



Installation, Operation, and Start-Up Instructions

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IMPORTANT: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with these instructions may cause radio interference. It has been tested and found to comply with the limits of a Class A computing device as defined by FCC regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

SAFETY CONSIDERATIONS

Installation and start-up of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, start up, or service air-conditioning equipment.

When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1 (latest version). Wear safety glasses and work gloves.

⚠ WARNING

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected. Electrical shock and personal injury could result.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

GENERAL

The Product Integrated Control (PIC) option is available for 39L and 39NX indoor units with a draw-thru configuration. The PIC control box can be supplied as part of a dedicated PIC section; it is factory-installed and wired and has the same hand (orientation) as the fan section. The control box can also be shipped separately for remote mounting without a PIC section. For the remote control box option, all connections from the control box to the unit are made to a junction box in the unit's fan section.

The control box includes electronic modules, fuses, relays, transformers, terminal blocks, low-limit air temperature protection (optional), static pressure transducer (VAV

[Variable Air Volume] units only) and high-pressure switch (VAV units). An ON/OFF switch is included to shut off the power to the control box.

PIC environmental limitations are as follows:

Shipping Temperature	— -20 to 165 F
Shipping Humidity	— 10 to 95%
Operating Temperature	— 32 to 125 F
Operating Humidity	— 30 to 90%

INSTALLATION

Follow all basic installation instructions for 39L or 39NX units as described in the 39L or 39NX Installation, Start-Up, and Service Instructions shipped with the unit. To verify the PIC and PIC option configurations according to the model numbers, see Fig. 1 and 2.

Leave protective coverings on the unit until it is installed inside and protected from the elements, construction debris, and dirt.

Use one of the keys provided in the 39L or 39NX installation packet (located in fan section) to open the control box door. Visually inspect all components and wiring for any damage. Remove the valve assembly packages and the sensor packages from the fan section. For units with PIC sections, remove protective plastic caps from the bulkhead fittings (located on the top edge of the control box) and discard.

Verify that the 10.0 amp ON/OFF switch located on the PIC control box door is in the OFF position. *Do not turn the power supply on at this time.*

NOTE: The 39NX and 39L air handlers are designed for indoor applications. Modified units are available for outdoor applications on pier or slab mounts (*not* curb mounts). *Product integrated controls are not available for outdoor applications.* Consult your Carrier sales representative for further details.

Service Area Requirements — Article 110-16 of the NEC (National Electrical Code) describes electrical installation. All 39L and 39NX PIC installations must comply with the minimum clearances required for electrical installation as listed in Table 110-16(a) of the code. Make sure to provide the necessary clearance from the PIC unit to any adjoining wall. Refer to the base unit installation instructions for detailed dimensions for each unit section.

Remote Control Box Option — This option allows the PIC control box to be mounted away from the unit; the remote control box (Fig. 3) must be wired to the supply fan section. Mount the remote control box assembly to the mechanical room wall near the unit using field-supplied Unistrut® metal framing or equivalent supports. The control box has 4 mounting holes in the back of the enclosure for this purpose.

Mount the remote control box as follows:

1. Loosen and remove the 4 nuts securing the control panel in the control box.
2. Remove the control panel from the box; set the panel and nuts aside for reassembly later.
3. Mount the control box to the Unistrut® support using field-supplied fasteners.
4. Locate, mark, and drill pilot holes on the top of the box for each of the following:
 - Motor starter wiring
 - Actuator and sensor wires to fan section junction box
 - Supply power wires (ac)
 - Valve wiring or tubing (water valves, field-supplied sensors, or other devices)
5. Expand the pilot holes as required. Recommended sizes are as follows:
 - Motor starter wiring — 3/4 in. (5 wires)
 - Actuator and sensor wires to fan section junction box — 3/4 in. to 1 in. (number of wires and hole diameter determined by application)
 - Supply power wires (ac) — 1/2 in. or 3/4 in.
 - Valve wiring or tubing — size as required

Fan section panels are provided with pilot holes that can be drilled or punched to accommodate an electrical conduit for the remote control box wiring. Where possible, install the conduit in a panel that will not be removed, such as the discharge panel. See Fig. 4.

REMOTE CONTROL BOX CONDENSATE PREVENTION — When the remote control box is installed, precautions must be taken to prevent condensation from forming inside the junction box mounted in the unit's supply fan section. Standard installation practice is to mount the remote control box adjacent to the air handling unit and then to enclose the Class II wiring in flexible conduit between the control box and the junction box in the fan section.

The sheet metal housing of the control box is not airtight, therefore warm, moist air can migrate through the flexible conduit to the junction box in the fan section. Condensate can form inside the junction box and possibly on the terminal lugs.

To prevent moist air from migrating through the conduit, seal the control wires inside the conduit at the remote control box enclosure. See Fig. 4. Use a nonconductive, non-hardening sealant. Permagum (manufactured by Schnee Morehead) or sealing compound, thumb grade (manufactured by Calgon), are acceptable materials.

Make Electrical Connections — 39L and 39NX units have internal control wiring for the operation of the PIC section and its control devices. The control system requires a dedicated 120 vac or 230 vac (50 or 60 Hz) power circuit capable of providing a minimum of 10 amps (but not greater than 20 amps) to the control box. The actual number of controls on one power source depends on the installation and power circuit requirements. Do not run PIC power wiring in the same conduit as sensor wiring or control wiring of field-installed devices.

IMPORTANT: To ease installation, control wiring is located on the service side of the unit with electrical connectors provided at all unit separation points. If a unit is separated into pieces for installation, rejoin all connectors in their original alpha-numeric sequence upon reassembly. Connectors for vertical fan sections that are shipped out of the normal operating position must also be joined at final assembly.

For units with an integral PIC section, all unit factory control wiring is internal. Only a small number of wires must be field-installed. All internal wiring consists of plenum wires which enter the rear of the control box through sealed fittings. Control wiring is 18 to 20 gage, 2-conductor twisted pair.

The electrical power disconnect and fan motor starter are field-supplied and installed. Connections are provided in the control box to wire a field-supplied HOA (HANDS/OFF/AUTOMATIC) switch. If an HOA switch is used, it must be field-installed in the supply and return fan motor starter circuit. The factory-wired high-pressure switch (variable air volume only) and low-temperature thermostat options are energized when the supply fan circuit is powered.

See Fig. 5-7 for control box component arrangements and Fig. 8 for fan motor wiring. PIC input and output points are listed in Table 1. Consult the wiring diagram located in the control box or Fig. 9-12 for further details.

CAUTION
Power is present in the PIC control box in the motor starter circuit even when the dedicated power to the PIC control box is off.

The supply and return fan starter circuits are independent from each other. Either circuit and its related control box interface can have 24 vac, 120 vac, or 240 vac power.

All options that require a factory-installed transformer are fused with 3.2 amp fuses on the secondary of each transformer.

When the control box is shipped separately for remote mounting, all unit wiring terminates in a junction box located in the fan section. Refer to Fig. 12 for the applicable wiring diagram and Table 2 for junction box connections.

If the unit is provided with a factory-installed smoke control option, refer to the section titled Field-Wiring Connections, Smoke Control Option, page 54.

All PIC electrical components are UL (Underwriters' Laboratories) listed. The electronic modules are approved under UL HVAC Equipment Standard 873. PIC units are listed and labeled by ETL (Engineering Testing Laboratory) to comply with UL Standard 1995 for heating and cooling units, and comply with NFPA (National Fire Protection Association) Standard 90A.

39LP 12 3 2 B A A 1 1 2 1 2

Model No.

39LP — Model 39L with PIC
 39NP — Model 39NX with PIC

Unit Size

	39L			39NX		
03	12	25	07	17	39	92
06	15	31	09	21	49	
08	18	35	11	26	61	
10	21		13	32	74	

Control Voltage (Single-Phase) Fan

- 1 — 115v 50/60Hz, CV
- 2 — 230v 50/60Hz, CV
- 3 — 115v 50/60Hz, VAV/FC
- 4 — 230v 50/60Hz, VAV/FC
- 5 — 115v 50/60Hz, with field-supplied inverter
- 6 — 230v 50/60Hz, with field-supplied inverter
- 7 — 115v 50/60Hz, VAV/AF (39NX)
- 8 — 230v 50/60Hz, VAV/AF (39NX)

Cooling Coil Valve

- 1 — None
- 2 — Normally open
- 3 — Normally closed
- 4 — Three-way
- 5 — Direct Expansion (DX)

Cooling Coil Valve Sizes (2- or 3- way)

A—None

Two-way valves:		Three-way valves:	
in.	cv*	in.	cv*
B—1/2,	0.4	Q—1/2,	2.0
C—1/2,	1.3	R—1/2,	4.0
D—1/2,	2.2	S—3/4,	6.8
E—1/2,	3.6	T—1,	12.0
F—3/4,	5.0	U—1 1/4,	16.0
G—3/4,	6.2	V—1 1/2,	33.0
H—1,	8.2	W—2,	55.0
J—1,	11.0	X—2 1/2,	67.0
K—1 1/4,	16.0	Y—3,	91.0
L—1 1/2,	25.0		
M—2,	40.0		
N—2 1/2,	65.0		
P—3,	85.0		

Heating Coil Valve

- A—None
- B—Normally open
- C—Normally closed
- D—Three-way

Local Interface Device (HSIO)

- 1—None
- 2—Standard
- 3—Remote

Filter Switch (FLTS) Option

- 1—None
- 2—One switch
- 3—Two switches (39NX only)
- 4—Three switches (39NX only)

Mixed-Air Temperature Sensor (MAT)

- 1—None
- 2—MAT factory installed in MXB/FMB/AMX
- 3—Separately shipped MAT
- 4—Low-temperature thermostat (LTT) factory installed, no MAT supplied
- 5—LTT factory installed with MAT in factory installed MXB/FMB/AMX
- 6—LTT factory mounted with separately shipped MAT

Humidity Sensors

- 1—None
- 2—Wall mounted space humidity sensor
- 3—Duct mounted sensor
- 4—Outside air and return air differential
- 5—Space and return air differential

Damper Control Type

1—None

Outside Air Source:

Factory Supplied:

- | | |
|---|---|
| 2—Top | MXB/FMB actuator and enthalpy switch |
| 3—Rear | MXB/FMB actuator and enthalpy switch |
| 4—Top | MXB/FMB actuator only (differential enthalpy) |
| 5—Rear | MXB/FMB actuator only (differential enthalpy) |
| 6—Top/Rear/Bottom | Enthalpy switch only |
| 7—Top/Rear/Bottom | Differential enthalpy only |
| 8—Top/Rear/Bottom
(two-position control) | — |
| 9—Bottom | MXB/FMB actuator and enthalpy switch |
| 0—Bottom | MXB/FMB actuator only (differential enthalpy) |

Heating Coil Valve Sizes

A—None

Two-way valves:		Three-way valves:	
in.	cv*	in.	cv*
B—1/2,	0.4	Q—1/2,	2.0
C—1/2,	1.3	R—1/2,	4.0
D—1/2,	2.2	S—3/4,	6.8
E—1/2,	3.6	T—1,	12.0
F—3/4,	5.0	U—1 1/4,	16.0
G—3/4,	6.2	V—1 1/2,	33.0
H—1,	8.2	W—2,	55.0
J—1,	11.0	X—2 1/2,	67.0
K—1 1/4,	16.0	Y—3,	91.0
L—1 1/2,	25.0		
M—2,	40.0		
N—2 1/2,	65.0		
P—3,	85.0		

LEGEND

- ABX — Air Blender
- AF — Airfoil
- CV — Constant Volume
- IGV — Inlet Guide Vanes
- FC — Forward-Curved
- FMB — Filter Mixing Box
- MXB — Mixing Box
- PIC — Product Integrated Controls
- VAV — Variable Air Volume

*The cv capacity rating is the flow (gpm) through a valve at 1 psi pressure drop.

Fig. 1 — Basic PIC Order Number

39LJ 1 1 1 1 B A 1 1 1 1 A A

Model No.

- 39LJ — Model 39L PIC with optional controls
- 39NJ — Model 39NX PIC with optional controls

Electric Heat (Factory Installed)

- 1 — None
- 2 — Yes, without DX cooling
- 3 — Yes, with DX cooling

Option (PSIO Slave) Module

- 1 — None
- 2 — Yes

Humidifier Control

- 1 — None
- 2 — 2 stages, spray bar
- 3 — Proportional, modulating valve

Smoke Control

- 1 — None
- 2 — On FMB1/MXB1; outside air top, return air rear
- 3 — On FMB1/MXB1; outside air rear, return air top
- 4 — Field-supplied for MXB
- 5 — On MXB2; outside air rear, return air bottom
- 6 — On MXB2; outside air bottom, return air rear
- 7 — On MXB3; outside air bottom, return air top
- 8 — On MXB3; outside air top, return air bottom

Optional Outputs

- A — None
- B — Yes

Optional Temperature Inputs

- A — None
- B — Space (field-installed)
- C — Duct (field-installed)
- D — Preheat, N.O. (factory-installed)
- E — Preheat, N.C. (factory-installed)
- F — Preheat, 3-way (factory-installed)

LEGEND

- AF — Airfoil
- CV — Constant Volume
- DX — Direct Expansion
- FC — Forward-Curved
- FMB — Filter Mixing Box
- MXB — Mixing Box
- N.C. — Normally Closed
- N.O. — Normally Open
- PIC — Product Integrated Controls
- VAV — Variable Air Volume

*The cv capacity rating is the flow (gpm) through a valve at 1 psi pressure drop.

Preheat Valve Sizes (2- or 3-way)

A — None

Two-way valves:

- | | in. | cv* |
|---|-------|------|
| B | 1/2 | 0.4 |
| C | 1/2 | 1.3 |
| D | 1/2 | 2.2 |
| E | 1/2 | 3.6 |
| F | 3/4 | 5.0 |
| G | 3/4 | 6.2 |
| H | 1 | 8.2 |
| J | 1 | 11.0 |
| K | 1 1/4 | 16.0 |
| L | 1 1/2 | 25.0 |
| M | 2 | 40.0 |
| N | 2 1/2 | 65.0 |
| P | 3 | 85.0 |

Three-way valves:

- | | in. | cv* |
|---|-------|------|
| Q | 1/2 | 2.0 |
| R | 1/2 | 4.0 |
| S | 3/4 | 6.8 |
| T | 1 | 12.0 |
| U | 1 1/4 | 16.0 |
| V | 1 1/2 | 33.0 |
| W | 2 | 55.0 |
| X | 2 1/2 | 67.0 |
| Y | 3 | 91.0 |

Indoor-Air Quality

- A — None
- B — Outdoor Air Velocity Pressure
- C — CO₂ space sensor
- D — CO₂ duct sensor
- E — CO₂ space and duct sensors
- F — CO₂ space sensors (2)
- G — CO₂ duct sensors (2)
- H — B and C
- I — B and D
- J — B and E
- K — B and F
- L — B and G
- M — Field-supplied sensors

Fan Tracking (VAV), Return Fan (CV)

- 1 — None
- 2 — Return fan (VAV/FC)
- 3 — Return fan (VAV/AF)
- 4 — Return fan with inverter
- 5 — Return fan field-supplied
- 6 — Return fan (CV)

Optional Exhaust Air Actuator

- 1 — None
- 2 — 15 in.-lb torque
- 3 — 75 in.-lb torque
- 4 — 190 in.-lb torque

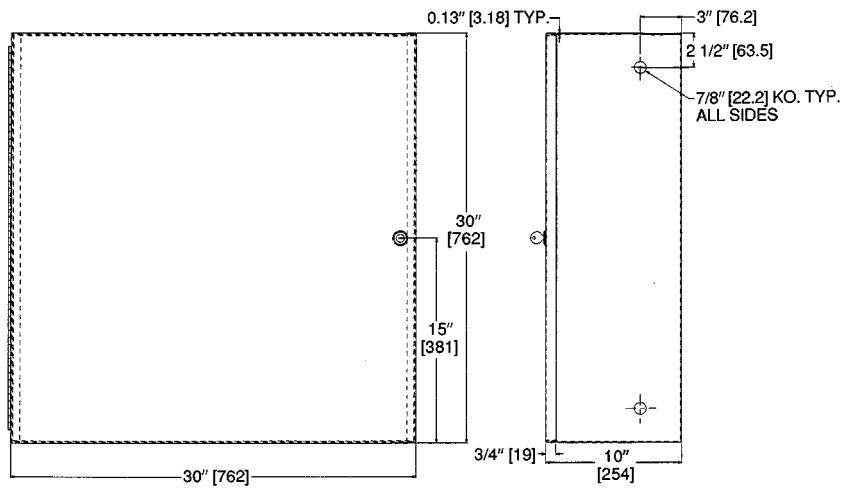
Optional Return Air Actuator

- 1 — None
- 2 — 15 in.-lb torque
- 3 — 75 in.-lb torque
- 4 — 190 in.-lb torque

Optional Outside Air Actuator

- 1 — None
- 2 — 15 in.-lb torque
- 3 — 75 in.-lb torque
- 4 — 190 in.-lb torque

Fig. 2 — PIC Option Order Number



NOTE: Dimensions in [] are in millimeters.

Fig. 3 — Control Box for Remote Mounting

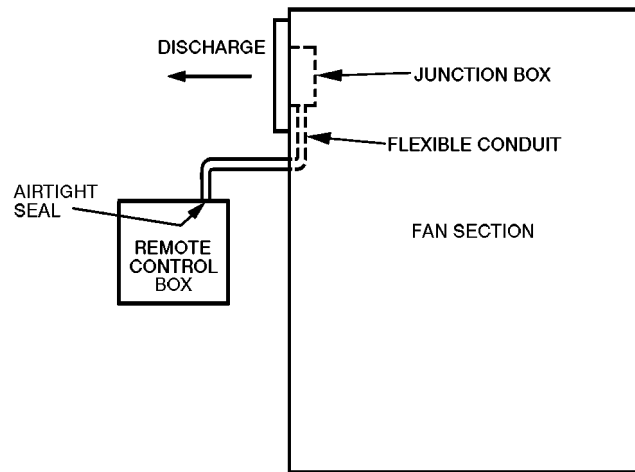













Fig. 4 — Sealing Control Wiring in Flexible Conduit

LEGEND (Fig. 5-12, Table 2)

<p>AFS — Airflow Switch AO — Analog Output AOTC — Analog Output Temperature Control AQ₁ — Air Quality Sensor, No. 1 AQ₂ — Air Quality Sensor, No. 2 C — Contactor CCW — Counterclockwise CH — Channel CR — Control Relay CUST — Condensing Unit Status CV — Constant Volume CW — Clockwise CWV — Chilled Water Valve DHH — Duct High Humidity DO — Discrete Output DOTC — Discrete Output Temperature Control DSIO — Control Module, Electric Heat and/or DX DTCC — Discrete Time Clock Control DX — Direct Expansion DXS — DX Cooling Stage DXSD — Direct Expansion Cooling Shutdown EHS — Electric Heaters ELEC — Electric ENT — Enthalpy Switch EQUIP — Equipment EVAC — Smoke Evacuation Input EXD — Exhaust Air Damper Actuator FLTS — Filter Status Switch FSD — Fire Shutdown Device FU — Fuse GND — Ground HIR — Heat Interlock Relay HOA — Hand-Off-Auto. Switch HPS — High-Pressure Switch HSIO — Keyboard and Display Module HT — Heat HUM — Humidifier HWV — Hot Water Valve IGV — Inlet Guide Vane Actuator LTT — Low Temperature Thermostat MAD — Mixed-Air Damper Actuator MAT — Mixed-Air Temperature MPSIO — Master Processor Module (Processor Module) OAD — Outdoor-Air Damper Actuator OARH — Outdoor-Air Relative Humidity OAT — Outdoor-Air Temperature OAVP — Outdoor-Air Velocity Pressure</p>	<p>OT — Outside-Air Thermostat PH — Preheat PL — Plug Assembly PRESS — Smoke Pressurization Input PSIO — Processor Module PURG — Smoke Purge Input RAD — Return-Air Damper Actuator RAT — Return-Air Temperature RFAN — Return Fan RFR — Return Fan Relay RFVC — Return Fan Volume Control RH — Relative Humidity RVP — Return Velocity Pressure SAT — Supply-Air Temperature SF — Fan Status Relay SFAN — Supply Fan SFR — Supply Fan Relay SMK — Smoke SNB — Snubber SP — Static Pressure Transducer SPSIO — Slave Processor Module (Option Module) SPT — Space Temperature SVP — Supply Velocity Pressure SW — Switch TB — Terminal Block Terminal TEMP — Temperature TRAN — Transformer VAV — Variable Air Volume W/ — With WO/ — Without</p> <p> Marked Wire or Cable  Terminal (Marked)  Terminal (Unmarked)  Terminal Block  Splice (Factory)  Splice (Field)  Wiring Factory  Wiring Field Control  Wiring Field Power  Option or Accessory  Common Potential</p>
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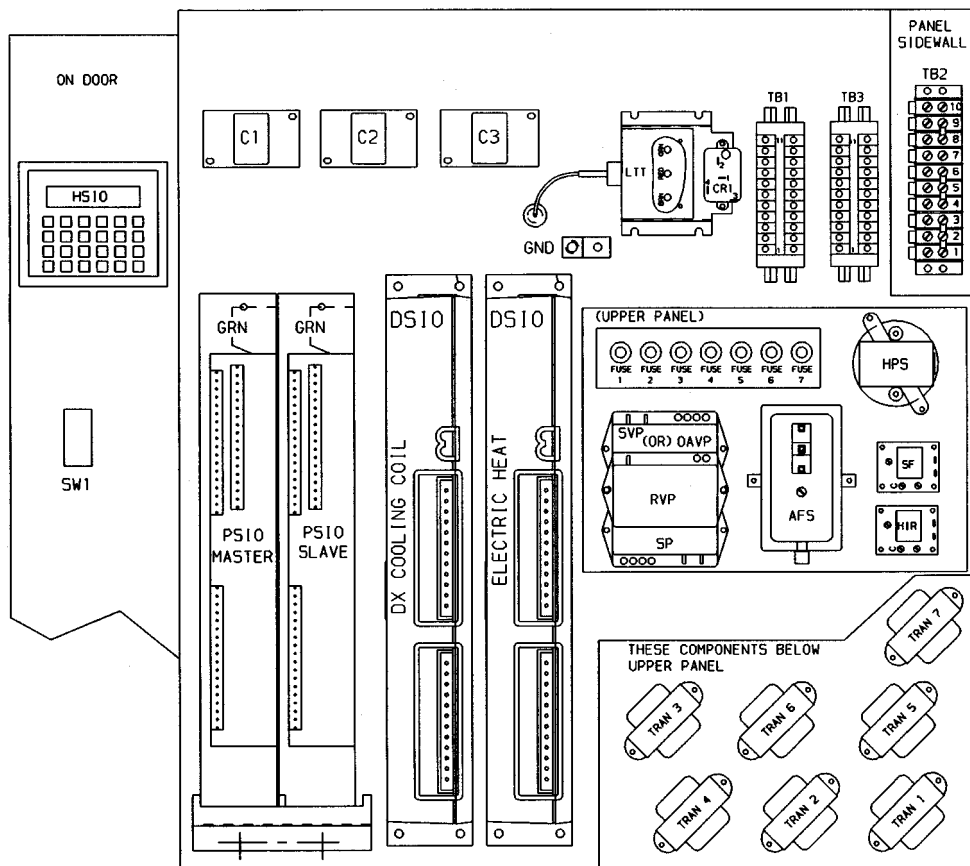
NOTES:

1. Use copper conductors only.
2. Wire is in accordance with National Electrical Code (NEC). For local codes, replace original wires with 90 C wire or its equivalent.
3. Replace wires from IGV, FLTS, MAT, SAT, OAD, RAD, and ELEC HT with 125 C plenum cable conductor as required.
4. Input channel numbers and points for configuration of the optional analog output temperature control (AOTC) follow:

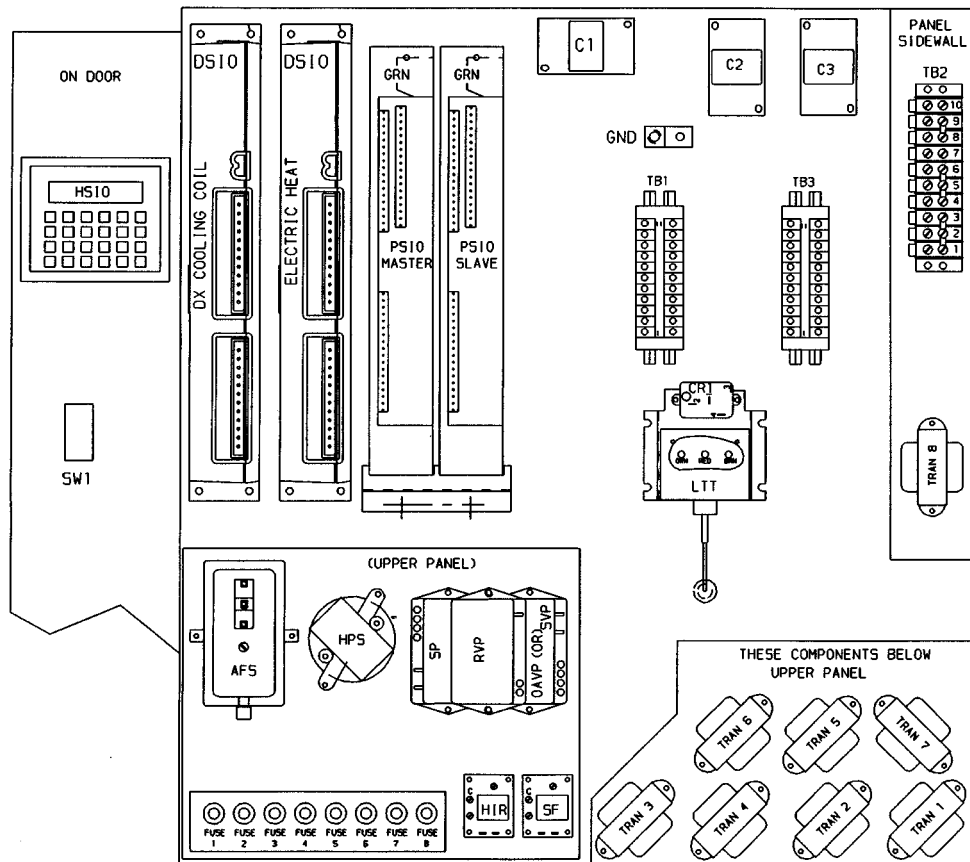
CHANNEL	SENSOR	DESCRIPTION
1	SAT	Supply-Air Temperature
2	OAT	Outdoor-Air Temperature
3	MAT	Mixed-Air Temperature
6	SPT	Space-Air Temperature
7	RAT	Return-Air Temperature
34	TEMP	Preheat or Optional Carrier Sensor

5. Reference for wire markers, where 'X' represents a numeral:

X — Item number on wiring harness
BX — Box wire
CX — Cable
KX — Accessory kit wire



ARRANGEMENT FOR SIZES 03 AND 06



ARRANGEMENT FOR SIZES 08 THROUGH 35

Fig. 5 — PIC Section Control Box Component Arrangements, 39L

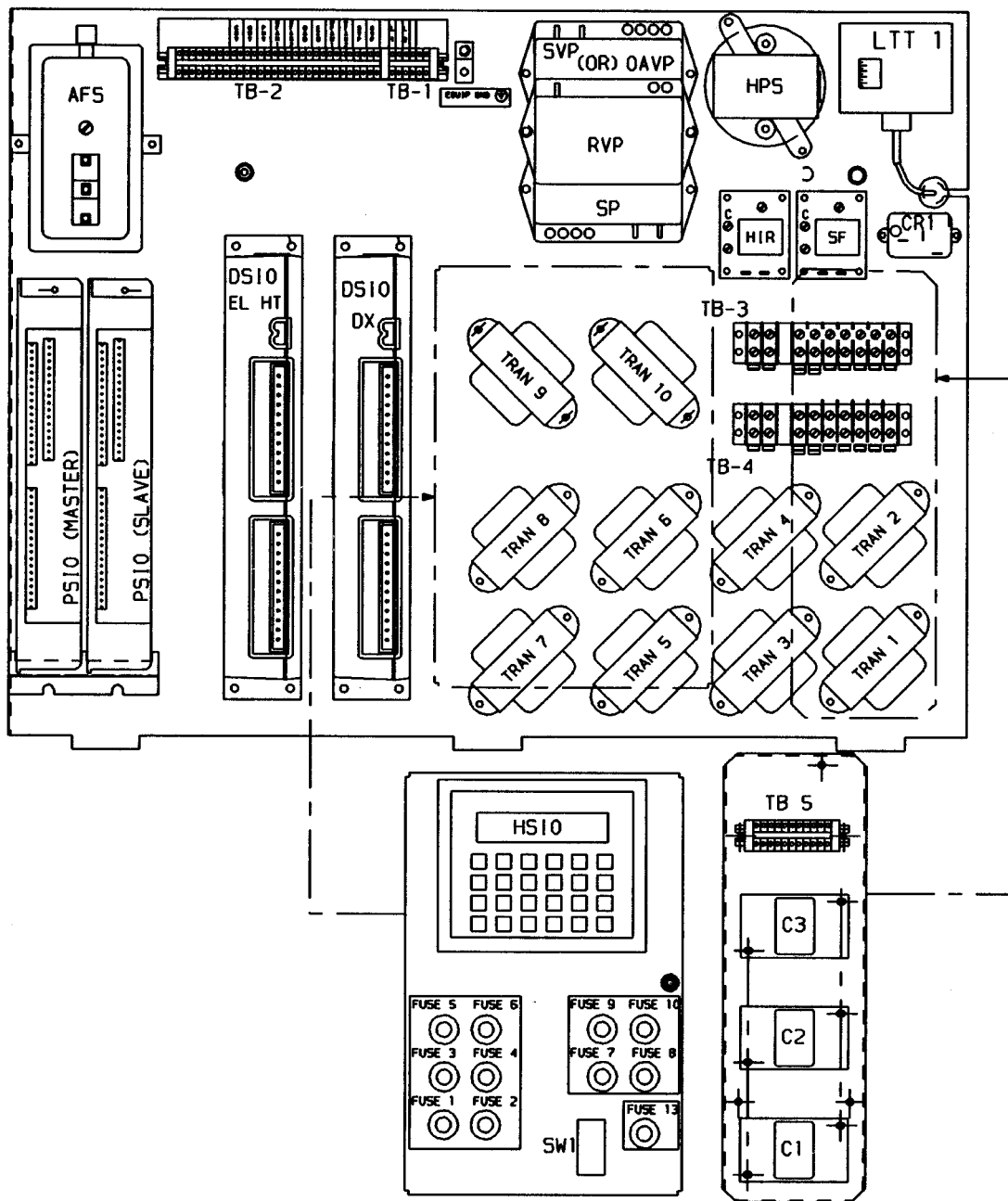


Fig. 6 — PIC Section Control Box Component Arrangement, 39NX Sizes 07-21

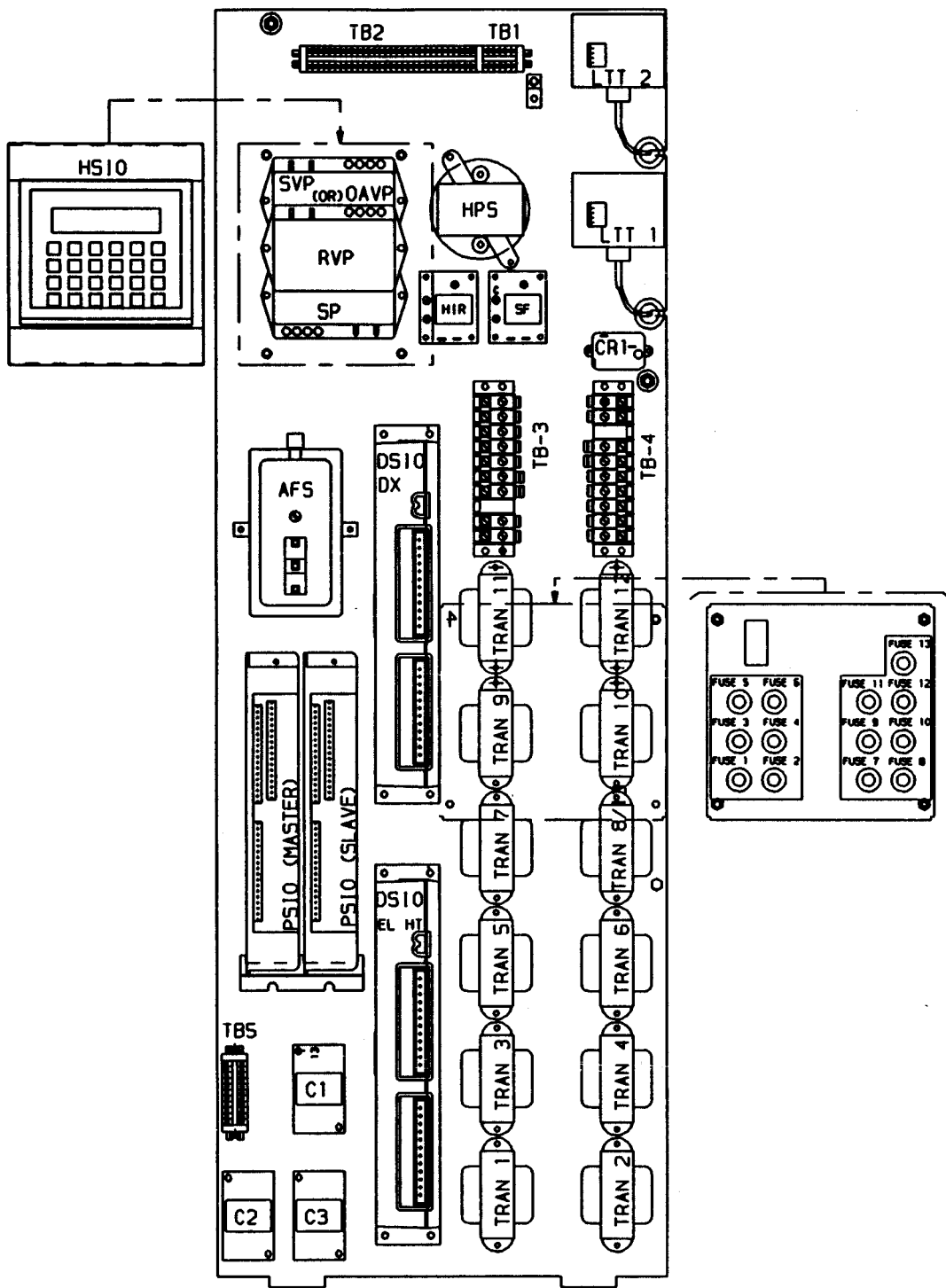


Fig. 7 — PIC Section Control Box Component Arrangement, 39NX Sizes 26-92

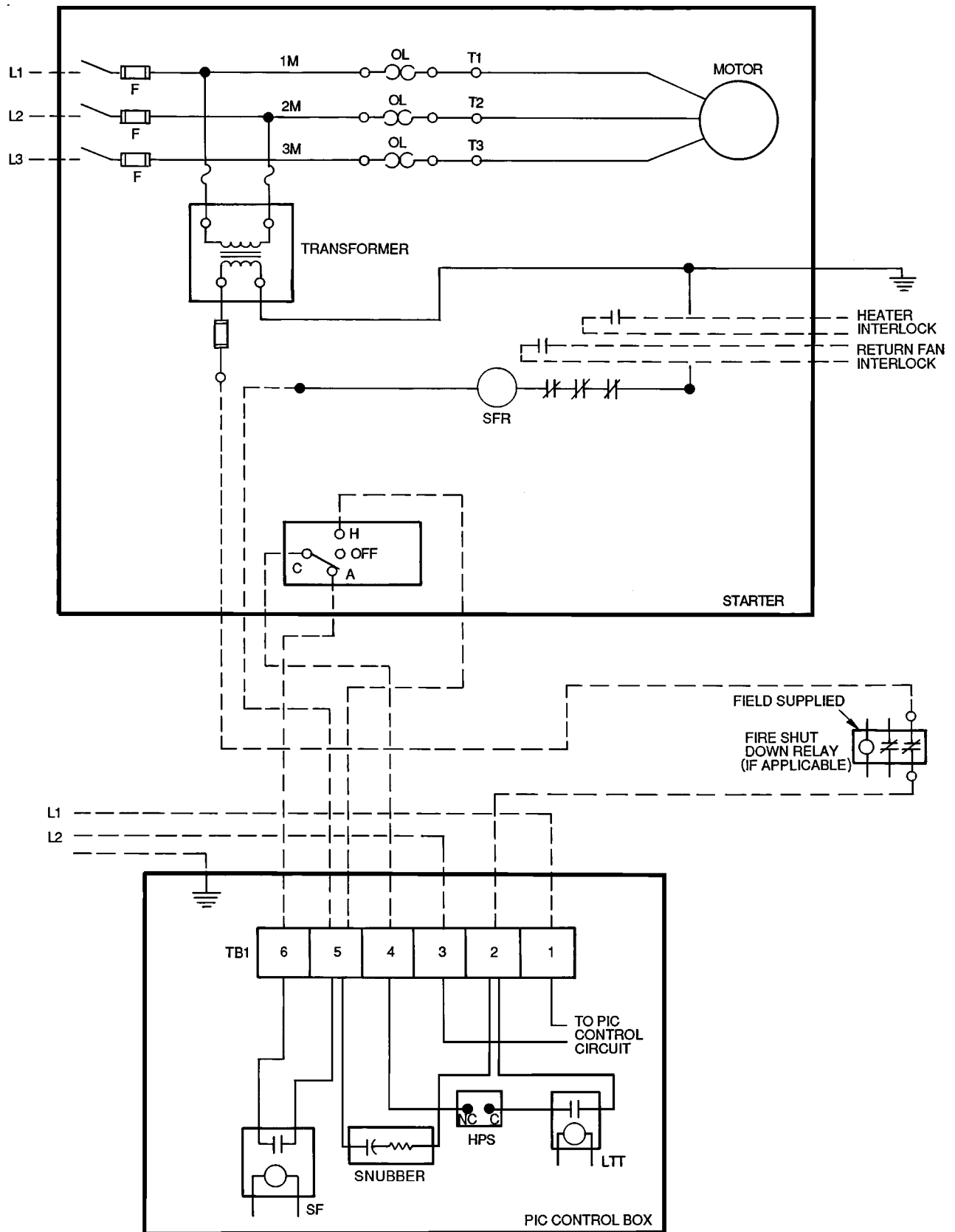


Fig. 8 — Fan Motor Starter Circuit and PIC Control Wiring Interface — PIC Power for Control Circuit From Dedicated Source

Table 1 — Input and Output Points

MODULE, DEFAULT ADDRESS	INPUT	INPUT TYPE	CHANNEL NUMBER	OUTPUT	OUTPUT TYPE	CHANNEL NUMBER
PSIO (Processor) ADDRESS 1	SAT	AI	1	IGV*	AO	13
	OAT	AI	2	MIXD	AO, DO†	14
	MAT	AI	3	HWC	AO	15
	RH	AI	4	CWC	AO	16
	LTT	DI	5	SF	DO	17
	SPT	AI	6	HIR*	DO	18
	RAT	AI	7	—	—	—
	SP*	AI	8	—	—	—
	AFS	DI	9	—	—	—
	FLTS	DI	10	—	—	—
PSIO (Option) ADDRESS 31	OARH	AI	11	—	—	—
	ENT	DI	12	—	—	—
	SVP*	AI	31	RFVC*	AO	43
	RVP*	AI	32	HUM1	AO, DO	44
	DHH	DI	33	HUM2	DO	45
	TEMP	AI	34	AOTC	AO	46
	PRES	DI	35	DOTC	DO	47
	EVAC	DI	36	DTCC	DO	48
	PURG	DI	37	—	—	—
	FSD	DI	38	—	—	—
DSIO (Electric Heat) ADDRESS 19	AQ1	AI	39	—	—	—
	AQ2	AI	40	—	—	—
	OAVP*	AI	41	—	—	—
	METER	DI	42	—	—	—
	—	—	—	EHS1	DO	23
	—	—	—	EHS2	DO	24
	—	—	—	EHS3	DO	25
	—	—	—	EHS4	DO	26
	—	—	—	EHS5	DO	27
	—	—	—	EHS6	DO	28
DSIO (DX without Electric Heat) ADDRESS 19	—	—	—	EHS7	DO	29
	—	—	—	EHS8	DO	30
	CUST	DI	19	DXS1	DO	23
	DXSD	DI	20	DXS2	DO	24
	—	—	—	DXS3	DO	25
	—	—	—	DXS4	DO	26
	—	—	—	DXS5	DO	27
	—	—	—	DXS6	DO	28
DSIO (DX with Electric Heat) ADDRESS 49	—	—	—	DXS7	DO	29
	—	—	—	DXS8	DO	30
	CUST	DI	49	DXS1	DO	53
	DXSD	DI	50	DXS2	DO	54
	—	—	—	DXS3	DO	55
	—	—	—	DXS4	DO	56
	—	—	—	DXS5	DO	57
	—	—	—	DXS6	DO	58
—	—	—	DXS7	DO	59	
—	—	—	DXS8	DO	60	

LEGEND

AFS — Airflow Switch (Supply Fan Status Switch)	DXS1-8 — Direct Expansion Cooling Stages 1-8	MIXD — Mixed-Air Dampers
AI — Analog Input	DXSD — Direct Expansion Cooling Shutdown	OARH — Outdoor-Air Relative Humidity
AO — Analog Output	EHS1-8 — Electric Heater Stages 1-8	OAT — Outdoor-Air Temperature
AOTC — Analog Output Temperature Control	ENT — Enthalpy Switch	OAVP — Outdoor-Air Velocity Pressure
AQ1, 2 — Air Quality Sensors 1, 2	EVAC — Evacuation	PRES — Pressurization
CUST — Condensing Unit Status (Outdoor Air Thermostat)	FLTS — Filter Status Switch	PURG — Purge
CWC — Chilled Water Coil	FSD — Fire Shutdown	RAT — Return-Air Temperature
DI — Discrete Input	HIR — Heat Interlock Relay	RFVC — Return Fan Volume Control
DHH — Duct High Humidity	HWC — Hot Water Coil	RH — Relative Humidity
DO — Discrete Output	HUM1, 2 — Humidity Stages 1, 2	RVP — Return Velocity Pressure
DOTC — Discrete Output Temperature Control	IGV — Inlet Guide Vanes	SAT — Supply-Air Temperature
DTCC — Discrete Output Timeclock Control	LTT — Low Temperature Thermostat (also labelled FRZ)	SF — Supply Fan Relay
	MAT — Mixed-Air Temperature Meter (Pulsed Dry-Contact Input)	SP — Static Pressure
		SPT — Space Temperature
		SVP — Supply Velocity Pressure
		TEMP — Optional Temperature Input

*Available on VAV only.

