuators for these units are positioned by a 4–20 mA signal from the microprocessor. The actuators contain a series of DIP switches that determine the maximum travel of the actuator.

The DIP switches are factory set to achieve the required rotation. See Table 33 for the degrees of travel and the correct DIP switch settings for each actuator.

When installing actuator linkage, actuator should be powered to its fully-open position. The linkage should then be connected so that the actuator does not stall against a fully-open damper.

Table 33 — Actuator Degrees of Travel and DIP Switch Settings

| 024-030 UNITS                                   |                   |                     |                     |
|-------------------------------------------------|-------------------|---------------------|---------------------|
| Actuator                                        | Degrees of Travel | DIP Switch(es) Open | DIP Switches Closed |
| Economizer                                      | 110               | 8 and 10            | All Others          |
| Inlet Guide Vanes/<br>Variable Frequency Drives | 45                | 6 and 10            | All Others          |
| Modulating Power Exhaust                        | 160               | 10                  | All Others          |
| 034-074 UNITS                                   |                   |                     |                     |
| Economizer                                      | 110               | 8 and 10            | All Others          |
| Inlet Guide Vanes                               | 45                | 6 and 10            | All Others          |
| Modulating Power Exhaust                        | 70                | 5 and 10            | All Others          |
| Modulating Return Fan<br>Damper Motor No. 1     | 45                | 6 and 10            | All Others          |
| Modulating Return Fan<br>Damper Motor No. 2     | 60                | 4 and 10            | All Others          |



LEGEND  
COMM — Communications Bus  
PWR — Power

Fig. 15 — Control Options Module (PSIO2)

**Quick Test** — The test function provides a check on control inputs and outputs, and can only be conducted when the unit is in the standby mode. To put the unit into the standby mode, press **1 1 STAT**, then **↓**, then **1 ENTR**. Display will read STBY YES.

The test function and associated subfunctions should be run to check all unit inputs and outputs prior to unit start-up. Refer to Table 18 for additional details on the test function and performing quick tests

**IMPORTANT:** Be sure unit is in the standby mode (**1 1 STAT**) PRIOR to initiating the test function. The standby/run mode under **1 1 STAT** MUST read STBY YES. Test mode will not operate unless unit is in standby.

To operate a test:

1. Enter the desired test subfunction.
2. Press **↓** to scroll to the desired test.
3. Press **ENTR** to start the test.

Pressing **↓** after a test has started advances the system to the next test whether the current test has timed out or not. If the keypad is not used for 10 minutes, the display will return to the rotating default display. You must press **6 TEST** and **ENTR** to exit quick test. To restart the test procedure, press **TEST**.

To terminate the quick test press **6 TEST**; EXIT TST will be displayed. Press **ENTR** and TST CMPL will be displayed, ending the quick test.

**IMPORTANT.** You MUST press **6 TEST ENTR** to re-store the unit software to automatic control. To return unit to run mode (STBY NO), press **1 1 STAT • ENTR**.

While the unit is in the test function, other functions can be accessed by pressing the appropriate keys. If a component is operating under a test function, it will remain operating when another function (such as temperatures or pressures under the status function) is accessed. The test function must be reentered to shut down that component.

**1 TEST** (Inputs) — The factory/field test of inputs function displays the current sensor input value (analog type) or status (discrete type). During the inputs portion of the quick test, the compressors and fan motors will not operate.

**2 TEST** (Analog outputs) — The factory/field test of analog outputs causes the analog outputs to be cycled to specific output values. Each output is disabled by selecting the next output (press the **↓** or **↑** key).

To test inlet guide vanes or variable frequency drives:

1. Press **2 TEST**. The display will be ANLGOUT.
2. Press **↓** once to scroll down. The display will read IGV (inlet guide vanes test).
3. Press **ENTR** to start the test. The IGVs/VFDs will go from fully closed (default position when unit starts) to 50% open.

4. Press **[ENTR]** again to drive the IGVs/VFDs from 50% to 100% open.
5. Press **[ENTR]** again to change the IGVs/VFDs from 100% open to fully closed
6. Press **[↓]** once to scroll down. The display will read ECON (economizer test).

NOTE: The economizer, heating coil valve, and analog humidifier tests operate in the same manner as the IGV test. The PERD (modulating power exhaust/return damper test) operates in a similar manner except that the sequence of operation when pressing the **[ENTR]** key is zero to 75% open (press **[ENTR]** once), 75% to 100% open (press **[ENTR]** again), 100% to 20% open (press **[ENTR]** again), and 20% to closed (press **[ENTR]** again). This is done to check the adjustment operation of the power exhaust damper or return fan motor. The power exhaust or return fan motor no. 2 should be energized during 75% to 100% open test, and deenergized during the 20% open to closed test

If the second motor does not operate properly, then the actuator switch adjustment must be changed. Refer to Auxiliary Switch, Power Exhaust section on page 64 for more details.

**[3] [TEST]** (Discrete outputs) — The factory/field test of discrete outputs enables the discrete outputs. Each output is disabled when the next output is selected by pressing the **[↓]** or **[↑]** keys.

**[4] [TEST]** (Compressors) — The factory/field test of compressors enables the supply-air fan and sets the inlet guide vanes or variable frequency drives to 30% (if so equipped) when any compressor is selected. During the compressor test, the compressors will operate for ten seconds after the fan has been enabled.

NOTE: The service valves must be open, and the crankcase heaters should be energized for at least 24 hours before performing the compressor tests.

Once a compressor is operated using the test function, it is not allowed to operate again for 30 seconds. The supply-air fan and inlet guide vanes or variable frequency drives (if so equipped) are not disabled until the compressor test is exited

**[5] [TEST]** (Heat) — During the factory/field test of heat, the supply-air fan is enabled. As the fan starts, the inlet guide vanes or variable frequency drives are set to 30% open (if so equipped). The heat interlock relay is turned on when any stage of heat is selected. The test delays approximately 11 seconds after the fan is enabled and prior to energizing the first selected heat stage.

NOTE: Any selected heat stage causes that stage to be selected and all other stages will be disabled. The supply-air fan, inlet guide vanes or variable frequency drives (if so equipped), and heat interlock relay are *NOT* disabled until the heat test is exited.

**48NP Units Only (Gas Heat)** — Quick test of heat stage no. 1 does not fully test the gas heat. For 024-044 low-heat units, everything runs but the gas valve is not fully opened. For 024-044 high-heat and all 054-074 units, only 1 (2 for 054-074 high-heat) of the 2 (3 for 054-074 high-heat) gas valves are tested by stage 1.

Quick test of stage 2 does nothing unless stage 1 is already energized. To fully test the gas heat, place a jumper between HR1-NO and HR2-NO **AFTER** quick testing stage 1. Then perform the quick test for stage 2.

**IMPORTANT:** After quick test has been performed for stage 2, remove the jumper between HR1-NO and HR2-NO.

**[6] [TEST]** (Exit Test) — In order to exit the factory/field test mode, press **[ENTR]**. TST CMPL is displayed, and the expansion of TST CMPL (press **[ENTR]**) indicates that the quick test has been terminated.

**Controls Troubleshooting** — Refer to Table 34 and Fig. 16 for controls troubleshooting details.

**Table 34 — Controls Troubleshooting**

| SYMPTOM(S)                                                                        | PROBABLE CAUSE(S)                                                                                                                                                                                                                                      | SOLUTION(S)                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaporator fan does not run.                                                      | <ol style="list-style-type: none"> <li>1. Circuit breaker open.</li> <li>2. Fan configured for automatic operation</li> </ol>                                                                                                                          | <ol style="list-style-type: none"> <li>1. Find cause and reset circuit breaker</li> <li>2. Reconfigure Evaporator Fan from Automatic to Constant using <b>[6] [SHVC]</b> on HSIO.</li> </ol>                                                                                                                           |
| Compressor does not run.                                                          | <ol style="list-style-type: none"> <li>1. Fan interlock does not sense evaporator fan is operating</li> <li>2. Circuit breaker is open</li> <li>3. There is no demand for cooling.</li> <li>4. The control is locking out cooling operation</li> </ol> | <ol style="list-style-type: none"> <li>1. Check fan status switch and pressure tubing</li> <li>2. Find cause and reset circuit breaker</li> <li>3. Correct operation</li> <li>4. Check rotating display for alarm codes. Resolve alarm cause and reset control by changing to standby and back to run mode.</li> </ol> |
| Condenser fans do not turn on.                                                    | <ol style="list-style-type: none"> <li>1. Unit is equipped with transducers and service valves are back seated</li> <li>2. Circuit breaker is open</li> </ol>                                                                                          | <ol style="list-style-type: none"> <li>1. Turn service valve at least one turn from backseated position</li> <li>2. Find cause and reset circuit breaker</li> </ol>                                                                                                                                                    |
| Heating and cooling occur simultaneously.                                         | Occupied heating is configured as on and occupied heat set point is set higher than the cooling set point                                                                                                                                              | Turn off occupied heating, or lower heating set point.                                                                                                                                                                                                                                                                 |
| Evaporator fan runs, but cooling or heating will not operate.                     | Fan interlock does not sense that evaporator fan is operating                                                                                                                                                                                          | Check fan status switch and pressure tubing                                                                                                                                                                                                                                                                            |
| Economizer does not appear to control to the discharge air set point.             | Economizer is probably working correctly                                                                                                                                                                                                               | Economizer controls to a modified set point to maximize free cooling. See Economizer Operation section on page 10                                                                                                                                                                                                      |
| Cooling demand exists and economizer modulates, but compression is not operating. | Compression cannot be initiated until economizer damper is 90% open                                                                                                                                                                                    | Correct operation.                                                                                                                                                                                                                                                                                                     |
| Controls do not seem to be operating.                                             | Remote on-off function may be keeping controls off.                                                                                                                                                                                                    | Terminals 1 and 2 on Channel 49 must be shorted by remote switch or jumper                                                                                                                                                                                                                                             |

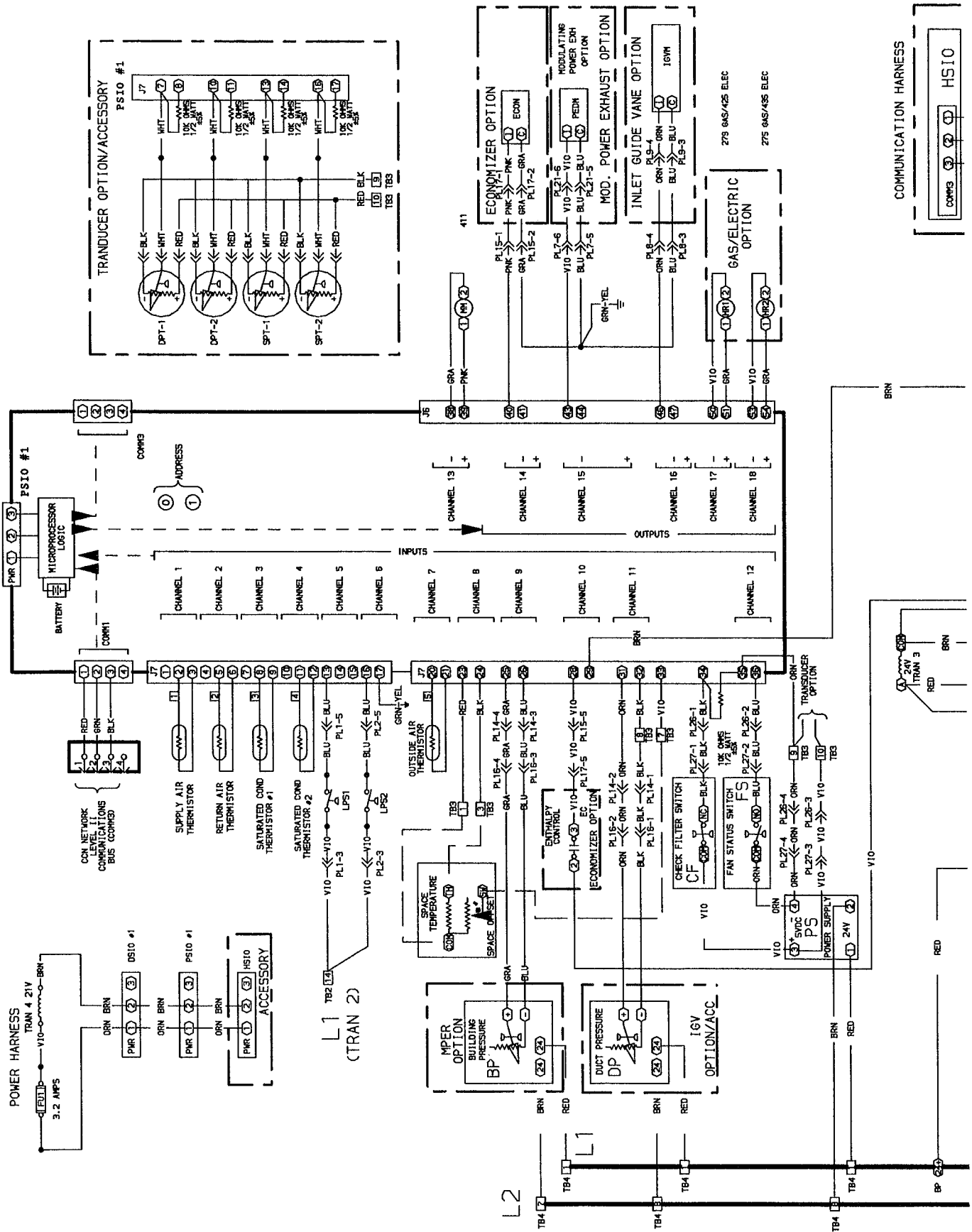


Fig. 16 — Typical Controls Wiring

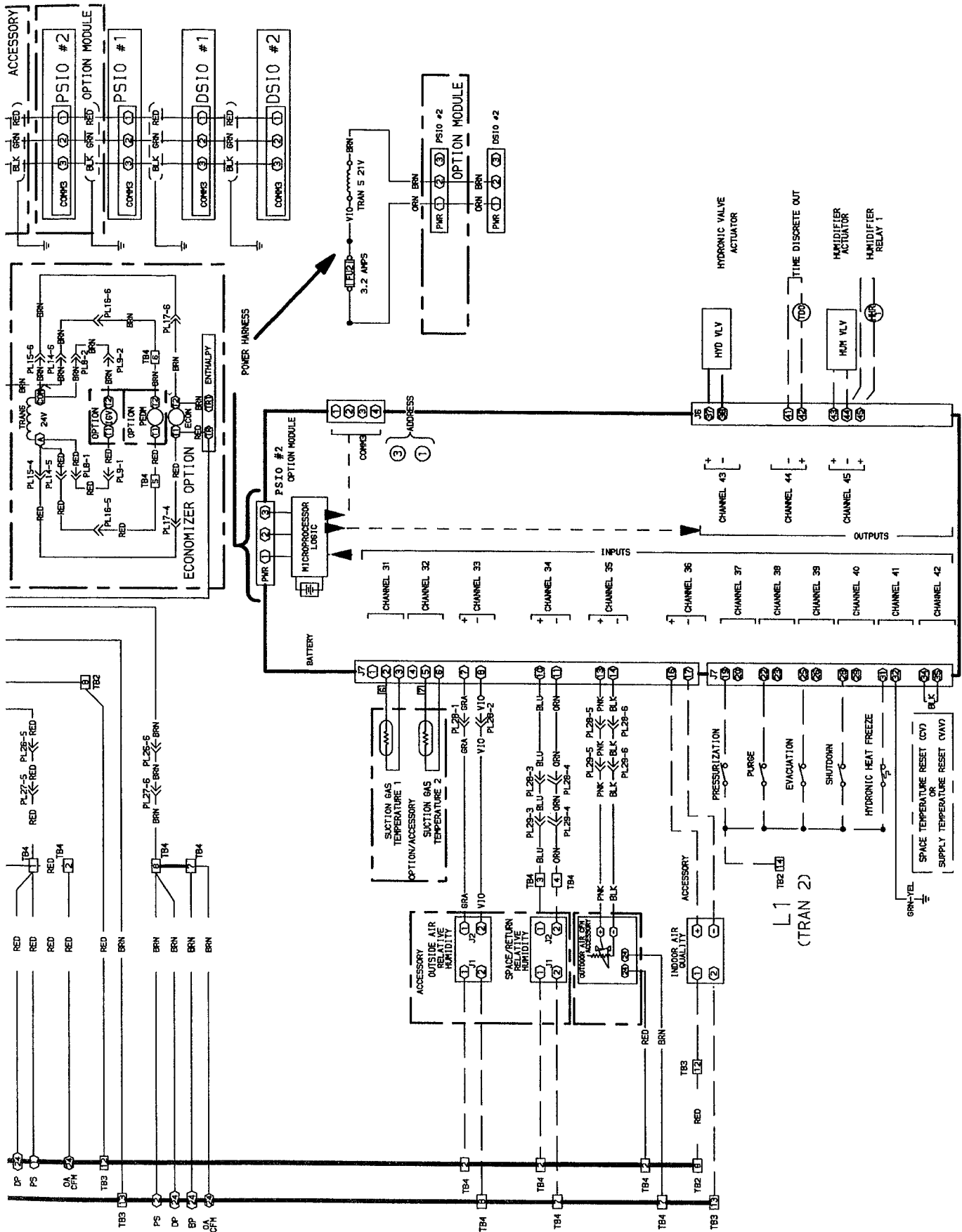


Fig. 16 — Typical Controls Wiring (cont)

# LEGEND

ACC — Accessory  
 BP — Actual Space Pressure  
 C — Contactor  
 CB — Circuit Breaker  
 CCN — Carrier Comfort Network  
 CF — Check Filter  
 CLO — Compressor Lockout  
 COM — Common  
 COMM — Communications Plug  
 COND — Condenser  
 CR — Control Relay  
 CV — Constant Volume  
 DP — Duct Pressure  
 DPT — Duct Pressure Transducer  
 DSIO — High-Voltage Relay Module  
 DU — Dummy Terminal  
 EC — Enthalpy Control  
 ECON — Economizer  
 FS — Filter Status  
 FU — Fuse  
 HC — Heater Contactor  
 HHC — Hydronic Heating Coil  
 HIR — Heat Interlock Relay  
 HPS — High-Pressure Switch  
 HR — Heater Relay  
 HSIO — Keypad and Display Module (LID)  
 HV — Heater Valve  
 HYD — Hydronic  
 IDC — Induced Draft Contactor  
 IFC — Indoor (Evaporator) Fan Contactor

IGV — Inlet Guide Vanes  
 IGVM — Inlet Guide Vane Motor  
 IP — Internal Protector  
 LPS — Low-Pressure Switch  
 LS — Limit Switch  
 MM — Head Pressure Control Function  
 MMC — Head Pressure Control Contactor  
 MOD — Modulating  
 MPER — Modulating Power Exhaust Relay  
 NO — Normally Open  
 OACFM — Outdoor Air Cfm Fan Motor  
 OFC — Outdoor (Condenser) Fan Contactor  
 PEC — Power Exhaust Contactor  
 PEDM — Power Exhaust Damper Motor  
 PER — Power Exhaust Relay  
 PL — Plug  
 PS — Pressure Switch  
 PSIO1 — Standard Processor Module  
 PSIO2 — Control Option Module  
 PWR — Power  
 SNB — Snubber  
 SPT — Suction Pressure Transducer  
 SW — Switch  
 TB — Terminal Block  
 TDO — Timed Discrete Output  
 TH — Thermistor, Heating  
 TRAN — Transformer  
 U — Unloader  
 VAV — Variable Air Volume  
 VLV — Factory Wiring

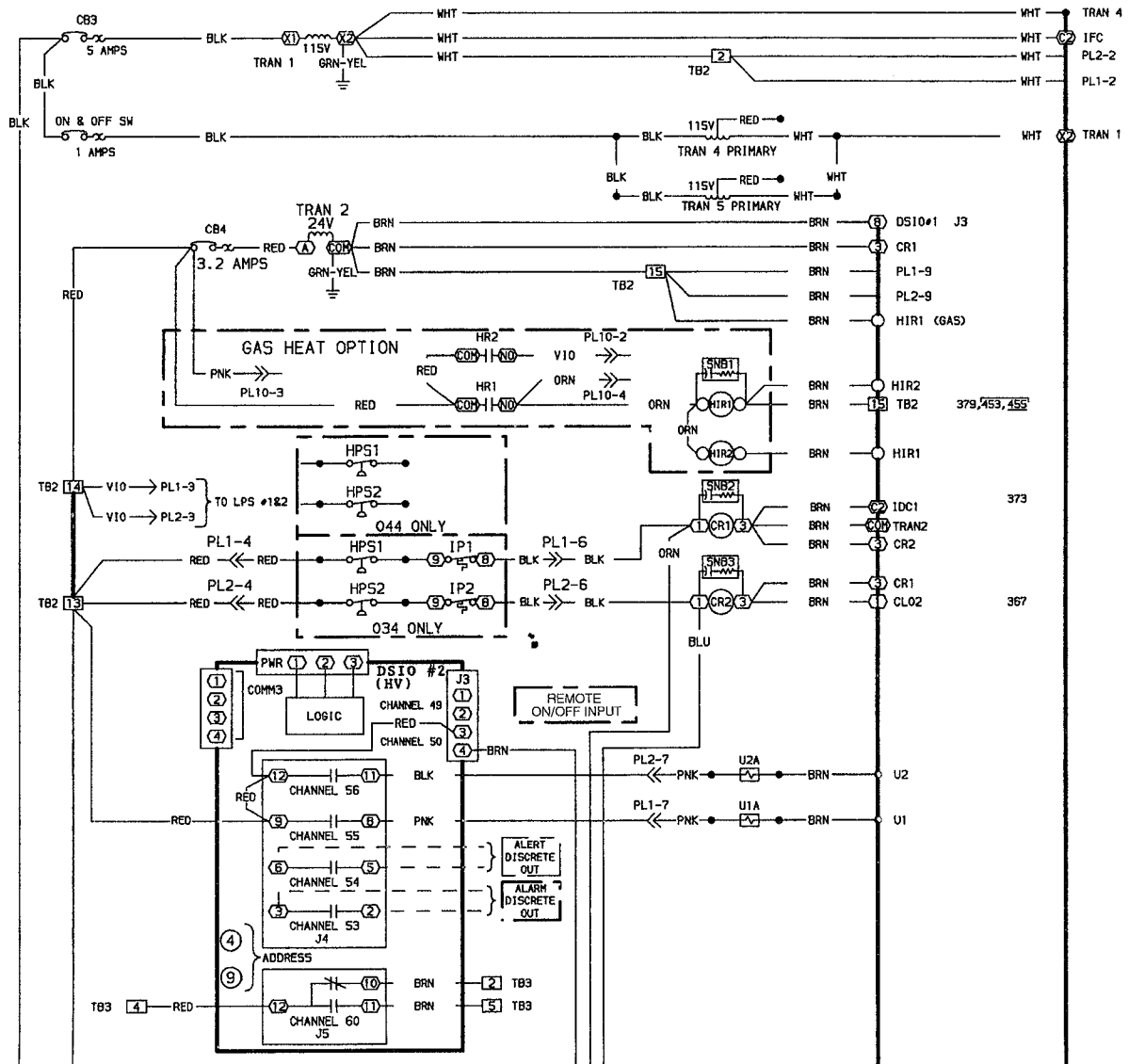


Fig. 16 — Typical Controls Wiring (cont)

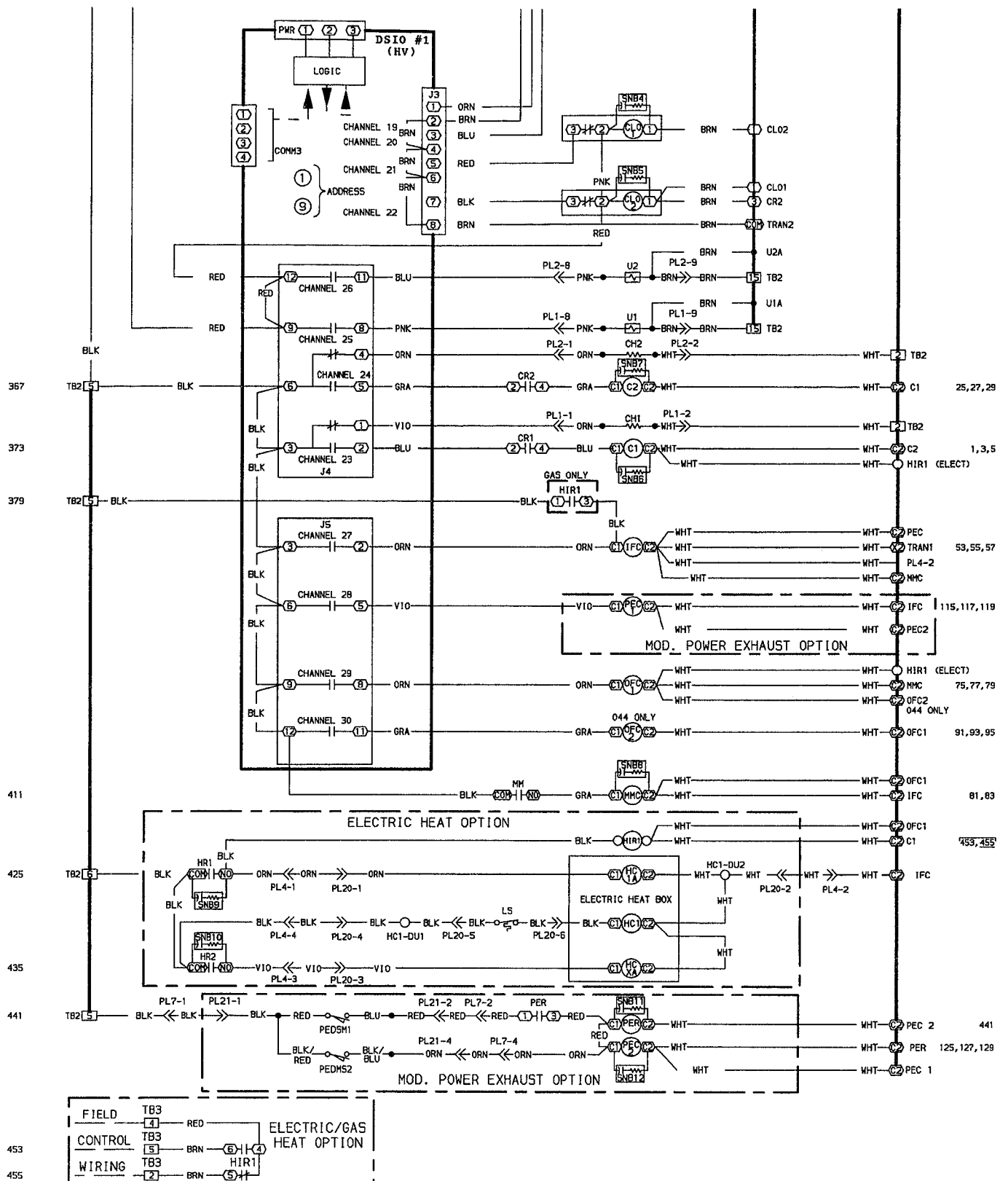


Fig. 16 — Typical Controls Wiring (cont)

## INSTALLATION INFORMATION

**Control Wiring** — See Fig. 17-24 for connections to main and auxiliary control boxes. The recommended types of control wiring for NB,NP unit devices is as follows (see Table 35):

**SENSORS** — Sensors should be wired using single twisted pairs of 20 AWG (American Wire Gauge) conductor cable rated for the application, except for the T56 accessory sensor which requires 3-conductor cable.

**NOTE:** Humidity and CO<sub>2</sub> sensors need to be powered from an isolated 24-v power supply.

**HUMIDITY CONTROL AND HOT WATER AND STEAM VALVES** — These devices require 20 AWG twisted pair conductor cables rated for the application for the 4-20 mA signal.

**SPACE TEMPERATURE SENSOR (T55)** — The space temperature sensor is shipped standard with every unit, and is located in the main control box. Space temperature sensor wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the Carrier Comfort Network (CCN) at the sensor. See RJ11 Plug Wiring section on page 57 to connect the RJ11 connector to the CCN.

### ⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result.

To connect the space temperature sensor (Fig. 17):

1. Connect 1 wire of the twisted pair to terminal T1 and connect the other wire to terminal T2 on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted pair conductor cable rated for the application.
2. Connect the other ends of the wires to terminals 1 and 3 on TB3 (034,044 units) or to terminals 1 and 2 on TB2 (024-030 and 054-074 units) located in the unit main control box.

**NOTE:** This sensor should be installed for all applications. For VAV applications, it is used to control heating and cooling during unoccupied periods. For DAV applications, it is used to maintain control of the space during linkage failures with the TSM (terminal system manager).

**NOTE:** Either the T55 or T56 sensor must be connected for CV applications to function properly.

**SPACE TEMPERATURE SENSOR (T56) (CV APPLICATIONS ONLY)** — Space temperature sensor wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the CCN at the sensor. See RJ11 Plug Wiring section on page 57 to connect the RJ11 connector to the CCN.

### ⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result

To connect the space temperature sensor (Fig. 17):

1. Connect 1 wire of the 3-conductor cable to terminal TH, 1 wire to terminal COM, and the other wire to terminal SW on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted 3-conductor cable rated for the application.

2. Connect the other ends of the wires to terminals 1, 3, and 7 on TB3 (034,044 units) or to terminals 1, 2, and 7 on TB2 (024-030 and 054-074 units) located in the unit main control box. The wire from terminal SW **MUST** be connected to terminal 7 for all sizes.