†Discrete output with two-position damper control.

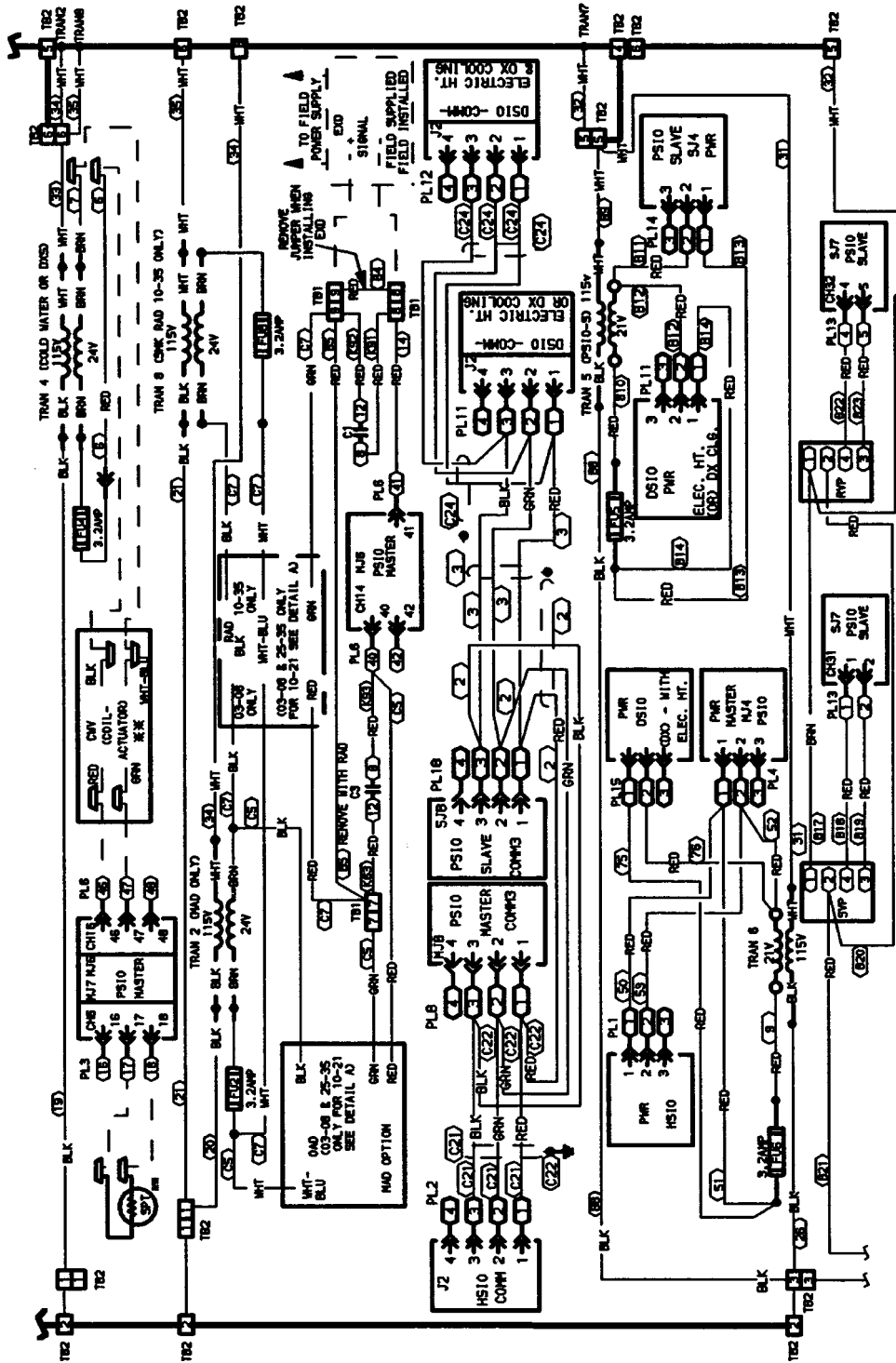


Fig. 9 — Unit Wiring Schematic, 39L Sizes 03-35 (115 v, Typical) (cont)

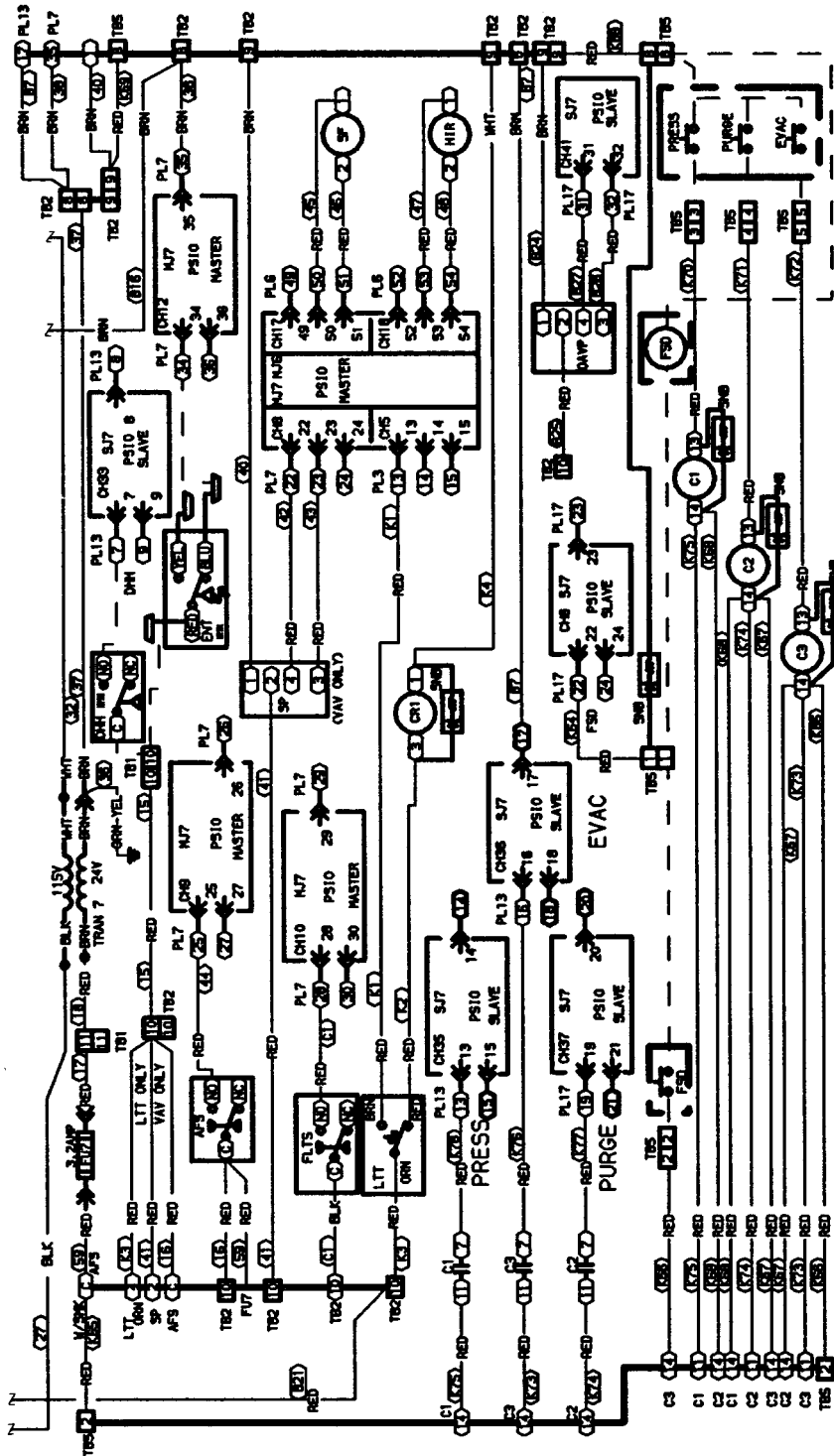
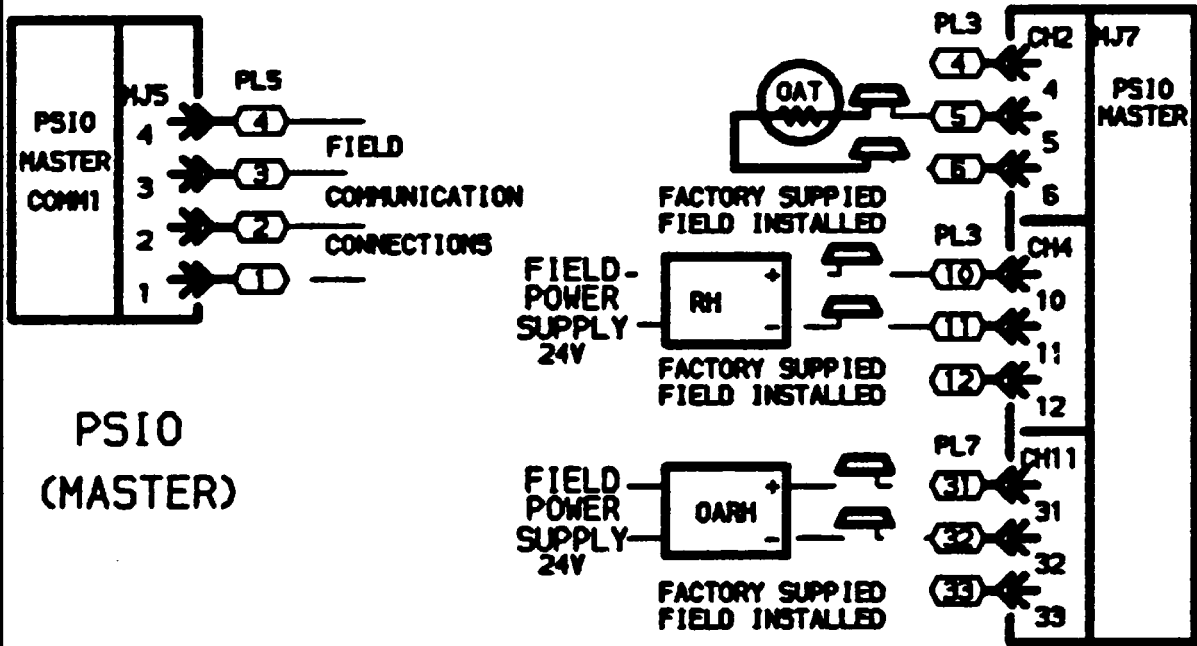


Fig. 9 — Unit Wiring Schematic, 39L Sizes 03-35 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS



PSIO (MASTER)

PSIO (SLAVE)

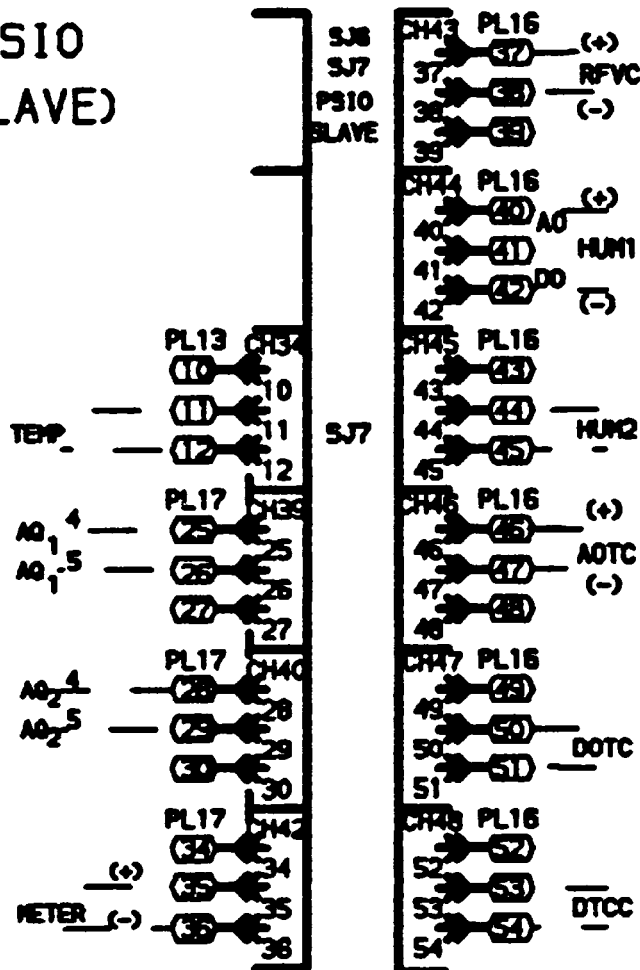


Fig. 9 — Unit Wiring Schematic, 39L Sizes 03-35 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS

ELECTRIC HEAT

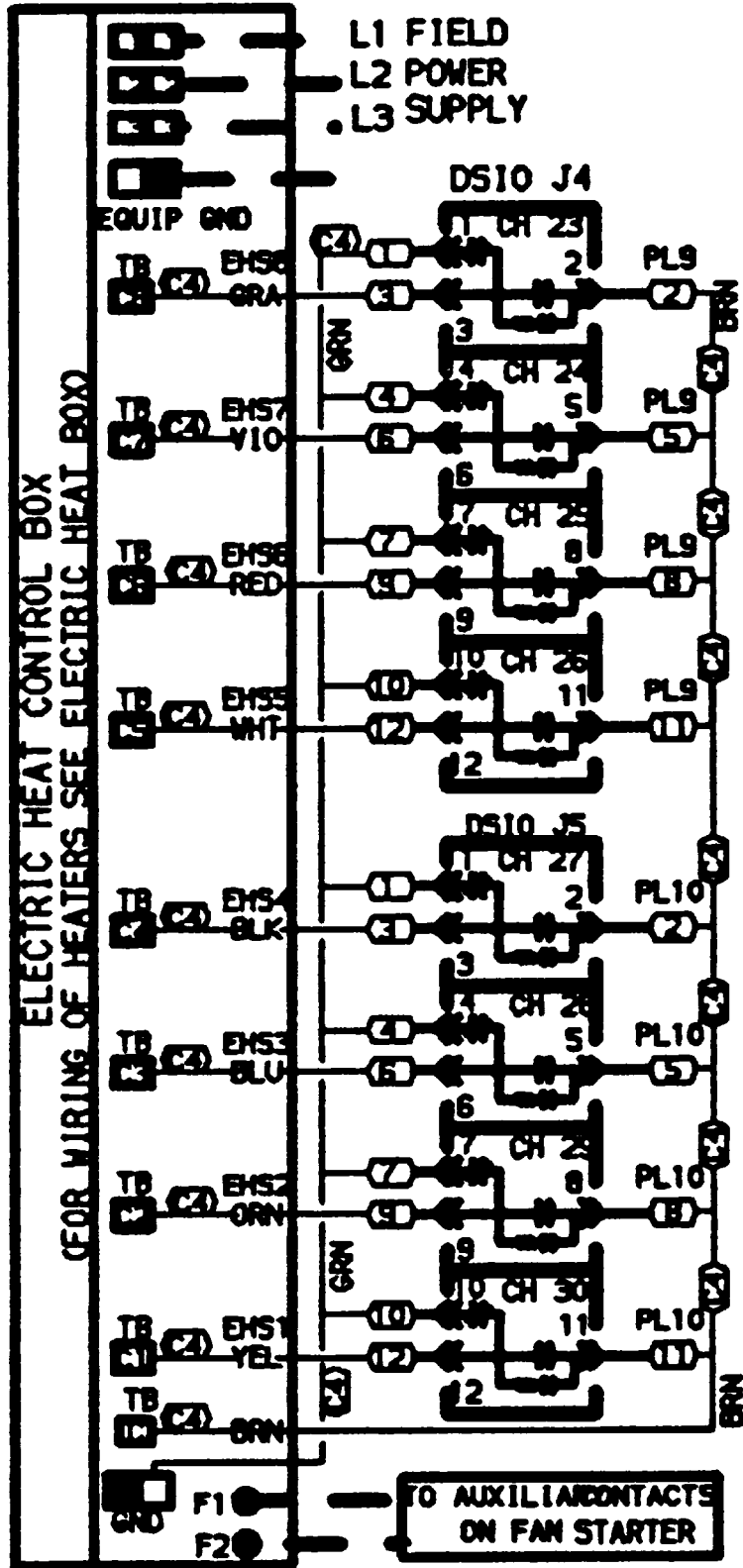


Fig. 9 — Unit Wiring Schematic, 39L Sizes 03-35 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS

DX COOLING

WO/ELEC. HT. WITH ELEC. HT.

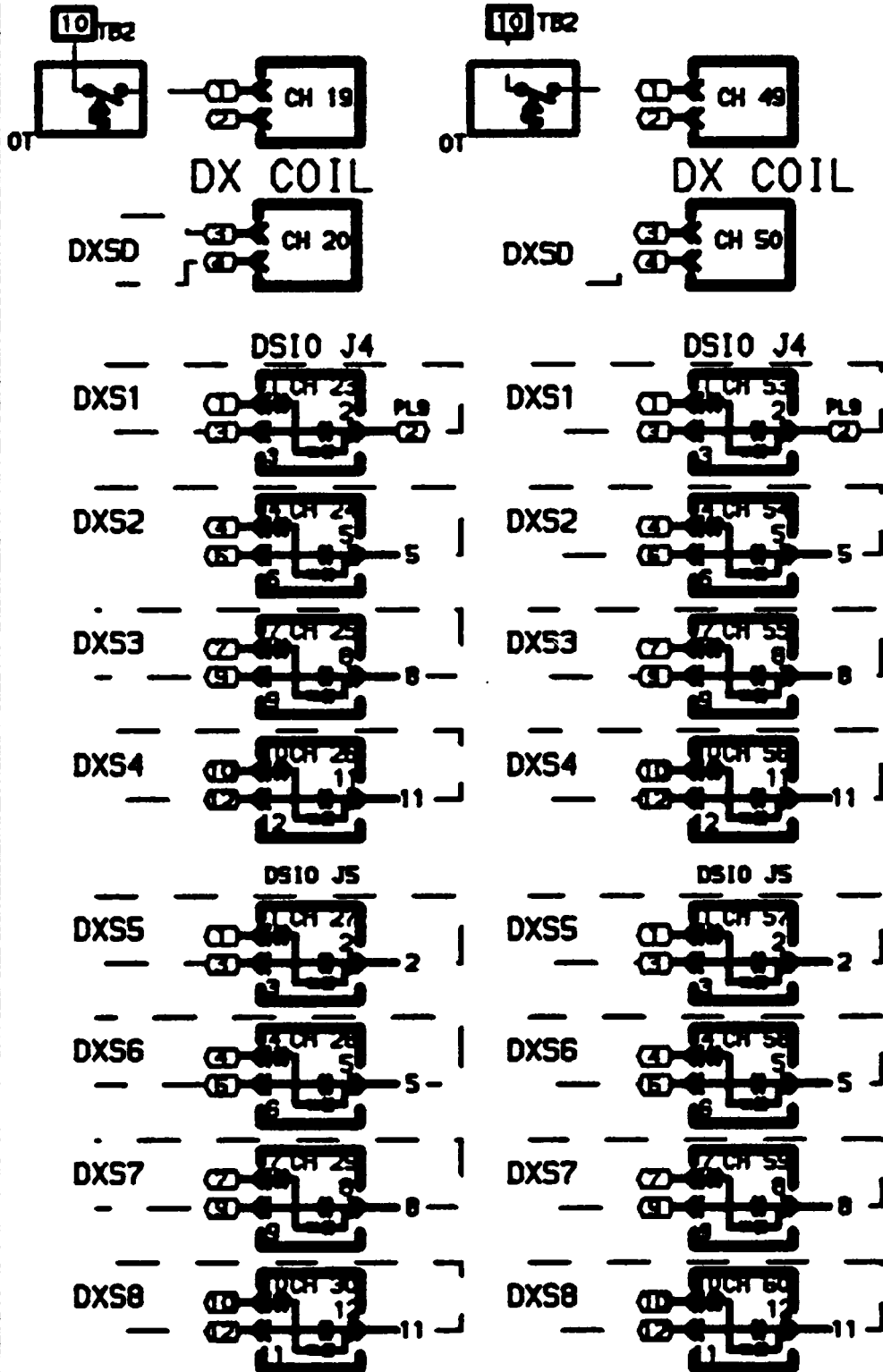


Fig. 9 — Unit Wiring Schematic, 39L Sizes 03-35 (115 v, Typical) (cont)

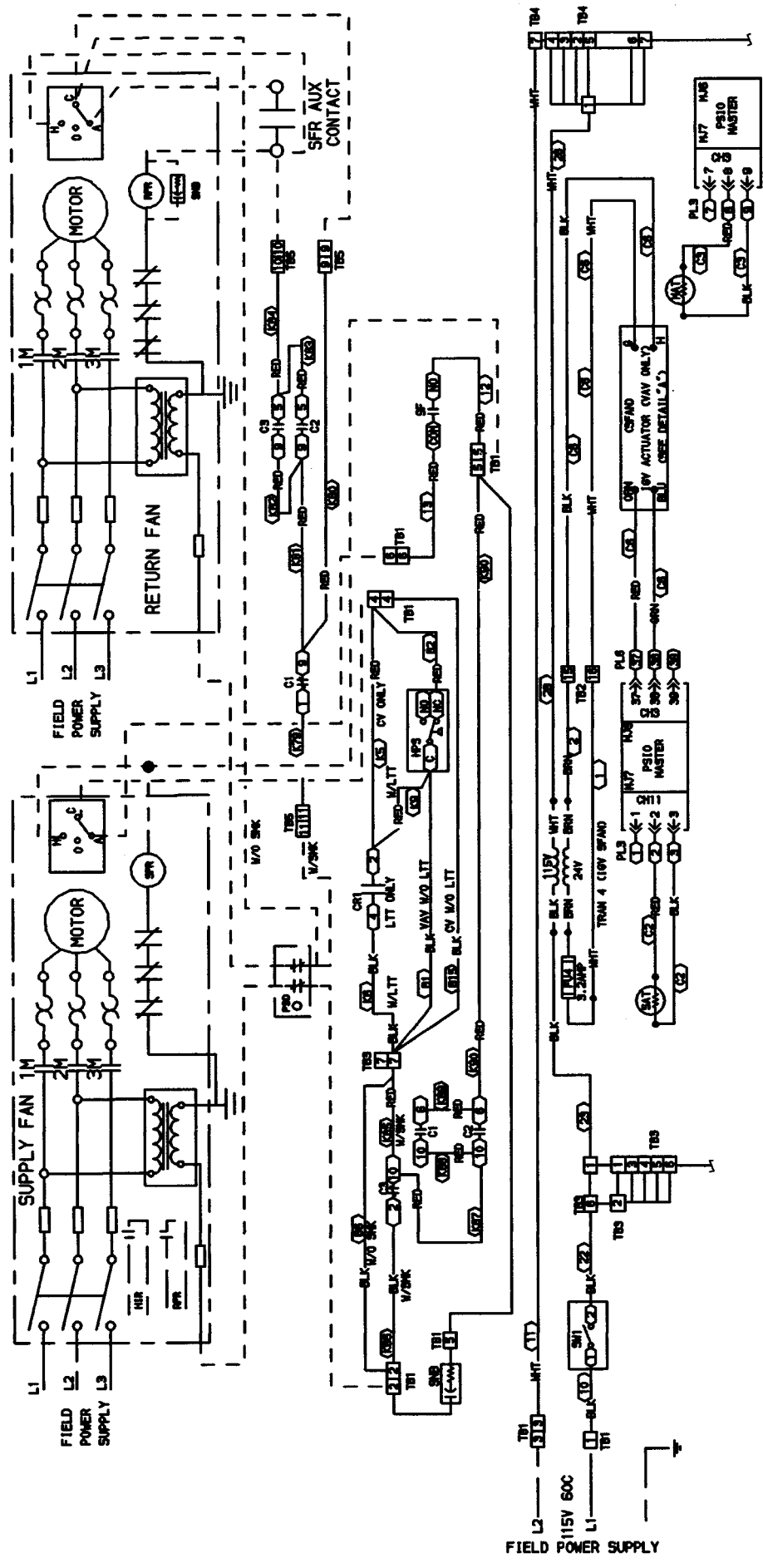


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical)

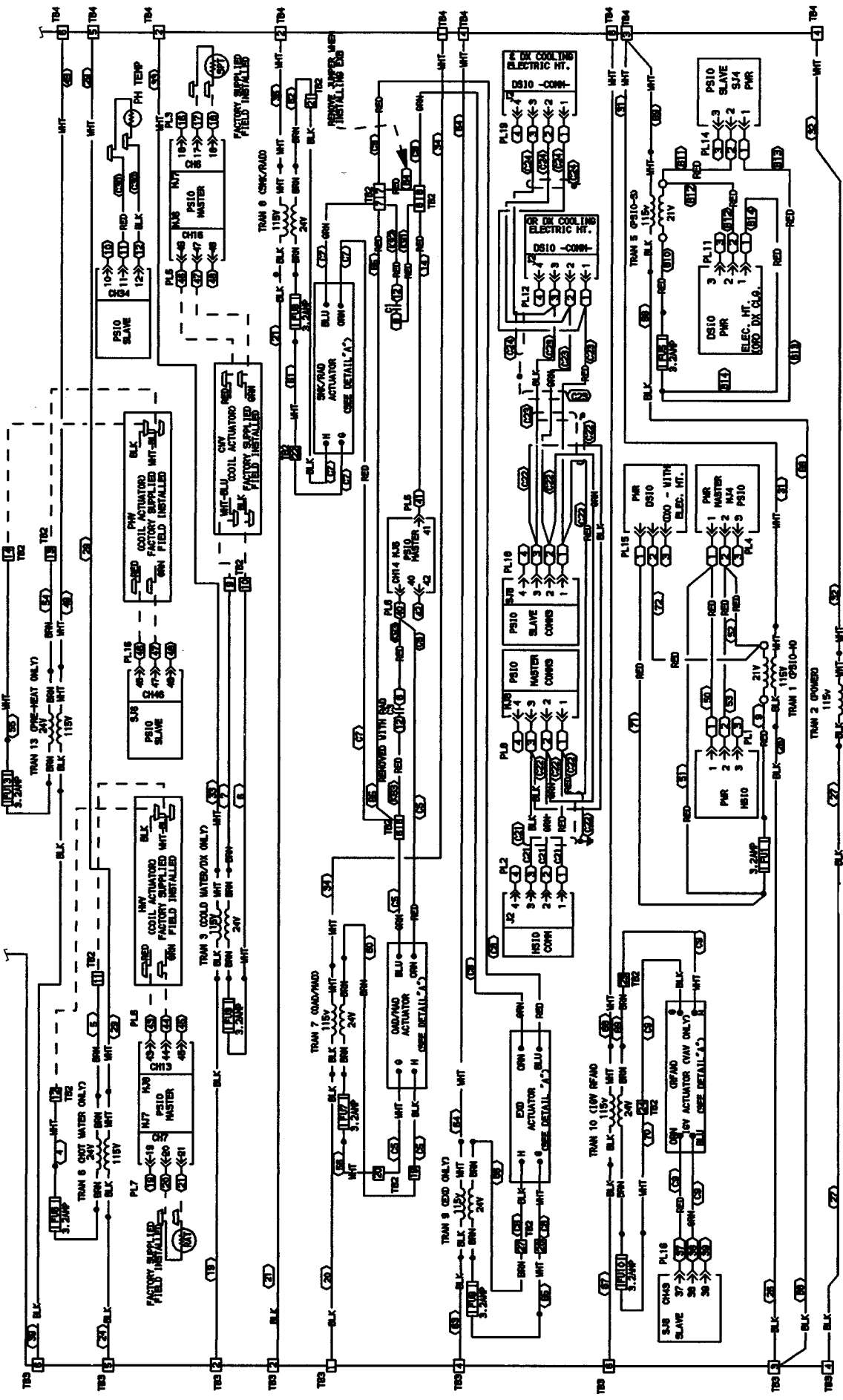


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical) (cont)

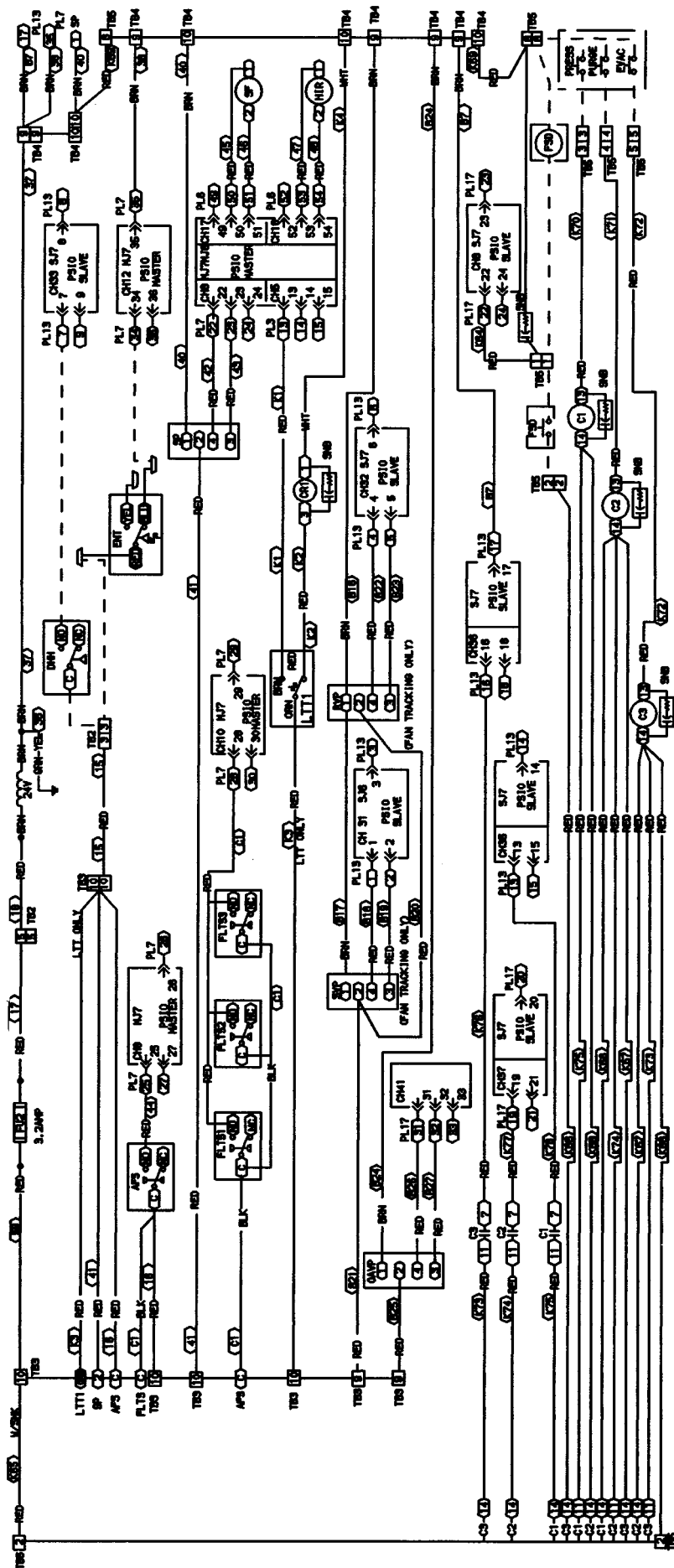
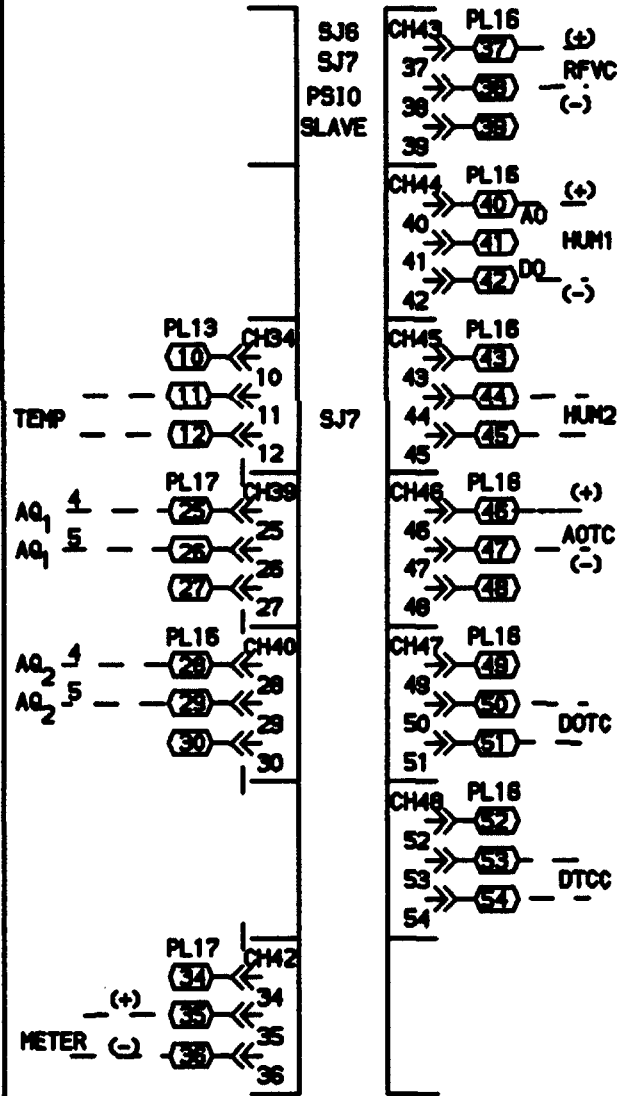


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS

PSIO-SLAVE



PSIO (MASTER)