**NOTE:** Either the T55 or the T56 sensor must be connected for CV applications to function properly

**Table 35 — Recommended Sensor and Device Non-Shielded Cable**

| MANUFACTURER | PART NO.       |               |
|--------------|----------------|---------------|
|              | Regular Wiring | Plenum Wiring |
| Alpha        | 1895           | —             |
| American     | A21451         | A48301        |
| Belden       | 8205           | 884421        |
| Columbia     | D6451          | —             |
| Manhattan    | M13402         | M64430        |
| Quabik       | 6130           | —             |

**Carrier Comfort Network Interface** — The NB,NP units can be connected to the CCN if desired. The communication bus wiring is supplied and installed in the field. It consists of shielded, 3-conductor cable with drain wire.

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 element on either side of it, the negative pins must be wired to the negative pins, and the signal pins must be wired to signal ground pins. Wiring connections for CCN should be made at the 4-pin plug (COMM) located at the bottom right side of the fuse bracket in the main control box. Consult CCN Contractor's Manual for further information.

**NOTE:** Conductors and drain wire must be 20 AWG 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. See Table 36 for cables that meet the requirements.

**Table 36 — CCN Connection Approved Shielded Cables**

| MANUFACTURER | CABLE PART NO. |
|--------------|----------------|
| Alpha        | 2413 or 5463   |
| American     | A22503         |
| Belden       | 8772           |
| Columbia     | 02525          |

**IMPORTANT:** When connecting the CCN communication bus to a system element, use a color coding system for the entire network to simplify installation and checkout.

The following color code is recommended:

| SIGNAL TYPE | CCN BUS CONDUCTOR INSULATION COLOR | COMM1 PLUG PIN NO. |
|-------------|------------------------------------|--------------------|
| +           | RED                                | 1                  |
| GROUND      | WHITE                              | 2                  |
| -           | BLACK                              | 3                  |

**NOTE:** If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

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 (1 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. (If a different network color scheme is used, substitute appropriate colors.)
3. Remove the 4-pin female plug from the fuse and control circuit breaker bracket in the main control box, and connect the wires as follows:
  - a. Insert and secure the red (+) wire to terminal 1 of the 4-pin plug.
  - b. Insert and secure the white (ground) wire to terminal 2 of the 4-pin plug.
  - c. Insert and secure the black (-) wire to terminal 3 of the 4-pin plug.
4. Insert the plug into the existing 4-pin mating connector on the fuse or control circuit breaker bracket in the main control box.

**IMPORTANT:** A shorted CCN bus cable will prevent some routines from running and may prevent unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check CCN connector, and run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

**RJ11 PLUG WIRING** — Units on the CCN can be monitored from the space at the sensor through the RJ11 connector, if desired. To wire the RJ11 connector into the CCN (Fig. 18):

**IMPORTANT:** The cable selected for the RJ11 connector wiring **MUST** be identical to the CCN communication bus wire used for the entire network. Refer to Table 36 for acceptable wiring.

1. Cut the CCN wire and strip ends of the red (+), white (ground), and black (-) conductors. (If another wire color scheme is used, strip ends of appropriate wires.)
2. Insert and secure the red (+) wire to pin J2 of the space temperature sensor terminal block (TB1).
3. Insert and secure the white (ground) wire to pin J3 of the space temperature sensor TB1.
4. Insert and secure the black (-) wire to pin J5 of the space temperature sensor TB1.
5. Connect the other end of the communication bus cable to the remainder of the CCN communication bus at the COMM1 plug located on the fuse and control circuit breaker bracket in the unit main control box.

**Optional Smoke Control (Fig. 19)** — When the NB,NP unit is equipped with an optional smoke control and

a fire system is installed, 4 modes are provided to control smoke within areas serviced by the rooftop unit. Each mode must be energized individually from the approved building fire alarm system, and the corresponding alarm is then generated at the HSIO keypad or building supervisor.

**NOTE:** The unit **MUST** be equipped with an optional factory-installed economizer, the optional processor module (PSIO2), and the optional factory-installed modulating power exhaust or return-air fan(s) to provide smoke control capabilities.

The building fire alarm system must provide 4 normally-open dry contact closures. These contacts must be wired between TB2-14 (034,044 units) or TB2-5 (024-030 and 054-074 units) and the PSIO2 plug J7 (bottom) appropriate connection. Refer to the unit wiring diagram for the corresponding connection point on PSIO2, plug J7 (bottom).

**FIRE SHUT DOWN MODE** — The fire alarm system must provide a normally-open dry contact closure which energizes the fire shut down mode when activated.

When the fire shut down mode is energized, the unit shuts down.

This mode remains in effect as long as the input signal is maintained at the fire system panel. An alarm is generated from this input and sent to the building supervisor. In order for this mode to be initiated, the input signal must be maintained for no less than 2 seconds.

**EVACUATION MODE** — The building fire alarm system must provide a normally-open dry contact closure which energizes the evacuation mode when activated. When the evacuation mode is energized, the supply-air fan will shut down, the supply-air fan inlet guide vanes will close, the return/power exhaust fan(s) will start, the return/power exhaust fan dampers will open, and the return-air dampers will close.

This mode remains in effect for as long as the input signal is maintained at the fire system panel. An alarm is generated from this input and sent to the building supervisor. In order for this mode to be initiated, the input signal must be maintained for no less than 2 seconds.

**PRESSURIZATION MODE** — The building fire alarm system must provide a normally-open dry contact closure which energizes the pressurization mode when activated. When the pressurization mode is energized, the supply-air fan will start, the power exhaust or return-air fan(s) will shut down, the economizer damper will open, and the power exhaust/return fan dampers will close.

This mode remains in effect as long as the input signal is maintained at the fire system panel. An alarm is generated from this input and sent to the building supervisor. In order for this mode to be initiated, the input signal must be maintained for no less than 2 seconds.

**SMOKE PURGE MODE** — The building fire alarm system must provide a normally-open dry contact closure which energizes the smoke purge mode when activated.

When the smoke purge mode is energized, the supply and power exhaust or return-air fans will start, the economizer and power exhaust or return-fan dampers will open, and the return-air dampers will close.

This mode remains in effect as long as the input signal is maintained at the fire system panel. An alarm is generated from this input and sent to the building supervisor. In order for this mode to be initiated, the input signal must be maintained for no less than two seconds

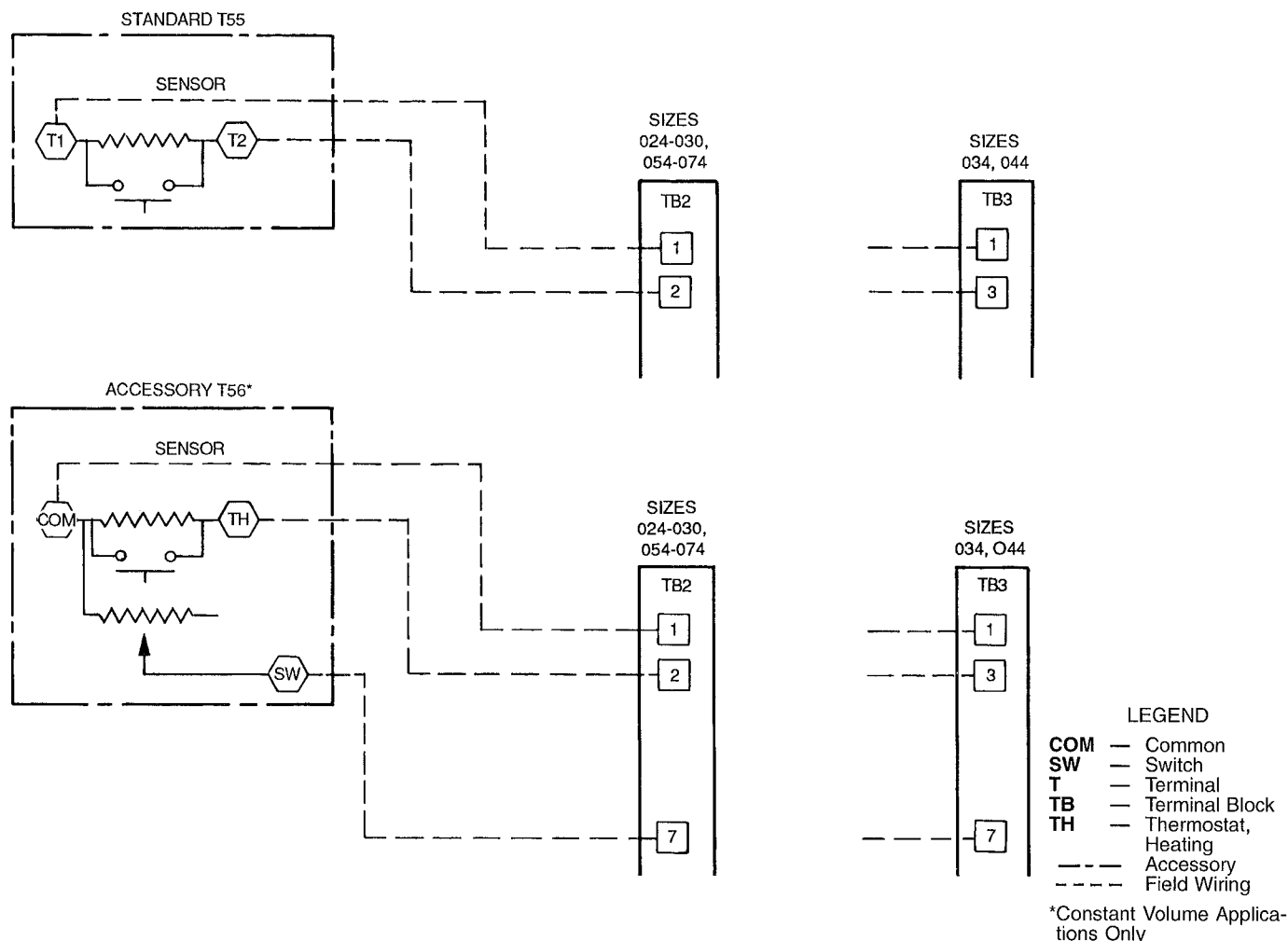


**Fig. 17 — Typical Space Temperature Sensor Wiring**

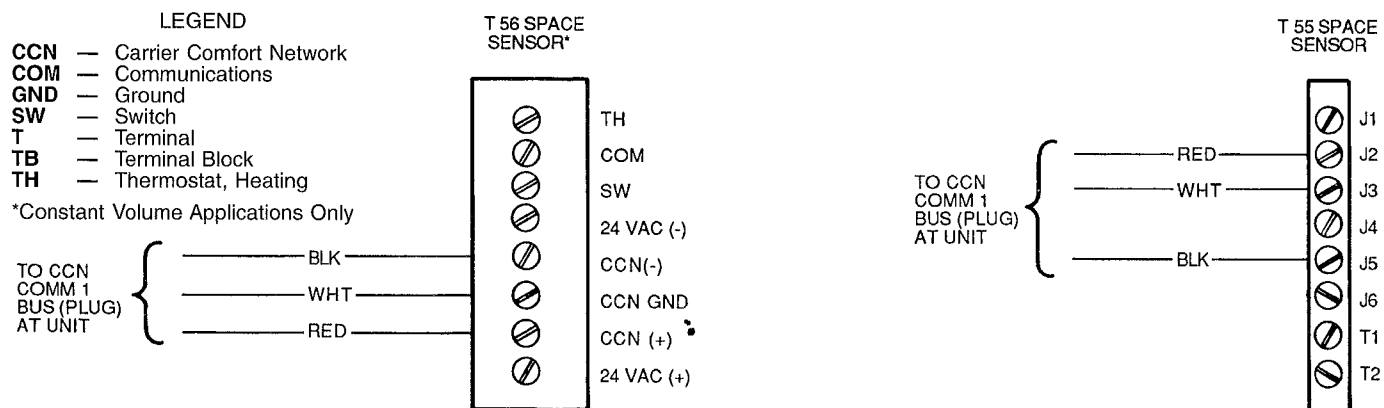


**Fig. 18 — CCN Communications Bus Wiring to Optional Space Sensor RJ11 Connector**

**Heat Interlock Relay (HIR) Function Wiring (VAV Units Only — Not necessary for DAV applications) (Fig. 19)** — Variable-air volume units using optimal start (morning warm-up) require that room terminals be controlled to go to the fully open position when the unit goes into the heating mode. The HIR function is provided for this control. The relay is located in the unit control box. When the unit goes into heating mode, the interlock relay is energized to provide switch closure or opening (depending on how the field-supplied power source is set up) to open the

room terminals. The field-supplied connections for interlock relays are:

| UNIT SIZE        | TERMINAL TYPE        | TERMINAL NO. | TERMINAL BLOCK |
|------------------|----------------------|--------------|----------------|
| 034,044          | Normally closed (NC) | 2 and 4      | TB3            |
|                  | Normally open (NO)   | 4 and 5      | TB3            |
| 024-030, 054-074 | Normally closed (NC) | 8 and 10     | TB2            |
|                  | Normally open (NO)   | 8 and 9      | TB2            |

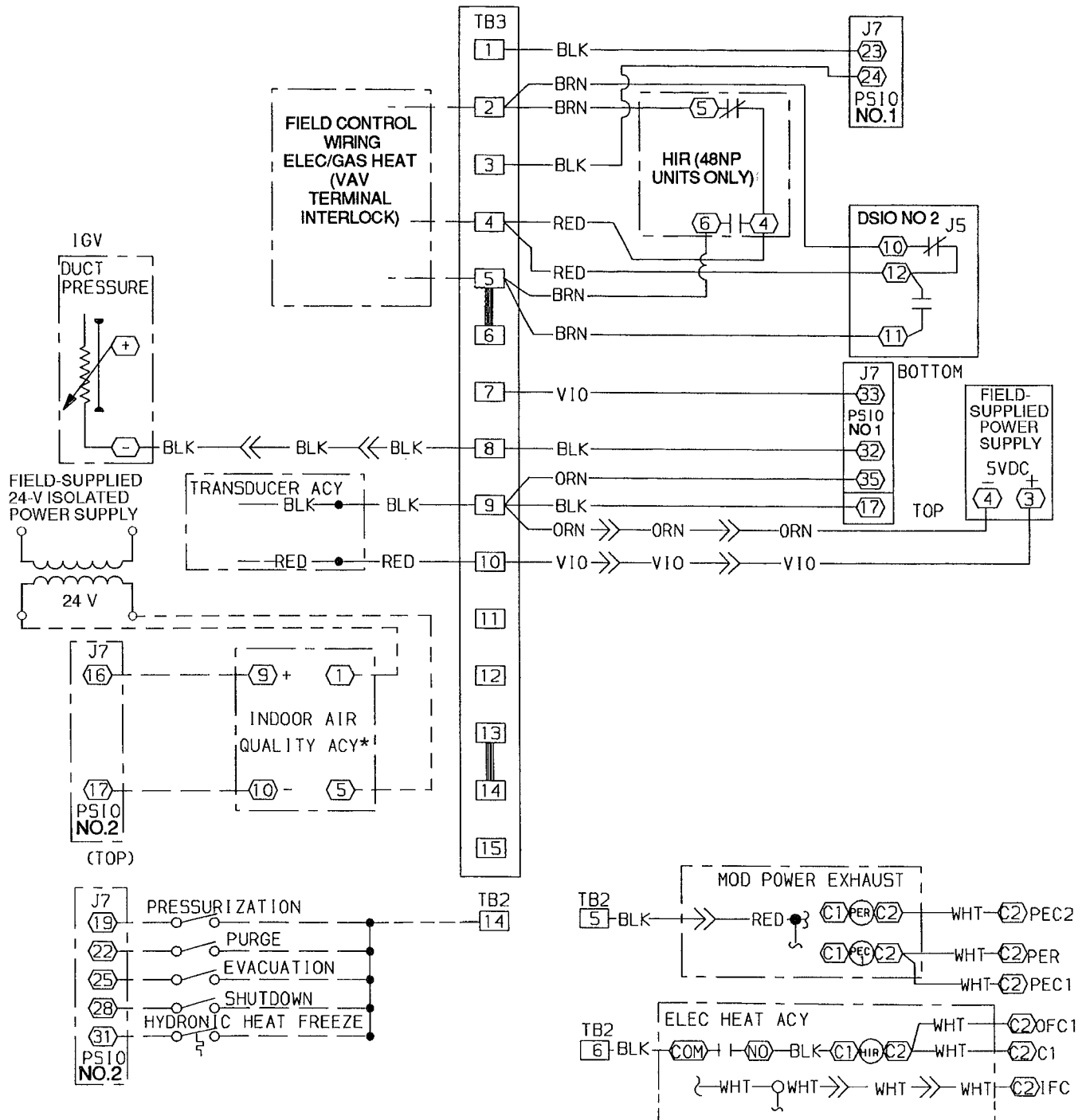
Note that a field-supplied power source is required. See Fig. 19 and unit wiring schematic for wiring details.

**Remote Reset** — The unit controls allow for remote input from an energy management system (EMS) or some other input to offset the space temperature set point on CV applications or to reset the cold deck set point on VAV applications. A remote, isolated, 2 to 10 vdc signal may be used to achieve this purpose. See Fig. 22 for wiring details.

**Remote ON-OFF Control** — This control is for applications where it is necessary to shut the unit down from

a remote time clock or switch. See Fig. 23 for appropriate field wiring.

**Timed Discrete Output** — A timed discrete output is available for switching on and off items such as parking lot lights. Time Schedule II ( [1] [1] SCHD to [1] [8] SCHD) operates this function. A special relay (part no. HK35AA001) with a 20 vdc holding coil must be field wired. See Fig. 24.

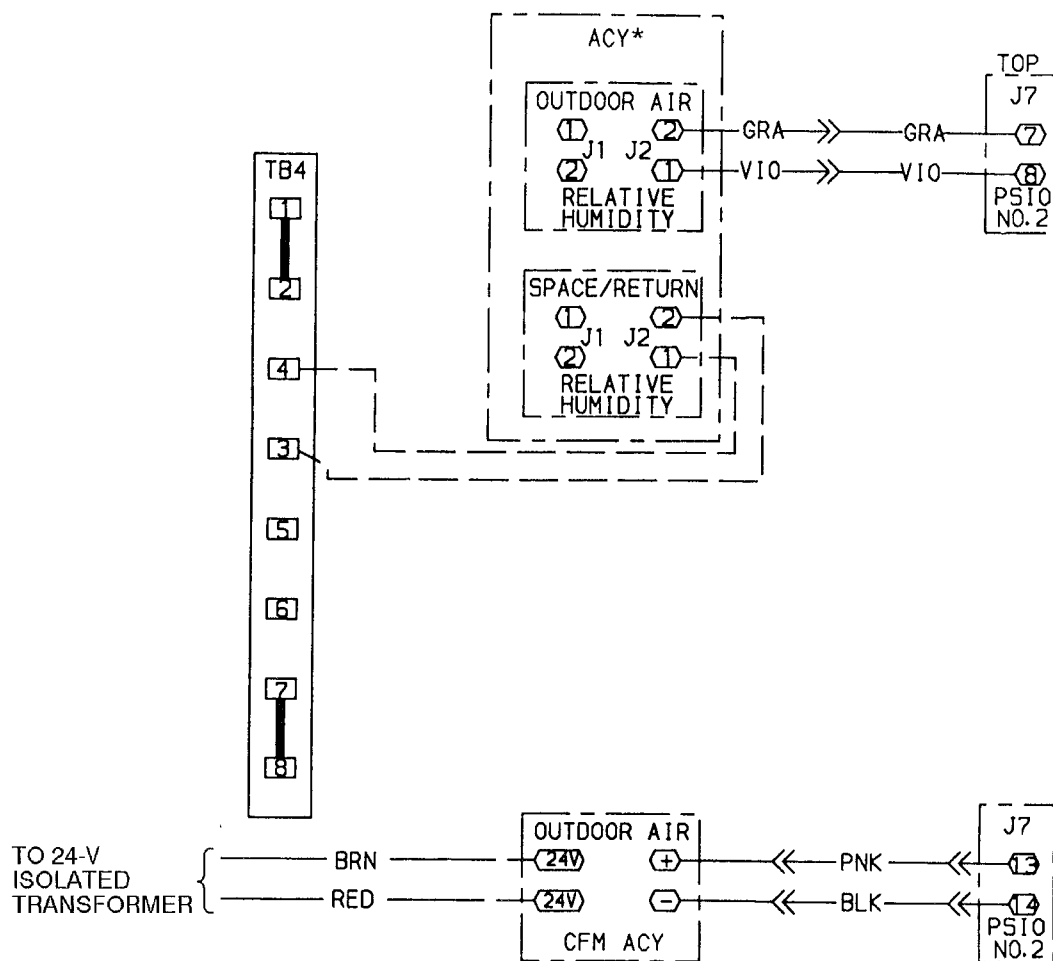


\*Sensors and actuators must be powered from an isolated transformer. Do not use unit 24-v transformer.

#### NOTES

- 1 All wiring should be done per local electrical codes.
- 2 All PSIO inputs are 2-10 vdc except the pressure transducers which are 1-5 vdc. All PSIO outputs are 4-20 mA.

**Fig. 19 — Field Control Terminal Block Wiring — Main Control Box (034,044 shown)**



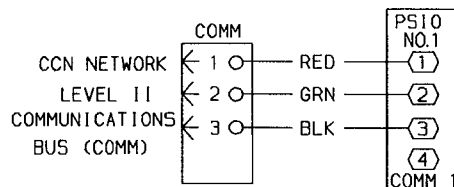
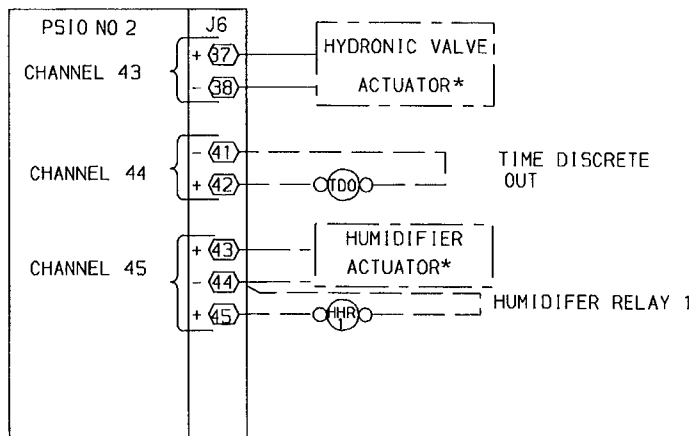
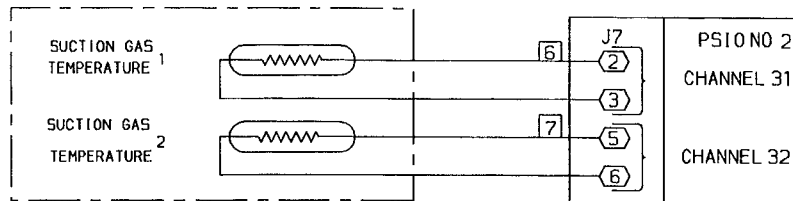
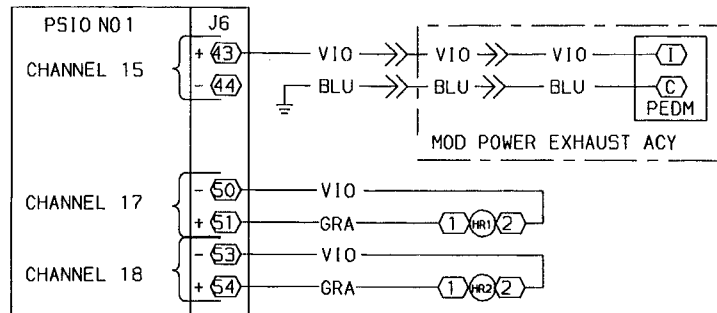
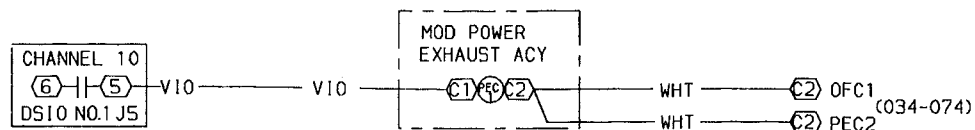
\*Sensors and actuators must be powered from an isolated transformer. Do not use unit 24 v transformer

NOTE: All wiring should be done per local electrical codes.

**Fig. 20 — Field Control Wiring — Auxiliary Control Box**

### Legend For Fig. 19-21

|             |                                     |              |                                            |
|-------------|-------------------------------------|--------------|--------------------------------------------|
| <b>C</b>    | — Contactor                         | <b>OFC</b>   | — Outdoor (Condenser) Fan Contactor        |
| <b>CCN</b>  | — Carrier Comfort Network           | <b>PEC</b>   | — Power Exhaust Contactor                  |
| <b>COM</b>  | — Common Motor                      | <b>PEDM</b>  | — Power Exhaust Damper Motor               |
| <b>CV</b>   | — Constant Volume                   | <b>PER</b>   | — Power Exhaust Relay                      |
| <b>DSIO</b> | — Relay Module                      | <b>PSIO1</b> | — Standard Processor Module                |
| <b>DU</b>   | — Dummy Terminal                    | <b>PSIO2</b> | — Accessory/Optional Control Option Module |
| <b>HHR</b>  | — Hydronic Humidifier Relay         | <b>SW</b>    | — Switch                                   |
| <b>HR</b>   | — Heater Relay                      | <b>TB</b>    | — Terminal Block                           |
| <b>HSIO</b> | — Keypad and Display Module         | <b>TDO</b>   | — Timed Discrete Output                    |
| <b>IFC</b>  | — Indoor (Evaporator) Fan Contactor | <b>TRAN</b>  | — Transformer                              |
| <b>IGV</b>  | — Inlet Guide Vanes                 | <b>VAV</b>   | — Variable Air Volume                      |
| <b>MOD</b>  | — Modulating                        | ---          | Field Wiring                               |
| <b>MPER</b> | — Modulating Power Exhaust Relay    | ---          | Factory Wiring                             |
| <b>NC</b>   | — Normally Closed                   | ---          | Field Supplied                             |
| <b>NO</b>   | — Normally Open                     |              |                                            |



\*Sensors and actuators must be powered from an isolated transformer. Do not use unit 24 v transformer.

NOTE: All wiring should be done per local electrical codes.

**Fig. 21 — Field Control Wiring — Main Control Box**

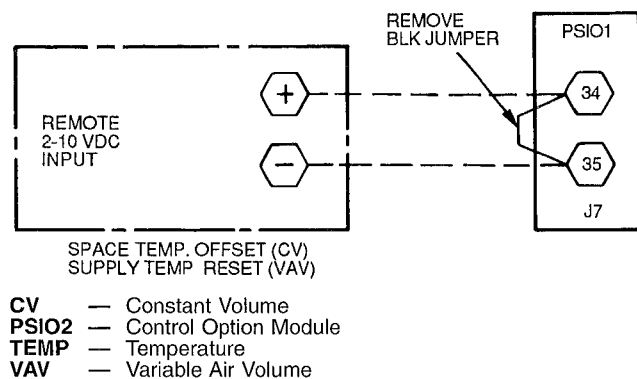


**Fig. 22 — Remote Offset/Reset**

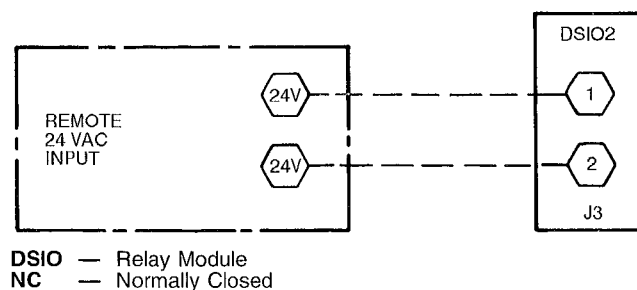


**Fig. 23 — Remote On-Off Control**

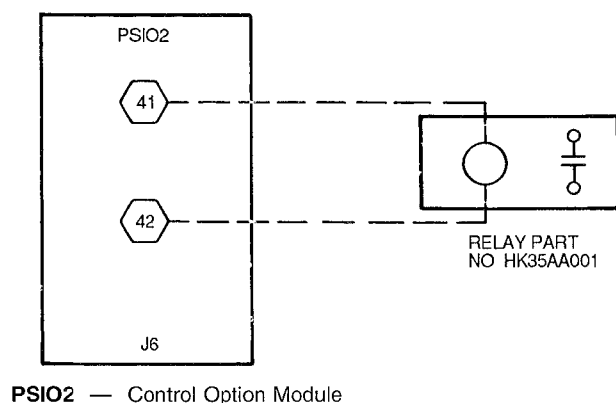


**Fig. 24 — Discrete Timed Output**

**Air Pressure Tubing** — Before options such as inlet guide vanes and modulating power exhaust can operate properly, the pneumatic tubes for pressure sensing must be installed. The recommended field-supplied tubing for this use is a nominal 1/4-in., fire-retardant tubing.

The tubing must be run from the appropriate location in the building to the auxiliary control box in the unit. Figures 25-27 show the locations of the auxiliary control boxes in each of the units. Figures 28 and 29 show the connection locations for the tubing on the duct pressure (DP) controller for the variable inlet guide vanes and on the building pressure (BP) controller for the damper on the modulating power exhaust or return fan.