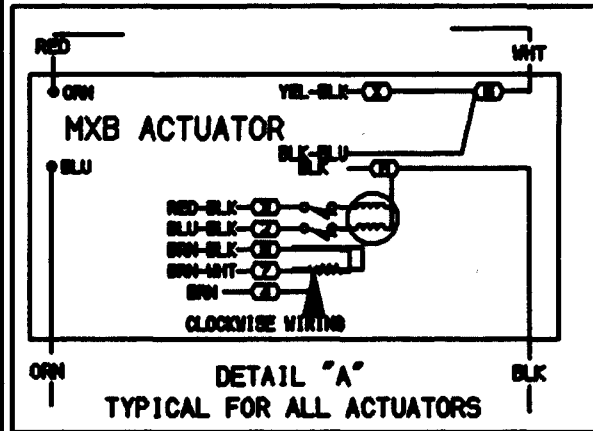
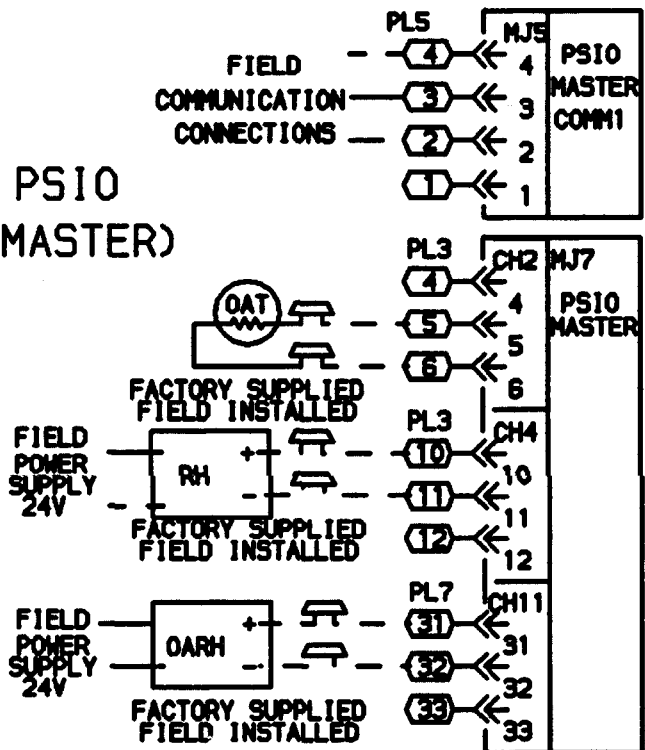


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS

ELECTRIC HEAT

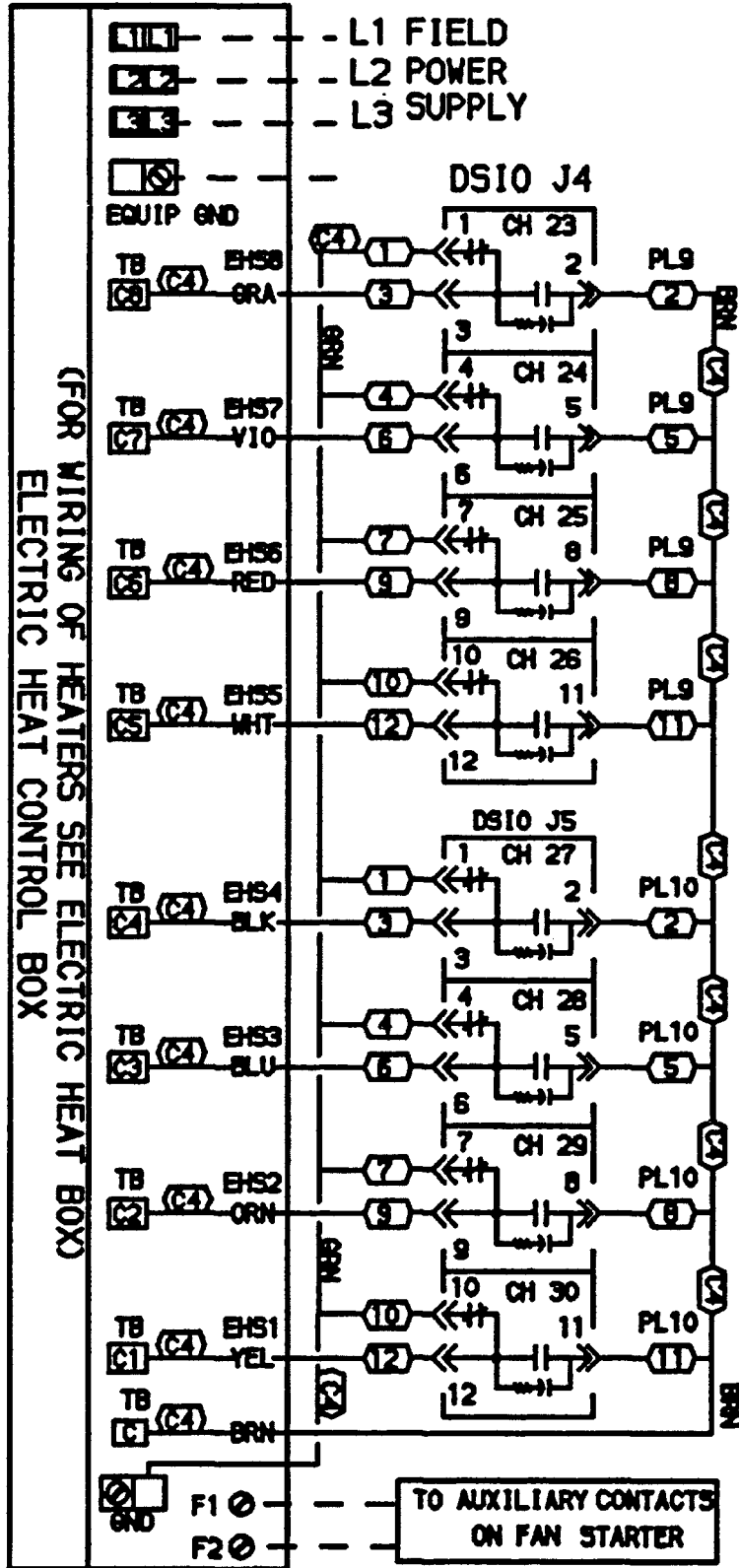
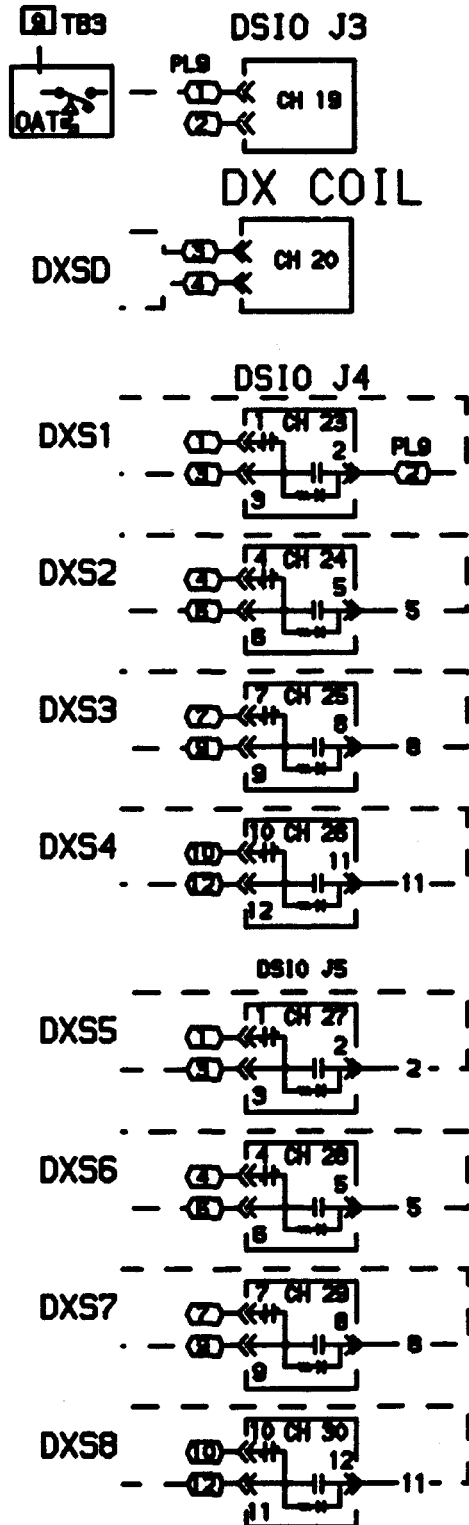


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical) (cont)

FIELD-INSTALLED CONNECTIONS

DX COOLING

WITHOUT ELEC. HT.



WITH ELEC. HT.

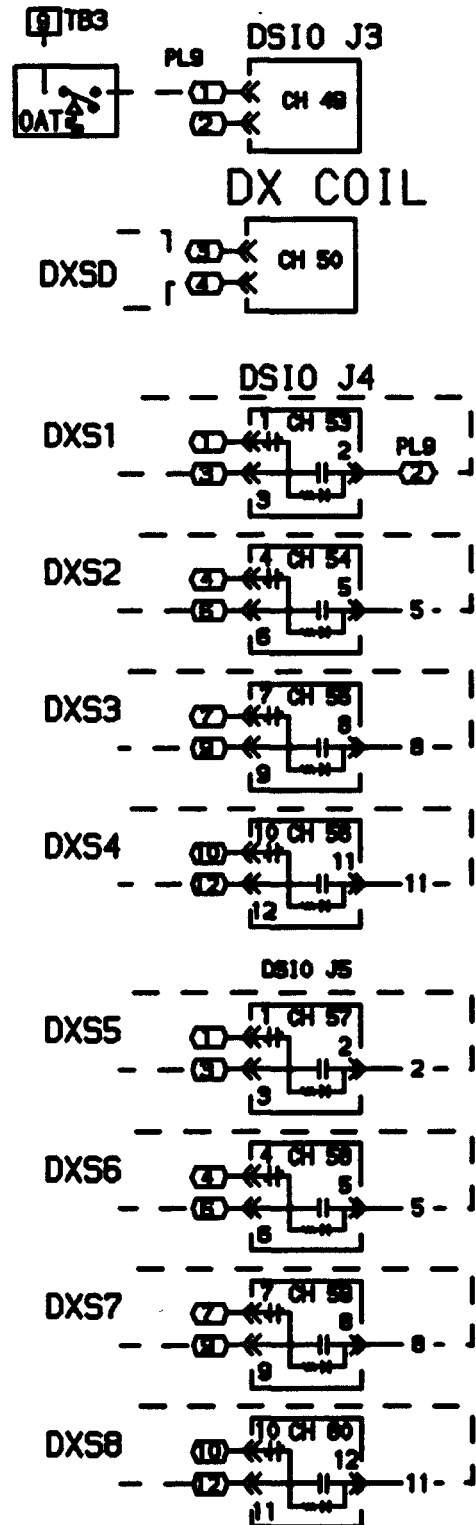


Fig. 10 — Unit Wiring Schematic, 39NX Sizes 07-21 (115 v, Typical) (cont)

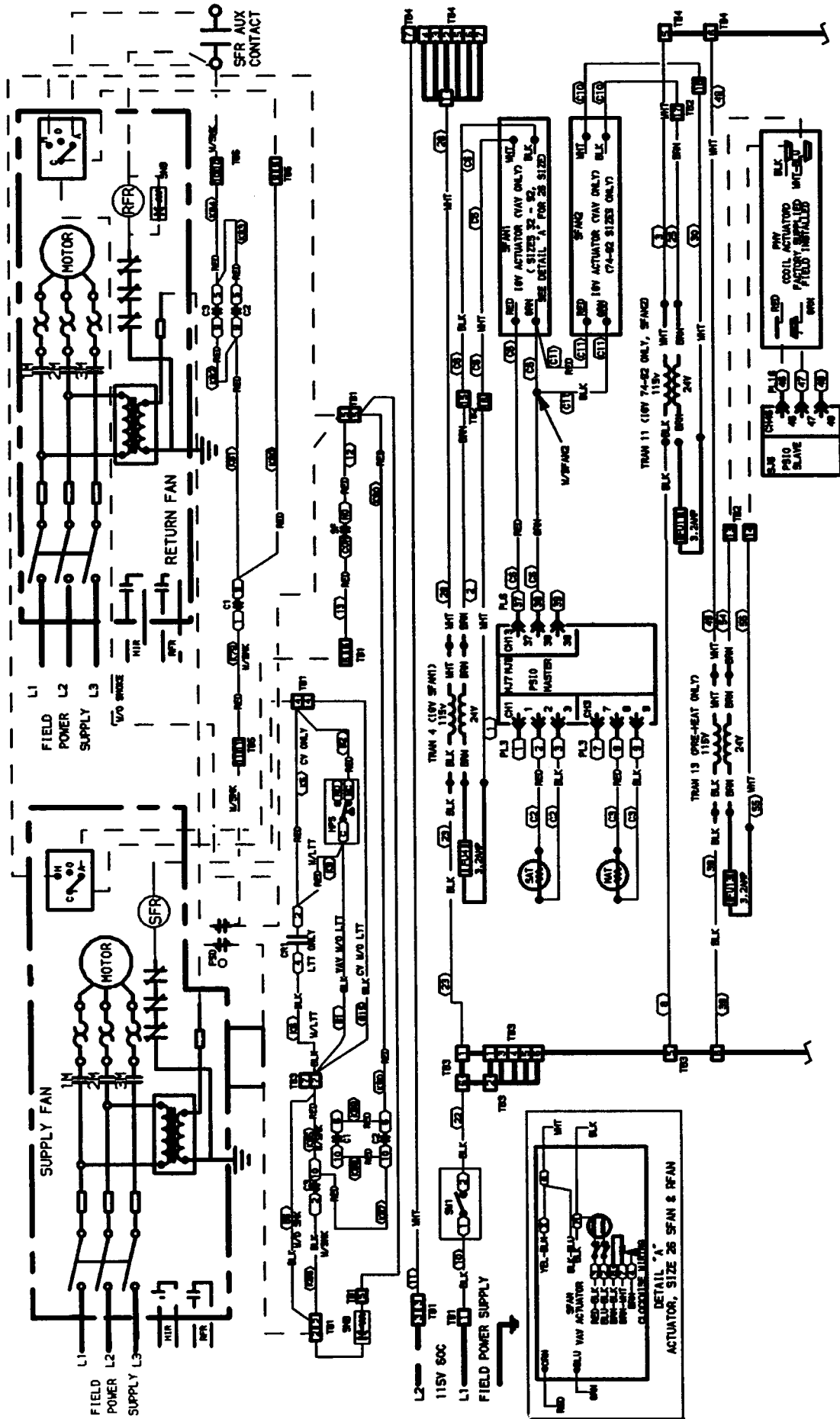


Fig. 11 — Unit Wiring Schematic, 39NX Sizes 26-92 (115 v, Typical)

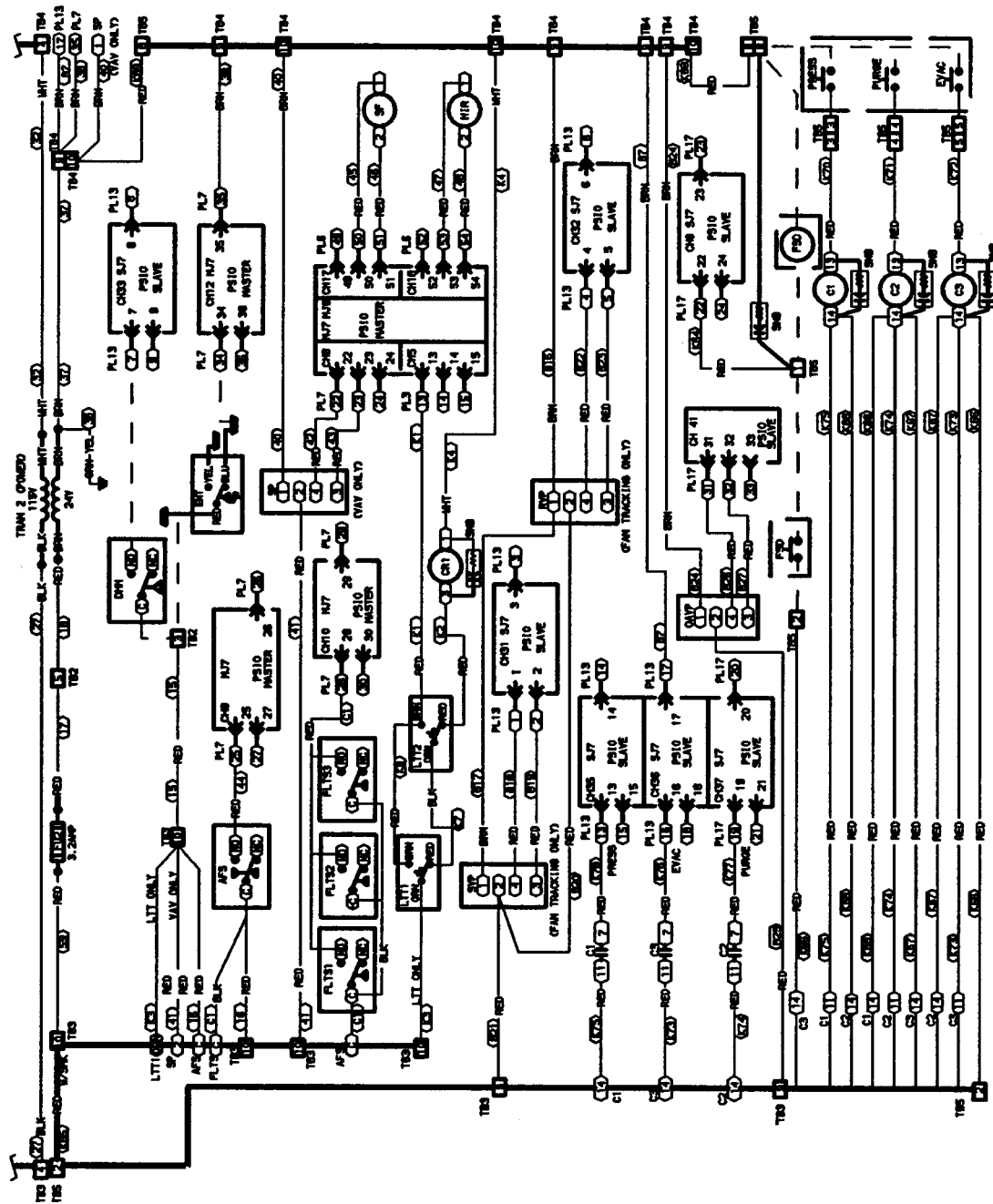


Fig. 11 — Unit Wiring Schematic, 39NX Sizes 26-92 (115 v, Typical) (cont)

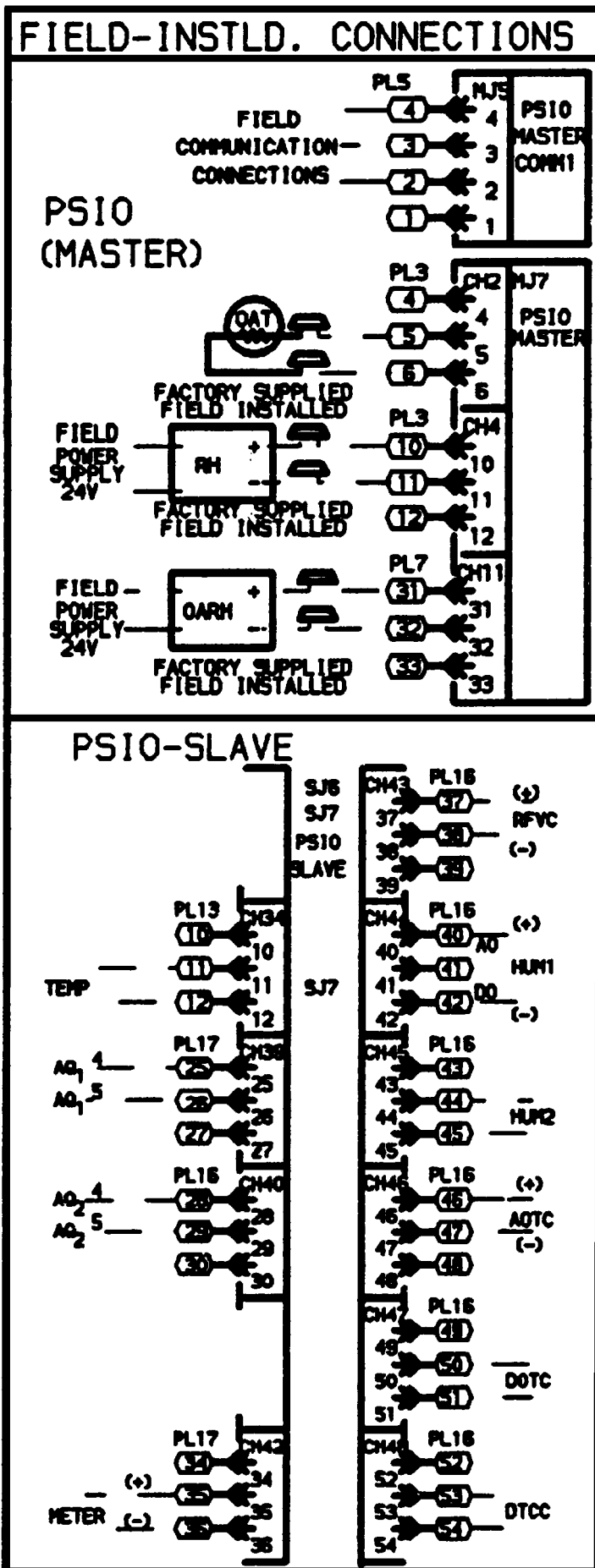


Fig. 11 — Unit Wiring Schematic, 39NX Sizes 26-92 (115 v, Typical) (cont)

FIELD-INSTLD. CONNECTIONS

ELECTRIC HEAT

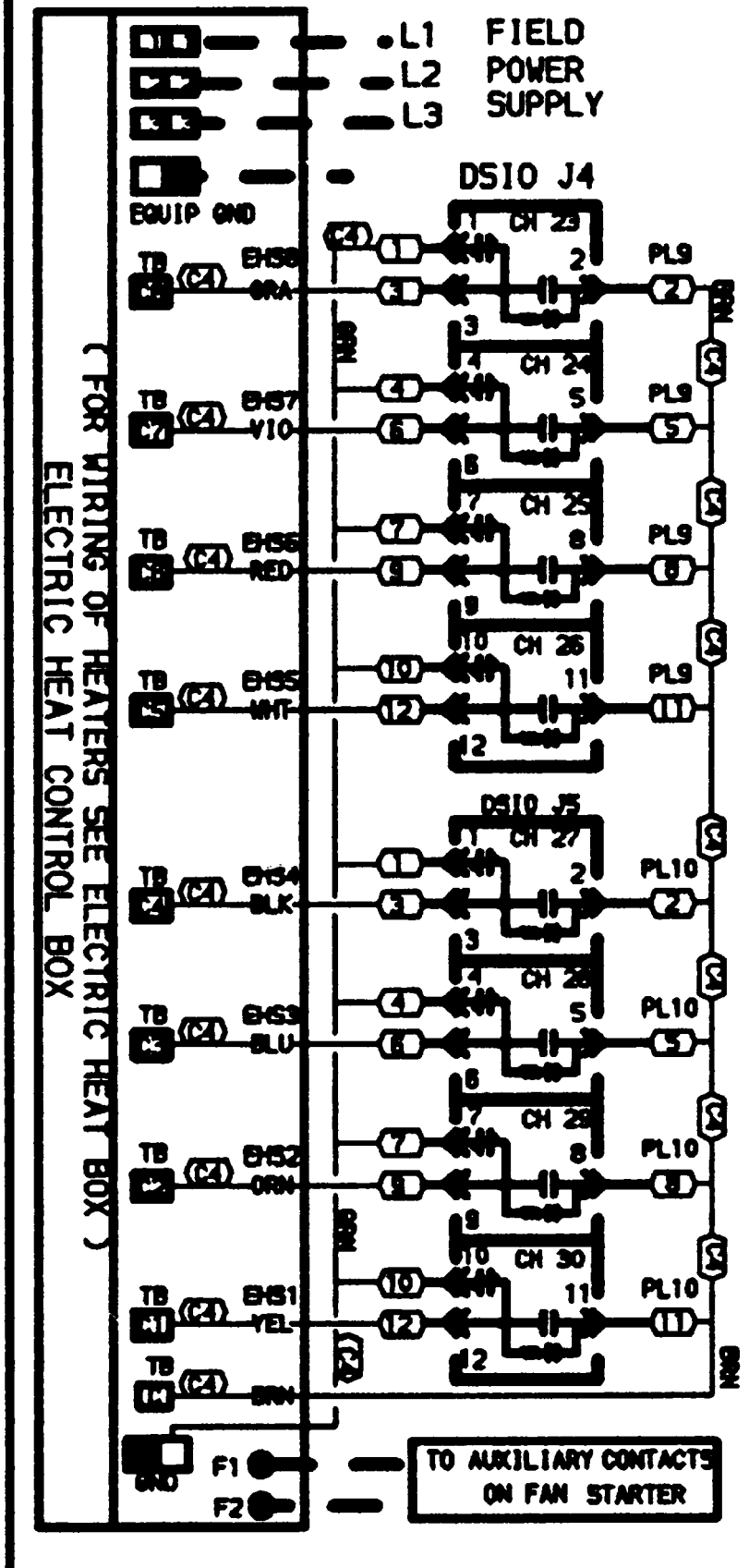
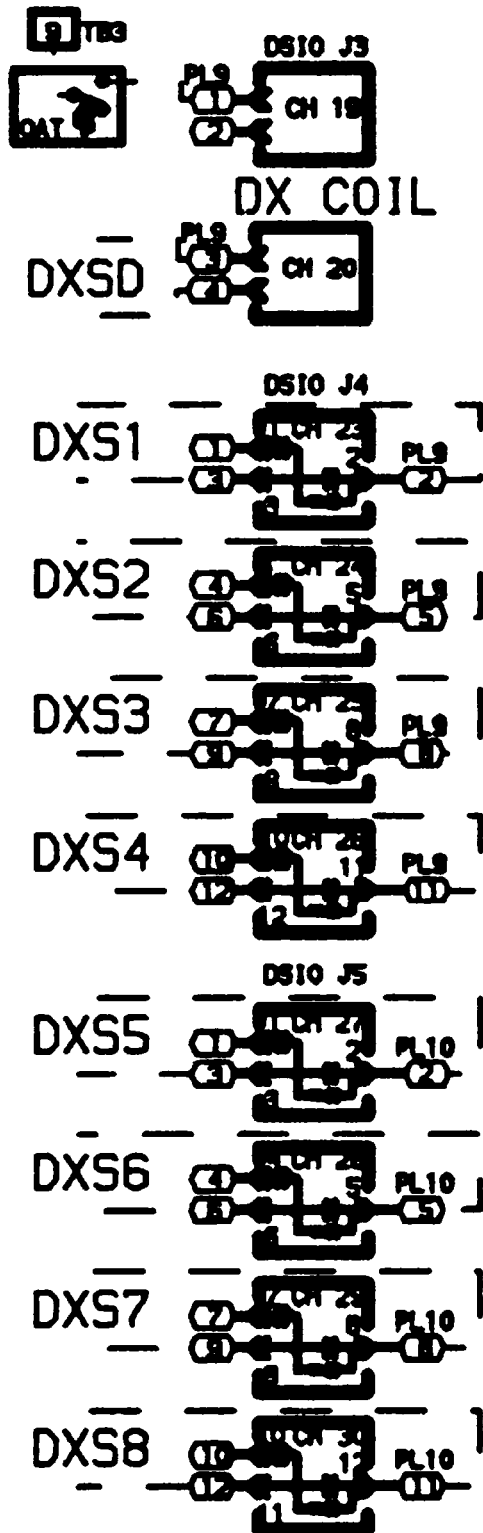


Fig. 11 — Unit Wiring Schematic, 39NX Sizes 26-92 (115 v, Typical) (cont)

FIELD-INSTLD. CONNECTIONS

DX COOLING

WITHOUT ELEC. HT.



WITH ELEC. HT.

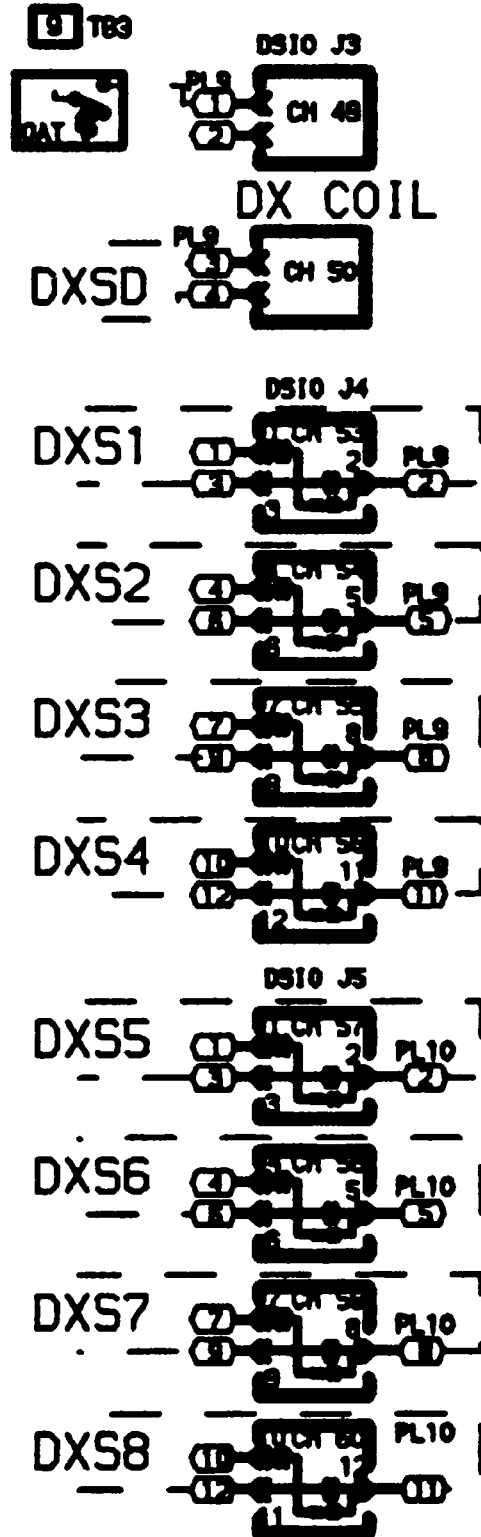


Fig. 11 — Unit Wiring Schematic, 39NX Sizes 26-92 (115 v, Typical) (cont)

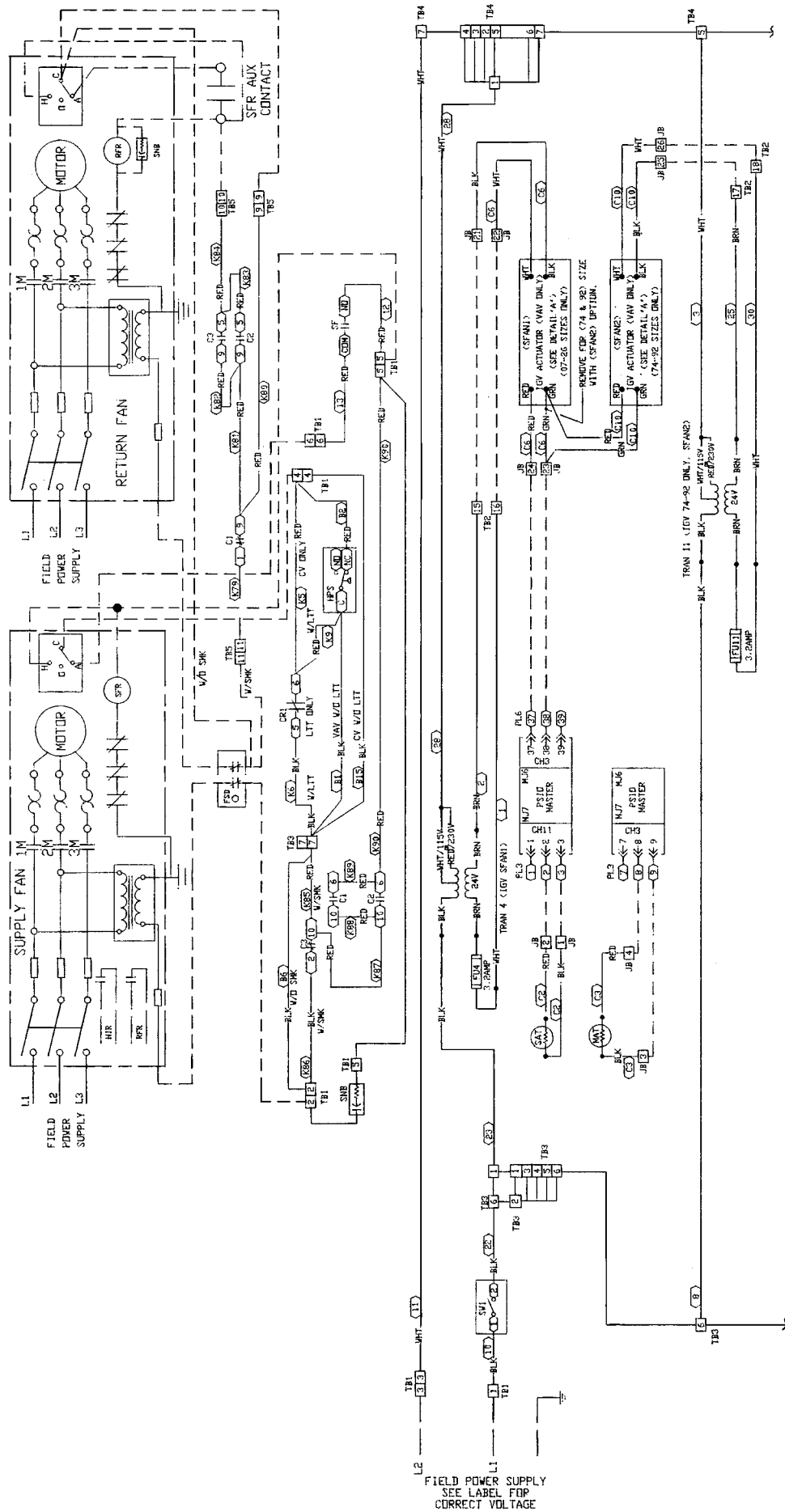


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box

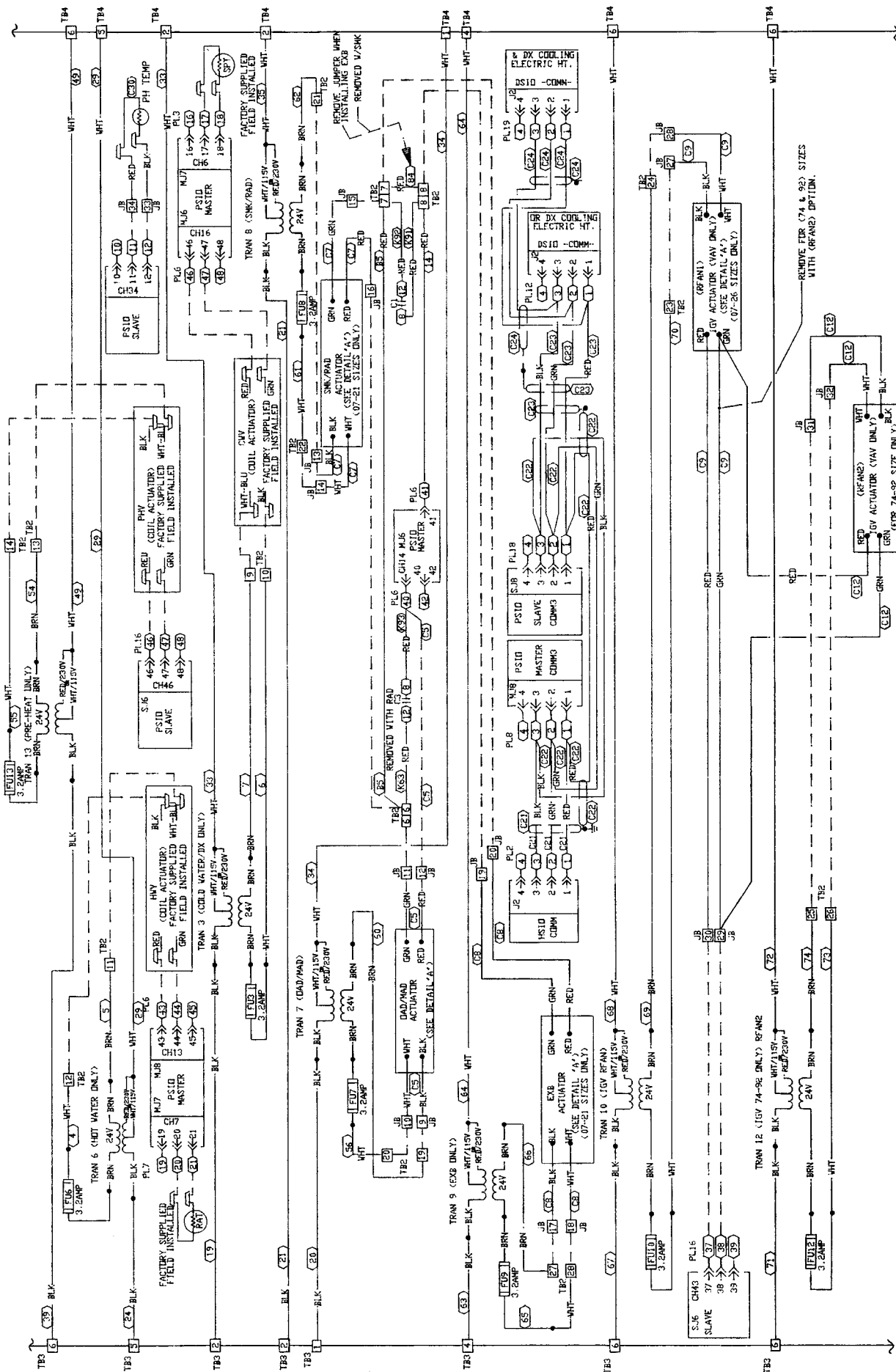


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box (cont)