The tubing for the duct pressure control (variable inlet guide vanes) should sample supply duct pressure about 2/3 of the way out from the unit in the main trunk duct. The tubing for the building pressure control should sample building pressure in the area near the entrance lobby so that location is controlled as closely to design pressures as possible.

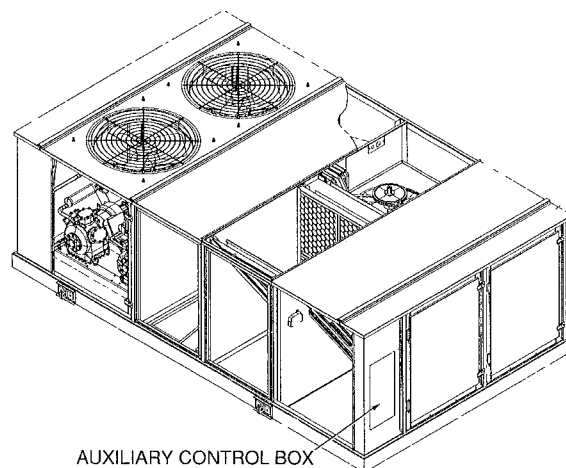


**Fig. 25 — Auxiliary Control Box Location;  
024-030 Units**

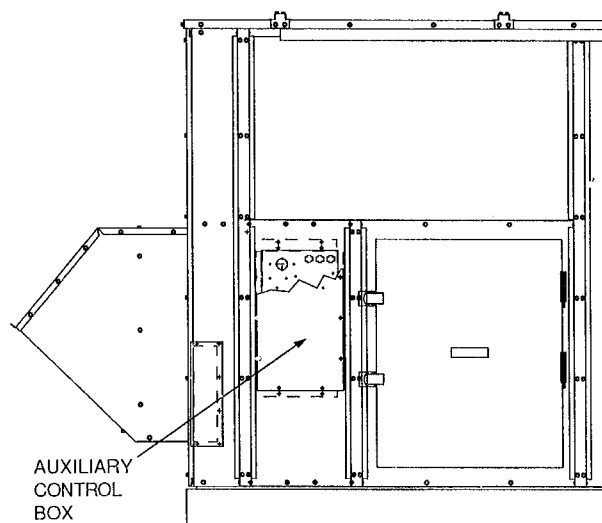
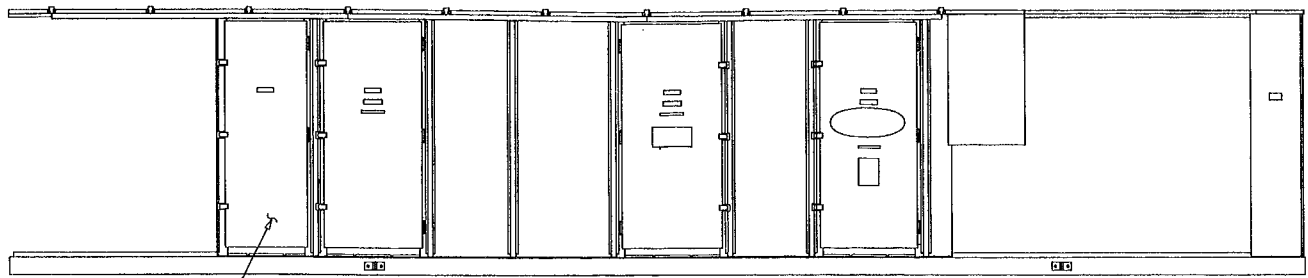


**Fig. 26 — Auxiliary Control Box Location;  
034,044 Units**



AUXILIARY CONTROL BOX PANEL  
LOCATED BEHIND ACCESS DOOR

**Fig. 27 — Auxiliary Control Box Location; 054-074 Units**

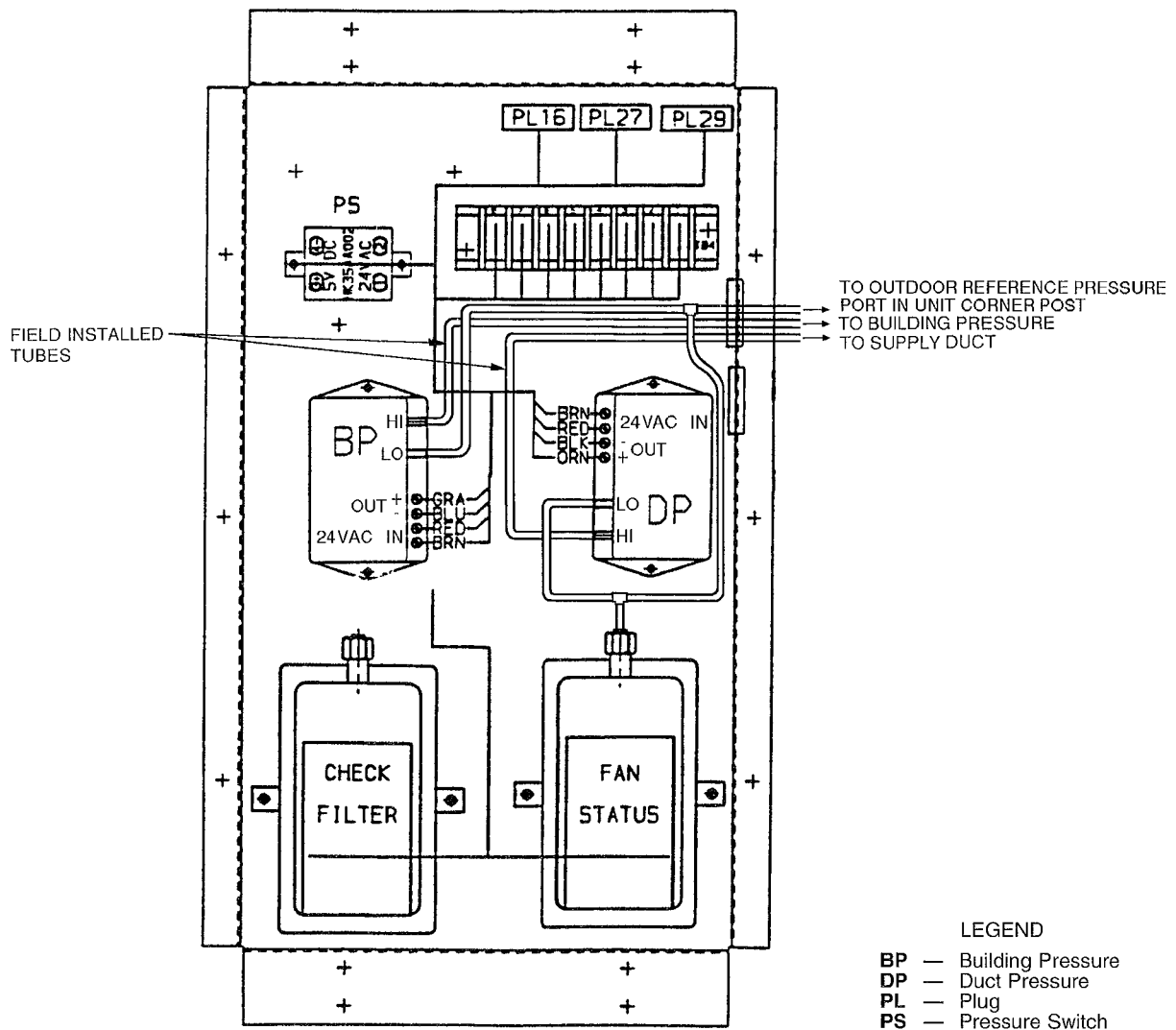


**Fig. 28 — Auxiliary Control Box Details; 024-044 Units**

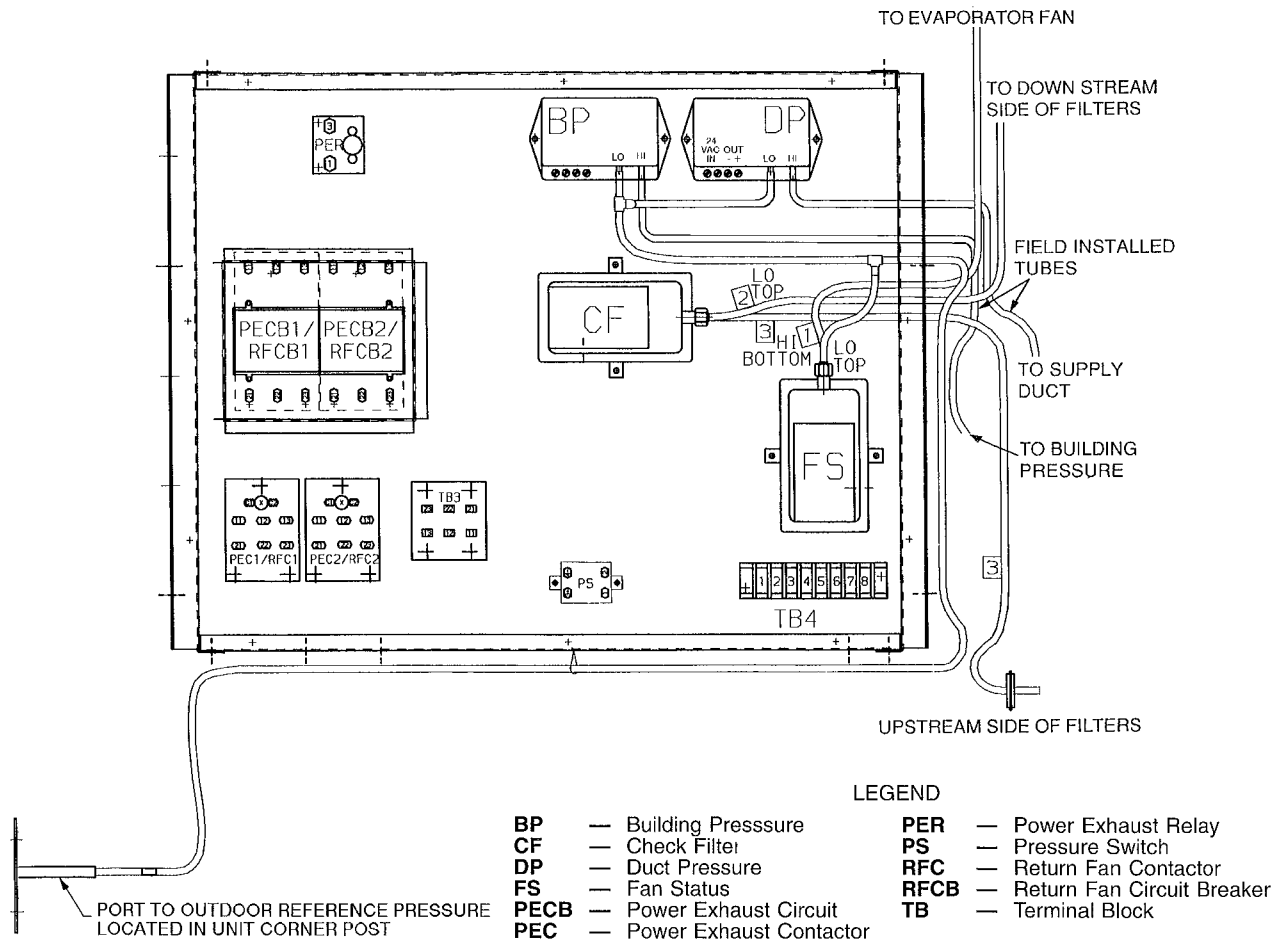


**Fig. 29 — Auxiliary Control Box Details; 054-074 Units**

**Auxiliary Switch, Power Exhaust** — All NB,NP units with the modulating power exhaust option have 2 auxiliary switches mounted on the cams inside the power exhaust damper motor. The switch cam is factory set to energize the second power exhaust motor. A pointer is printed on the red cam and the numbers 35 and 63 are both printed on the blue cam. See Fig. 30.

If the damper motor has been replaced or improper operation is suspected, perform the following test before attempting to adjust the switch cams:

- Put the unit into the standby mode.
- For 034,044 units: Remove damper motor top cover and verify that pointer points at number 35. If installing new motor, use screwdriver to turn blue cam so pointer lines up with the number 35. See Fig. 31.
  - For 024-030 and 054-074 units: Remove damper motor top cover and verify that pointer points at number 63. If installing new motor, use screwdriver to turn blue cam so that pointer lines up with the number 63. See Fig. 31.
- Enter quick test function ( **2** **TEST** ) and press **↓** until you reach the PERD display.
- Press the **ENTR** key once and wait 30 seconds. Was power exhaust motor no. 2 energized? Yes/No
- Press the **ENTR** key again and wait 30 seconds. Was power exhaust motor no. 2 energized? Yes/No
- Press the **ENTR** key again and wait 30 seconds. Was power exhaust motor no. 2 deenergized? Yes/No

- Press the **ENTR** key again and wait 30 seconds. Was power exhaust motor no. 2 deenergized? Yes/No
- Exit the quick test. See Quick Test section on page 50 for details.
- Proceed with evaluation below.

If the answers in Step 5 and Step 7 above were both yes, the switch cams are properly adjusted. If the answers to either Step 4 or Step 6 above were yes, the switch cams need adjustment. To adjust auxiliary switch cams:

- Remove damper motor top cover.
- Use 1/8 in. straight blade screwdriver to make adjustments

### ⚠ CAUTION

Do not turn motor shaft by hand or with wrench. Damage to the gear train will result.

- Adjustments should be made to the blue cam only. The pointer on the red cam should remain centered and at the top, as this will deenergize motor no. 2 properly.
- Each click of the blue cam changes the switch setting by approximately 3 degrees of travel.
- If motor no. 2 was energized too soon (Step 4 of the test above was yes), turn blue cam one click to left (see Fig. 31). If motor no. 2 was not energized (Steps 4 and 5 of the test above were no), turn blue cam one click to the right (see Fig. 31)
- Repeat the quick test.
- Repeat Steps 5 and 6 as necessary until proper operation is observed.
- Replace damper motor top cover.

## START-UP

### Initial Check

**IMPORTANT:** Do not attempt to start unit, even momentarily, until all items on the Controls Start-Up Checklist (page CL-1) and the following steps have been completed.