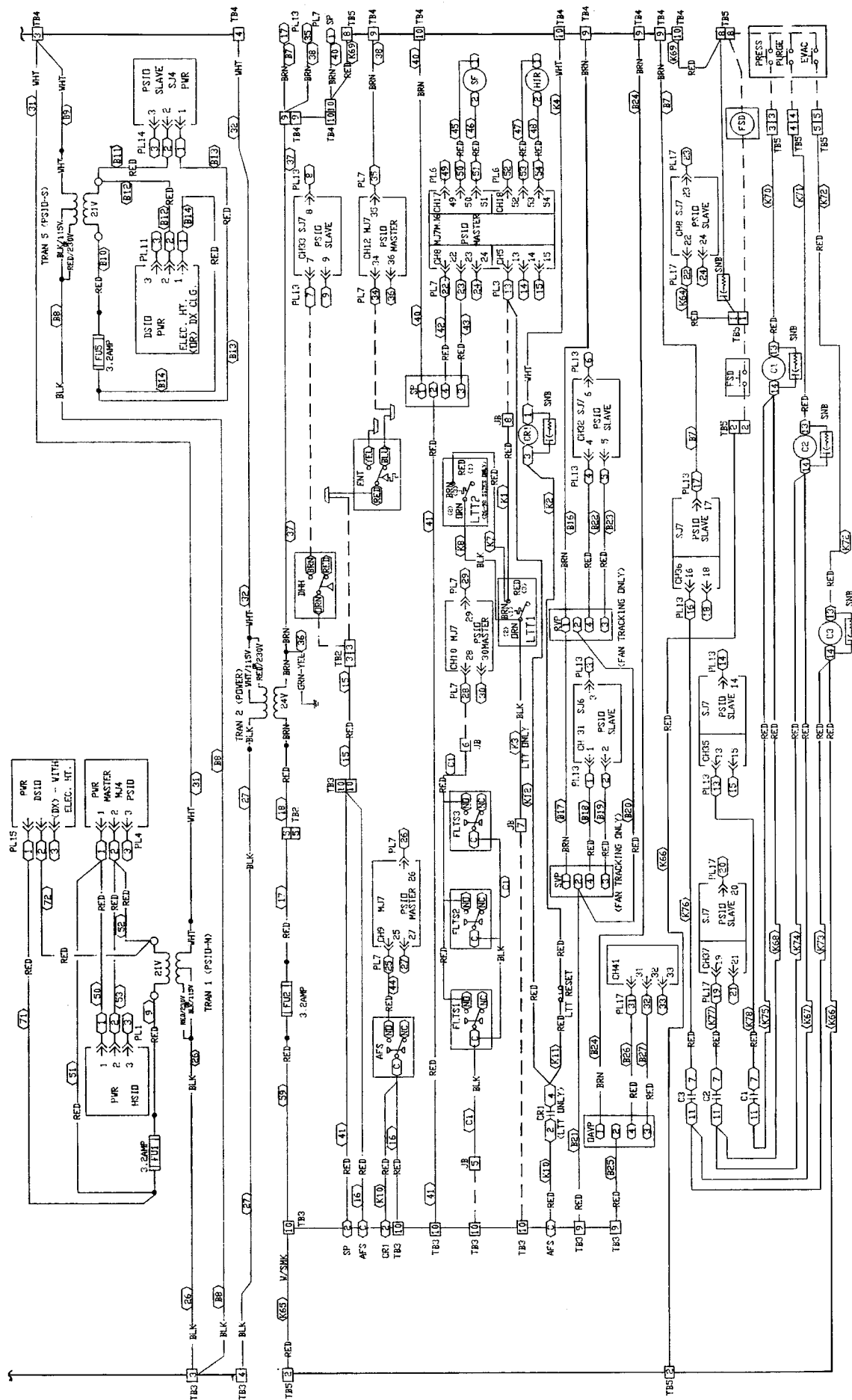
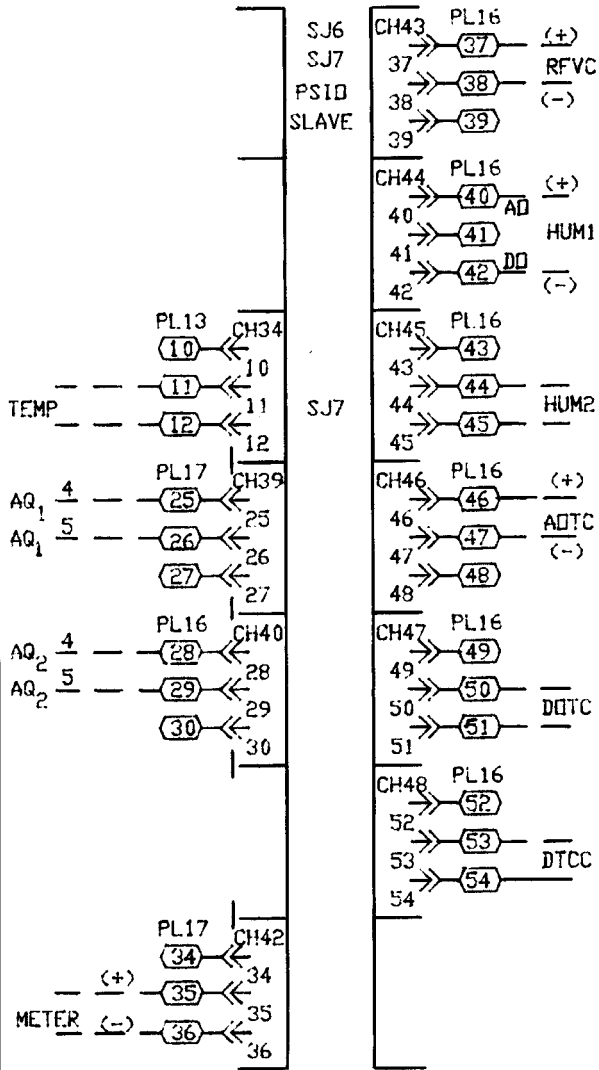


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box (cont)

FIELD-INSTALLED CONNECTIONS

PSIO-SLAVE

ADDRESS 31



PSIO (MASTER)

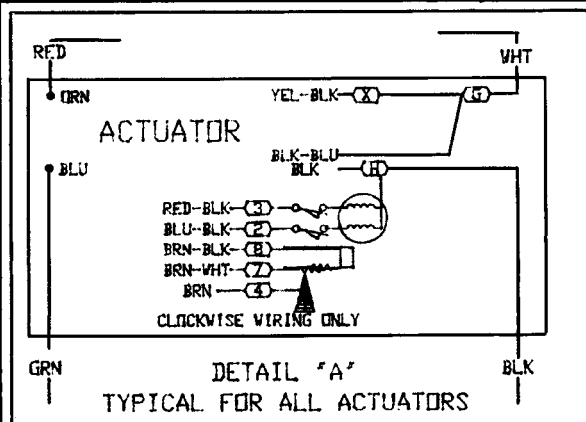
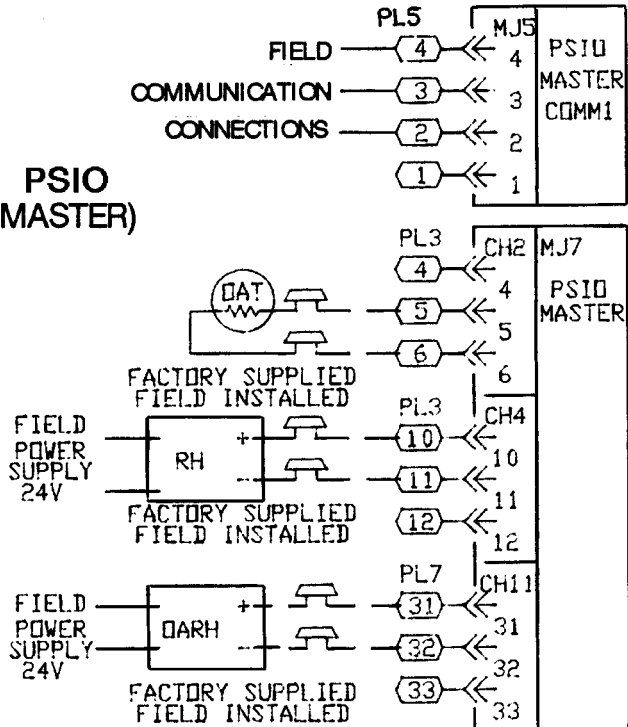


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box (cont)

FIELD-INSTALLED CONNECTIONS

ELECTRIC HEAT

ADDRESS 19

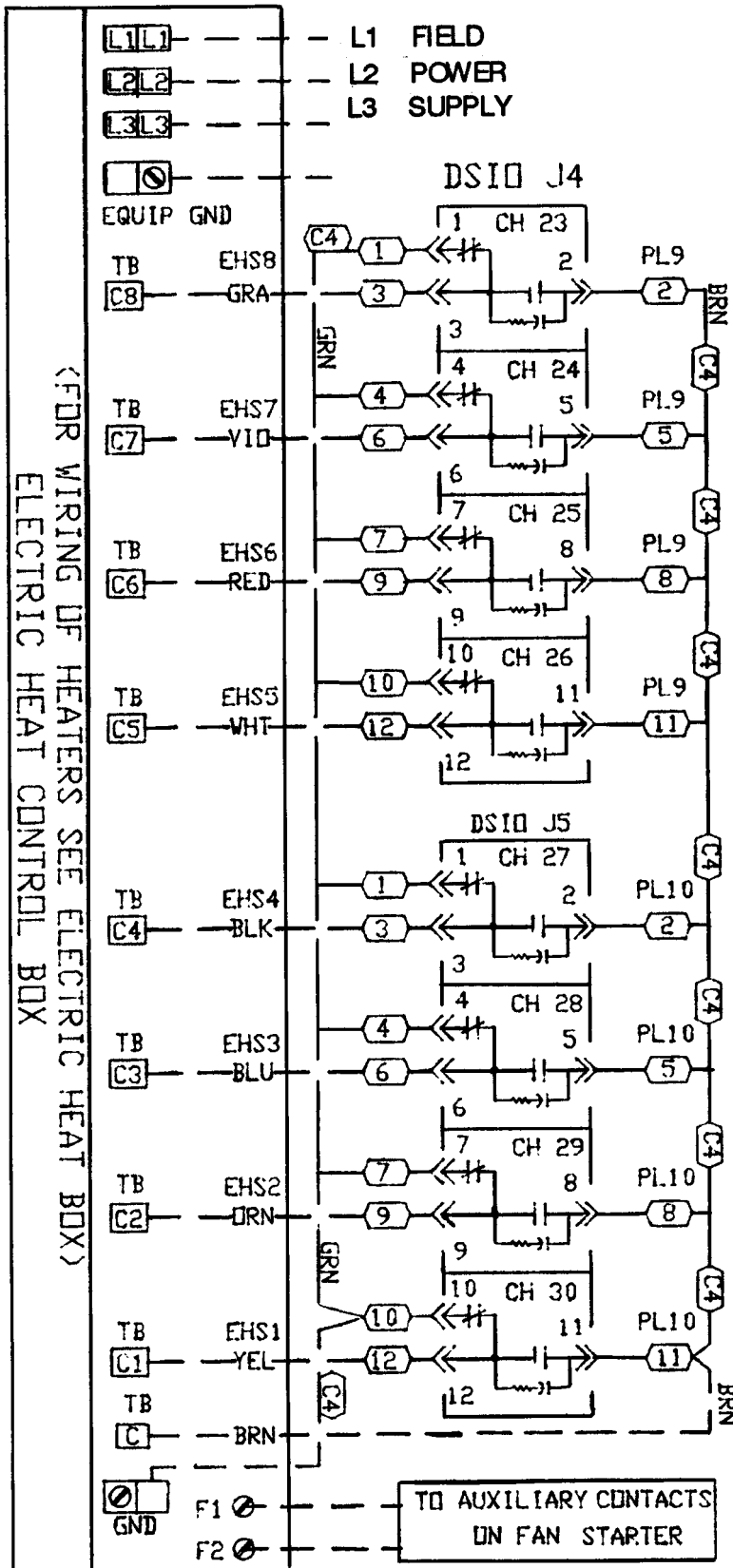
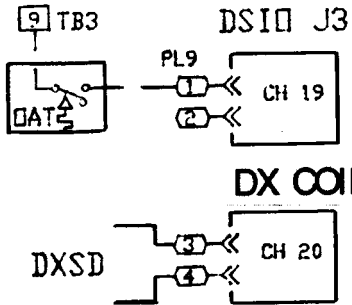


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box (cont)

FIELD-INSTALLED CONNECTIONS

DX COOLING

ADDRESS 19 WITHOUT ELEC. HT.



ADDRESS 49 WITH ELEC. HT.

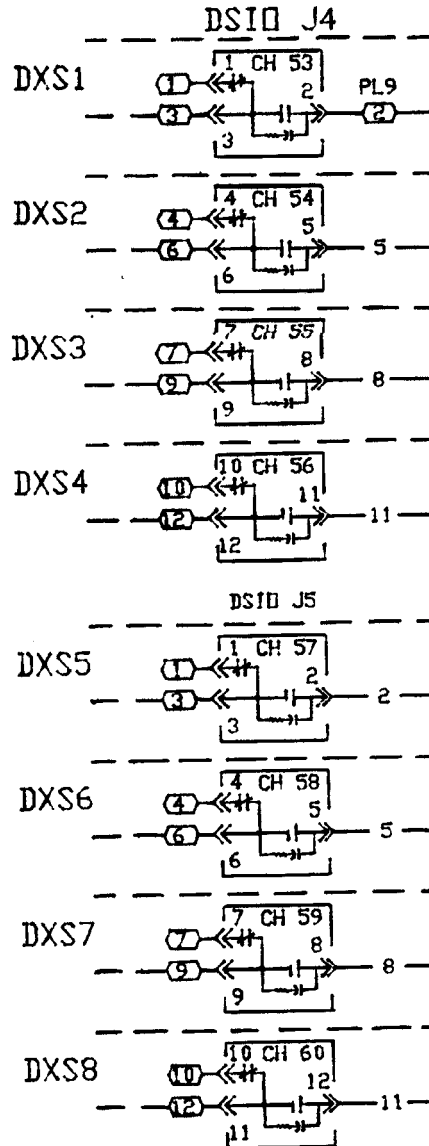
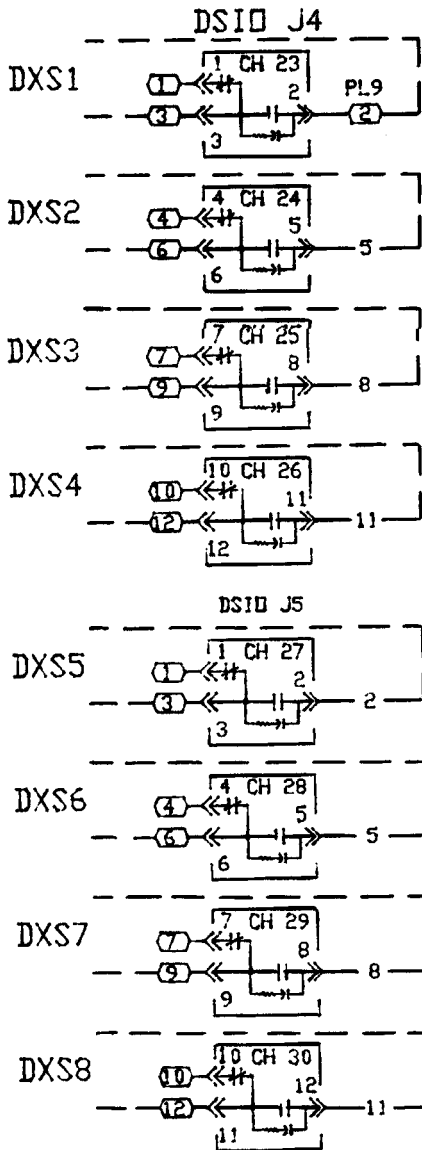
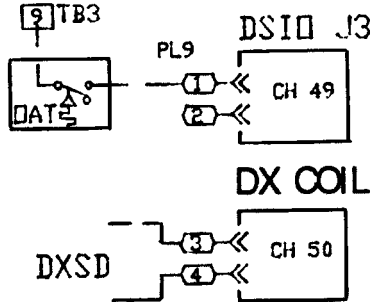


Fig. 12 — Unit Wiring Schematic, 39L and 39NX PIC with Remote Control Box (cont)

Table 2 — Junction Box Connections for Optional Remote Control Box

REMOTE CONTROL BOX LOCATION	CONTROL BOX TERMINAL	FAN SECTION JUNCTION BOX SIGNAL	JUNCTION BOX TERMINAL
MPSIO	2	SAT — BLK	1
MPSIO	3	SAT — RED	2
MPSIO	8	MAT — BLK	3
MPSIO	9	MAT — RED	4
TB3	10	FLTS — BLK	5
MPSIO	28	FLTS — RED	6
TB3	10	LTT — K3	7
MPSIO	13	LTT — K1	8
TB2	19	OAD — BLK	9
TB2	20	OAD — WHT	10
TB2	6	OAD — GRN	11
MPSIO	40	OAD — RED	12
TB2	21	RAD — BLK	13
TB2	22	RAD — WHT	14
TB2	7	RAD — GRN	15
TB2	6	RAD — RED	16
TB2	27	EXD — BLK	17
TB2	28	EXD — WHT	18
TB2	8	EXD — GRN	19
TB2	7	EXD — RED	20
TB2	15	SFAN1 — BLK	21
TB2	16	SFAN1 — WHT	22
MPSIO	38	SFAN1 — GRN	23
MPSIO	37	SFAN1 — RED	24
TB2	17	SFAN2 — BLK	25
TB2	18	SFAN2 — WHT	26
TB2	23	RFAN1 — BLK	27
TB2	24	RFAN1 — WHT	28
SPSIO	38	RFAN1 — GRN	29
SPSIO	37	RFAN1 — RED	30
TB2	25	RFAN2 — BLK	31
TB2	26	RFAN2 — WHT	32
SPSIO	12	PH — BLK	33
SPSIO	11	PH — RED	34

NOTES:

1. Pneumatic tubing to connect the airflow sensor in the fan to the remote control box is bundled with the internal PIC wiring to the junction box, but does not enter the box. Route tube directly to remote control box along with conduit containing wiring from junction box to remote control box.
2. See Legend on page 7.

Variable-Frequency Drives — The input signal for the inverter must be 4 to 20 mA. Use a 2-conductor 20 AWG (American Wire Gage) cable (single twisted pair, unshielded) to connect the input of the inverter to the output of the PIC control terminals. See Fig. 8.

Wire the inverter so that if it is placed in the manual or bypass mode the low temperature thermostat and the high-pressure switch (if supplied) are still in the motor control circuit to protect the unit.

Adjust the minimum inverter speed to provide at least 10% airflow when inlet guide vanes are at 0% (4 mA) and maximum design airflow when inlet guide vanes are at 100% (20 mA). Use the local interface device to verify that the supply fan status (4 STAT) shows the fan is ON and that the supply fan is operating at the lowest airflow adjustment. Increase inverter minimum speed as required. For additional information, see the Quick Test section on page 103.

Water Valve Assemblies — Water valve assemblies (Fig. 13) are shipped inside the fan section for field installation. All valve assemblies have electrically powered actuators. Each actuator has an external junction box for field wiring. The junction box contains 24 vac power wires (WHITE/BLUE, BLACK) and 4 to 20 mA signal wires (+RED, -GREEN). The actuators operate the valve through a linear stroke; if power is lost, a return spring reverses the stroke and returns the valve stem to the normal position.

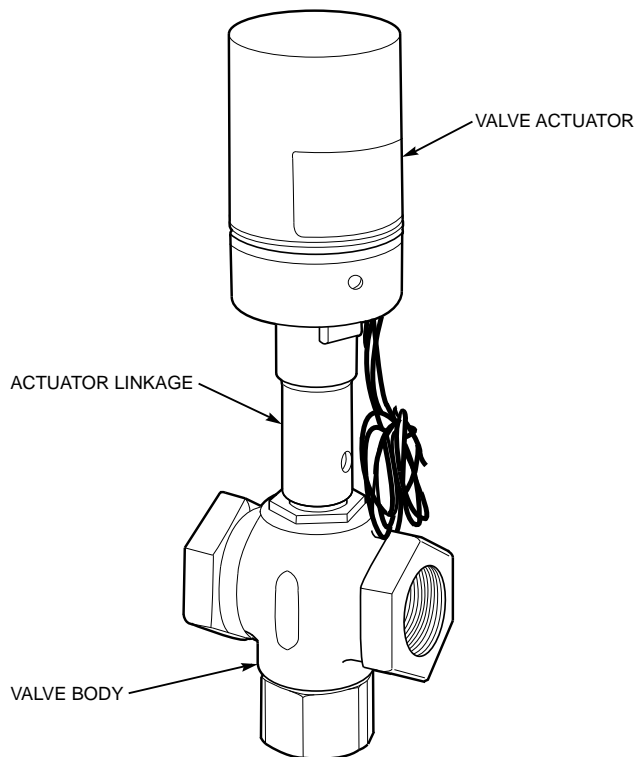


Fig. 13 — Valve Assembly (Typical)

⚠ CAUTION

To prevent electric shock and equipment damage, disconnect the power to the control box before installing valve assemblies. Turn power switch located on control box door to OFF.

On installations where valve mounting space is limited, use unions to couple valve assemblies to water lines. If unions do not provide sufficient clearance, refer to the Valve Troubleshooting section, page 109.

On chilled water applications or hot water applications with 1½ to 3-in. valves, the valve actuators can be mounted in any position above the centerline of the valve body. For steam applications or hot water applications with ½ to 1¼-in. valves that have actuators and high-temperature linkage extensions, mount the actuator above the centerline of the valve body and 45 degrees from vertical. This position helps to prevent actuator exposure to direct heat convection.

⚠ CAUTION

DO NOT install valve assembly where excessive moisture, corrosive fumes, and/or vibration are present.

INSTALL all 2-way valve assemblies so that they close against system flow. An arrow on the valve body indicates the proper flow direction.

ALWAYS install 3-way mixing valve with 2 inlet flows and one outlet. Normal flow will be from port B to port AB with stem up. See Fig. 14.

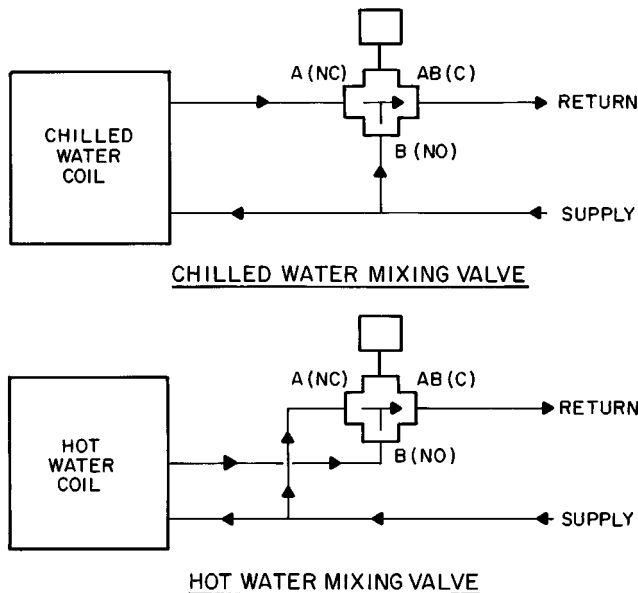


Fig. 14 — Three-Way Mixing Valve — Normal Flow, Typical Piping

⚠ CAUTION

Valves **MUST** be connected to the correct processor module terminal to operate properly. Damage to the actuator may occur if the valve is improperly connected.

Hot Water Valves (Fig. 15) — Using a 4-conductor 20 AWG cable (two twisted pairs, no shield), connect the hot water valve actuator as follows:

1. Using twist-on wire connectors, connect the BLACK and WHITE/BLUE leads inside the actuator junction box to the 24 vac power wires of the cable. Connect the other ends of the power wires to TB2, pins 11 and 12, in the PIC control box.
2. Using twist-on wire connectors, connect the RED (+) and GREEN (-) leads inside the actuator junction box to the other 2 wires in the cable. Note the polarity of each wire.
3. Connect the positive signal wire (connected to the RED lead) to pin 43 on the processor module. Connect the negative signal wire (connected to the GREEN lead) to pin 44 on the processor module.

Chilled Water Valves (Fig. 16) — Using a 4-conductor 20 AWG cable (two twisted pairs, no shield), connect the chilled water valve actuator as follows:

1. Using twist-on wire connectors, connect the BLACK and WHITE/BLUE leads inside the actuator junction box to the 24 vac power wires of the cable. Connect the other ends of the power wires to TB2, pins 9 and 10, in the PIC control box.

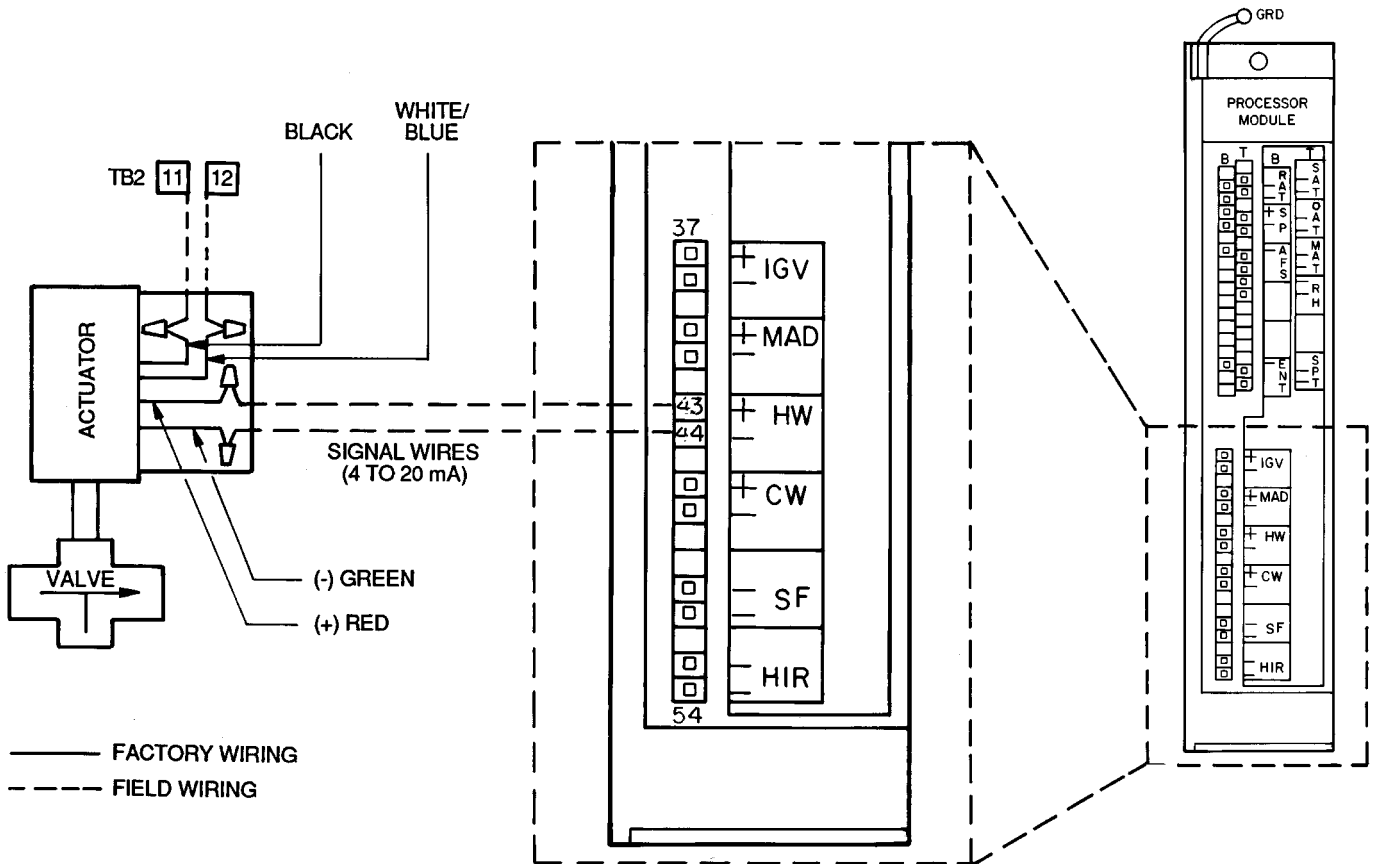
2. Using twist-on wire connectors, connect the RED (+) and GREEN (-) leads inside the actuator junction box to the other 2 wires in the cable. Note the polarity of each wire.
3. Connect the positive signal wire (connected to the RED lead) to pin 46 on the processor module. Connect the negative signal wire (connected to the GREEN lead) to pin 47 on the processor module.

Duct Static Pressure Probe (VAV Units) — The duct static pressure probe is shipped inside the control box.

Select a location in the ductwork where the static pressure will be representative of the static pressure to be monitored and maintained (typically 2/3 of the distance down the duct from the fan). Install the probe with the tip facing the air-flow. See Fig. 17.

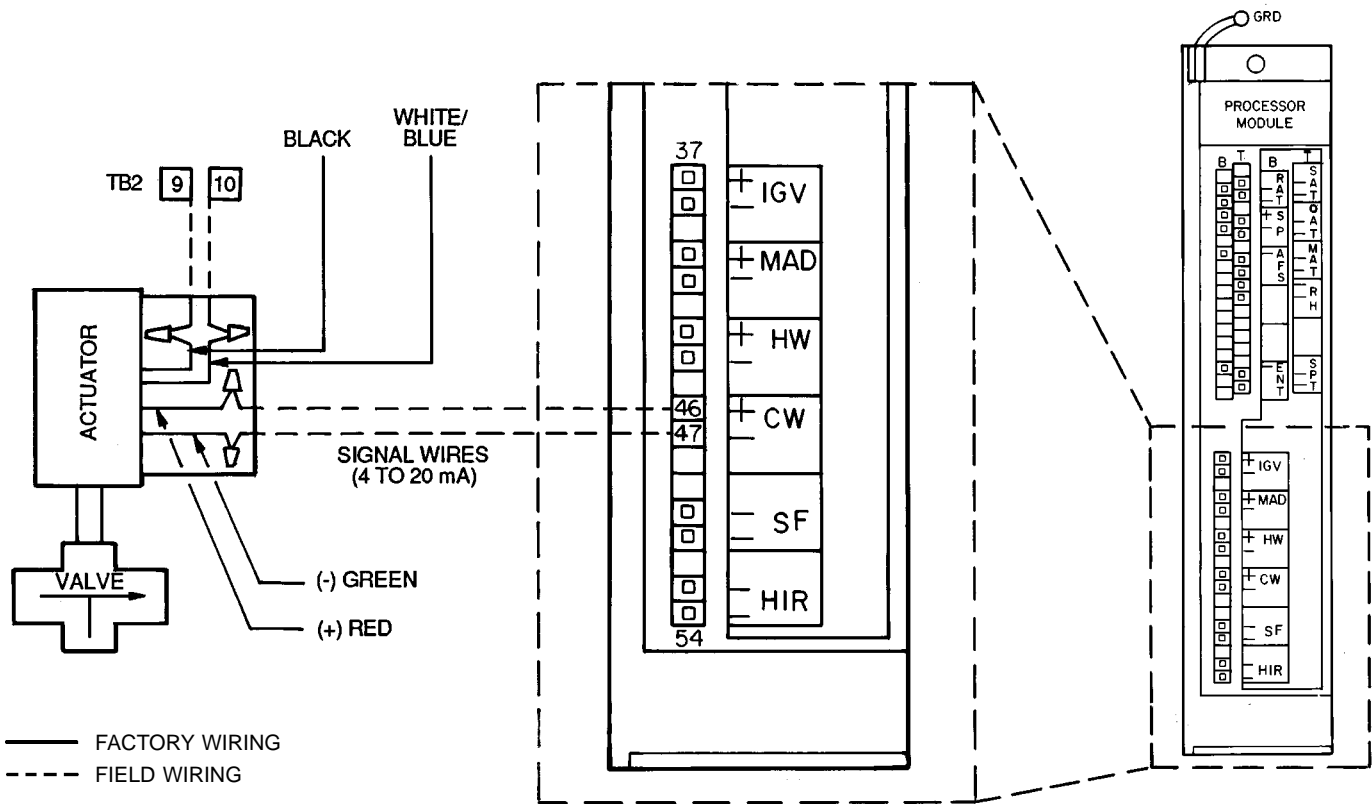
Use 1/4-in. OD approved polyethylene tubing for up to 50 ft (3/8-in. OD for 50 to 100 ft) to connect the probe to the 39L or 39NX unit. Route the tubing back to the mechanical room and connect the tubing to the bulkhead fitting labelled H (HIGH), located on the bottom edge of the 39L control box or top edge of the 39NX control box.

NOTE: If the probe is more than 100 ft from the control box, it is recommended that the static pressure sensor be removed from the control box and mounted remotely. The sensor should be mounted closer to the probe and then rewired to the original connections in the control box.



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 15 — Hot Water Valve Wiring



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 16 — Chilled Water Valve Wiring

Space Temperature Sensor (Fig. 18) — The space temperature sensor (SPT) is packaged and shipped inside the fan section. It is installed on a building interior wall to measure room air temperature.

The wall plate accommodates both the NEMA (National Electrical Manufacturers' Association) standard and the European ¼ DIN (Deutsche Industrie Norm) standard. The use of a junction box to accommodate the wiring is recommended for installation. The sensor can be mounted directly on the wall, if acceptable by local codes.

DO NOT mount the sensor in drafty areas such as near heating or air conditioning ducts, open windows, fans, or over heat sources such as baseboard heaters or radiators. Sensors mounted in these areas produce inaccurate readings.

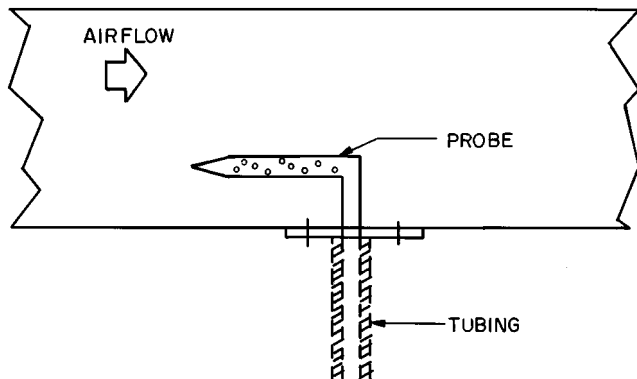


Fig. 17 — Duct Static Pressure Probe

Avoid corner locations. Allow at least 3 ft between the sensor and any corner. Airflow near corners tends to be reduced, resulting in erratic sensor readings.

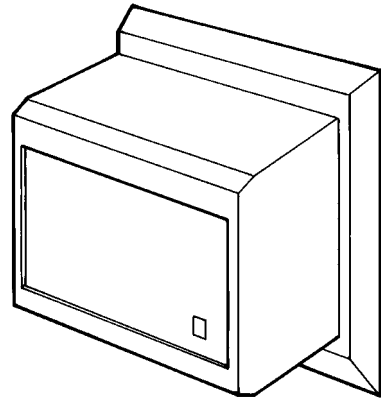
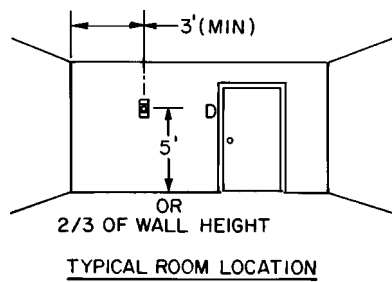
The sensor should be mounted approximately 5 ft up from the floor, in the area representing the average temperature.

Install the sensor as follows:

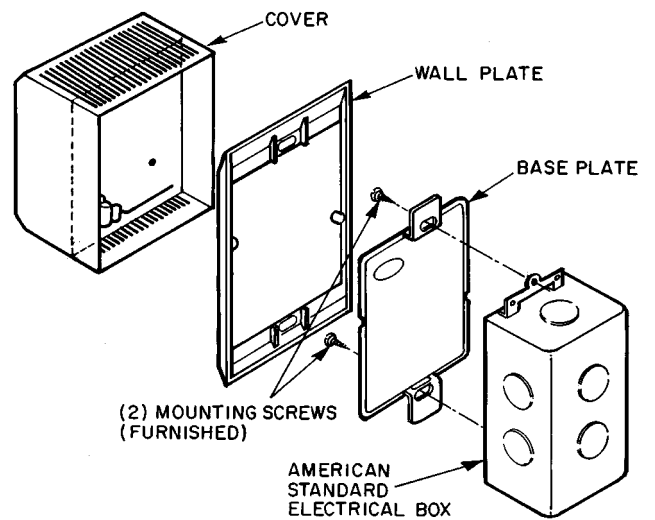
1. Remove sensor cover. Using a small blade screwdriver, insert blade into sensor cover latch slot on bottom of slat. Gently push upward on the screwdriver to release the cover latch. Rotate the cover forward as the screwdriver is removed.
2. Snap off the wall plate from the base assembly.
3. Feed the wires from the electrical box through the sensor base assembly.
4. Using two 6-32 x 5/8-in. flat screws, mount the sensor base assembly to the electrical box.
5. Dress the wires down and inside the perimeter of the sensor base.
6. Attach the wall plate by snapping it onto the sensor base assembly.
7. Replace the cover by inserting the top inside edge of the cover over the tab on top of the sensor base assembly and rotating the cover down. Snap cover on.

Refer to Field Wiring Connections section, page 52 for wiring instructions and details. See Table 3 for Thermistor Resistance vs. Temperature Values.

NOTE: Clean sensor with damp cloth only. Do not use solvents.



SENSOR COVER



NEMA STANDARD ELECTRICAL BOX

NEMA — National Electrical Manufacturers' Association

Fig. 18 — Space Temperature Sensor (P/N HH51BX001)

Table 3 — Thermistor Resistance vs. Temperature Values for Space Temperature Sensor, Return-Air Temperature Sensor, and Supply-Air Temperature Sensor

RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)
173,631.0	-30	38,308.7	22	10,698.1	74	3602.5	126	1409.7	178
168,222.0	-29	37,304.0	23	10,459.4	75	3533.4	127	1386.3	179
162,998.0	-28	36,328.8	24	10,226.8	76	3465.9	128	1363.3	180
157,954.0	-27	35,382.1	25	10,000.0	77	3399.8	129	1340.7	181
153,083.0	-26	34,463.0	26	9,778.9	78	3335.2	130	1318.6	182
148,378.0	-25	33,570.7	27	9,563.4	79	3272.0	131	1296.9	183
143,833.0	-24	32,704.2	28	9,353.1	80	3210.1	132	1275.6	184
139,442.0	-23	31,862.8	29	9,148.2	81	3149.6	133	1254.8	185
135,200.0	-22	31,045.7	30	8,948.4	82	3090.4	134	1234.3	186
131,101.0	-21	30,252.0	31	8,753.5	83	3032.5	135	1214.2	187
127,139.0	-20	29,481.1	32	8,563.4	84	2975.8	136	1194.5	188
123,310.0	-19	28,732.2	33	8,378.0	85	2920.3	137	1175.1	189
119,609.0	-18	28,004.6	34	8,197.1	86	2866.0	138	1156.1	190
116,031.0	-17	27,297.7	35	8,020.7	87	2812.9	139	1137.5	191
112,571.0	-16	26,610.8	36	7,848.6	88	2760.9	140	1119.2	192
109,226.0	-15	25,943.4	37	7,680.6	89	2710.0	141	1101.3	193
105,992.0	-14	25,294.7	38	7,516.8	90	2660.2	142	1083.7	194
102,863.0	-13	24,664.2	39	7,356.9	91	2611.4	143	1066.4	195
99,837.3	-12	24,051.4	40	7,200.9	92	2563.7	144	1049.4	196
96,910.2	-11	23,455.6	41	7,048.6	93	2516.9	145	1032.8	197
94,078.4	-10	22,876.5	42	6,900.0	94	2471.2	146	1016.5	198
91,338.6	-9	22,313.4	43	6,755.0	95	2426.4	147	1000.4	199
88,687.3	-8	21,765.9	44	6,613.4	96	2382.5	148	984.7	200
86,121.6	-7	21,233.5	45	6,475.2	97	2339.5	149	969.2	201
83,638.4	-6	20,715.7	46	6,340.3	98	2297.5	150	954.0	202
81,234.8	-5	20,212.2	47	6,208.5	99	2256.3	151	939.1	203
78,908.0	-4	19,722.4	48	6,079.9	100	2215.9	152	924.5	204
76,655.3	-3	19,245.9	49	5,954.3	101	2176.4	153	910.1	205
74,474.2	-2	18,782.4	50	5,831.7	102	2137.7	154	896.0	206
72,362.1	-1	18,331.5	51	5,712.0	103	2099.8	155	882.2	207
70,316.7	0	17,892.8	52	5,595.0	104	2062.6	156	868.6	208
68,335.6	1	17,465.9	53	5,480.8	105	2026.3	157	855.2	209
66,416.7	2	17,050.4	54	5,369.2	106	1990.6	158	842.1	210
64,557.9	3	16,646.1	55	5,260.2	107	1955.7	159	829.2	211
62,756.9	4	16,252.6	56	5,153.7	108	1921.5	160	816.6	212
61,012.0	5	15,869.6	57	5,049.7	109	1887.9	161	804.1	213
59,321.1	6	15,496.8	58	4,948.1	110	1855.1	162	791.9	214
57,682.4	7	15,133.8	59	4,848.8	111	1822.9	163	779.9	215
56,094.3	8	14,780.4	60	4,751.8	112	1791.3	164	768.2	216
54,554.9	9	14,436.4	61	4,657.0	113	1760.4	165	756.6	217
53,062.2	10	14,101.3	62	4,564.4	114	1730.1	166	745.2	218
51,615.9	11	13,775.1	63	4,473.8	115	1700.4	167	734.0	219
50,213.1	12	13,457.3	64	4,385.3	116	1671.3	168	723.1	220
48,853.0	13	13,147.9	65	4,298.9	117	1642.7	169	712.3	221
47,533.9	14	12,846.4	66	4,214.3	118	1614.7	170	701.7	222
46,254.7	15	12,552.8	67	4,131.7	119	1587.3	171	691.3	223
45,013.9	16	12,266.8	68	4,050.9	120	1560.4	172	681.0	224
43,810.3	17	11,988.1	69	3,971.9	121	1534.1	173	671.0	225
42,642.6	18	11,716.6	70	3,894.6	122	1508.2	174	661.1	226
41,509.8	19	11,452.0	71	3,819.1	123	1482.9	175	651.4	227
40,410.5	20	11,194.2	72	3,745.3	124	1458.0	176	641.8	228
39,343.9	21	10,943.0	73	3,673.1	125	1433.6	177	632.4	229

Outdoor-Air Temperature Sensor (Fig. 19) —

The outdoor-air temperature (OAT) sensor is shipped inside the fan section. The OAT sensor continuously monitors the temperature of the air outside the building. The integral shield prevents ice formation on the sensor conductors. A field-supplied conduit junction box is required for installation. See Fig. 20.

Position the OAT sensor so that it accurately senses only the outdoor-air temperature. The sensor must be located upstream from outside air dampers and located where it is unaffected by interior and duct temperatures. During the unoccupied (fan off) period the sensor's location should have a minimal effect on its readings.

Do not mount the sensor in direct sunlight. Inaccurate readings may result. It may be necessary to field-fabricate a shield to protect the sensor from direct sunlight.

Do not mount the sensor near the exhaust from air-handling units or compressors, or near leakage drafts of indoor air, or near shrubbery or trees. Inaccurate readings may result. Do not mount under direct water runoff. Water may freeze around the sensor in winter and produce a false reading.

If sensor wire is shielded, strip back the sensor shield and tape it to prevent contact.

Position the sensor with the slotted end pointed downward.

The field-supplied junction box housing must be threaded to screw onto a male ½-in. NPT electrical metal tubing (EMT) conduit adaptor. The assembled box and sensor must be mounted parallel to the building wall. See Fig. 20. The sensor can also be installed on a roof or other location.

For distances up to 500 ft, use 2-conductor 20 AWG cable to connect the sensor to the PIC terminals. Refer to the Field Wiring Connections section, page 52 for further wiring instructions. See Table 4 for thermistor resistance according to temperature value.

Table 4 — Thermistor Resistance vs Temperature Values for Outdoor-Air Temperature Sensor

RESISTANCE (Ohms)	TEMPERATURE (F)	RESISTANCE (Ohms)	TEMPERATURE (F)
168,250	-40	5,000.0	77
121,350	-31	4,028.5	86
88,500	-22	3,265.0	95
65,200	-13	2,663.3	104
48,535	-4	2,185.0	113
36,476	5	1,801.5	122
27,665	14	1,493.0	131
21,165	23	1,244.0	140
16,325	32	1,041.5	149
12,695	41	876.0	158
9,950	50	739.5	167
6,245	68	627.5	176

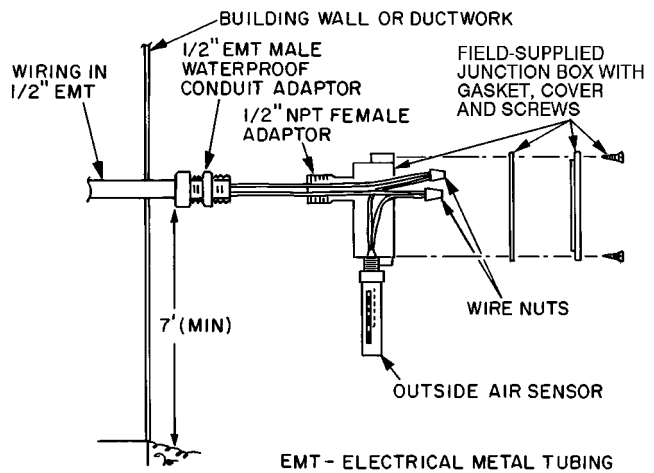


Fig. 20 — Outdoor-Air Temperature Sensor Installation

Mixed-Air Temperature Sensor — The optional mixed-air temperature sensor (MAT) is factory wired and installed on all units with a factory-installed mixing box (MXB), filter mixing box (FMB), or air blender (AMX). On units without an AMX, MXB, or FMB, the optional MAT is packaged and shipped inside the fan section for field installation.

The field-installed MAT should be mounted downstream of the return air duct and filters, but as close as possible to the 39L or 39NX unit.

CAUTION

AVOID repeated bending of copper tubing, as this will place stress on the sensor element and lead to eventual breakage.

DO NOT fold or crimp copper tubing.

USE CARE in forming and securing the element.

STRIP back and tape the shield in order to prevent contact.

Mount field-installed MAT as follows (Fig. 21):

1. Punch a 1-in. diameter hole in the duct and feed the sensor element through the hole. Mount the utility box on the outside of the duct.
2. Bend the copper tubing surrounding the sensor element to conform to the area of the duct. Do not bend it to less than 2½ in. diameter on any turn. The sensor element should be evenly distributed over the entire cross-sectional area of the duct.
Existing support structures may be used for the sensor element, as long as there is no metal-to-metal contact with the copper tubing, and the mounting does not interfere with other functions.
3. Use a field-supplied plastic spacer, clamp, and screws to secure the sensor in the airstream. See Detail A, Fig. 21.
4. Using 2-conductor 20 AWG plenum-rated cable, connect the sensor to the PIC control box terminals.

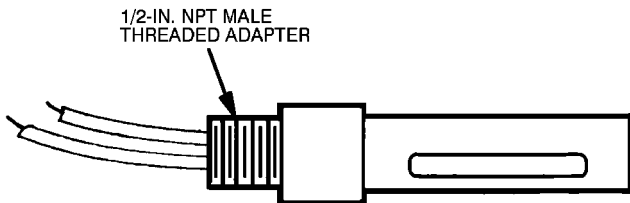


Fig. 19 — Outdoor-Air Temperature Sensor (P/N HH79NZ023)

NOTE: This sensor uses a resistance temperature device (RTD) element. Polarity is not a consideration.

When space does not allow working inside the duct, mount as follows (Fig. 22):

1. Open a duct penetration on the opposite side of the sensor junction box.
2. Wrap the element around a 3/4-in. PVC pipe, cut holes near the center of the duct on both sides and feed the pipe with sensor element through the hole.
3. Secure the seal around the PVC pipe.

NOTE: If local codes do not permit the use of PVC, use EMT instead.

Refer to Field Wiring Connections section, page 52 for wiring instructions and details. See Table 5 for RTD resistance vs temperature values.

Table 5 — RTD Resistance vs Temperature Values for Mixed-Air Temperature Sensor

RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)	RESISTANCE (Ohms)	TEMP (F)
693	-40	940	50	1223	140
719	-30	970	60	1257	150
745	-20	1000	70	1290	160
772	-10	1031	80	1325	170
799	0	1062	90	1360	180
827	10	1093	100	1395	190
854	20	1125	110	1430	200
883	30	1157	120	—	—
912	40	1190	130	—	—

Enthalpy Switch (Fig. 23) — The enthalpy switch and mounting template are located in a box shipped inside the fan section.

The enthalpy switch is normally mounted in a horizontal position with the sensing element exposed to freely circulating outdoor air.

CAUTION

DO NOT install enthalpy switch in locations where excessive moisture, corrosive fumes, and/or vibration are present.

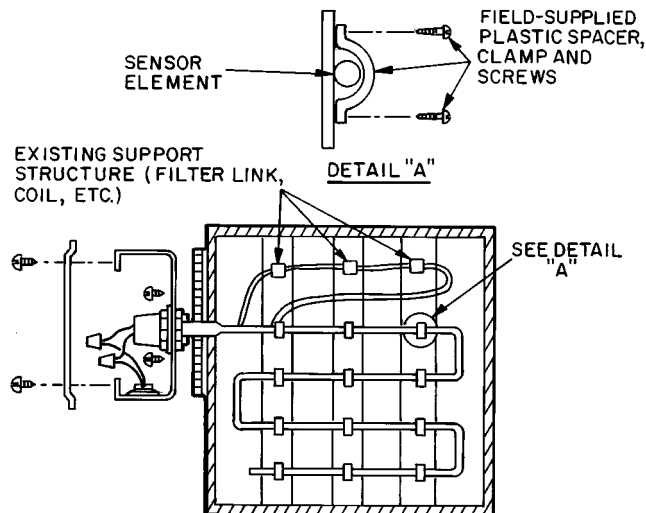


Fig. 21 — Mixed-Air Temperature Sensor (P/N HH79NZ021) Installation

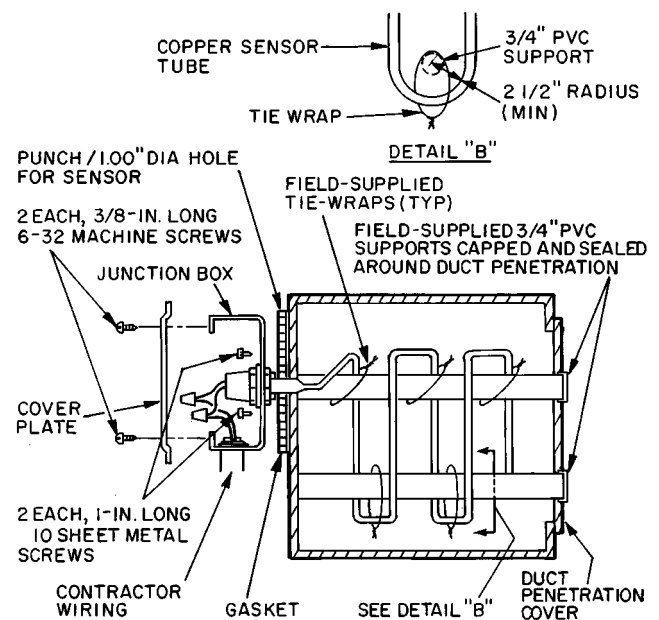


Fig. 22 — Alternate Mixed-Air Temperature Sensor Installation

Mount the switch as follows:

1. Position mounting template on duct. Remove adhesive backing and press template onto outside air duct.
2. Drill four 1/8-in. mounting holes as indicated on the template.
3. Cut out center portion of duct as outlined on template.
4. Mount controller to duct using screws provided.

If no outside air duct is present, mount the enthalpy switch on a field-supplied and installed plate upstream of the outside air damper.

Connect the red and blue wires of the enthalpy switch to the PIC control box terminals. Refer to Field Wiring Connections section, page 52 for further details.

CONTROL RANGES — See Fig. 24 for control settings and intermediate settings.

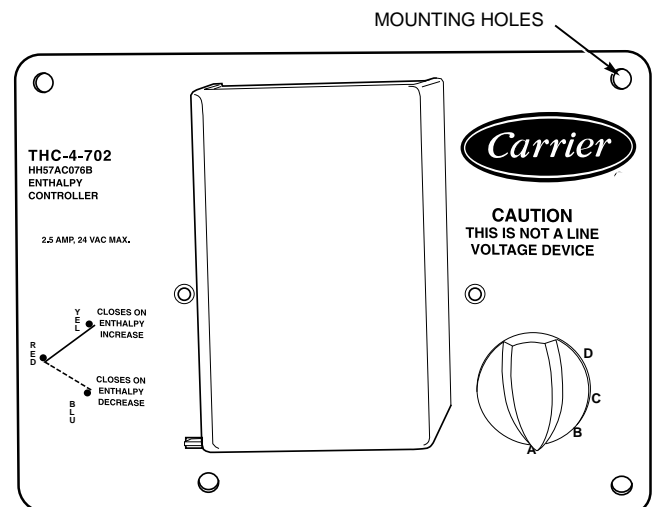
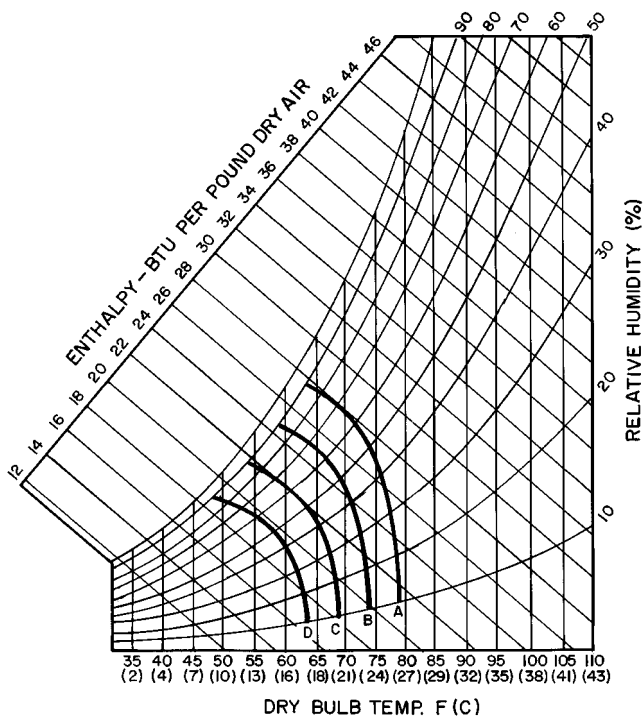


Fig. 23 — Enthalpy Switch (P/N HH57AC076)



CONTROL SETTINGS

DIAL SETTING	RELATIVE HUMIDITY (%)			CONTROL CURVE
	20	50	80	
A	78 F (26 C)	73 F (23 C)	68 F (20 C)	A
B	73 F (23 C)	68 F (20 C)	63 F (17 C)	B
C	68 F (20 C)	63 F (17 C)	59 F (15 C)	C
D	62 F (17 C)	58 F (14 C)	53 F (12 C)	D

Fig. 24 — Enthalpy Control Settings

Supply-Air Temperature Sensor (Fig. 25) — The supply-air temperature sensor (SAT) measures the temperature of the air as it leaves the supply fan. The sensor is factory-installed on the fan scroll.

Return-Air Temperature Sensor (Fig. 25) — The return-air temperature sensor (RAT) is shipped inside the fan section. It measures the temperature in the return air duct. Mount the sensor in the middle of the return air duct approximately 4 to 5 ft from the return air damper. The sensor's probe tip must be within a straight length of duct.

Mount the sensor as follows:

1. Remove the cover of the sensor junction box.
2. Drill or punch a $\frac{5}{16}$ -in. hole on the centerline of the return air duct as indicated in Fig. 26.
3. Drill or punch 2 holes through the sensor gasket into the fan scroll.

4. Remove the adhesive backing from the gasket; attach the gasket to the outside of the junction box, aligning the holes in the gasket with the holes in the box.
5. Attach the junction box to the duct with the 2 screws provided.
6. Insert the probe assembly through the compression fitting and into the duct. Tighten screws one half-turn past finger tight. *Do not overtighten.*

For distances up to 500 ft, use 2-conductor 20 AWG cable to connect the sensor to the PIC control box terminals. Refer to Field Wiring Connections section, page 32 for further details. See Table 3 for thermistor resistance vs. temperature values.

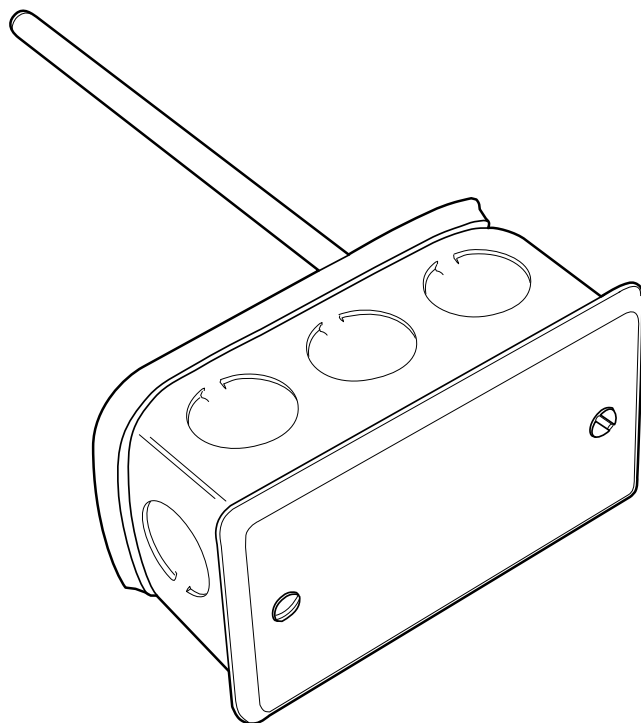


Fig. 25 — Supply/Return Air Temperature Sensor (P/N HH79NZ019)

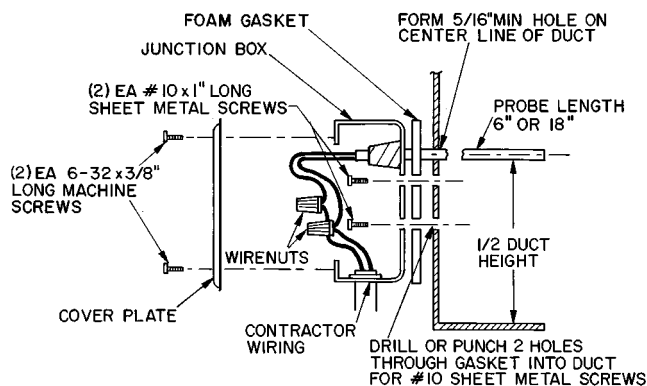


Fig. 26 — Return-Air Temperature Sensor Installation

Heat Interlock Relay (Fig. 27) — The heat interlock relay (HIR) is factory wired and installed on VAV units only. It is a single-pole, double-throw (SPDT) relay that provides normally-open and normally-closed contacts to interface with air terminal units. It allows the air terminals to open when the PIC unit goes into the heating mode. The contacts are silver cadmium oxide and are rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

The contact terminations are no. 6 screw terminals.

NOTE: The HIR is not used in digital air volume control (DAV) applications.

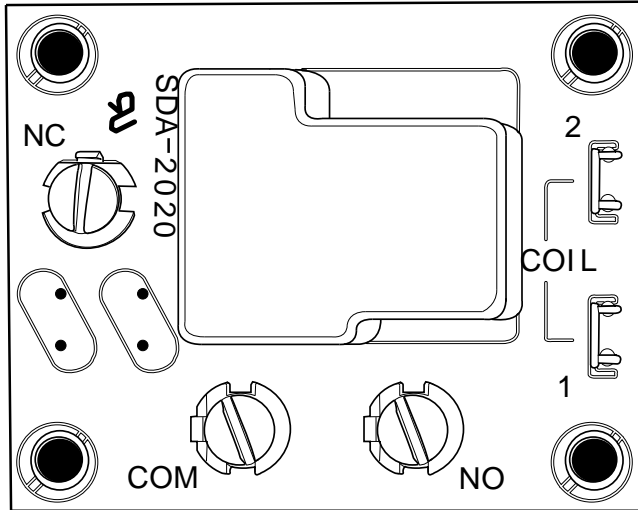


Fig. 27 — Relay (P/N HK35AB001)

Fan Relay — The fan relay is factory wired and installed on all 39L and 39NX units. It is a SPST relay that provides a normally-open contact. The relay interfaces with the motor starter circuit and automatically starts/stops the fan when the HOA switch is in the AUTO mode. The contacts are silver cadmium oxide and are rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

The contact terminations are factory wired to TB1.

Duct High Humidity Switch (Fig. 28) — The duct high humidity switch (DHH) is shipped inside the fan section. It is used as a safety input when the humidity control options have been ordered. The DHH adjustment knob provides settings from 15 to 95% humidity.

Locate the DHH control element in the duct, downstream of the humidifier. Adjust the DHH to the ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) recommended maximum setting of 80%. Settings higher than 80% are not recommended.

The DHH is normally mounted in a horizontal position on the outside surface of the duct with the sensing element exposed to freely circulating air.

⚠ CAUTION

DO NOT install the duct high humidity switch in locations where excessive moisture, corrosive fumes, and/or vibration are present. Be sure to allow minimum dimensions from the elbows or junctions as indicated in Fig. 29.

Mount the DHH as follows:

1. Position the mounting template on the duct. Remove adhesive backing and press template onto duct.
2. Drill four 1/8-in. mounting holes as indicated on the template.
3. Cut out center portion of duct as outlined on template.
4. Mount DHH to duct using screws provided.

For distances up to 500 ft, use 2-conductor 20 AWG cable to connect the switch to the PIC control box terminals. Refer to Field Wiring Connections section, page 52 for further details.

The DHH adjustment knob provides settings from 15 to 95% relative humidity. The scale range is marked on the face of the switch. The high humidity set point should be at least 65%.

NOTE: The duct high humidity switch has a relative humidity differential of 5%.

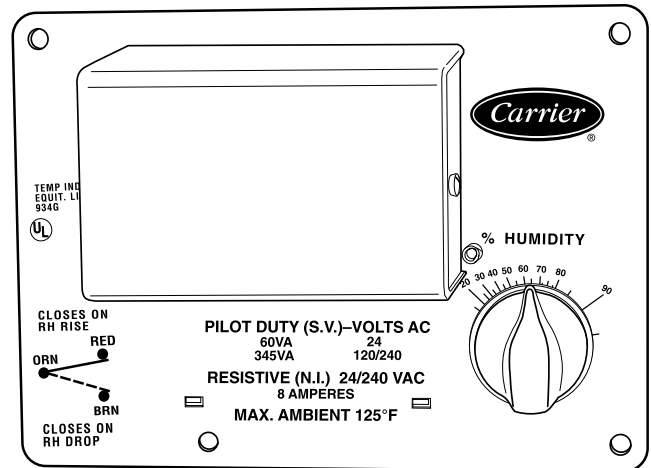


Fig. 28 — Duct High Humidity Switch (P/N HL38ZG024)

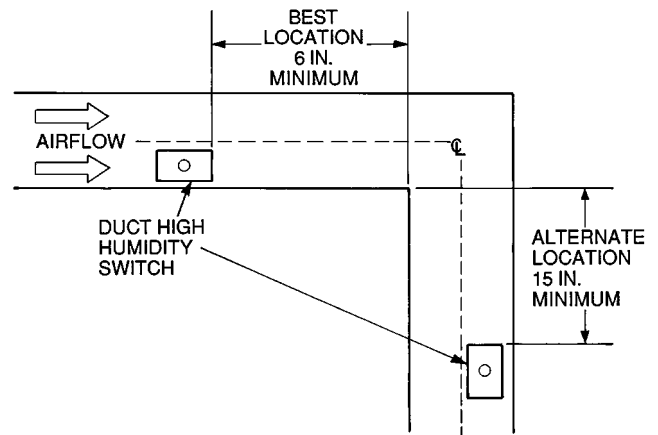


Fig. 29 — Duct High Humidity Switch Locations

Wall-Mounted Relative Humidity Sensor (Fig. 30)

— The wall-mounted relative humidity sensor is packaged and shipped inside the fan section. It is installed on interior walls to measure the relative humidity of the air within the occupied space.

The use of a junction box to accommodate the wiring is recommended for installation. The sensor may be mounted directly on the wall, if acceptable by local codes.

DO NOT mount the sensor in drafty areas such as near heating or air conditioning ducts, open windows, fans, or over heat sources such as baseboard heaters or radiators. Sensors mounted in those areas will produce inaccurate readings.

Avoid corner locations. Allow at least 3 ft between the sensor and any corner. Airflow near corners tends to be reduced, resulting in erratic sensor readings.

Sensor should be vertically mounted approximately 5 ft up from the floor, beside the space temperature sensor.

Install the sensor using 2 screws and 2 hollow wall anchors (if required); *do not overtighten screws*. See Fig. 31. Sensor must be mounted with terminals ACIN and OUT+ located at the top of the sensor as shown in Fig. 32.

For distances up to 500 ft, use 4-conductor 20 AWG cable (2 twisted pairs, no shield) to connect the sensor to the PIC control box terminals and power supply. Refer to Field Wiring Connections section, page 52 for wiring instructions and details.

The PIC controller has a space relative humidity default set point of 40%.

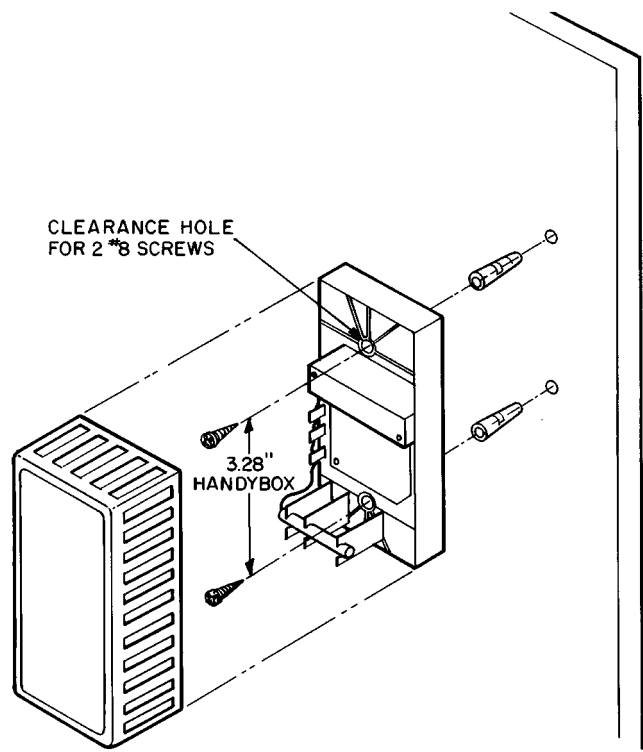


Fig. 31 — Wall-Mounted Relative Humidity Sensor Installation

⚠ CAUTION

Never attempt to clean or touch the sensing element with chemical solvents, as permanent damage to the sensor will occur.

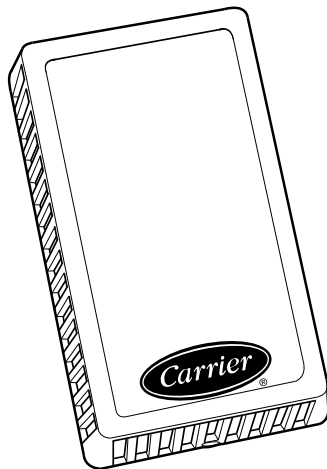


Fig. 30 — Wall-Mounted Relative Humidity Sensor (P/N HL39ZZ001)

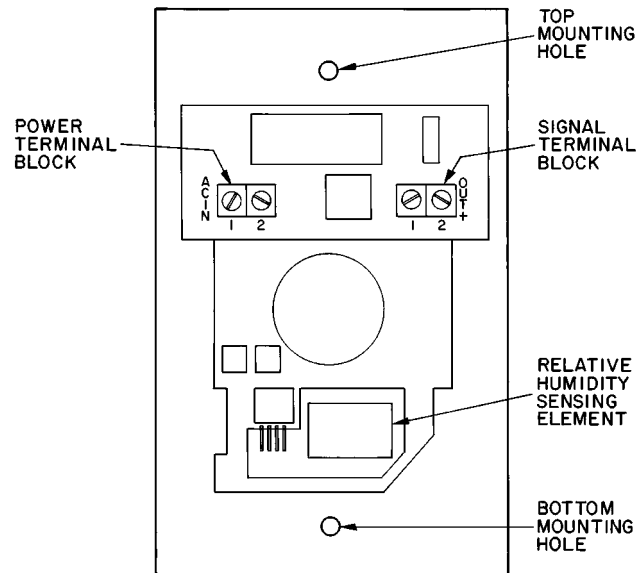


Fig. 32 — Wall-Mounted Relative Humidity Sensor Positioning

Duct-Mounted Relative Humidity Sensor — The duct-mounted relative humidity sensor and mounting template are packaged and shipped inside the fan section. The sensor is installed in either the return air ductwork or in the outside air ductwork. If 2 relative humidity sensors are ordered for differential enthalpy control, then the sensors must be installed in both the return air and outside air ducts. If the sensor is used for control of a humidifier, install the sensor in the return air duct.

The PIC controller has a return air relative humidity default set point of 40%.

LOCATION FOR OUTSIDE AIR RELATIVE HUMIDITY — Locate the sensor where it accurately measures outdoor conditions, yet is protected from the elements. During the unoccupied (fan off) period, the sensor's location should have a minimal effect on its readings.

LOCATION FOR RETURN AIR RELATIVE HUMIDITY — Locate the sensor at least 6 in. upstream or 15 in. downstream of a 90 degree turn in the ductwork. The best location is 15 in. downstream of the 90 degree turn of the duct. The probe should be mounted in the center of the duct. See Fig. 33.

Mount the relative humidity sensor (Fig. 34) as follows.

1. Position mounting template on duct.
2. Drill four 1/8-in. mounting holes as indicated on the template.
3. Punch a 1 1/8-in. hole as indicated on the mounting template.
4. Mount sensor to duct using four no. 8 screws. Install 9-in. sensor probe into the 1 1/8-in. hole.

CAUTION

Never attempt to clean or touch the sensing element with chemical solvents, as permanent damage to the sensor will occur.

Mixing Box Linkage — On units with mixing box (MXB) or filter mixing box (FMB), the actuator and linkage are factory installed. The actuator is directly linked to the outdoor-air damper and holds the damper closed. No adjustment is necessary.

For shipping purposes, the secondary linkage rod connecting the outdoor-air and return-air dampers is factory set for a closed return-air damper.

Adjust the secondary linkage as follows:

1. Open the door of the MXB or FMB to access the return air damper crankarm.

NOTE: On MXB/FMB with top outdoor-air damper, it may be necessary to remove the vertical panel holding the return-air damper to access the return-air damper crankarm.
2. Loosen the setscrew on the return-air damper crankarm.
3. Move the damper to its full open position.
4. Secure the setscrew on the return-air damper crankarm.
5. Close the MXB or FMB access door.

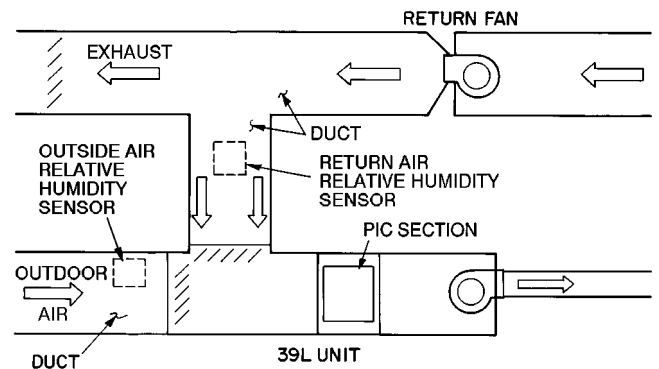


Fig. 33 — Duct-Mounted Relative Humidity Sensor Locations

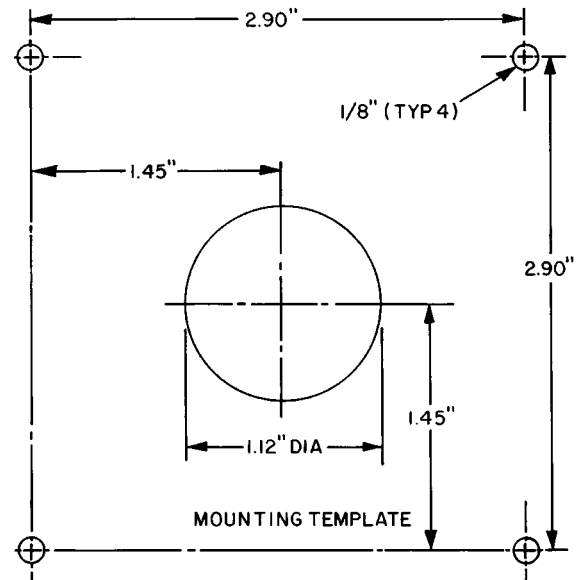
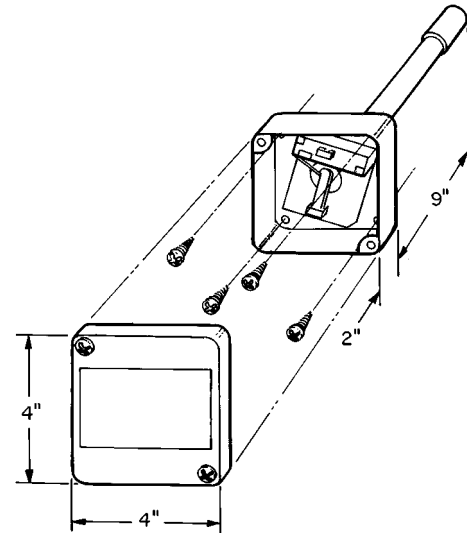
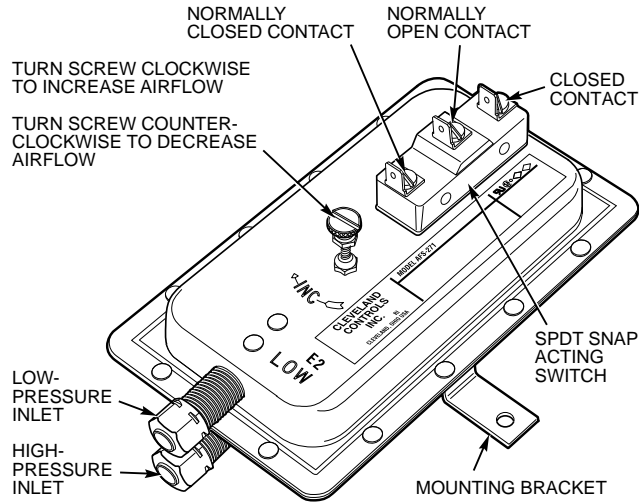


Fig. 34 — Duct-Mounted Relative Humidity Sensor (P/N HL39ZZ002) Installation

Airflow Switch — The airflow switch (AFS) is a snap-acting SPDT switch that is factory installed in the PIC control box. It senses the air supplied by the 39L or 39NX unit and provides the microprocessor module with a 24 vac discrete signal for fan status. See Fig. 35.

A length of plenum tubing connects the switch to the probe located on the fan side plate.

The airflow switch range is 0.05 to 2.0 in. wg with a dead-band of 0.02 in. wg at minimum set point and 0.1 in. wg at maximum set point.



SPDT — Single-Pole, Double Throw

Fig. 35 — Airflow Switch (P/N HK06WC030)

Low-Temperature Thermostat (Fig. 36) — The optional low-temperature thermostat (LTT) is factory wired and installed. It is used to protect the chilled water coil from freezing whenever abnormally cold air passes through the coil.

The LTT consists of a 20-ft capillary tube that is serpentine in the airstream on the entering side of the chilled water coil. It has a range of 34 to 60 F and is factory set at 35 F.

The LTT is wired in series with the motor starter fan relay. If any 1-ft section of the capillary tube senses cold air at or below the thermostat setting, the fan shuts down. A manual reset is provided to restart the fan after the abnormal problem is fixed. The temperature setting is field-adjustable.

To adjust the temperature set point, turn the adjustment screw (located on the top of the case) until the position indicator is at the desired temperature. (A clockwise rotation increases the set point.)

CAUTION

DO NOT set low-temperature thermostat below 35 F. Damage to freezestat may result.

If the temperature exceeds the set point by 5 F or more, the reset button will restore the circuit.