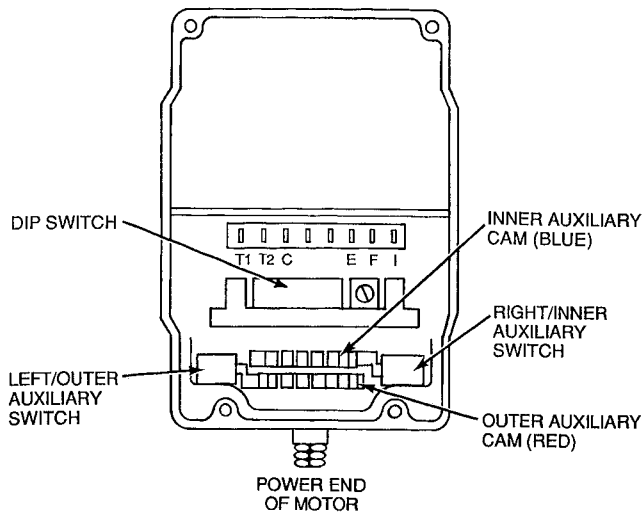


**Fig. 30 — Auxiliary Switch Stroke Adjustment**

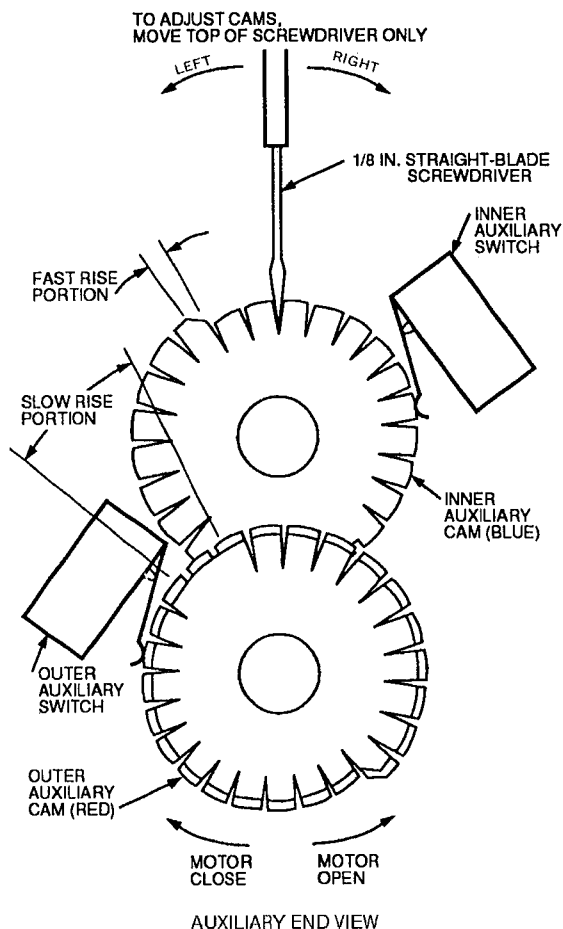


**Fig. 31 — Auxiliary Switch Adjustment**

1. Verify unit has been installed per the Installation Instructions included in the unit installation packet.
2. Verify that all auxiliary components (sensors, controls, etc.) have been installed and wired to the NB, NP control boxes per these instructions, the unit Installation Instructions, and the unit wiring label diagrams.
3. Verify that pressure hoses (static, duct, etc.) are properly attached, routed, and free from pinches or crimps that may affect proper control operation.
4. Set any control configurations that are required (field-installed accessories, etc). The unit is factory configured for all appropriate factory-installed options with the applicable controls programmed to the default values. See Adjusting Set Points section on page 66 for configuration values.
5. Enter unit set points. The unit is shipped with the set point default values shown in Adjusting Set Points section on page 66. If a different set point is required, change per the example shown under Set Point Function section on page 66.
6. Configure schedule subfunctions: occupied, unoccupied, and holiday periods. See Program Time Sequences section on page 69 for details on setting periods.
7. Verify that control time periods programmed meet current requirements.
8. Check tightness of all electrical connections.
9. Perform quick test (see Quick Test section on page 50).

### Set Fan Status and Check Filter Switches

**SUPPLY FAN STATUS SWITCH (FS)** — A snap acting single-pole, double-throw (SPDT) differential pressure switch is factory mounted in the NB, NP auxiliary control box. The switch senses the change in pressure across the supply-air fan and provides the fan status. A length of plenum tubing connects the switch to the probe located on the fan side plate.

The switch must be set prior to unit operation. To set the switch, turn the adjustment screw on top (center) of switch clockwise to increase set point, or counterclockwise to decrease set point. The set point switch range is 0.05 to 2.0 in. wg with a deadband of 0.02 in. wg at minimum set point and 0.1 in. wg at maximum set point.

Set switch so that contact makes to NC when supply-air fan is energized. Adjust switch with inlet guide vanes closed on VAV units. The switch should make (fan on) within 1 minute after supply-air fan is energized and break (fan off) within 1 minute after the fan is deenergized.

**CHECK FILTER SWITCH (CFS)** — A snap acting SPDT switch is factory mounted in the NB, NP auxiliary control box. The switch senses the differential pressure and provides the microprocessor module with a signal for filter status. Two lengths of plenum tubing connect the switch to probes located both upstream and downstream of the unit filters.

The switch must be set prior to unit operation. To set the switch, turn the adjustment screw on top (center) of switch slowly clockwise to find the “pivot” point where the filter status still reads clean under **8** **STAT** in the HSIO display. Check the switch operation with the supply-air fan running, the inlet guide vanes full open (if applicable), and nominal cfm delivery. See Table 37 for clean filter pressure drops for help in locating the “pivot” point. Once this point is found, turn the screw clockwise to obtain the set point at which the filter status will be dirty. Use Table 37 as a guide.

**Table 37 — Filter Switch Dirty Set Point**

| FILTER TYPE          | INCREASED<br>PRESSURE DROP<br>TO “DIRTY”<br>FROM PIVOT<br>POINT | APPROXIMATE<br>CLOCKWISE<br>TURNS |
|----------------------|-----------------------------------------------------------------|-----------------------------------|
| 2-in. Throwaway      | 0.30 in. wg                                                     | 2                                 |
| 2-in. Pleated        | 0.75 in. wg                                                     | 5                                 |
| Bag with Pre-filters | 0.75 in. wg                                                     | 5                                 |

### Adjusting Set Points

**SET POINT FUNCTION** — The set point function allows the user to view the current values set for the unit. From this function, the user can change the values.

**Reading and Changing Set Points**— To change the set point of a particular feature, enter the appropriate subfunction and scroll to the variable desired. Once the desired variable has been reached, type in the new value and press **ENTR**. The new value will appear in the display.

For example, the occupied cool set point is currently set at the default value of 78 F. To change the occupied set point to 72 F:

1. Press **1** **SET** **↓** **↓** to enter the occupied cool set point function. The display will read OCSF 78.
2. Press **7** **2** **ENTR** and the display will read OCSF 72.

Set points can be changed by the user provided that the values are within the allowable range for the input. If the input is not within the allowable range, the original value will remain displayed. See Table 38 for allowable ranges and default values.

To change the demand limit set points, the functions must first be enabled in the field configuration subfunction (See Table 39 for more details on operation modes.)

**Table 38 — Set Point Ranges and Defaults**

| DISPLAY | SET POINT<br>DESCRIPTION               | DEFAULT<br>VALUE | ALLOWABLE<br>RANGE |
|---------|----------------------------------------|------------------|--------------------|
| BPSP    | Building pressure set point            | 0.05 in. wg      | 0 to 50 in. wg     |
| ECSP*   | Economizer set point offset            | 3                | 1 to 10            |
| HHOR†   | High humidity override (percent)       | 99               | 0 to 100%          |
| HTMP    | High temperature minimum position      | 35 F             | 0 to 100 F         |
| HUSP    | Humidity set point (percent)**         | 40%              | 0 to 100%          |
| IAQS†   | IAQ set point                          | 1                | 0 to 2000 ppm      |
| LIMIT†  | Reset limit (F)                        | 10 F             | 0 to 20 F          |
| LSP     | Loadshed set point (percent)           | 50%              | 0 to 100%          |
| LTMP    | Low temperature minimum position       | 10 F             | 0 to 100 F         |
| MDP†    | Minimum damper position (percent)      | 20%              | 0 to 100%          |
| NTLO†   | NTFC lockout temperature (F)           | 50 F             | 40 to 70 F         |
| OACS†   | Outdoor-air cfm set point              | 1                | 0 to 50,000 cfm    |
| OCSP    | Occupied cool set point (F)**          | 78 F             | 55 to 80 F         |
| OHSP    | Occupied heat set point (F)**          | 68 F             | 55 to 80 F         |
| PES1†   | Power exhaust on-set point 1 (percent) | 90%              | 30 to 100%         |
| PES2†   | Power exhaust on-set point 2 (percent) | 90%              | 30 to 100%         |
| RTIO†   | Reset ratio (F)                        | 3 F              | 0 to 10 F          |
| SASP    | Supply air set point (F)               | 55 F             | 45 to 70 F         |
| SPSP    | Static pressure set point††            | 1.5 in. wg       | 0 to 5.0 in. wg    |
| UCDB*   | Unoccupied cooling deadband            | 1                | 0 to 10            |
| UCSP    | Unoccupied cool set point (F)**        | 90 F             | 75 to 95 F         |
| UHDB*   | Unoccupied heating deadband            | 1                | 0 to 10            |
| UHSP    | Unoccupied heat set point (F)**        | 55 F             | 40 to 80 F         |

IAQ — Indoor-Air Quality  
 NTFC — Nighttime Free Cooling  
 PPM — Parts Per Million  
 VAV — Variable Air Volume

\*These items are found under the Service function, and can only be accessed using either the Building Supervisor or Service Tool

†These items are found under the Service function

\*\*Occupied space

††Supply duct

NOTE. For VAV applications, the OHSP is the same as the morning warm-up set point, and the OCSP is the reset set point

Table 39 — Operating Modes

| MODE NO. | OPERATING MODE          | TO CONFIGURE OPTION                                                                                                                    |                       | TO ENABLE MODE                                                                                        |                     |
|----------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------|---------------------|
|          |                         | Press                                                                                                                                  | Display               | Press*                                                                                                | Display             |
| 21       | Space Temperature Reset | <input type="button" value="1"/> <input type="button" value="4"/> <input type="button" value="SRVC"/>                                  | SPCRESET              | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | RSEN ENB            |
| 22       | Demand Limit            | <input type="button" value="1"/> <input type="button" value="5"/> <input type="button" value="SRVC"/>                                  | LOADSHED              | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | DLEN ENB            |
| 23       | Unoccupied Heating      | <input type="button" value="7"/> <input type="button" value="SRVC"/>                                                                   | HEATCOIL (MODULATING) | —                                                                                                     | —                   |
|          |                         | <input type="button" value="1"/> <input type="button" value="1"/> <input type="button" value="SRVC"/>                                  | HEAT (STAGED)         |                                                                                                       |                     |
| 24       | Unoccupied Cooling      | <input type="button" value="8"/> <input type="button" value="SRVC"/>                                                                   | COOLING               | —                                                                                                     | —                   |
|          |                         | <input type="button" value="1"/> <input type="button" value="0"/> <input type="button" value="SRVC"/>                                  | ECONMIZR              |                                                                                                       |                     |
| 25       | Standby                 | —                                                                                                                                      | —                     | <input type="button" value="1"/> <input type="button" value="1"/> <input type="button" value="STAT"/> | STBY YES            |
| 26       | Optimal Start           | <input type="button" value="1"/> <input type="button" value="3"/> <input type="button" value="SRVC"/>                                  | AOSS                  | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | OSEN ENB            |
| 27       | Unoccupied              | <input type="button" value="2"/> <input type="button" value="SCHD"/>                                                                   | PERIOD 1              | —                                                                                                     | —                   |
| 28       | IAQ Purge               | <input type="button" value="1"/> <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | IAQ                   | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | PURG ENB            |
| 29       | Optimal Stop            | <input type="button" value="1"/> <input type="button" value="3"/> <input type="button" value="SRVC"/>                                  | AOSS                  | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | OSEN DSB            |
| 30       | Occupied Heating        | <input type="button" value="7"/> <input type="button" value="SRVC"/>                                                                   | HEATCOIL (MODULATING) | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | OHEN ENB            |
|          |                         | <input type="button" value="1"/> <input type="button" value="1"/> <input type="button" value="SRVC"/>                                  | HEAT (STAGED)         |                                                                                                       |                     |
| 31       | Occupied Cooling        | <input type="button" value="8"/> <input type="button" value="SRVC"/>                                                                   | COOLING               | —                                                                                                     | —                   |
| 32       | Occupied                | <input type="button" value="2"/> <input type="button" value="SCHD"/>                                                                   | PERIOD 1              | —                                                                                                     | —                   |
| 33       | Nighttime Free Cooling  | <input type="button" value="1"/> <input type="button" value="2"/> <input type="button" value="SRVC"/>                                  | NTFC                  | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | NTEN ENB            |
| 34       | Pressurization          | See Table 22 for details                                                                                                               |                       |                                                                                                       |                     |
| 35       | Evacuation              |                                                                                                                                        |                       |                                                                                                       |                     |
| 36       | Smoke Purge             |                                                                                                                                        |                       |                                                                                                       |                     |
| 37       | Fire Shutdown           |                                                                                                                                        |                       |                                                                                                       |                     |
| 38       | Timed Override          | From: HSIO or Building Supervisor                                                                                                      |                       | <input type="button" value="1"/> <input type="button" value="SCHD"/>                                  | OVRD XHR            |
|          |                         | From: T55 or T56                                                                                                                       |                       | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | TSCH v<br>TOVR v    |
| 39       | DAV Control             | —                                                                                                                                      | —                     | —                                                                                                     | —                   |
| 40       | Factory/Field Test      | <input type="button" value="1"/> through <input type="button" value="6"/> TEST                                                         | —                     | —                                                                                                     | INPUTS through EXIT |
| 41       | High Humidity Override  | <input type="button" value="8"/> <input type="button" value="SRVC"/> <input type="button" value="↓"/> <input type="button" value="↓"/> | HHL X                 | <input type="button" value="6"/> <input type="button" value="SRVC"/>                                  | HUSN X              |

— — Not Applicable  
**DSB** — Disabled  
**ENB** — Enable

\*Press  until desired display appears once you have accessed the correct function

(Set point) — The system set point subfunction displays the occupied and unoccupied heat and cool set points, as well as the static pressure, supply air, and humidity set points.

(Loadshed set point) — This subfunction displays the loadshed set point (in percent of unit capacity).

The demand limit/loadshed feature is activated by a red-line alert and loadshed commands from the CCN loadshed option. Before any set points can be changed for demand limit, the user must first log into the system. Refer to example below for details on how to log in.

To disable demand limit:

1. Press   for the user configuration.
2. Press  to scroll down until the display reads DLEN.

3. Press   to disable the demand limit option. The display now reads DLEN DSB.

To use demand limit, first enable the demand limit option (see example below), and then enter the loadshed set point

NOTE: The demand limit function must be enabled in order to function and may be turned off when its operation is not desired.

In the following example, demand limit will be enabled, and the loadshed set point will be set at 60% of available capacity.

1. Press
2. Press     . (This is the login command.)
3. Press  . The display will read USER CONFIGURATION.

4. Press **[↓]** to scroll down until the display reads DLEN DSB.
5. Press **[1] [ENTR]** to change the demand limit selection. This will change the display to DLEN ENB; enabling load-shed control.
6. Press **[2] [SET]** to change to the demand limit set point function.
7. Press **[↓]** once to change the display to LSP 50 (the default value).
8. Press **[6] [0] [ENTR]**, and the display will change to LSP 60. The unit will reduce capacity to 60% when the load-shed command is in effect.