Outdoor-Air Thermostat (Fig. 37) — Also called the condensing unit status (CUST) switch, the outdoor air thermostat is a temperature-actuated switch used in systems with direct-expansion cooling. The thermostat is field-installed in the outdoor condensing unit to prevent the system from operating when the outdoor-air temperature is lower

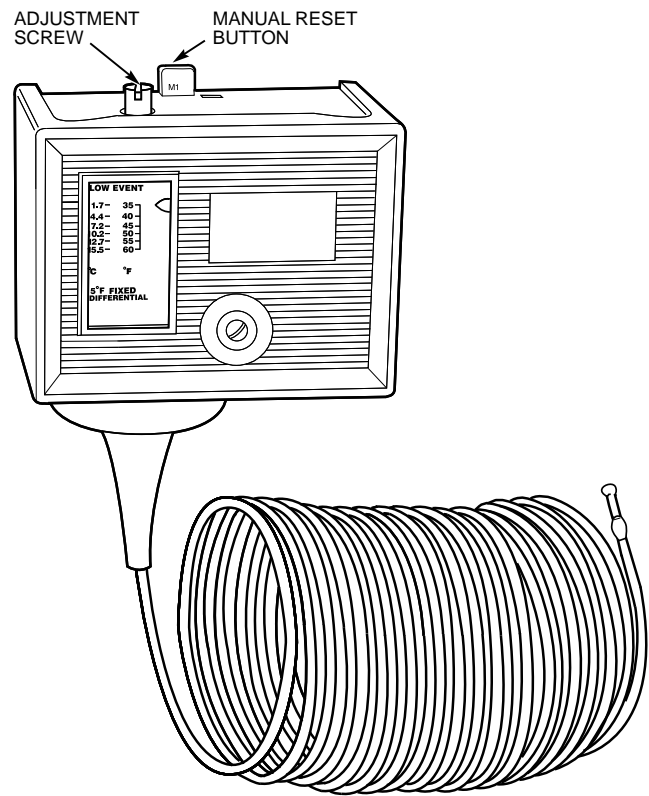


Fig. 36 — Low-Temperature Thermostat (P/N HH22CZ001)

than the condensing unit's minimum temperature. When installed, the thermostat must be set to the minimum operating temperature of the condensing unit. If the condensing unit has an optional low-ambient control (Motormaster® device), an outdoor-air thermostat is not required.

The outdoor-air thermostat is an SPST switch; the contacts open on temperature rise and the set point is adjustable from 45 to 75 F (7.2 to 23.9 C). To increase the set point, turn the indicator clockwise. See Fig. 37 for thermostat set point adjustment and mounting hole locations. Thermostat should be mounted inside condensing unit control box where it can sense the outdoor air temperature but is protected from rain and snow.

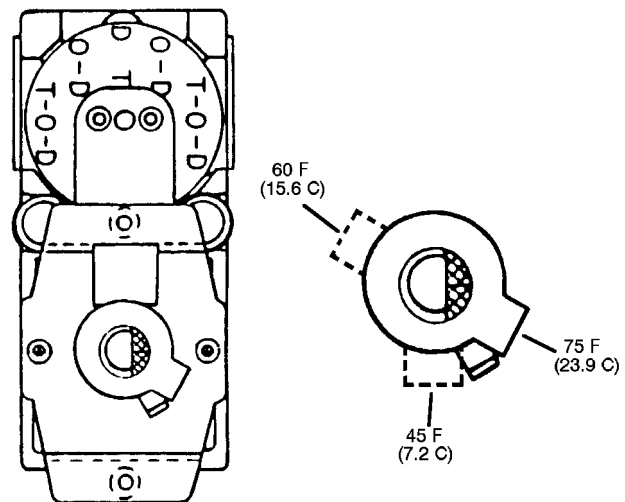


Fig. 37 — Outdoor-Air Thermostat (Condensing Unit Status Switch)

Filter Status Switch — The filter status switch (FLTS) is factory-installed in the filter section on all PIC-equipped units. The switch is a snap-acting SPDT switch. When dirty filter elements cause the pressure drop across the filter media to exceed the switch setting, the switch closes and sends an alarm signal to the PIC.

The 39L units use a single switch. In 39NX units, up to 3 switches can be connected in parallel. When the switches are wired in parallel, it is not possible to isolate an alarm signal to a single switch.

The FLTS has an operating range of 0.05 to 2.0 in. wg. Factory settings for the switch are as follows:

Filter Type	Setting (in. wg)
Flat	0.5
Bag/Cartridge	1.0
Final	1.5

The FLTS electrical ratings are as follows:

300 va pilot duty at 115 to 277 vac
 10 amps non-inductive to 277 vac
 Rated for NO (normally open) and NC (normally closed) contacts.

High-Pressure Switch (Fig. 38) — The high-pressure switch (HPS) is factory installed in the PIC control box on VAV units only. It is a snap-acting SPDT switch with manual reset that is used to shut down the supply fan whenever the duct pressure reaches the switch setting. The manual reset is used to restart the fan after the problem has been corrected.

The switch is factory set at 3.0 in. wg. It has a range of 1.4 to 5.5 in. wg and can be field adjusted for specific applications.

Adjust the high-pressure switch setting as follows:

1. Loosen conduit enclosure retaining screw, pull firmly on the bottom end and snap off cover.
2. Raise set point by turning slotted adjustment screw (located at top of range spring housing) clockwise. Turn adjustment screw counterclockwise to lower set point.

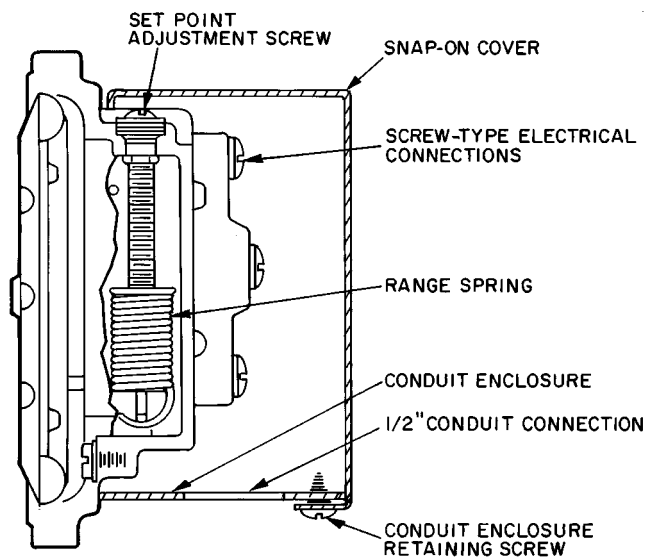


Fig. 38 — High-Pressure Switch (P/N HH02WC001)

3. To change or check calibration, use a T assembly with 3 rubber tubing leads. Attach one lead to the HPS and another to an accurate manometer with the appropriate range. Apply pressure through the third lead and approach set point slowly.
4. Adjust set point to at least 0.5 in. wg greater than configured static pressure set point.

Air Quality Sensors (Fig. 39) — The air quality (AQ) sensors are shipped inside the fan section for field installation. Two types of sensors are supplied; one sensor monitors the conditioned air space, and the other sensor monitors the return air duct. Both sensors use infrared technology to detect the levels of CO₂ present in the air.

Sensor descriptions and part numbers are shown in Table 6. To mount the sensor, refer to the installation instructions shipped with the sensor.

Table 6 — CO₂ Sensor Accessories

CO ₂ SENSOR ACCESSORY PART NUMBERS	DESCRIPTION
CGCDXSEN001A00	Wall Mount Sensor (No Display)
CGCDXSEN002A00	Wall Mount Sensor with Display
CGCDXSEN003A00	Duct Mount Sensor (No Display)
CGCDXGAS001A00	Sensor Calibration Service Kit
CGCDXPRM001A00	User Interface Program (UIP)

The CO₂ sensors listed in Table 6 are all factory set for a range of 0 to 2000 ppm and a linear voltage output of 2 to 10 vdc. Fig. 40 shows ventilation rates for various CO₂ set points when outside air with a typical CO₂ level of 350 ppm is used to dilute the indoor air. Refer to the instructions supplied with the CO₂ sensor for electrical requirements and terminal locations.

Any changes to the sensor's factory configuration require the purchase of the User Interface Program (UIP) or Sensor Calibration Service Kit, which also contains the UIP.

To accurately monitor the quality of the air in the conditioned air space, locate the sensor near the return air grille so it senses the concentration of CO₂ leaving the space. The sensor should be mounted at least 1 ft above or 1 ft below the thermostat to avoid direct breath contact.

Do not mount the space sensor in drafty areas such as near supply ducts, open windows, fans, or over heat sources. Allow at least 3 ft between the sensor and any corner. Avoid mounting the sensor where it is influenced by the supply air; the sensor gives inaccurate readings if the supply air is blown directly onto the sensor or if the supply air does not have a chance to mix with the room air before it is drawn into the return air stream.

To accurately monitor the quality of the air in the return air duct, locate the sensor at least 6 in. upstream or 15 in. downstream of a 90 degree turn in the duct. The downstream location is preferred. Mount the sensor in the center of the duct.

If the sensor is mounted in the return air duct, readjust the mixed-air dampers to allow a small amount of air to flow past the return air damper whenever the mixing box is fully open to the outside air. If the damper is not properly adjusted to provide this minimum airflow, the sensor may not detect the indoor-air quality during the economizer cycle.

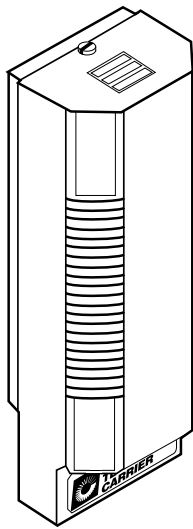


Fig. 39 — Air Quality (CO₂) Sensor (Wall Mount Version Shown)

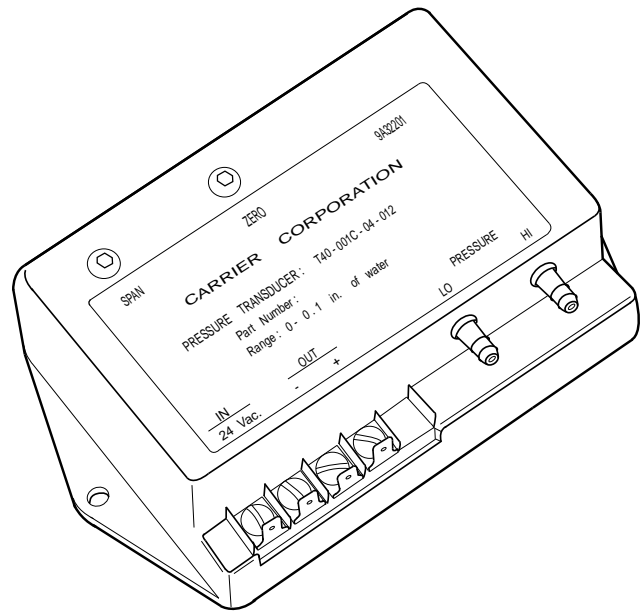


Fig. 41 — OAVP Transducer (P/N HK05ZG004)

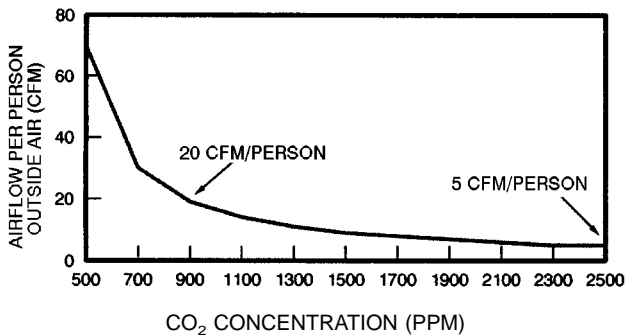


Fig. 40 — Ventilation Rates Based on CO₂ Set Point

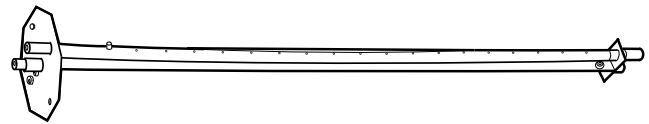


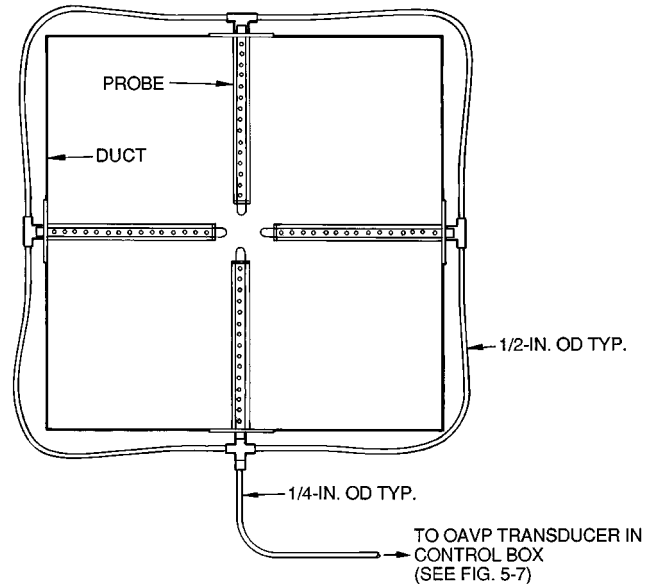
Fig. 42 — OAVP Probe (P/N 35DN40007001)

Constant Outside Air (OAC) Control — This feature ensures a continuous supply of outside air to the unit and occupied space. The OAC control monitors the outside air velocity pressure (OAVP) with a probe and pressure transducer. The pressure transducer is factory-installed; the probe is factory-supplied for field installation in the outside air ducts. See Fig. 41 and 42.

PROBE INSTALLATION — Locate each probe in a straight portion of the outside air duct with any dampers, elbows, or fittings at least 2 diameters away. The probe should be in a portion of the duct where the airflow is uniform, so that the probe senses the average air velocity in the duct. The probe must also be located so that measurements at the probe are not influenced by the opening or closing of the outdoor-air dampers.

Install the probe at a 90 degree angle to the airflow and ensure that the holes in the probe are facing and in line with the airflow. The probe tube that is closest to the incoming airflow measures velocity pressure; the rear tube measures duct static pressure. Use approved plenum tubing to connect the probe to the bulkhead fittings on top of the control box. For runs up to 150 ft, use 1/4-in. OD tubing. For runs over 150 ft, use 3/8-in. OD tubing. Use at least 25 ft of tubing to prevent pulsations and erratic operation. Coil any extra tubing if necessary.

If the outside air duct is large, additional probes can be installed in the duct and manifolded to obtain a more accurate velocity pressure reading for the entire duct. Manifold tubing must be larger than the plenum tubing connecting the manifold to the control box. See Fig. 43 and the preceding for recommended tube sizes.



NOTE: High-pressure manifold connections shown. Low-pressure connections are identical and must duplicate high-pressure connections.

Fig. 43 — Probe Manifolding

OAC CALIBRATION — Once the probe and tubing are installed, input the set point to match the probe readings. Before adjusting the OAVP probe, ensure that the supply-air fan is providing the maximum design airflow and that the outside-air dampers are adjusted for the design outdoor airflow intake.

To calibrate the PIC processor to match the probe location, use a precision manometer to measure the velocity pressure in the outdoor air duct at design conditions. Use the HSIO (local interface device) or Building Supervisor to input the value as the OAVP set point.

Note that the probe does not measure true velocity pressure; when positioned as recommended, the probe measures a velocity pressure 1.563 times that of the velocity pressure in the duct. This multiplier (magnification) factor varies with the probe's location, and can even be negative if the probe is located at an elbow or turn. All OAVP values displayed on the HSIO incorporate the multiplier factor to show the true duct velocity pressure.

If a precision manometer is not available, read the velocity pressure value at the HSIO when the system is running at maximum design airflow and input that value as the set point. During normal operation, the velocity pressure is held constant as the supply fan modulates.

USING OAVP VALUES TO DETERMINE DUCT AIRFLOW — It is possible to determine the airflow (cfm) in the outside air duct based on the readings obtained by the OAVP probe. See the following procedure.

Use the HSIO and status function () to display the outside air velocity pressure (Pv) at the transducer.

Find the average velocity (V) in the duct, in fpm:

$$4005 \sqrt{P_v} = V$$

Obtain the cross-sectional area of the duct in sq ft. (A). To determine the airflow (F) in the duct, in cfm:

$$V \times A = F$$

If the airflow obtained by the preceding method is different from the design airflow or a measurement obtained with a balancer, the OAVP probe is not sensing the average duct velocity and/or the probe's multiplier factor is effectively not 1.563. To match the design or measured airflow to the airflow determined with the preceding formulas, relocate the probe as recommended or use the HSIO and service function () to change the probe multiplier factor.

FIELD-SUPPLIED OR HIGH-VELOCITY PRESSURE TRANSDUCERS — The default pressure transducer installed at the factory (P/N HK05ZG004) has a range of 0.00 to 0.05 in. wg, which matches an air velocity range of approximately 225 to 680 fpm. The maximum velocity for optimum OAC operation and response, however, is 620 fpm. If the average duct air velocity is greater than 620 fpm, use one of the alternate transducers shown in Table 7.

For a field-supplied pressure transducer, use the service function () to configure the OAC control with the transducer's specifications:

- OALV = Transducer minimum output voltage
- OAHV = Transducer maximum output voltage
- OALR = Transducer low pressure (range minimum output) value
- OAHR = Transducer high pressure (range maximum output) value

Table 7 — OAC Pressure Transducers

CARRIER PART NO.	MODUS PART NO.	RANGE (in. wg)	INDICATED VELOCITY PRESSURE AT TRANSDUCER (in. wg)		TRUE VELOCITY PRESSURE IN DUCT (in. wg)		VELOCITY IN DUCT (fpm)	
			Optimum Range	Theoretical Range	Optimum Range	Theoretical Range	Optimum Range	Theoretical Range
HK05ZG004	T40-005C-04-013	0.00 — 0.05	0.013 — 0.037	0.005 — 0.045	0.008 — 0.024	0.003 — 0.029	360 — 620	225 — 680
HK05ZG005	T40-001C-04-012	0.00 — 0.10	0.025 — 0.075	0.010 — 0.090	0.016 — 0.048	0.006 — 0.057	505 — 875	320 — 960
HK05ZG006	T40-003C-04-015	0.00 — 0.30	0.075 — 0.225	0.030 — 0.270	0.048 — 0.144	0.019 — 0.173	875 — 1520	555 — 1665

Field Wiring Connections — All field wiring must comply with National Electric Code (NEC) and all local requirements. The recommended wiring is as follows:

- Dampers, actuators, and valves — 4-conductor 20 AWG cable (2 twisted pairs, unshielded)
- Sensors — 2-conductor 20 AWG cable (one twisted pair, unshielded)

Refer to Table 8 for recommended brands and part numbers.

Table 8 — Recommended Sensor and Device Wiring

MANUFACTURER	PART NUMBER	
	Regular*	Plenum*
Alpha	1895	—
American	A21501	A48301
Belden	8205	88442
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

*Within a building.

NOTE: Wiring is 20 gage, 2-conductor twisted cable.

REMOTE LOCAL INTERFACE DEVICE (HSIO) — When ordered as part of a 39L or 39NX unit, the HSIO is factory-installed and fully wired.

To reinstall the HSIO in a remote location away from the control box, refer to the factory wiring connections in Fig. 9-12 and proceed as follows:

1. Use a 20 AWG 2-conductor twisted wire pair (Belden No. 8205 or equivalent) to supply power to the HSIO module. Use a 20 AWG 3-conductor cable shielded with drain wire (Belden No. 8772 or equivalent) for communication with the HSIO. Cable length must not exceed 1000 ft.
2. Pull the 2 cables (power and signal) through the electrical conduit to the NEMA standard box or HSIO. Leave approximately 4 ft of wire in the PIC control box for terminations.
3. Route the cables from the PIC control box to the HSIO bracket. Secure the HSIO cables to the existing cables using either tie wraps or by twisting the HSIO cables around the existing cables. Strip back the jacket 6 in. on each cable after cutting off the excess. Connect the power cable at the PIC control box to the existing 3-pin connector hanging at the HSIO bracket. The wires should be terminated in the screw-type locking clamps on Terminals 1 and 2.
4. Connect the signal cable at the PIC control box to the existing 4-pin communications connector hanging at the HSIO bracket. The wires should be terminated in the locking clamps on Terminals 1, 2, and 3. The shield should be terminated at the HSIO bracket (ground). Be sure to note the color coding used on the cable for later reference when terminating the other end of the cable.
5. At the NEMA standard box or HSIO, connect the power conductors to Pin 1 and 2 of the 3-pin plug. Using the color coding from the above step, connect the signal cable to Pin 1, Pin 2, and Pin 3 of the 4-pin communications connector. Remove the shield and drain wire from this end of the cable.
6. After the HSIO is installed inside the remote cover, connect the 4-pin and 3-pin plugs to the HSIO.

RETURN-AIR TEMPERATURE SENSOR, OUTDOOR-AIR TEMPERATURE SENSOR, ENTHALPY SWITCH, AND MIXED-AIR TEMPERATURE SENSOR — Wires are to be connected to the proper terminals on the processor module. See Fig. 44 for details.

Select a 20 AWG twisted pair, no shield cable. Connect as per table below:

SENSOR	PROCESSOR MODULE PIN NO.
Return-air temperature sensor (RAT)	20 and 21
Outside-air temperature sensor (OAT)	5 and 6
Enthalpy switch (ENT)	34 and TB2-3
Mixed-air temperature sensor (MAT)	8 and 9
Space temperature sensor (SPT)	17 and 18

NOTE: The MAT is factory wired on all units with a factory-installed mixing box, filter mixing box, or air blender.

SPACE TEMPERATURE SENSOR (SPT) — The space temperature sensor cover includes terminal block TB1, a jumper between Pin E2 and Pin E3, and an RJ11 female connector. The RJ11 female connector connects the service tool with the Carrier Comfort Network.

⚠ CAUTION

Jumper **MUST** be in place between Pin E2 and Pin E3 or inaccurate readings could result. Ensure that the jumper is in place before installing the sensor.

Using a 20 AWG twisted pair conductor cable rated for the application, connect one wire of the twisted pair to Terminal T1 and connect the other wire to Terminal T2 on TB1. See Fig. 45.

The other ends of the wires are connected to the processor (PSIO master) module. As polarity is not a consideration, connect one wire to Terminal 17 and one wire to Terminal 18 of the processor module.

RJ11 Plug Wiring — Refer to the Carrier Comfort Network Interface, page 64, for communication bus wiring and cable selection. The cable selected must be identical to the CCN communication bus wire used for the entire network.

Cut the CCN wire and strip the ends of the RED, WHITE, and BLACK conductors. Insert and secure the RED (+) wire to Pin J2 of the SPT terminal strip TB1. Insert and secure the WHITE (ground) wire to Pin J3 of the SPT terminal strip TB1. Insert and secure the BLACK (–) wire to Pin J5 of SPT terminal strip TB1.

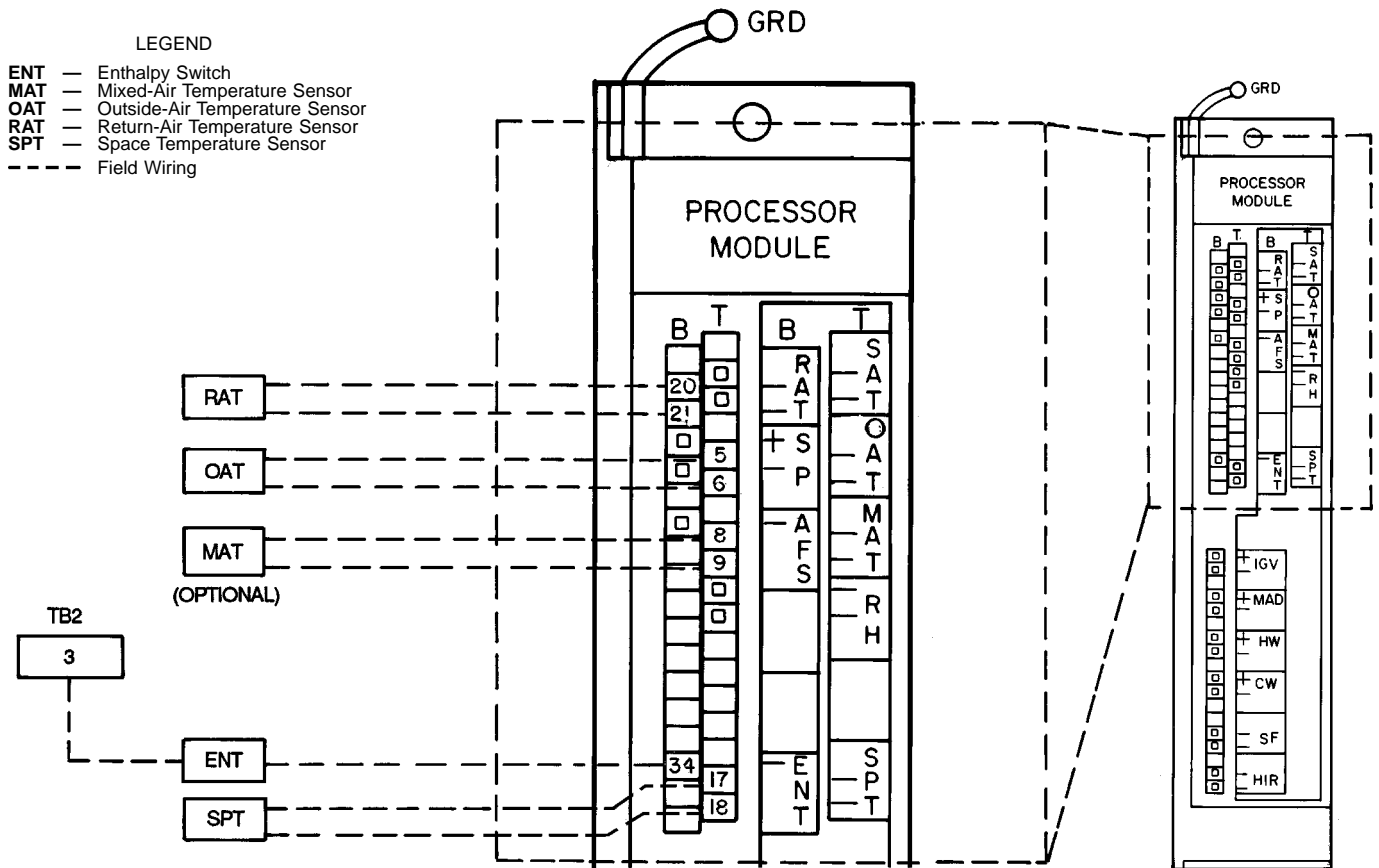
The other end of the communication bus cable must be connected to the remainder of the CCN communication bus at the COMM1 plug on the processor (PSIO master) module. Refer to Carrier Comfort Network Interface section, page 64, for more details.

DAMPER ACTUATORS — The PIC processor can activate a field-installed modulating exhaust/relief damper. This is achieved by wiring the factory-supplied damper actuator in series with the factory-supplied and field-installed mixing box damper actuator.

The PIC processor can also activate a field-installed damper actuator mounted in a field-supplied mixing box. These actuators are available from the factory when ordered as an option with the unit.

See Table 9 for recommended actuators.

NOTE: The actuator selected must be capable of receiving a 4 to 20 mA signal and must have a total impedance of less than 250 ohms. Wire should be 20 gage minimum, twisted-pair type and rated for the application.



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 44 — Field Wiring of Sensors

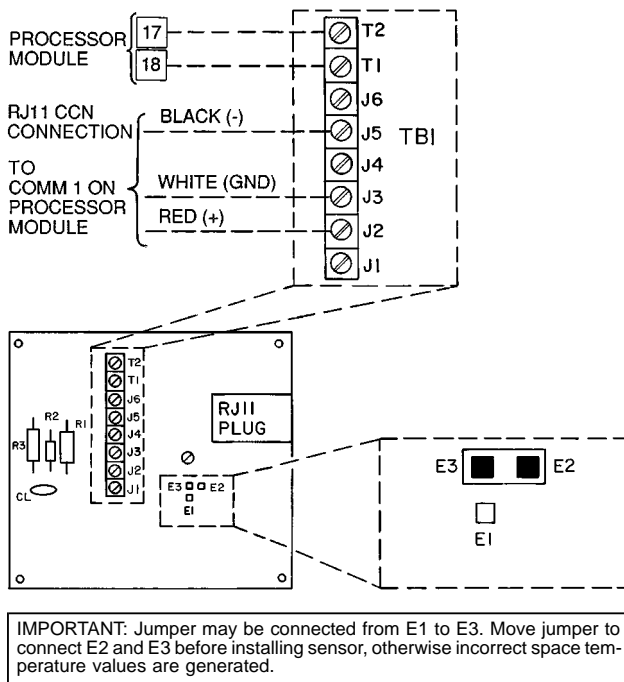


Fig. 45 — Space Temperature Sensor Wiring

For factory-supplied actuators that are field-installed, the 24 vac power source is included with the unit wired in the control box. For field-supplied actuators, a 24 vac power source must be field-supplied and installed for each actuator.

⚠ CAUTION

To prevent equipment damage: Power must NOT be connected to an earth ground; actuator case must NOT be connected to control input terminals.

Field-Supplied Exhaust Damper — Wire the 4 to 20 mA signal of the factory-supplied exhaust damper actuator as follows (Fig. 46):

1. Select a 20 AWG twisted pair conductor cable rated for the application. Identify the positive (+) and negative (-) signal contacts on the actuator.
2. Install cable from the actuator to the PIC control box.
3. Remove jumper no. 84 from between terminals TB2, 7 and 8. Connect positive (+) lead to terminal 8 of TB2. Connect negative (-) lead to terminal 7 of TB2.

Field-Supplied Modulating Mixing Box — Wire the 4 to 20 mA signal of the factory-supplied damper actuator as follows (Fig. 47):

1. Select a 20 AWG twisted pair conductor cable rated for the application. Identify the positive (+) and negative (-) signal contacts on the actuator.
2. Install cable from the actuator to the PIC control box.
- 3a. For the outside-air damper (OAD) actuator, connect the positive (+) lead to pin 40 of the processor module. Connect the negative (-) lead to terminal 6 of terminal block 2 (TB2).
- b. If the actuator is factory-supplied, connect the actuator's 24 vac power wires to TB2, terminals 19 and 20. If the actuator is field-supplied, connect the power wires to a separate, isolated 24 vac power source.

Table 9 — Recommended Actuators

PART NO.	VOLTAGE (50/60 Hz)	VA (24 vac)	IMPEDANCE (Ohms)	SIGNAL INPUT (mA)	DAMPER AREA (sq ft)		TORQUE (in.-lb)	STROKE
					Parallel	Opposed		
HF27BB006	24	18	82.5	4 to 20	8.4	10.8	15	2 in.
HY27BB001*	24	60	250.0	4 to 20	42	54	50	180°
HF27BB010	24	44	82.5	4 to 20	106	137	190	3½ in.

*Shipped with drive HF39CB001, which must be field-installed on actuator.

NOTES:

- All actuators are spring return.
- Damper area ratings are nominal and are based on standard (NOT low leak) dampers at 1.0 in. wg pressure and 2000 fpm velocity.
- Actuator wire coding is as follows:

HF27BB006 - BLACK and WHITE (24 vac)
 RED (+ signal)
 GREEN (- signal)

HY27BB001 - BLACK and WHITE (24 vac)

ORANGE (+ signal)
 BLUE (- signal)

HF27BB010 - WHITE/BLUE and BLACK (24 vac)

RED (+ signal)
 GREEN (- signal)

- Actuator HH27BB006 is equipped with 20 ft of plenum cable. Wires for actuators HY27BB001 and HF27BB010 are in the actuator junction box.
- Actuators are available as an option when ordered with the unit.

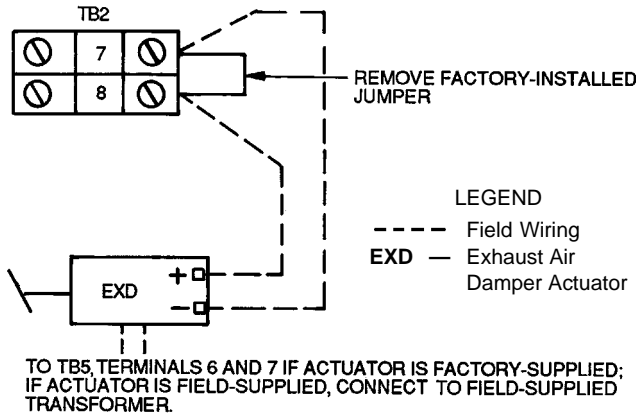


Fig. 46 — Exhaust Damper Actuator Wiring (Smoke Control Option or Modulating Dampers)

- For the return-air damper (RAD) actuator, connect the positive (+) lead to TB2, terminal 6. Connect the negative (-) lead to TB2, terminal 7.
- If the actuator is factory-supplied, connect the actuator's 24 vac power wires to TB2, terminals 21 and 22. If the actuator is field supplied, connect the power wires to a separate, isolated 24 vac power source.

Field-Supplied Two-Position Damper — The factory-supplied SPDT relay must be field-installed and wired. The relay contacts are rated as follows:

- 48 va at 24 vac and .25 service factor
- 125 va at 115 vac and .25 service factor
- 125 va at 230 vac and .25 service factor

The relay provides a set of contacts (normally open and normally closed) using no. 6 screw terminals; the 24 vdc coil connections are through ¼-in. quick connects.

Using a 20 AWG twisted cable, connect the relay coil contacts 1 and 2 to the processor module pins 41 and 42. See Fig. 48.

To connect the field-supplied two-position damper actuator (Fig. 48): Connect one contact of the actuator to the normally-open contact of the relay. Connect the common contact of the relay to one leg of the power source. Connect the other contact of the actuator to the other leg of the power source.

SMOKE CONTROL OPTION — The smoke control option includes 3 relays which control the 4 different modes of the option. These relays are factory wired. Terminal block 5 (TB5) provides an easy means to wire the field-supplied smoke control panel to the PIC controller on the 39L or 39NX unit. See Fig. 49 and 50.

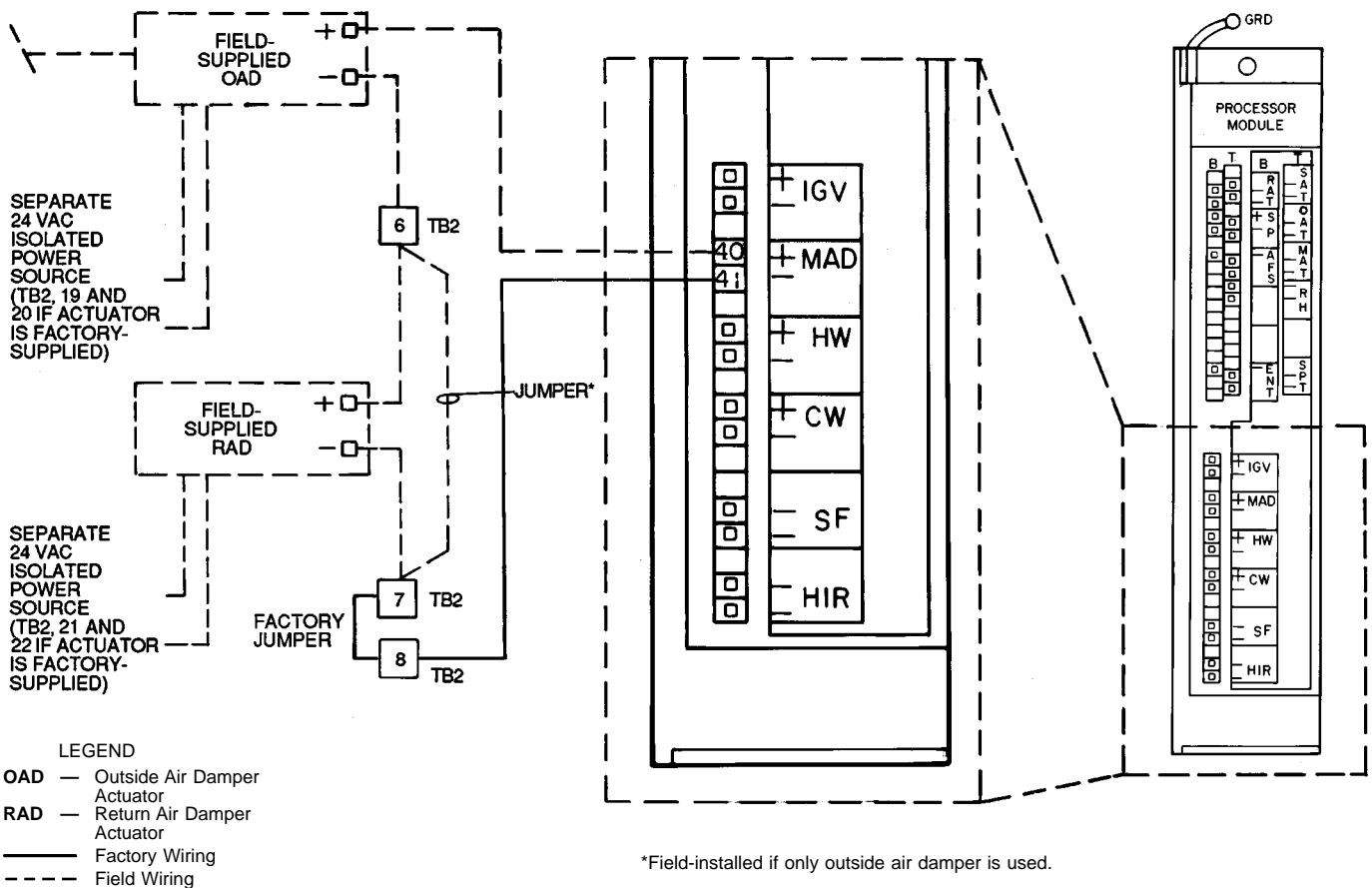
The approved building fire alarm system must provide 4 different normally-open dry contact closures. A field-supplied 24 vac, double-pole, double-throw (DPDT) fire shutdown (FSD) relay rated for the application (240 vac with a 10 amp minimum) is required.

All power going through the smoke control panel dry contacts and the FSD relay coil is furnished by the PIC control box. A 24 vac fused power source uses a factory-installed 3 amp in-line fuse. See Fig. 49 or 50 for smoke control option wiring details.