**[3] [SET]** (Time) — The current time is displayed once the subfunction has been accessed. Press the **[↓]** key to scroll to the next display which will be the day of week and time. The day of the week is entered as a number:

- 1 = Monday
- 2 = Tuesday
- 3 = Wednesday
- 4 = Thursday
- 5 = Friday
- 6 = Saturday
- 7 = Sunday

Time is entered in military time format using a 24-hour clock (9:00 PM = 21:00), with **[.]** used as a colon.

Press **[↓]** to scroll to the next display (the current date in month, date, and year format). The month is also entered as a number: 1 = January, 2 = February...12 = December.

In the following example, the day, time, and date will be set. Assume the current date is December 30, 1996, the day is Monday, and the time is 4:45 p.m.

1. Press **[3] [SET]** to enter the day, date, and time subfunction. The display will read TIME.
2. Press **[↓]** to scroll down until the current day of the week and time programmed into the processor is displayed.
3. Press **[1] [.] [1] [6] [.] [4] [5] [ENTR]** for Monday at 4:45 p.m. The display should read, MON 16.45.
4. Press **[↓]** to scroll down until the current date programmed into the processor is displayed.
5. Press **[1] [2] [.] [3] [0] [.] [9] [6]** for December 30, 1996. The display should read DEC 30 96.

**[4] [SET]** (Daylight savings time) — This subfunction reads and displays daylight savings time.

The month, the day of week, and the time of the day are entered as explained in **[3] [SET]** above. Refer to Table 40.

**[5] [SET]** (Holiday periods) — The holiday configuration can set up to 18 Holiday periods for one calendar year. When the calendar year changes, the holidays must be reconfigured for the new year.

**IMPORTANT:** Because each new year has different holiday and daylight savings time dates, the holiday and daylight savings time periods must be reprogrammed each year.

**Table 40 — Setting Daylight Savings Time**

| KEYBOARD ENTRY                | DISPLAY  | COMMENTS                                                                    |
|-------------------------------|----------|-----------------------------------------------------------------------------|
| <b>[4] [SET]</b>              | DAYLIGHT | Daylight savings time field configuration of set point function             |
| <b>[↓]</b>                    | ENM X    | Month when daylight savings time begins                                     |
| <b>[4] [ENTR]</b>             | ENM 4    | Daylight savings time configured to start month 4 (April)                   |
| <b>[↓]</b>                    | END X    | Day of month when daylight savings time begins                              |
| <b>[1] [6] [ENTR]</b>         | END 16   | Daylight savings time configured to start on the 16th of the month          |
| <b>[↓]</b>                    | ENT X    | Time of day when daylight savings time begins                               |
| <b>[2] [.] [0] [0] [ENTR]</b> | ENT 2.00 | Daylight savings time configured to start at 2.00 a.m. on the 16th of April |
| <b>[↓]</b>                    | LVM X    | Month when daylight savings time ends                                       |
| <b>[1] [1] [ENTR]</b>         | LVM 11   | Daylight savings time configured to end month 11 (November)                 |
| <b>[↓]</b>                    | LVD X    | Day of month when daylight savings time ends                                |
| <b>[1] [2] [ENTR]</b>         | LVD 12   | Daylight savings time configured to end on the 12th of November             |
| <b>[↓]</b>                    | LVT X    | Time of day when daylight savings time ends                                 |
| <b>[2] [.] [0] [0] [ENTR]</b> | LVT 2.00 | Daylight savings time configured to end at 2.00 a.m. on November 12         |

## Program Time Sequences

**SCHEDULE FUNCTION** — Two schedules are provided with the unit controls. Schedule I provides a means to automatically switch the unit from an occupied mode to an unoccupied mode. Schedule II provides a means to automatically change the optional discrete output (such as outdoor building or parking lot lights) from occupied to unoccupied mode.

Each schedule consists of from 1 to 8 occupied time periods set by the operator. These time periods can be flagged to be in effect or not in effect on each day of the week.

a. To flag a day for operation on that schedule, press

**1** **ENTR**.

b. To change a flag to NO, press **.** **ENTR**.

The day begins at 00.00 and ends at 24.00. The unit is in unoccupied mode unless a scheduled time period is in effect or an override period is in effect.

**IMPORTANT:** If an occupied mode is to extend past midnight, it must be programmed in the following manner: occupied period must end at 24.00 hours (midnight), and a new occupied period must be programmed to begin at 00.00 hours.

**1** **SCHD** (Override) — The time schedule can be overridden to keep the unit in the occupied mode for between 1 and 4 hours on a one-time basis.

To override the unoccupied schedule, press **1** **SCHD** and the display will read OVRD OHR. Press the number of hours of override desired followed by **ENTR**. For example, for 3 hours of override, press **3** **ENTR**; changing the display to OVRD 3HR.

NOTE: Only whole numbers can be used.

To cancel the override, press **.** **ENTR** and the display will change back to the default display (OVRD OHR).

**2** **SCHD** through **9** **SCHD** (Occupied and unoccupied schedules) — In this subfunction, the occupied and unoccupied times and days are scheduled.

In the following example, the building occupancy is on a set point schedule. There are 5 periods of time that must be programmed.

1. Period 1 is a 3-hour off-peak cool-down period from midnight to 3:00 a.m. following the weekend shutdown.
2. Period 2 is scheduled for Monday and Tuesday from 7:00 a.m. to 6:00 p.m.
3. Period 3 is scheduled for Wednesday, 7:00 a.m. to 9:30 p.m.
4. Period 4 is scheduled for Thursday and Friday from 7:00 a.m. to 5:00 p.m.
5. Period 5 is scheduled for Saturday from 7:00 a.m. to 12:00 p.m.

To program this schedule:

NOTE: This is an example of a schedule. Each application will require its own schedule that should be determined by the building load.

To Program Period 1:

1. Press **2** **SCHD** to enter the period 1 subfunction. The display will read PERIOD 1.
2. Press **↓** to scroll down to OCC (occupied time).

3. Press **0** **0** **.** **0** **0** **ENTR** for midnight.

4. Press **↓** to scroll down to UNO (unoccupied time).

5. Press **3** **.** **0** **0** **ENTR** for 3:00 a.m.

Next are the flags for each day.

6. Press **↓** to move to MON (Monday). Suppose that the display reads MON NO. To change the flag so that this period will be in effect, press **1** **ENTR**, and the display will change from MON NO to MON YES.

7. Scroll through the rest of the days (press **↓**) to be sure that no other days have been flagged. Suppose, for this example, Tuesday was flagged for this period. To change this period from YES to NO, press **.** **ENTR**, and the display will change to TUE NO.

To Program Period 2:

1. Press **3** **SCHD** to enter the period 2 subfunction. The display will read PERIOD 2.

2. Press **↓** to scroll down to OCC.

3. Press **7** **.** **0** **0** **ENTR** for 7:00 a.m.

4. Press **↓** to scroll down to UNO.

5. Press **1** **8** **.** **0** **0** **ENTR** for 6:00 p.m.

Next are the flags for each day.

6. Press **↓** to move to MON. Suppose that the display reads MON NO. To change the flag so that this period will be in effect, press **1** **ENTR**, and the display will change to MON YES.

7. Scroll through the rest of the days to flag Tuesday for this schedule and be sure that no other days have been flagged.

To Program Period 3:

1. Press **4** **SCHD** to enter the period 3 subfunction. The display will read PERIOD 3.

2. Press **↓** to scroll down to OCC.

3. Press **7** **.** **0** **0** **ENTR** for 7:00 a.m.

4. Press **↓** to scroll down to UNO.

5. Press **2** **1** **.** **3** **0** **ENTR** for 9:30 p.m.

Next are the flags for each day.

6. Press **↓** to move to MON. Suppose the display reads MON YES. To change the flag so that this period will not be in effect, press **.** **ENTR**, and the display will change to MON NO. Do the same for Tues day. Scroll through the rest of the days to flag Wednesday for this schedule and be sure that no other days have been flagged.

To Program Periods 4 and 5: These can be programmed in the same manner as above, flagging Thursday and Friday yes for period 4 and Saturday yes for period 5.

To Program Periods 6, 7, and 8: Since these schedules are not used in this example, they should be programmed for OCC 00.00 and UNO 00.00.

NOTE: When a day is flagged yes for 2 overlapping periods, occupied time will take precedence over the unoccupied time. Occupied times can overlap in the schedule with no consequence.

The same scheduling procedures can be used to set optional discrete output schedule II. Subfunctions **2** **SCHD** through **9** **SCHD** define the schedule of the rooftop unit (schedule I). Subfunction **1** **0** **SCHD** provides the override for schedule II. Subfunctions **1** **1** **SCHD** through **1** **8** **SCHD** define schedule of optional discrete output (schedule II).

NOTE: If the unit is connected to a DAV system, the unit time schedule is ignored. The time schedule should still be entered into the unit in case communications are lost with the network.

## Start Unit

1. Put the ON/OFF switch in the ON position. Close the control circuit breaker (CCB), which will energize the control circuit and the crankcase heaters.
2. Using the HSIO keypad or building supervisor, verify that no alarms have been detected.
3. Ensure that quick test has been performed to make sure controls are operating properly. Refer to Quick Test section on page 50 for instructions on quick test.
4. Using the HSIO keypad, put unit into the run mode:
  - a. Press **1** **1** **STAT**.
  - b. Press **↓**.
  - c. Press **CLR**. This will put unit in "RUN" mode.
  - d. Press **3** **STAT** and the unit changes status from mode 25 (standby) to mode 32 (occupied) or mode 27 (unoccupied), depending on the programmed time schedule. When the unit receives a call for cooling or heating (either from the internal control or the CCN Network command), the unit will initiate activity to meet the respective set point value.

## Operating Sequence

**ADAPTIVE OPTIMAL START** — Optimal start is used to heat up or cool down the space prior to occupancy. The purpose is to have the space temperature approach and then achieve the occupied set point by the time of occupancy. The control utilizes outdoor-air temperature, space temperature, occupied set point, and a "K" factor. The "K" factor is expressed in minutes per degree, and calculates a start time offset, which is the time in minutes that the system shall be started in advance of the occupied time. The control monitors its results and adjusts the "K" factor to ensure that the occupied set point is achieved at time of occupancy rather than too early or too late.

**ADAPTIVE OPTIMAL STOP (CV Applications Only)** — Optimal stop is used to allow space temperature to drift to an expanded occupied set point during the last portion of an occupied period. The control calculates a stop time offset, (the time in minutes prior to the scheduled unoccupied time) during which expanded heating and cooling set points can be used. Adaptive optimal stop utilizes space temperature, an expanded occupied set point, and a "K" factor to calculate stop time offset. The amount (F) to expand the occupied set point is user configurable. Like adaptive optimal start, the control corrects itself for optimal operation by adjusting the "K" factor as required.

## COOLING

NOTE: The cooling algorithms used in the NB,NP units will only run when the supply-air (evaporator) fan is on.

**Units With Economizer** — The economizer will modulate to satisfy the supply-air set point if the outdoor-air enthalpy is suitable. If the economizer cannot satisfy the leaving-air set point, the economizer will remain at 100% open, and mechanical cooling will be initiated. If the outdoor-air enthalpy is not suitable, economizer will remain at minimum position during mechanical cooling.

**CV Operation** — The controls will compare the occupied space temperature to the occupied cooling set point. If the occupied space temperature is above the set point, the unit will commence cooling. The supply-air temperature set point that has been determined by the NB,NP software is compared to the actual supply-air temperature to determine when to add or remove stages of capacity to satisfy the load.

**VAV Operation** — The controls will compare the supply-air temperature to the modified supply-air set point. The modified supply-air temperature set point is compared to the actual supply-air temperature to determine when to add or remove stages of capacity to satisfy the load.

**All Units** — The controls try to control the supply-air temperature (SAT) to the value specified by the supply-air temperature set point by cycling the compressor and the unloader(s). Both the supply- and return-air temperature sensors are used to adjust the cycling deadband to match the actual load. The control system provides up to 6 stages of cooling capacity control, using 2 compressors and up to 4 unloaders, to maintain supply-air temperature (VAV) or space temperature (CV) to an occupied or unoccupied set point. Automatic lead-lag circuit switching occurs (if configured) to equalize run times per compressor for improved compressor reliability. The compressor to start first is changed every time stage equals zero.

NOTE: Automatic lead/lag should be disabled if optional hot gas bypass is employed because the unit only contains hot gas bypass on one circuit.

The CV control system sequence reads the space sensor and performs a calculation to determine the supply-air temperature required (a cooling coil submaster reference [CCSR] value) to satisfy conditions and outputs this value to the submaster loop.

The VAV control system sequence uses the modified supply-air set point (MSAT = supply-air set point + reset value) as the supply-air temperature required to satisfy conditions (submaster reference value) and outputs this value to the submaster loop.

The submaster loop uses the modified supply-air set point compared to the actual supply-air temperature to determine the required number of capacity stages to satisfy the load. The logic for determining when to add or subtract a stage is a time-based integration of the deviation from the set point plus the rate of change of the supply-air temperature.

If the supply-air temperature is above the set point and the supply-air temperature is increasing, SMZ (the capacity ratio) will increase.

- a. If the next capacity stage is a compressor, when SMZ = 100% a stage of capacity is added and SMZ is set to zero.
- b. If the next capacity stage is an unloader, a stage of capacity is added when SMZ = 60% and SMZ is set to zero.

If the supply-air temperature is below the set point and the rate of change is less than or equal to zero, then SMZ will decrease. If the next capacity stage is a compressor, when SMZ = -100% a stage is removed and SMZ is set to zero. If the next capacity stage is an unloader, when SMZ = -60% a stage is removed and SMZ is set to zero. SMZ is updated every 30 seconds.

**First Stage and Slow Change Override** — The first stage override reduces cycling on the first stage of capacity, and the slow change override prevents the addition or subtraction of another stage of capacity if the SAT is close to the set point and gradually moving towards the set point.

**Low Temperature Override** — Low temperature override protects against rapid load decreases by removing a stage every 30 seconds when required based on temperature and the temperature rate of change.

**High Temperature Override** — High temperature override protects against rapid load increases by adding a stage once every 60 seconds as required.

**Time Delay** — A time delay feature sets SMZ to zero for 90 seconds after each capacity change. This prevents the compressors from rapid cycling and permits oil to return to the compressors when there are short compressor cycles (excluding overrides).

The first compressor starts 1½ to 3 minutes after the call for cooling. During the initial start-up of a circuit, the low pressure input shall be ignored for 2 minutes. If shutdown occurs due to a compressor safety, the circuit is locked out and the appropriate fault code is displayed. If the low pressure alarm is generated, it may reset a maximum of 3 times automatically if low pressure alarm resets within 5 minutes after alarm is tripped (after initial 2 minute delay).