Wire as follows:

- Disconnect all power at the unit, PIC control box, return fan (if applicable), and fire panel.
- Wire the supply fan motor starter per Fig. 8.
- If applicable, wire the return fan as shown in Fig. 49 or 50.
 NOTE: Return fan power may be different from supply fan power.
- Connect leads from the return fan HOA switch to terminals 9 and 10 of TB5.
- Wire the first set of contacts of the DPDT FSD. For fire shutdown of the unit from a local smoke detector, wire ONLY the normally-closed contacts (NEC, class 1 power rated) to the hot leg of the fan power supply and terminal 2 of TB1.
- Terminal 8 of TB5 is internally connected to ground. Connect one side of the EVAC, PURG, and PRES dry contacts of the smoke control panel to terminal 8 of TB5.
- Connect the other side of the PRES dry contact to terminal 3 of TB5. Connect the other side of the PURG dry contact to terminal 4 of TB5. Connect the other side of the EVAC dry contact to terminal 5 of TB5.
- Connect the normally-open dry contacts of the FSD device (smoke detector with auxiliary relay and/or smoke control panel dry contact set) to terminal 1 and 2 of TB5.
- Connect the 24 vac relay coil of the FSD relay to terminals 1 and 8 of TB5.
- Connect the second pole of the FSD relay to the hot leg of the return fan power supply and to terminal 11 of TB5.

Refer to Fig. 49 or 50 for point-to-point wiring of the smoke control option inside the PIC control box.



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 47 — Field-Supplied Mixing Box Actuator Signal Wiring

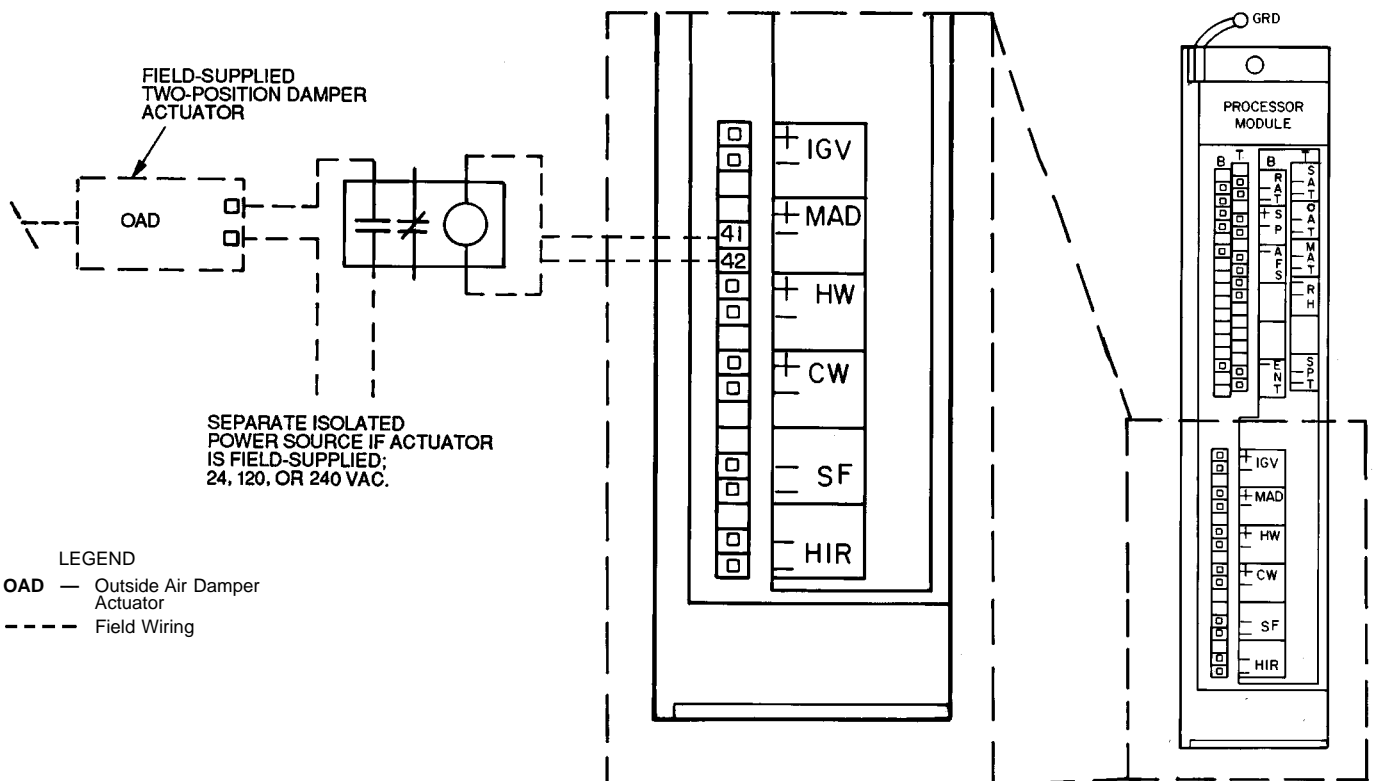
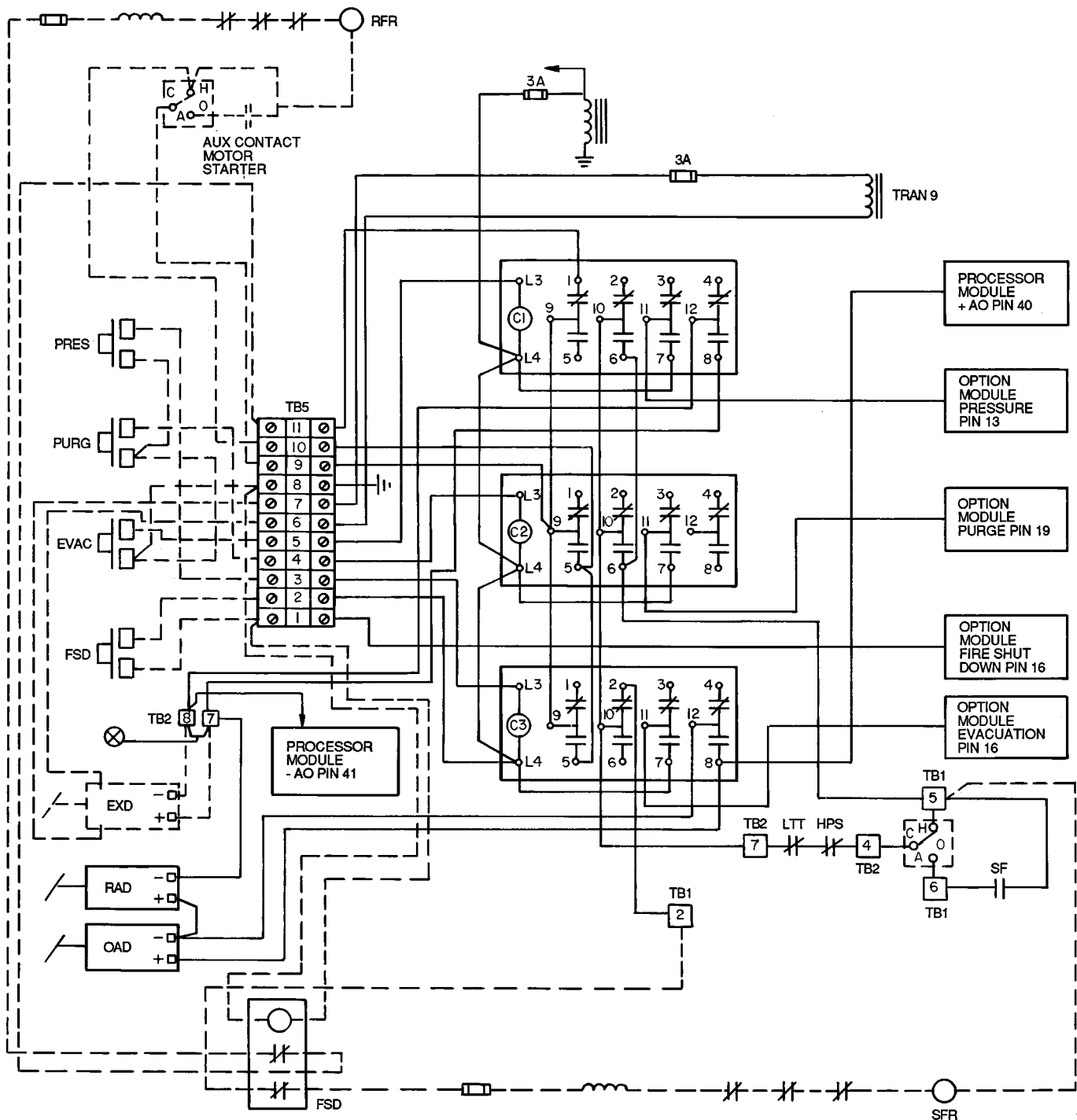


Fig. 48 — Field-Supplied Two-Position Damper Relay and Actuator Wiring

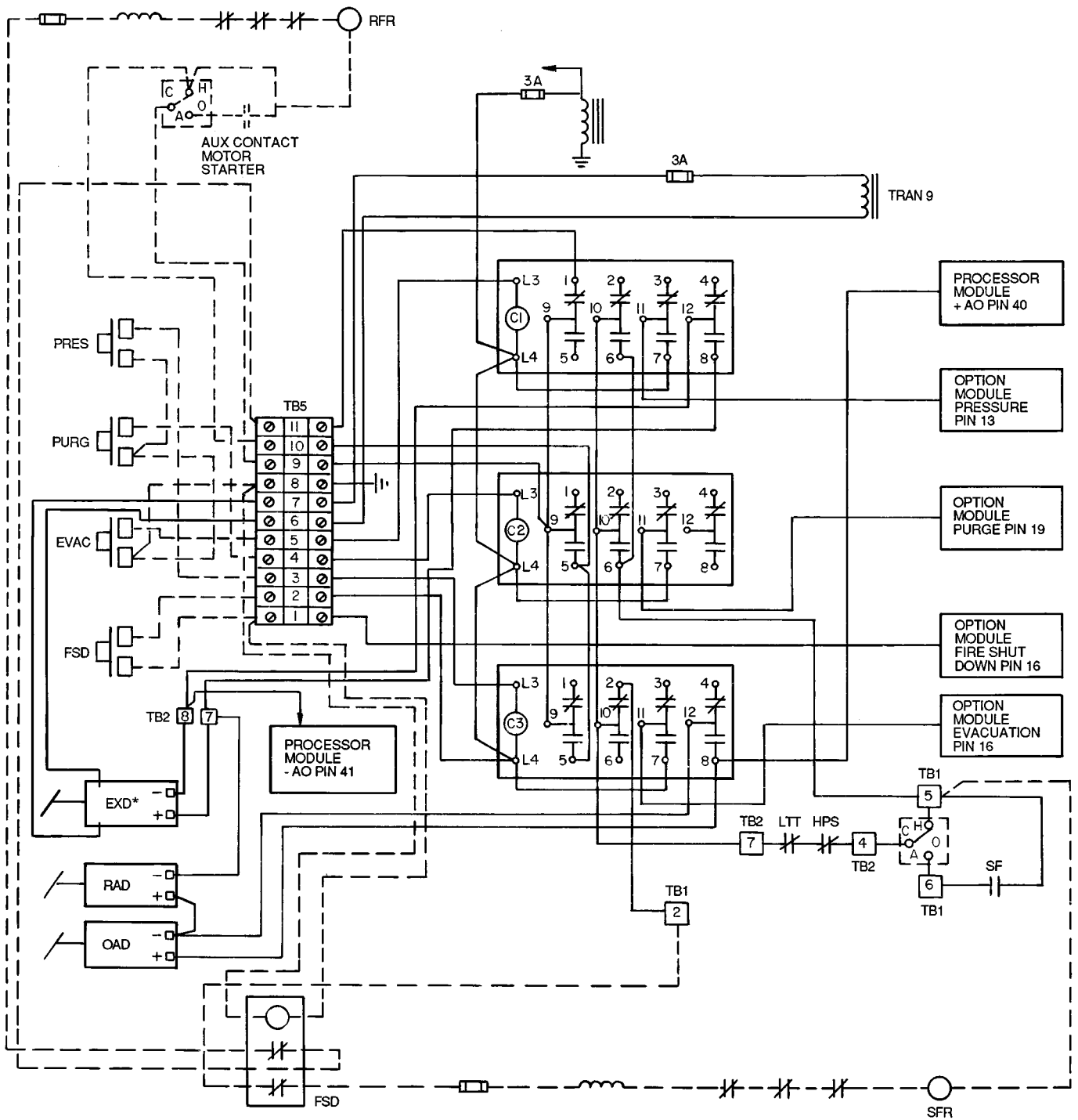


LEGEND

- | | |
|--|----------------------------------|
| AO — Analog Output | RFR — Return Fan Relay |
| EVAC — Evacuation | SF — Supply Fan Contactor |
| EXD — Exhaust Air Damper Actuator | SFR — Supply Fan Relay |
| FSD — Fire Shut Down | TB — Terminal Block |
| HOA — HAND/OFF/AUTO Switch | TRAN — Transformer |
| HPS — High-Pressure Switch | (X) — Remove Jumper |
| LTT — Low Temperature Thermostat | — — — — — Factory Wiring |
| OAD — Outside Air Damper Actuator | — — — — — Field Wiring |
| PRES — Pressurization | |
| RAD — Return Air Damper Actuator | |

NOTE: The return fan power circuit may be different than the supply fan starter power.

Fig. 49 — Smoke Control Option Wiring Schematic (39L)



LEGEND

- | | |
|--|----------------------------------|
| AO — Analog Output | RFR — Return Fan Relay |
| EVAC — Evacuation | SF — Supply Fan Contactor |
| EXD — Exhaust Air Damper Actuator | SFR — Supply Fan Relay |
| FSD — Fire Shut Down | TB — Terminal Block |
| HOA — HAND/OFF/AUTO Switch | TRAN — Transformer |
| HPS — High-Pressure Switch | — Factory Wiring |
| LTT — Low Temperature Thermostat | - - - Field Wiring |
| OAD — Outside Air Damper Actuator | |
| PRES — Pressurization | |
| RAD — Return Air Damper Actuator | |

*Factory installed and wired if ordered with exhaust box.

NOTE: Return fan power circuit may be different than the supply fan starter power.

Fig. 50 — Smoke Control Option Wiring Schematic (39NX)

ANALOG DEVICE FOR ANALOG OUTPUT TEMPERATURE CONTROL — The analog controlled device selected must be capable of receiving a 4 to 20 mA signal. Its internal impedance must not exceed 600 ohms.

The power supply of the analog device must be field installed.

Using a 20 AWG twisted wire pair, wire the control signal as follows (Fig. 51).

1. Connect the positive (+) contact to pin 46 of the option module.
2. Connect the negative (-) contact to pin 47 of the option module.

DEVICE UNDER DISCRETE OUTPUT TEMPERATURE CONTROL — The factory-supplied SPDT relay must be field installed and wired. See Fig. 52. The relay contacts are rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

The relay provides a set of contacts (normally open and normally closed) using no. 6 screw terminals while the 24 vdc coil connections are through ¼-in. quick connects.

Using a 20 AWG twisted cable, connect the relay coil contacts 1 and 2 to the option module pins 50 and 51. Connect the device to be controlled to the normally-open or normally-closed contacts of the relay. Pay close attention to the contact ratings listed above. See Fig. 53.

DISCRETE OUTPUT DEVICE UNDER TIMECLOCK CONTROL — The factory-supplied SPDT relay must be field installed and wired. (Fig. 52.) The relay contacts are rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

The relay provides a set of contacts (normally open and normally closed) using no. 6 screw terminals while the 24 vdc coil connections are through ¼-in. quick connects.

Using a 20 AWG twisted cable, connect the relay coil contacts to the option module pins 53 and 54. Connect the device to be controlled to the normally-open or normally-closed contacts of the relay. Pay close attention to the contact ratings listed above. See Fig. 54.

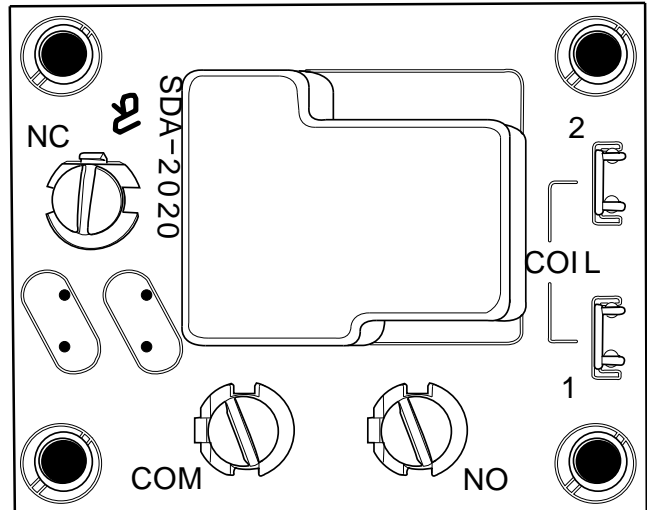


Fig. 52 — Single-Pole, Double-Throw (SPDT) Relay

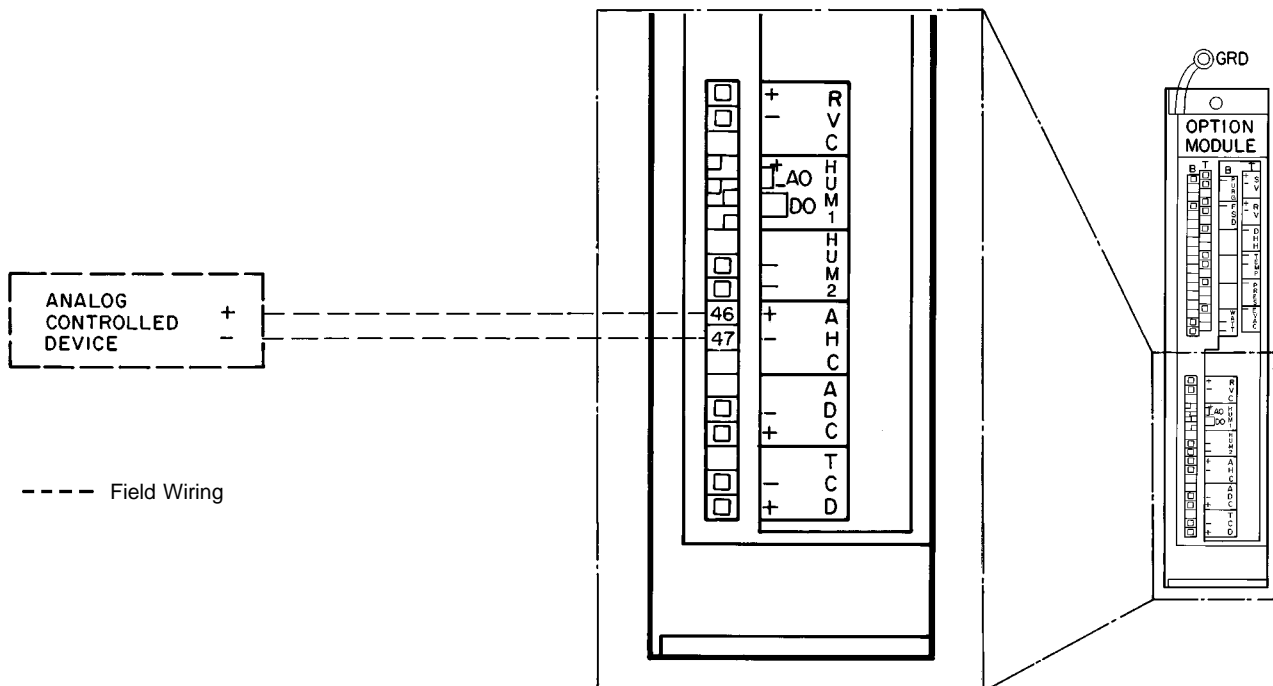
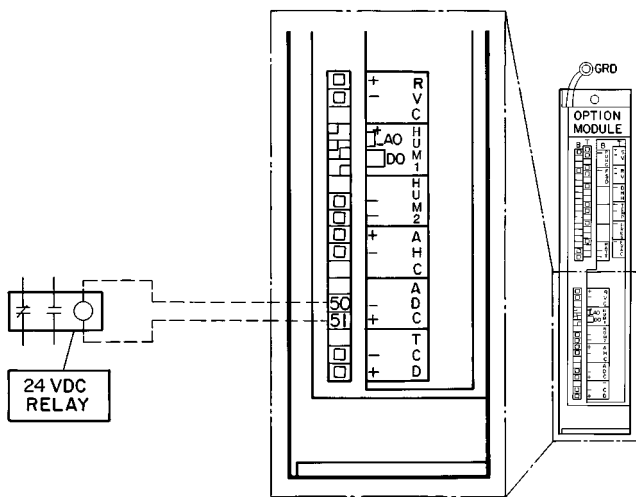


Fig. 51 — Wiring of Analog Device for Analog Output Temperature Control

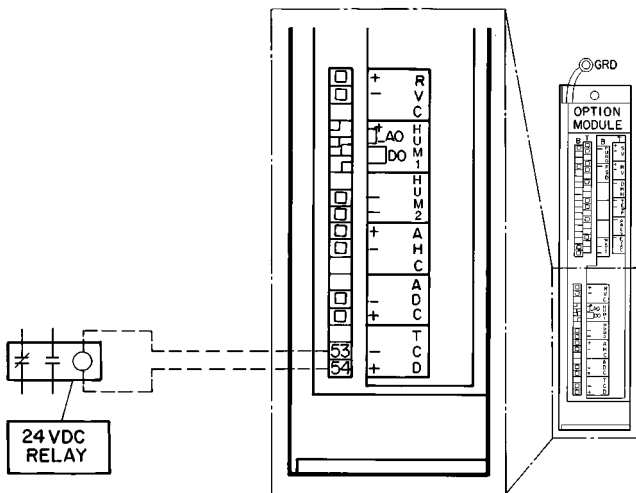


----- Field Wiring

NOTE: The relay furnished is a SPDT relay with silver cadmium oxide contacts, rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

Fig. 53 — Wiring of Device Under Discrete Output Temperature Control



----- Field Wiring

NOTE: The relay furnished is a SPDT relay with silver cadmium oxide contacts, rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

Fig. 54 — Wiring of Discrete Output Device Under Timeclock Control

HUMIDIFICATION DEVICES

Modulating Valve for Analog Output Humidity Control (Fig. 55) — Valve selected must be able to receive a 4 to 20 mA signal and must NOT exceed an impedance of 600 ohms. Valve power supply must be field-installed and isolated.

Install valve on humidifier piping and connect actuator power supply. Using a 20 AWG twisted wire pair, connect the positive (+) contact of the valve actuator to pin 40 of the option module. Connect the negative (-) contact of the valve actuator to pin 41 of the option module.

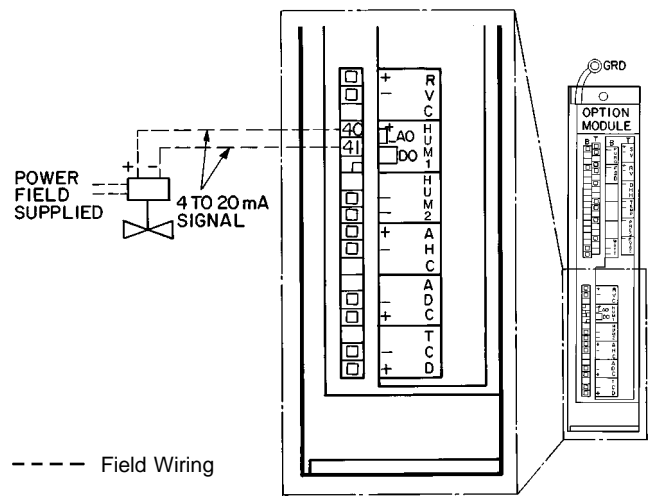


Fig. 55 — Wiring of the Modulating Valve for Analog Output Humidity Control

Two-Stage Humidification Control Relays — Two SPDT relays with silver cadmium contacts are shipped with the unit when 2-stage humidification control is requested. See Fig. 52. The relays are rated as follows:

- 48 va at 24 vac and .25 power factor
- 125 va at 115 vac and .25 power factor
- 125 va at 230 vac and .25 power factor

The relays must be field installed within a field-supplied enclosure rated for the application.

Wire the stage 1 relay as follows: Connect the 24 vac coil contacts 1 and 2 to pins 41 and 42 of the option module. The stage 1 relay is intended to open a normally-closed steam valve and not energize the spray pump. See Fig. 56 for field wiring of the stage 1 valve and steam pump.

Wire the stage 2 relay as follows: Connect the 24 vac coil contacts 1 and 2 to pins 44 and 45 of the option module. The stage 2 relay is intended to open a second normally-closed steam valve. See Fig. 56 for field wiring of the stage 2 valve.

Duct High Humidity Switch — The humidistat is factory supplied and field installed. It is shipped (with a template) in its own box.

All wiring must comply with applicable local codes and ordinances. Wire the DHH as follows:

1. Turn switch on PIC control box to OFF.

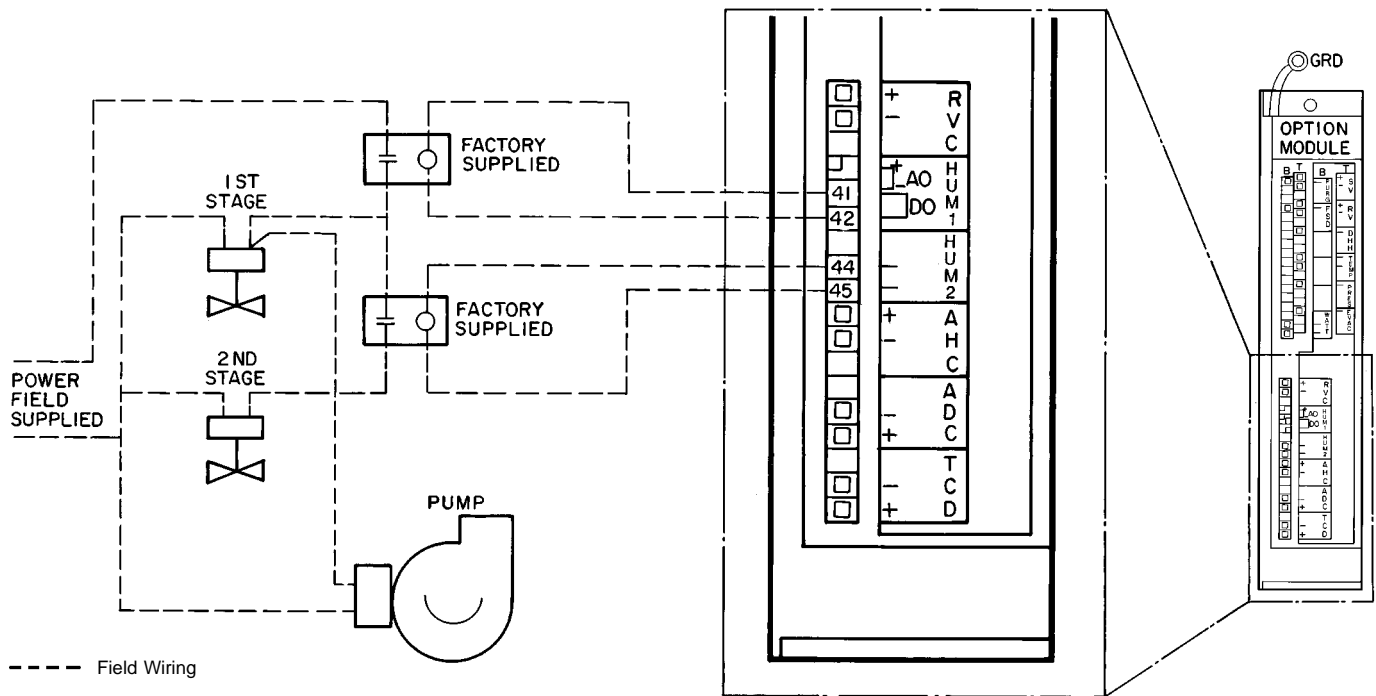
⚠ CAUTION

Turn switch on PIC control box to OFF before connecting DHH wiring, otherwise electrical shock or equipment damage can result.

2. Connect wire from terminal 3 of terminal block 2 (TB2) to the terminal labeled ORANGE on the DHH sensor. See Fig. 57.
3. Connect wire from pin 7 of the option module to the sensor screw terminal labelled RED.

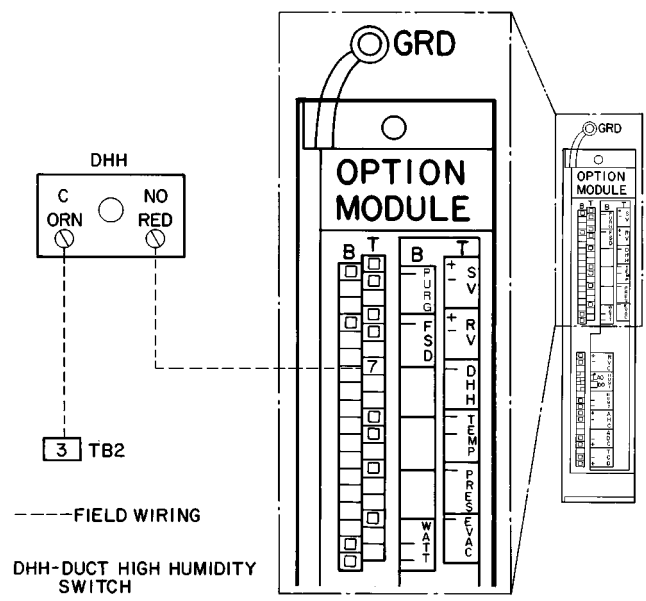
During humidification, the duct high humidity switch must be set to the maximum humidity level desired in the supply duct (80% minimum).

Duct Mounted/Wall Mounted Relative Humidity Transmitter (Fig. 58) — Identify the power terminal block (ACIN) and signal terminal block (OUT). See Fig. 59 and 60. Using 20 AWG twisted wire pair, connect the 24 vac power to the terminal labeled ACIN.



NOTE: The relay furnished is a SPDT relay with silver cadmium oxide contacts, rated as follows:
 48 va at 24 vac and .25 power factor
 125 va at 115 vac and .25 power factor
 125 va at 230 vac and .25 power factor

Fig. 56 — Wiring of Two-Stage Humidification Control Relays



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 57 — Wiring of the Duct High Humidity Switch

The power for the relative humidity transmitters may be sourced from the valve 24 vac power source at wire no. 6 and 7 or at wire no. 4 and 5.

Connect the signal wires as follows: Secure one wire to the terminal labelled OUT + (located at the right of terminal block OUT). Secure the other wire to the negative signal output terminal (terminal adjacent to the terminal labelled OUT +). Run the twisted pair of signal wires to the PIC control box. Observe all local code requirements.

Outdoor Relative Humidity Transmitter: Connect the positive (+) wire to pin 31 of the processor module. Connect the negative (-) wire to pin 32 of the processor module.

Return Air or Space Relative Humidity Transmitter; Connect the positive (+) wire to pin 10 of the processor module. Connect the negative (-) wire to pin 11 of the processor module. See Fig. 61.

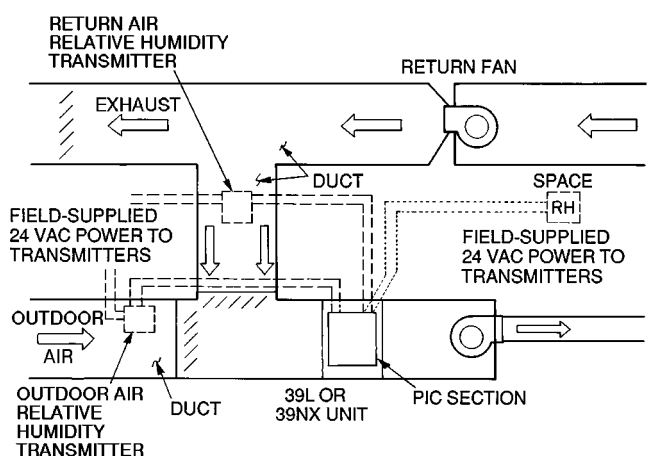


Fig. 58 — Field-Installed Relative Humidity Transmitters

CAUTION
 The 24 vac power source(s) to both duct mounted and wall mounted relative humidity transmitters MUST be isolated. Connecting either side to a ground will permanently damage the sensor.

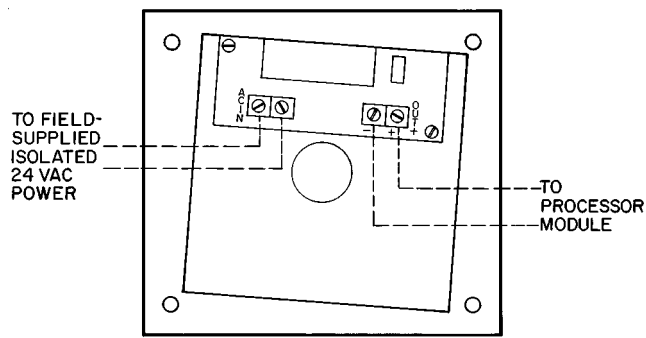


Fig. 59 — Duct Mounted Relative Humidity Transmitter Wiring

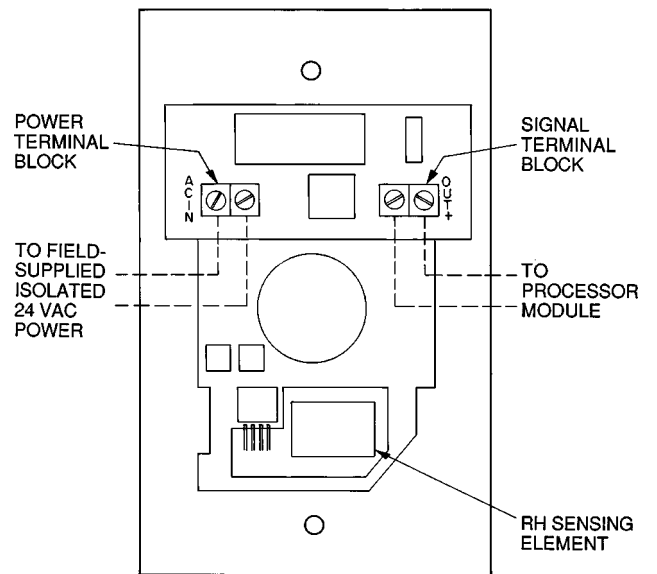
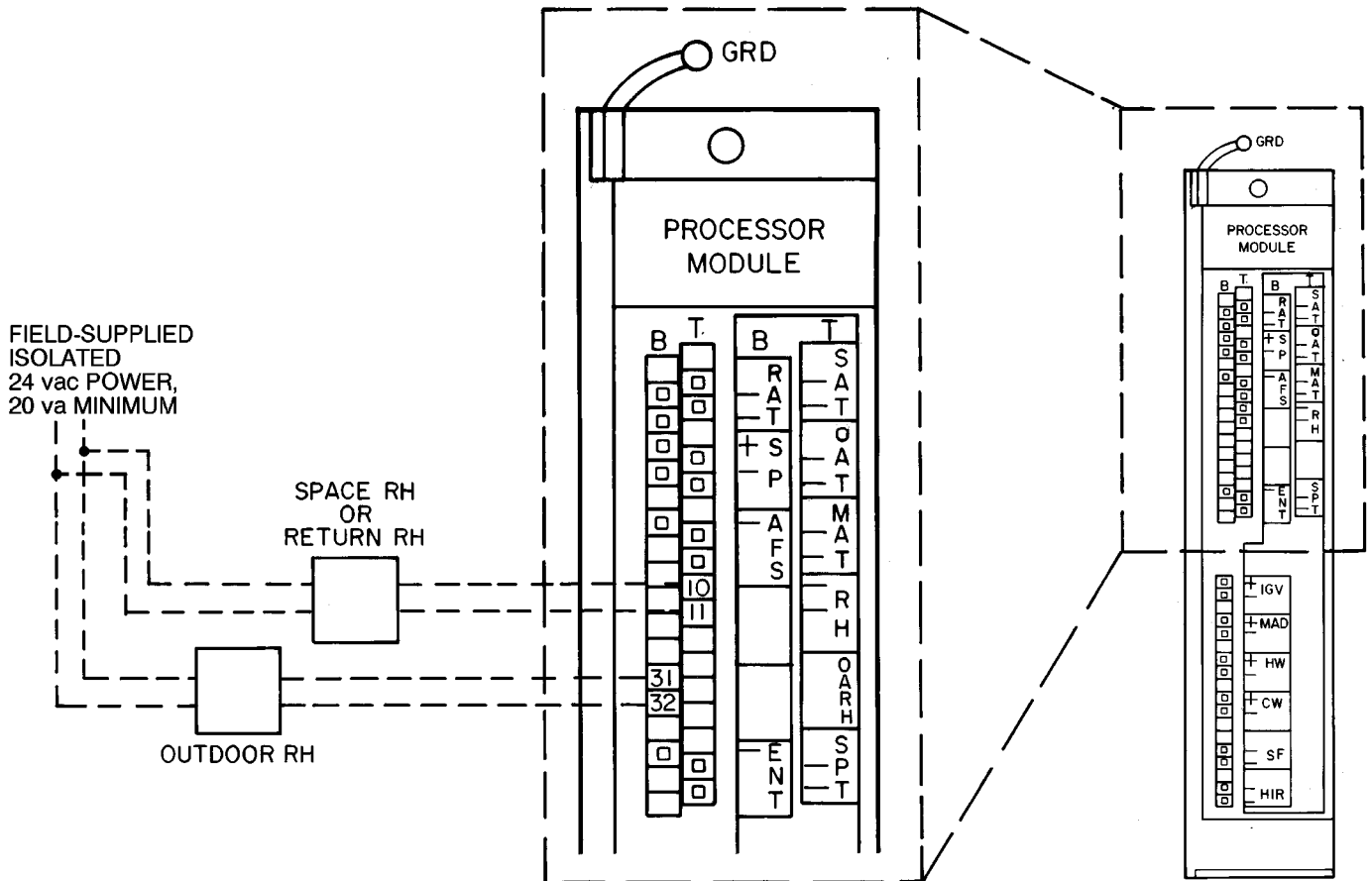


Fig. 60 — Wall Mounted Relative Humidity Transmitter Wiring



LEGEND
 RH — Relative Humidity
 - - - - Field Wiring

Fig. 61 — Wiring of Relative Humidity Transmitters

AIR QUALITY SENSOR — Air quality (AQ) sensors are CO₂ sensors shipped inside the fan section for field installation. To wire the sensors after they are mounted in the conditioned air space and return air duct, see Fig. 62 and the instructions shipped with the sensors. For each sensor, use two 2-conductor 20 AWG twisted-pair cables (unshielded) to connect the separate 24 vac power source to the sensor and the sensor to the option module (PSIO slave) terminals. To connect each AQ sensor to the option module, identify the positive (+) and negative (–) terminals on the sensor; connect AQ1 to terminals 25 and 26 and connect AQ2 to terminals 28 and 29.