Automatic lead-lag circuit switching (if configured) occurs to equalize run times per compressor. The compressor to start first is changed each time the stage is equal to zero.

**Space Temperature Reset** — If optional space temperature reset (VAV only) is being used, the unit controls to a higher supply-air set point as the building load reduces to prevent overcooling. The supply-air temperature set point is reset upward as the space temperature falls below the occupied cooling set point (space set point) as a function of the reset ratio.

The reset ratio is used to raise the supply-air set point upward by  $X^{\circ}\text{F}$  equal to the reset ratio times the number of  $^{\circ}\text{F}$  that the space temperature is below the occupied cooling set point. The new set point is called the modified supply-air set point (MSAT). The equation is:

$$\text{MSAT} = \text{supply air set point} + (\text{occupied cooling set point} - \text{space temperature}) \times \text{the reset ratio}$$

A reset limit should be configured which will limit the number of  $^{\circ}\text{F}$  that the supply-air set point may be raised. The modified set point (displayed as the control set point) is recalculated every 2 minutes. Both the reset ratio and the reset limit are user defined. For DAV systems, the average occupied zone temperature (AOZT) replaces space temperature in the MSAT calculation.

**Demand Limit** — If demand limit is in effect, the mode will be displayed on the HSIO display. If demand limit is being used (available on units connected to the CCN only), the unit may temporarily be unable to maintain the desired supply-air temperature because of imposed power limitations (loadshed set point). The demand limit option must be enabled before the control can receive and accept redline alert and loadshed commands from the network loadshed option.

When the redline alert is received, the control sets the current stage of capacity as the maximum stage of capacity. The redline alert can only be in effect for 1 hour. The redline alert will be cleared when the loadshed sends a command to clear the redline for the unit. Once the loadshed command is received, the unit reduces its present maximum stage of capacity by the user-defined percentage in the loadshed set point. This reduced capacity will be in effect for a maximum of 1 hour or until the loadshed is cleared by the loadshed option. If the 1 hour expires before the loadshed is cleared by the loadshed option, the control will clear the loadshed command itself and return to normal control.

**Units With Return Fans or Power Exhaust** — On units configured for return-air fans (054-074 only), the return fans will be energized whenever the supply-air fan is energized. Dampers on the return fans will modulate to maintain the building pressure set point.

On units configured with modulating power exhaust fans, power exhaust fan no. 1 will be energized when the building pressure set point is exceeded, and the damper will modulate to maintain the building pressure set point. When the damper is approximately 90% open, the switch in the motor will energize power exhaust fan no. 2. When the power exhaust fan no. 1 damper closes to approximately 20% open, power exhaust fan no. 2 will be deenergized.

## HEATING

**NOTE:** The heating algorithms on the NB,NP units will only run when the supply-air (evaporator) fan is on. Two-stage factory-installed gas heat is standard on the 48NP units.

When the unit is in the heating mode, room terminals must be fully open. The room terminals should be controlled by the heat interlock relay (HIR) on VAV applications.

**NOTE:** HIR not applicable on units using DAV applications.

During heating, the economizer dampers (if so equipped) will be at the minimum damper position during occupied heating mode, and will be fully closed during unoccupied heating.

**Occupied CV Operation** — The heater is staged to prevent the occupied space temperature from falling below the desired set point. The control reads the space temperature and computes the supply-air temperature necessary to heat the space to the heating set point. The NB,NP controls will compare the calculated supply-air temperature set point to the actual supply-air temperature to compute the number of stages required to satisfy the conditions.

**Occupied VAV Operation** — Heating is primarily used for morning warm-up or occupied space heating with the heater being staged to maintain desired return-air temperature. If the unit is in morning warm-up, the return-air temperature is read and compared to the occupied heating set point. The NB,NP controls will compare the calculated supply-air temperature set point to the actual supply-air temperature to compute the number of stages required to satisfy the conditions. Once morning warm-up is completed and the unit is in occupied mode, heat will not be activated again unless the occupied heating mode has been selected.

**NOTE:** Morning warm-up begins only before the timeclock designated occupied time.

**Morning Warm-Up (VAV Only)** — Morning warm-up occurs when the adaptive optimal start (AOS) algorithms start the unit before the occupied start time, and the unit has a heating demand. The morning warm-up control uses the occupied heating set point for controlling heat stages. Once the return air reaches the set point, heating will be shut off.

When the heating demand is satisfied, the warm-up condition will terminate. The unit may reenter morning warm-up if there is another call for heat before the start of the occupied period. Morning warm-up can continue into the occupied period as long as there is a need for heat, even if occupied heating is disabled.

**NOTE:** On units equipped with optional economizer, the dampers will be fully closed during morning warm-up, except when morning warm-up continues into the occupied period. If morning warm-up continues into the occupied period, the dampers will open to the minimum position to provide ventilation air.

Room terminals should go to the fully open position when the unit enters the heating mode. The terminals should be controlled by the HIR, located in the unit control box. When the unit goes into heating mode, the HIR is energized and opens the room terminals.

#### NOTES:

1. Morning warm-up is initiated before the time clock designated occupied time.
2. HIR is not applicable on units using DAV applications.

**Economizer Minimum Position** — The control has the capability of maintaining the minimum economizer position based on 3 inputs when the optional PSIO2 module and economizer are installed. The 3 inputs are minimum position, outdoor-air cfm, and IAQ set points. The 6 SRVC VENT function is used to configure the control for the minimum position of the economizer.

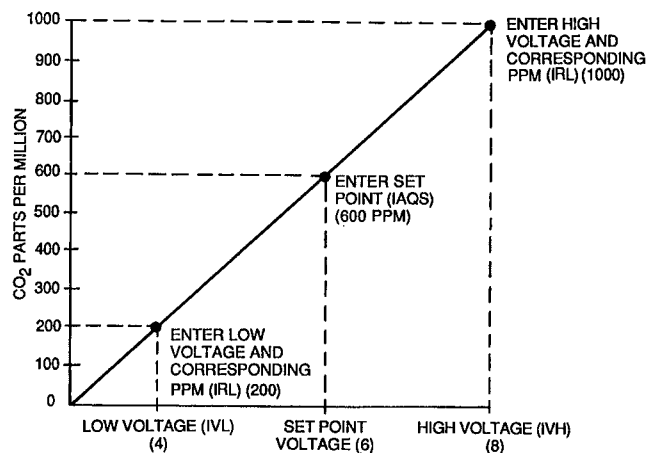
**Indoor-Air Quality (IAQ)** — If the unit is configured to control the occupied space indoor-air quality by maintaining a constant cfm of outdoor air and/or an allowable level of undesirable gases or vapors (CO<sub>2</sub>, CO, formaldehyde, etc.), it must be equipped with an economizer. The economizer dampers will modulate to maintain the user-defined set points.

An alert will be generated after 10 minutes if the air quality level has not been reduced below the set point. In the Service function, the high and low voltage readings for the sensor being used and the corresponding reference levels (in parts per million) for the voltages must be entered for proper operation. See Fig. 32 for example. For gas or vapor level, constant cfm (VENT = 2), or both (VENT = 3), a controlling set point must be entered.

The indoor air quality feature has 3 priority levels as follows (Refer to Indoor Air Quality (IAQ) and Outdoor Air Cfm (OAC) Control section on page 9 for more details):

**Priority Level 1** — This is the lowest priority level. When the IAQ set point is exceeded, an alert is broadcast on the CCN network, but no other action is taken.

**Priority Level 2** — This is a medium level priority and provides for some occupied space comfort overrides. The IAQ algorithms adjust the economizer damper position to purge



NOTE: Voltage range is 0 to 10.

**Fig. 32 — Sensor Use Example**

the controlled space of CO<sub>2</sub> or other contaminants. However, the following comfort overrides may take precedence:

- space temperature
- supply air temperature (VAV)
- space humidity

**Priority Level 3** — This is the highest level of priority for indoor air quality. When the IAQ set point is exceeded, the IAQ algorithms adjust the economizer damper position to purge the controlled space of CO<sub>2</sub> or other contaminants.

NOTE: Consult the latest updated issue of ASHRAE Standard 62 when determining required set points for indoor air quality (ASHRAE 62, Ventilation for Acceptable Indoor-Air Quality section).



# CONTROLS START-UP CHECKLIST

## CONTROL SETTINGS FOR NON-NETWORKED, FREESTANDING UNIT

### PRELIMINARY CHECKLIST ITEMS (DETERMINE BEFORE CONFIGURING CONTROLS)

- ☐ UNIT TO BE OPERATED ON CONSTANT AIR VOLUME (CV) RATHER THAN VARIABLE-AIR VOLUME (VAV)
- ☐ CONFIRM THAT SPACE TEMPERATURE SENSOR (T55) HAS BEEN WIRED CORRECTLY PER SPACE TEMPERATURE SENSOR (T55) SECTION ON PAGE 56.
- ☐ CONFIRM THAT TUBING FOR SPACE AND SUPPLY DUCT PRESSURES HAS BEEN INSTALLED
- ☐ SET ENTHALPY CONTROL SET POINT ON STANDARD ECONOMIZER
- ☐ SET SUPPLY FAN AND "CHECK FILTER" STATUS SWITCHES FOR JOB REQUIREMENTS

### UNIT OPTION CHECKLIST

| ITEM | PRESENT?                 |                                                                                |
|------|--------------------------|--------------------------------------------------------------------------------|
| A    | <input type="checkbox"/> | ECONOMIZER PRESENT                                                             |
| B    | <input type="checkbox"/> | CONSTANT VOLUME POWER EXHAUST (NOT AVAILABLE WITH ITEM C)                      |
| C    | <input type="checkbox"/> | VARIABLE VOLUME POWER EXHAUST (NOT AVAILABLE WITH ITEM B)                      |
| D    | <input type="checkbox"/> | VARIABLE INLET GUIDE VANES ON SUPPLY FAN (VAV ONLY)                            |
| E    | <input type="checkbox"/> | CONSTANT VOLUME RETURN-AIR FAN (NOT AVAILABLE WITH ITEM F OR ON 024-044 UNITS) |
| F    | <input type="checkbox"/> | VARIABLE VOLUME RETURN-AIR FAN (NOT AVAILABLE WITH ITEM E OR ON 024-044 UNITS) |
| G    | <input type="checkbox"/> | HOT GAS BYPASS                                                                 |
| H    | <input type="checkbox"/> | OPTIONS MODULE (PSIO2)                                                         |

(Controls Start-Up Checklist continued on page CL-2)

CUT ALONG DOTTED LINE

| CONTROL CONFIGURATION                                                                       |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KEYPAD ENTRY                                                                                | DISPLAY                                                              | DESCRIPTION<br>VALUES IN [ ] INDICATE FACTORY DEFAULTS                                                                                                                                                                                                                                                                                                                                                      |
| 1 <input type="button" value="SRVC"/>                                                       | LOG ON                                                               | Enter password followed by <input type="button" value="ENTR"/>                                                                                                                                                                                                                                                                                                                                              |
| 1 1 1 1 <input type="button" value="ENTR"/>                                                 | LOGGEDON                                                             | Logged on okay                                                                                                                                                                                                                                                                                                                                                                                              |
| 3 <input type="button" value="SRVC"/><br>↓<br>X <input type="button" value="ENTR"/>         | FACT CFG<br>TYPE X<br>TYPE X                                         | Factory configuration<br>Unit type (0=CV, 1=VAV) [1 if item D above is present, 0 if not]<br>Verify unit type and change if necessary                                                                                                                                                                                                                                                                       |
| 6 <input type="button" value="SRVC"/><br>↓<br>0 <input type="button" value="ENTR"/>         | FACT CFG<br>LLAG X<br>DISABLE                                        | Factory Configuration<br>Use ↓ to access lead/lag option — disable with HGBP (Item G above)<br>Disable lead/lag (0=DIS, 1=ENB) [1]                                                                                                                                                                                                                                                                          |
| 1 8 <input type="button" value="SRVC"/><br>↓<br>X <input type="button" value="ENTR"/>       | BLD PRES<br>BPS 05<br>BPS X                                          | Configure building pressure control (Item C or F above)<br>Use ↓ for building pressure set point (range 0 to 5) [05]<br>Set building pressure set point per job requirements                                                                                                                                                                                                                                |
| 1 <input type="button" value="SRVC"/><br>↓<br><input type="button" value="ENTR"/>           | LOGGEDON<br>LOG OFF<br>LOGD OFF                                      | Access log on/off function<br>Use ↓ to access log off<br>Logged off okay                                                                                                                                                                                                                                                                                                                                    |
| 1 <input type="button" value="TEST"/><br>through<br>6 <input type="button" value="TEST"/>   | INPUTS                                                               | Run quick test to verify operation of unit functions (see page 50)                                                                                                                                                                                                                                                                                                                                          |
| 1 <input type="button" value="SET"/><br>↓<br>↓<br>↓<br>↓<br>↓<br>↓<br>↓                     | SETPOINT<br>OHSP X<br>OCSP X<br>UHSP X<br>UCSP X<br>SPSP X<br>SASP X | Set system set points per job requirements<br>Set occupied heat set point (Range 55-80 F) [68] CV only<br>Set occupied cool set point (Range 55-80 F) [78] CV only<br>Set unoccupied heat set point (Range 40-80 F) [55]<br>Set unoccupied cool set point (Range 75-95 F) [90]<br>Set supply duct pressure set point (Range 0-5 0 in wg) [1 5]<br>Set supply air set point temperature (Range 45-70 F) [55] |
| 3 <input type="button" value="SET"/><br>↓<br>↓                                              | TIME<br>dow hh mm<br>mm dd yy                                        | Current time/date<br>Set day of week and time<br>Set month, day, and year                                                                                                                                                                                                                                                                                                                                   |
| 4 <input type="button" value="SET"/>                                                        | DAYLIGHT                                                             | Set daylight savings time begin/end dates. Required if job conditions require adjustment of clock for daylight savings time (see page 68)                                                                                                                                                                                                                                                                   |
| 5 <input type="button" value="SET"/>                                                        | HOLIDAY                                                              | Set holiday dates. Required if job conditions require a different schedule on holidays than other days (see page 68)                                                                                                                                                                                                                                                                                        |
| 2 <input type="button" value="SCHD"/><br>through<br>1 8 <input type="button" value="SCHD"/> | PERIOD X                                                             | Set occupied/unoccupied schedules. Required if job conditions require unit to enter unoccupied cycle at programmed times of day or days of week (see page 69)                                                                                                                                                                                                                                               |
| 8 <input type="button" value="STAT"/><br>↓<br>X <input type="button" value="ENTR"/>         | FLTS X<br><br>FLTS X                                                 | Set check filter switch set point.<br><br>Use ↓ to access check filter switch and set per Check Filter Switch (CFS) section on page 65.                                                                                                                                                                                                                                                                     |