OUTSIDE AIR VELOCITY PRESSURE (OAVP) SENSOR — The OAVP sensor is factory installed and wired. As shown in Fig. 62, the sensor's power wiring is connected to TB2, 9 and 10 for 39L units or TB2, 29 and 30 for 39NX units; the signal leads are connected to terminals 31 and 32 in the option module.

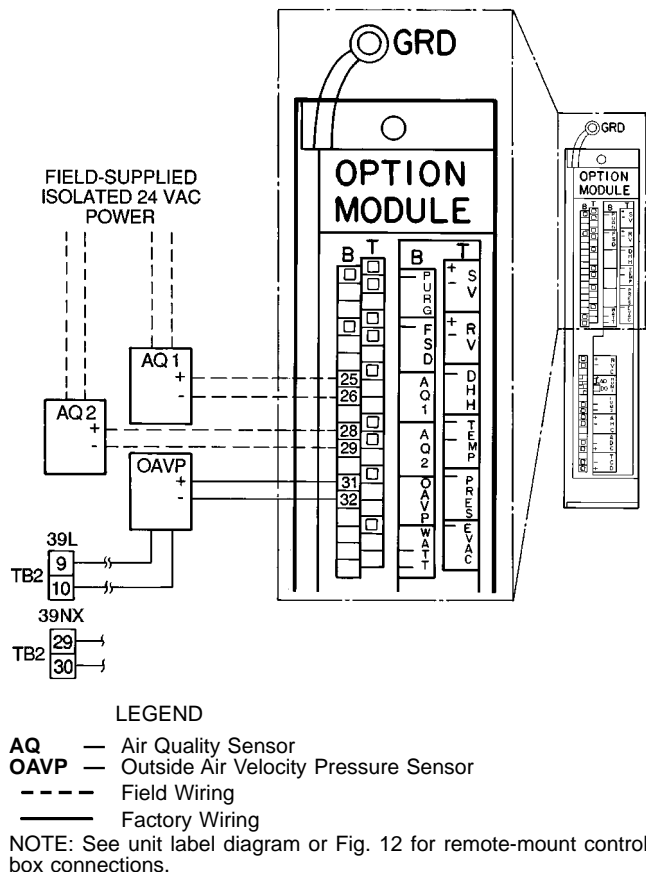


Fig. 62 — Air Quality and OAVP Sensor Wiring

FAN VOLUME CONTROL (Fig. 63)

Airflow Monitoring Stations are field-selected and field-installed in the supply and return air ducts; see Fig. 63. Install each monitoring station in a straight portion of the duct with any upstream or downstream elbows or fittings at least 2.5 diameters away.

Use approved plenum tubing to connect each monitoring station to the bulkhead fittings on top of the control box. For runs up to 50 ft, use 1/4-in. OD tubing. For runs over 50 ft, use 3/8-in. OD tubing.

Differential Pressure Transducers for fan volume control are factory-installed in the control box (two are supplied). The power supply for the transducers is also factory installed. Both transducers have pressure ranges of 0.0 to 1.0 in. wg and produce 2 to 10 vdc signals. See Fig. 64 for wiring details.

Note that if the velocity pressure of the supply and/or return air is below 0.75 in. wg, the system may require transducers with lower ranges than those of the default factory-supplied transducers. As a general rule, size transducers so that the maximum air velocity pressure is 75% of the transducer's maximum value. For example, if the 39L or 39NX unit produces a maximum air velocity pressure of 0.15 in. wg, a transducer with a maximum value of 0.20 in. wg can be used. Sizing the transducers according to these guidelines ensures that they have good resolution.

Factory-Supplied Return Fans with Inlet Guide Vanes (IGVs) are factory wired except for the air supply control signal from the airflow monitoring stations, which is connected in the field to the bulkhead fitting.

Return Fans with Field-Supplied IGV Actuators must be able to receive a 4 to 20 mA signal and may NOT have an impedance of more than 600 ohms. An isolated power source must be field-supplied and installed. See Table 9 for recommended actuators.

To install actuators, see Fig. 65. Using a 2-conductor 20 AWG conductor cable (one twisted pair, unshielded) rated for the application, connect the positive (+) wire to terminal 37 in the option module. Connect the negative (–) wire to terminal 38. Connect the 24 vac power leads to TB2, terminals 23 and 24.

Field-Supplied Return Fans with Variable Frequency Drives must have 4 to 20 mA signal input boards and their own field-supplied and installed power sources.

To install return fans with variable frequency drives, see Fig. 66. Using a 2-conductor 20 AWG conductor cable (one twisted pair, unshielded) rated for the application, connect the positive (+) signal wire to terminal 37 in the option module. Connect the negative signal (–) wire to terminal 38.

The supply fan minimum set point must be equal to the return fan minimum airflow, plus the delta airflow that is to be maintained.

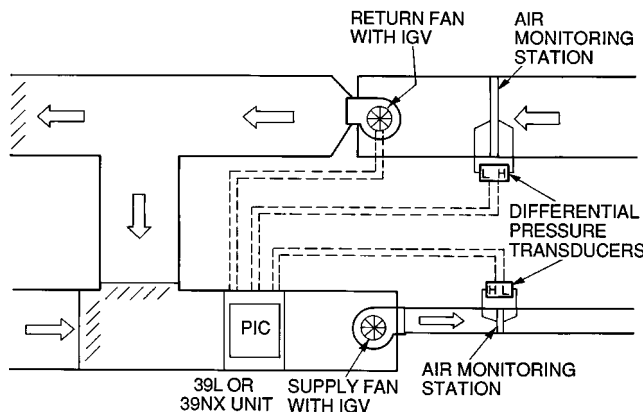
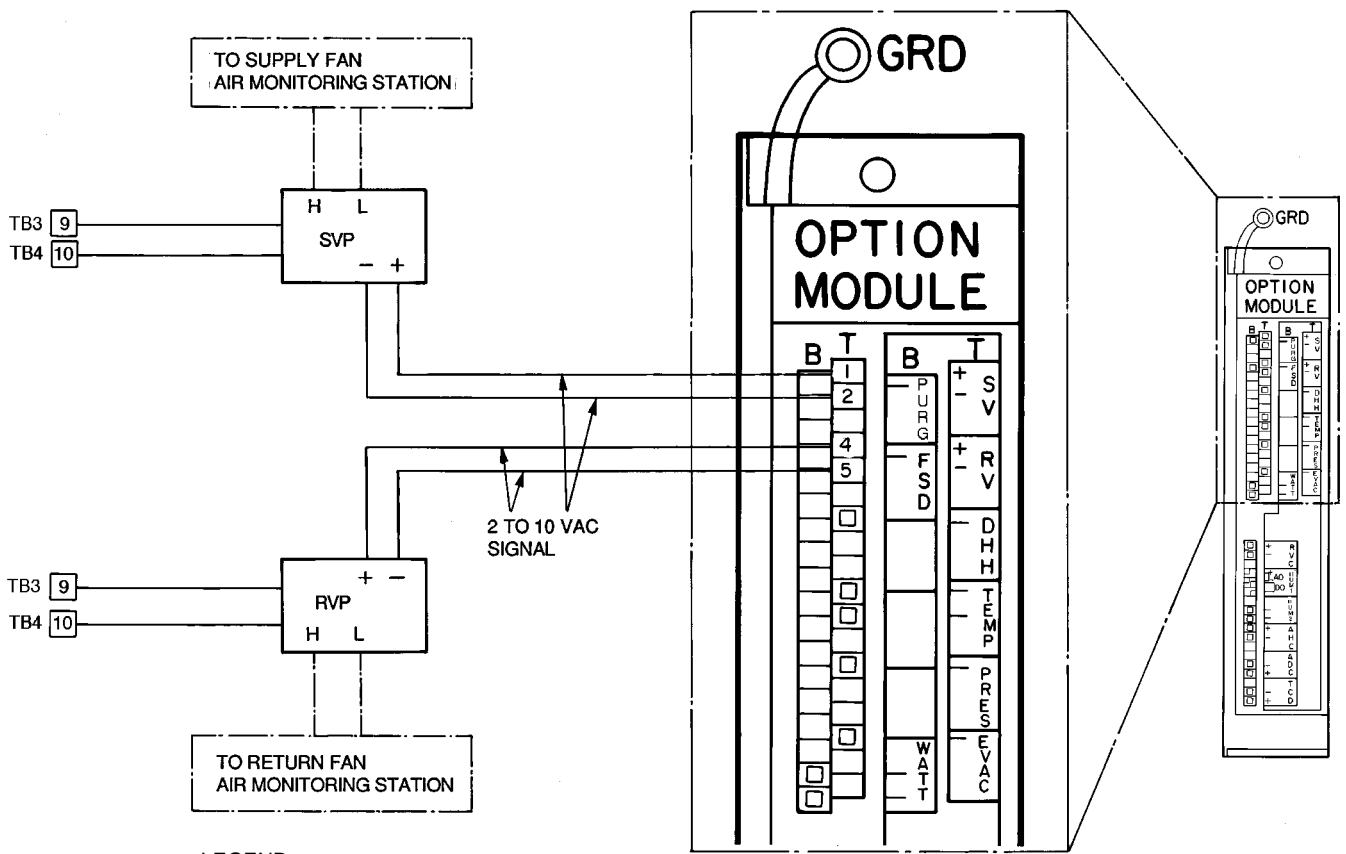


Fig. 63 — Field-Installed Fan Volume Control

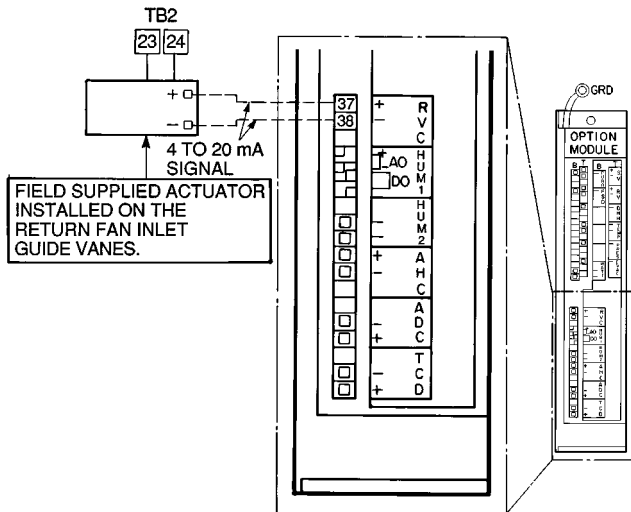


LEGEND

- RVP** — Return Velocity Pressure Transducer
- SVP** — Supply Velocity Pressure Transducer
- — — Field Tubing

NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 64 — Fan Volume Control — Differential Pressure Transducer (P/N HK05ZG007) Factory Wiring



NOTE: Connections for 39NX with integral PIC shown. See wiring diagrams in Fig. 9 and 12 for terminal connections in 39L control box and all remote-mount control boxes.

Fig. 65 — Wiring of Return Fan Volume Control with IGVs

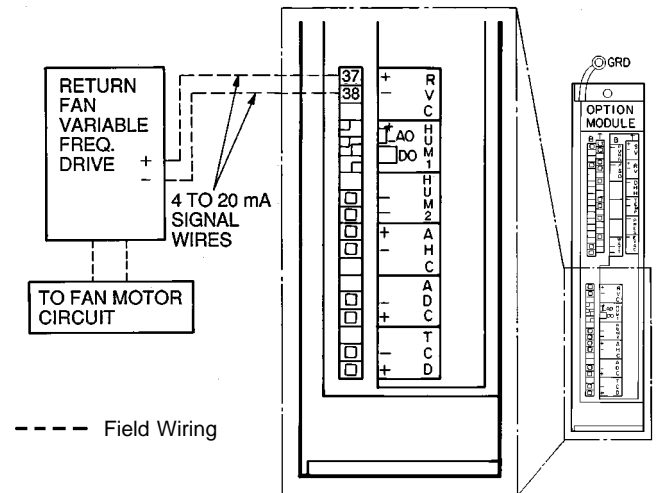
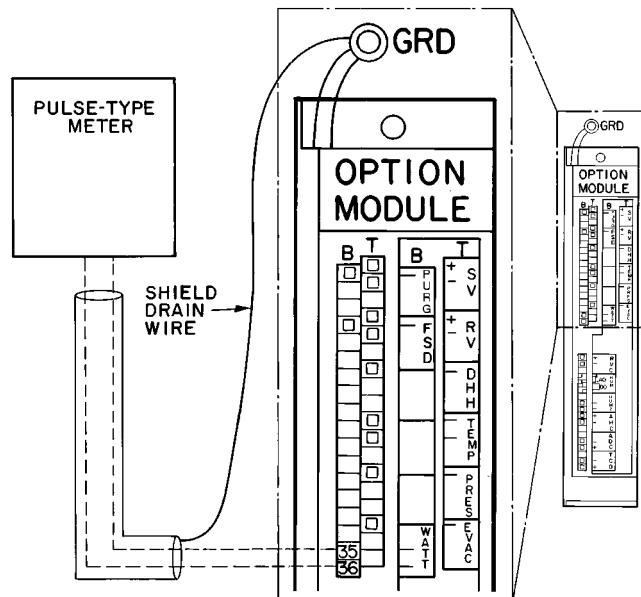


Fig. 66 — Wiring of Return Fan Volume Control with Variable Frequency Drive

Pulse-Type Meter (Fig. 67) — Monitors power usage, which is passed through the Carrier Comfort Network (CCN) for use by the loadshed module of the Building Supervisor. The meter must provide a dry contact signal (not exceeding 4 Hz maximum). Using a 2-conductor 20 AWG shielded twisted-pair conductor cable, connect one wire to terminal 35 of the option module and the other wire to terminal 36. Connect the drain wire to the ground lug inside the PIC control box and remove the drain wire and shield on the meter end of the cable. Tape to insulate, if required.



----- Field Wiring

Fig. 67 — Pulse-Type Meter Wiring

ELECTRIC HEATER — The electric heater is factory wired and installed and is controlled by the PIC processor and DSIO. There is no field wiring or installation required.

CARRIER COMFORT NETWORK INTERFACE — The Carrier Comfort Network (CCN) communication bus wiring is supplied and installed by the electrical contractor. 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; the signal ground pins must be wired to signal ground pins. See Fig. 68 for location of the CCN communication plug (COMM1) on the processor module.

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 below for cables that meet the requirements.

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

When connecting the CCN communication bus to a system element, a color code system for the entire network is recommended 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

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 ground at only one point. See Fig. 69. If the communication bus cable exits from one building and enters another, the shields must be connected to ground at the lightning suppressor in each building where the cable enters or exits the building (one point only).

To connect the 39L or 39NX unit to the network, proceed as follows (Fig. 69):

1. Turn power to the PIC control box to OFF.
2. Remove the COMM1 plug from the processor module.
3. Cut the CCN wire and strip the ends of the RED, WHITE, and BLACK conductors.
4. Using a wire nut, connect the 2 drain wires together.
5. Insert and secure the 2 RED wires to terminal 1 of the COMM1 plug.
6. Insert and secure the 2 WHITE wires to terminal 2 of the COMM1 plug.
7. Insert and secure the 2 BLACK wires to terminal 3 of the COMM1 plug.

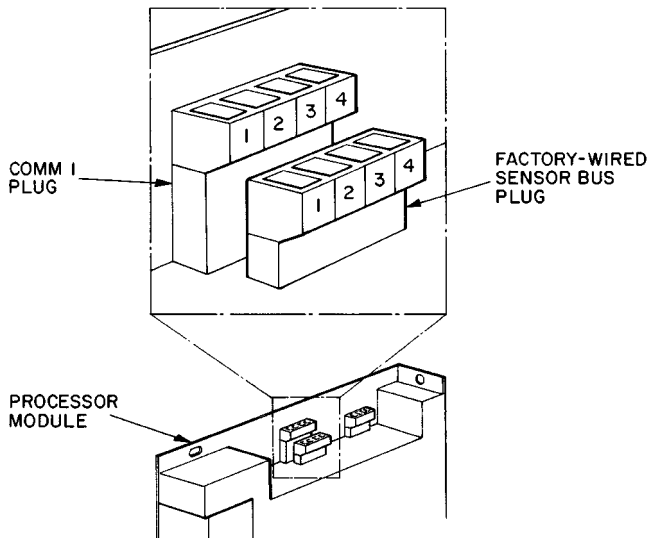


Fig. 68 — CCN Sensor Plug and Communication Plug Locations

OUTDOOR-AIR THERMOSTAT — Use field-supplied, 2-conductor 20 AWG wire to connect the thermostat to the DSIO and terminal block in the PIC control box. See Fig. 70. Connect one wire between the thermostat and J3-1 on the DSIO. For 39NX units, connect a second wire between the other thermostat terminal and TB3-9 (TB2-10 for 39L units). For 39NX units, connect a third wire between J3-2 on the DSIO and TB4-10 (TB2-9 on 39L units).

CONTROL SYSTEM

The control system consists of a processor module (Fig. 71), sensors, and controlled devices. Available options include a processor option module (Fig. 71), relay modules (Fig. 72), and local interface device.

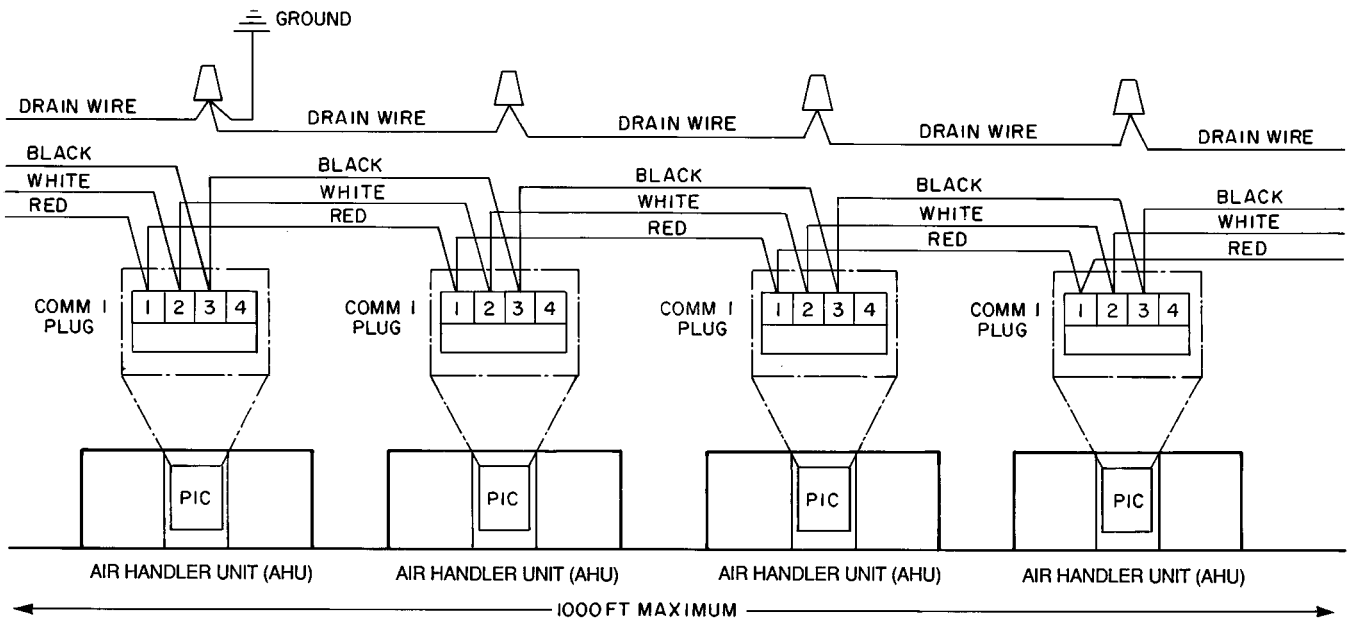


Fig. 69 — CCN Communication Wiring

All system software and operating intelligence is in the processor (PSIO master) module, which controls the unit. This module monitors and controls conditions through input and output ports and through the option (PSIO slave) and relay (DSIO) modules.

The machine operator communicates with the PSIO master through the local interface device (HSIO). Communications between the PSIO and other modules is accomplished by a 3-wire sensor bus that runs in parallel between modules. See Fig. 73.

On the sensor bus terminal strips, terminal 1 of the PSIO module is connected to terminal 1 of each of the other modules (see Fig. 73). Terminals 2 and 3 are connected in the same manner. If a terminal 2 wire is connected to terminal 1, the system does not work.

The PSIO master and slave and DSIO are all powered from a 21 vac power source connected to terminals 1 and 2 of the power input connector on each module. Refer to the 39L or 39NX unit wiring diagram for transformer locations and wiring.

Processor (PSIO Master) and Option (PSIO Slave) Modules (Fig. 71) — The PSIO master module monitors and controls components such as the supply fan, cooling and heating coil valves, inlet guide vanes, and mixed-air dampers. The PSIO slave module provides additional inputs and outputs to the PSIO master for options such as return fan volume, humidifier, smoke, and air quality control. The processor and option modules are factory installed.

Each PSIO input and output channel has 3 terminals; only 2 of the terminals are used. The unit application determines the terminal connections. Refer to the unit wiring diagram for terminal numbers.

The PSIO address switches are factory set at address 01 (master) and 31 (slave). Use a local or remote HSIO or the CCN to change the unit address. Do NOT change the address switches on the PSIO modules.

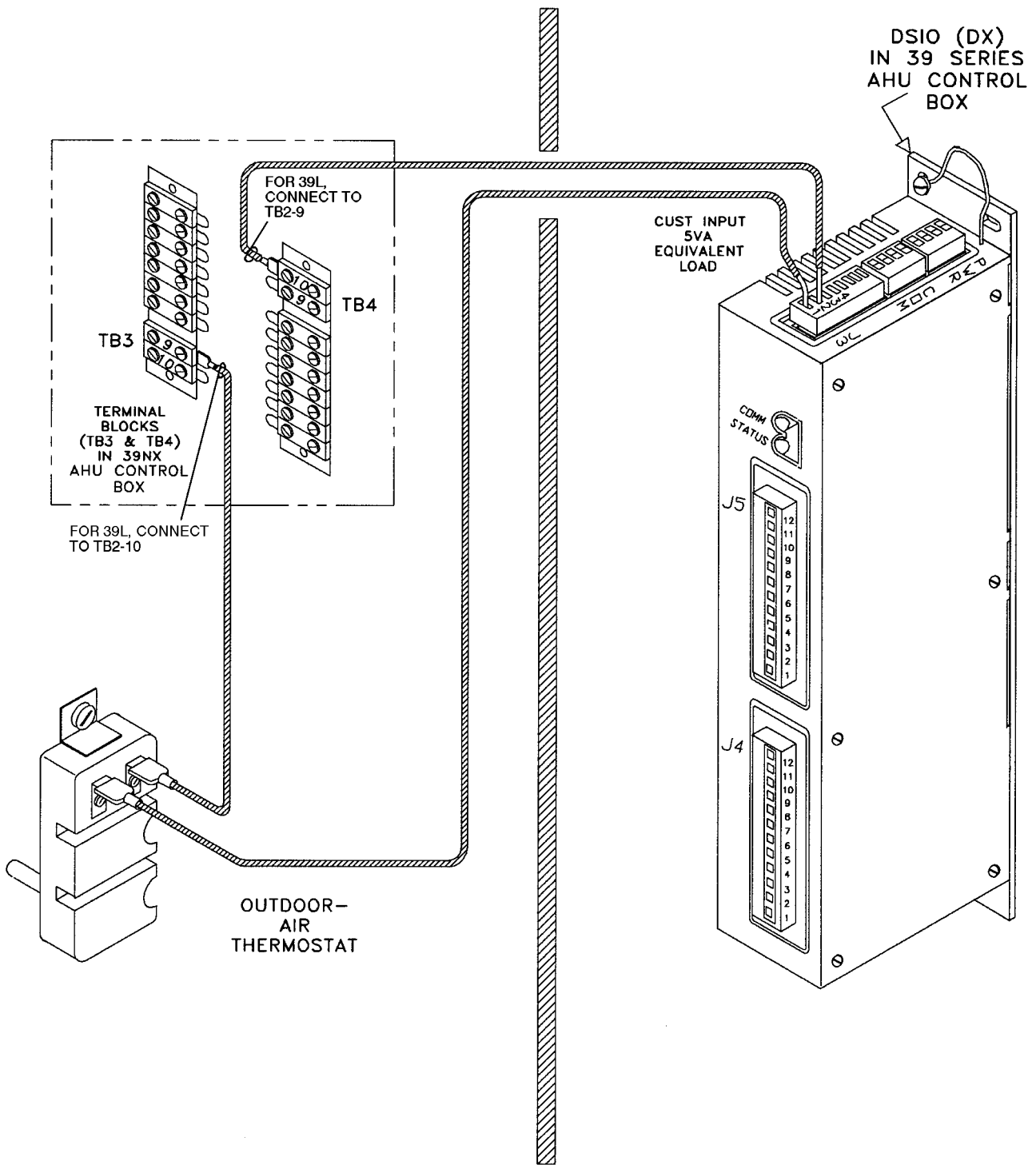
Relay (DSIO) Module (Fig. 72) — The DSIO module provides additional inputs and outputs to the PSIO master for electric heater and direct expansion coil staging. The DSIO module is factory installed. If only one DSIO module is used for electric heat or DX cooling, the DSIO address switches are factory-set at 19. If 2 DSIO modules are used for electric heat and DX cooling, the heat module is set to address 19 and the cooling module is set to address 49. See Table 1.

The DSIO inputs on strip J3 are discrete (ON/OFF) inputs. When 24 vac are applied across the 2 terminals, the corresponding channel reads one state. When no power is applied across the terminals, the channel reads the opposite state.

IMPORTANT: The 24 vac inputs on J3 of the DSIO module are polarized, with one side tied to earth ground. The grounded side of the signal must be connected to the even-number pins.

Terminal strips J4 and J5 are internal relays whose coils are powered on and off by a signal from the microprocessor. The relays switch the circuit to which they are connected. Only Class II power should be applied to these connections.

IMPORTANT: Use only the normally-open contacts on DSIO modules. These contacts have internal snubbers that protect the control modules from destructive arcing produced by switching inductive loads. NEVER use the normally-closed contacts.



LEGEND

- AHU — Air Handling Unit
- CUST — Condensing Unit Status
- DSIO — Relay Module
- DX — Direct Expansion
- OAT — Outdoor Air Thermostat
- PIC — Product Integrated Control
- Factory Wiring
- Field Wiring

Fig. 70 — Outdoor Air Thermostat/DSIO Wiring

Local Interface Device (HSIO) (Fig. 74) — The HSIO consists of a keyboard with 6 function keys, 5 operative keys, 10 numeric keys (0-9), and an alphanumeric 8-character liquid crystal display (LCD). Key use is explained in Table 10. Each function has one or more subfunctions as shown in Table 11. These functions are described in greater detail in the Control Operation section of this book. The HSIO can be factory- or field-installed, and can be remotely mounted if necessary.

Table 10 — Local Interface Device Key Usage

FUNCTION KEYS	USE
STAT	Status — Display diagnostic codes and current operating information about the machine
TEST	Quick Test — Check inputs and outputs for proper operation
HIST	History — Check latest service dates and alarms in order of occurrence
SRVC	Service — Enter specific unit configuration information
SET	Set Point — Enter operating set points and day/time/date, holiday, and daylight savings time information
SCHD	Schedule — Enter occupied/unoccupied schedules for unit operation
OPERATIVE KEYS	USE
EXPN	Expand Display — Display a non-abbreviated expansion of the display
CLR	Clear — Clear the screen of all displays
↑	Up Arrow — Return to previous display position
↓	Down Arrow — Advance to next display position
ENTR	Enter data

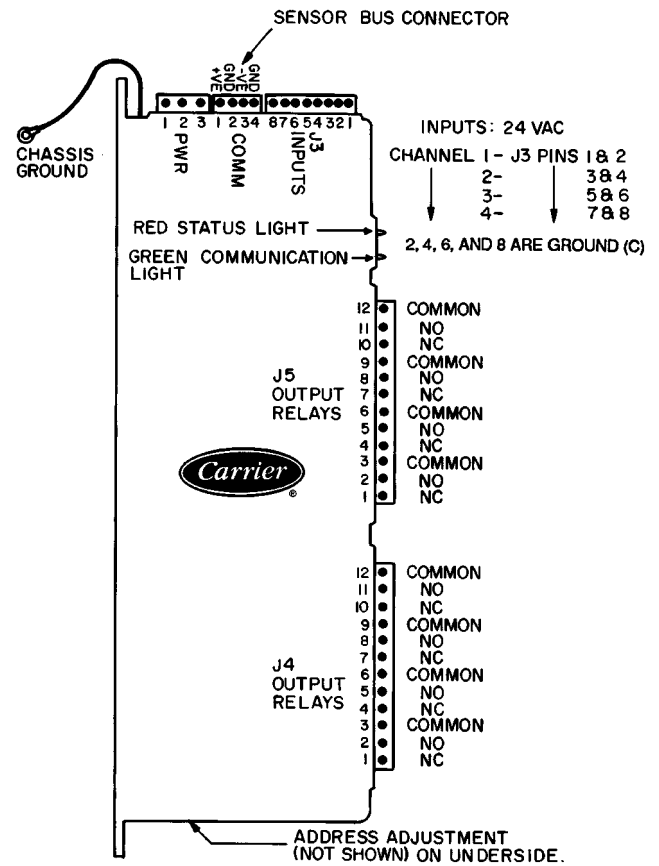
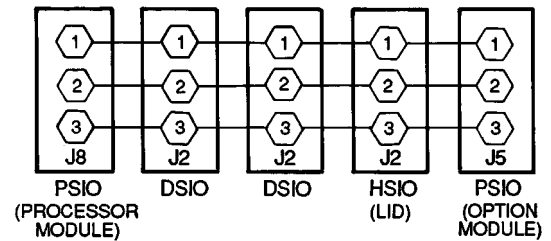


Fig. 72 — Relay Module (DSIO)



LID — Local Interface Device

Fig. 73 — Sensor Bus Wiring (Communications)

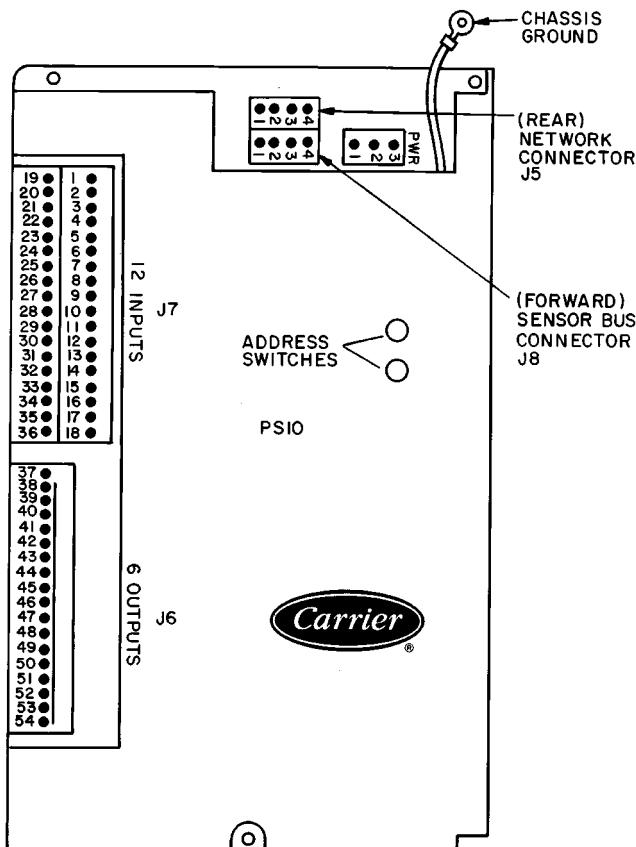


Fig. 71 — Processor Module (PSIO Master/Slave)

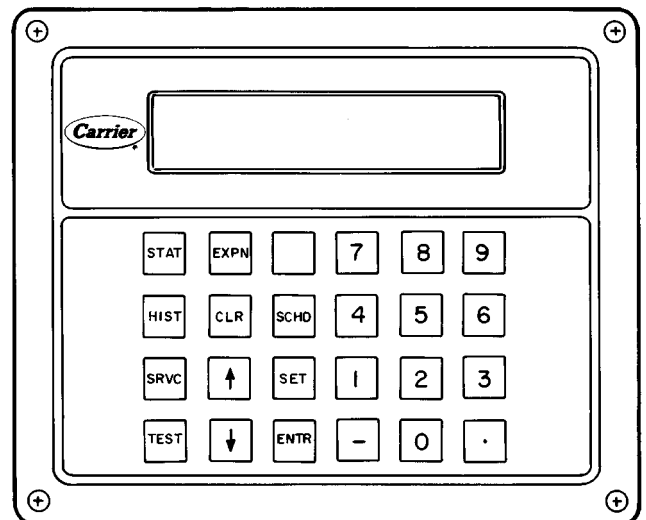


Fig. 74 — Local Interface Device

Table 11 — Functions and Subfunctions

SUB-FUNCTION NUMBER	FUNCTION					
	Status	History	Schedule	Service	Set Point	Test
1	Current alarms	Alarm history	Occupied mode override sched 1	Log on and Log off	System set points	Quick test of inputs
2	Current operating modes	Maintenance history	Period 1 of schedule 1	Software version	Demand limits	Quick test of outputs
3	Current operating set points	—	Period 2 of schedule 1	Factory configuration	Current time	Quick test of electric heat
4	System inputs	—	Period 3 of schedule 1	English/metric system	Daylight savings time configuration	Quick test of DX cooling
5	System outputs	—	Period 4 of schedule 1	User configuration	Holiday configuration	Exit quick test
6	—	—	Period 5 of schedule 1	Heating coil configuration	—	—
7	—	—	Period 6 of schedule 1	Cooling coil configuration	—	—
8	—	—	Period 7 of schedule 1	DX cooling configuration	—	—
9	—	—	Period 8 of schedule 1	Inlet guide vanes configuration	—	—
10	—	—	Occupied mode override sched 2	Mixed-air damper configuration	—	—
11	—	—	Period 1 of schedule 2	Electric heat configuration	—	—
12	—	—	Period 2 of schedule 2	Nighttime free cooling configuration	—	—
13	—	—	Period 3 of schedule 2	Night purge configuration	—	—
14	—	—	Period 4 of schedule 2	OAVP configuration	—	—
15	—	—	Period 5 of schedule 2	Air quality configuration 1	—	—
16	—	—	Period 6 of schedule 2	Air quality configuration 2	—	—
17	—	—	Period 7 of schedule 2	Optimal start/stop configuration	—	—
18	—	—	Period 8 of schedule 2	Space temperature reset configuration	—	—
19	—	—	—	Loadshed configuration	—	—
20	—	—	—	Fan tracking configuration	—	—
21	—	—	—	Humidity configuration	—	—
22	—	—	—	Alarms limits configuration	—	—
23	—	—	—	Analog temperature configuration	—	—
24	—	—	—	Discrete temperature configuration	—	—
25	—	—	—	Service history configuration	—	—
26	—	—	—	Service maintenance configuration	—	—
27	—	—	—	Timed override history	—	—

DX — Direct Expansion

CONTROL OPERATION

Accessing Functions and Subfunctions — See Table 12. Refer also to Table 11, which shows the 6 functions (identified by name) and the subfunctions (identified by number). Table 13 shows the sequence of all the elements in a subfunction.

Display Functions

SUMMARY DISPLAY — Whenever the keyboard has not been used for 10 minutes, the display automatically switches to an alternating summary display. This display has 3 parts (day/time, mode, and alarms), shown below, which alternate in continuously rotating sequence.

Display	Expansion
TUE 12:45	TODAY IS TUE, TIME IS 12:45
MODE 23	UNOCCUPIED HEATING
2 ALARMS	THERE ARE 2 ALARMS DETECTED

Return to the previous display at any time by pressing



Table 12 — Accessing Functions and Subfunctions

OPERATION	KEYBOARD ENTRY	DISPLAY	DESCRIPTION
To access a function, press the subfunction number and the function name key. The display shows the subfunction group	1 SET	SETPOINT	System set points
To move to the other elements, scroll up or down using the arrow keys	↓	OHSP X	Occupied heating set point
	↓	OCSP X	Occupied cooling set point
	↓	UHSP X	Unoccupied heating set point
	↓	UCSP X	Unoccupied cooling set point
When the last element in a subfunction has been displayed, the first element is repeated	SET	DEMAND	Demand limit set points
To move to the next subfunction, it is not necessary to use the subfunction number. Pressing the function name key advances the display through all subfunctions within a function and then back to the first	SET	TIME	Time of day and day of week display
	SET	DAYLIGHT	Daylight savings time
	SET	HOLIDAY	Holiday display
	SET	SETPOINT	System set points
To move to another function, either depress the function name key for the desired function (display shows the first subfunction)	STAT	X ALARMS	X alarms detected
or			
Access a particular subfunction by using the subfunction number and the function name key	3 STAT	SETPOINT	Current operating set points

Table 13 — Keyboard Directory

STATUS		
Keyboard Entry	Display	Description
1 STAT	ALARMS	Current alarm display
↓	ALARM X	1st alarm
↓	ALARM X	2nd alarm
↓	ALARM X	3rd alarm
↓	ALARM X	4th alarm
↓	ALARM X	5th alarm
↓	ALARM X	6th alarm
↓	ALARM X	7th alarm
↓	ALARM X	8th alarm
↓	ALARM X	9th alarm
↓	ALARM X	10th alarm
↓	ALARM X	11th alarm
↓	ALARM X	12th alarm
↓	ALARM X	13th alarm
↓	ALARM X	14th alarm
↓	ALARM X	15th alarm
↓	ALARM X	16th alarm
↓	ALARM X	17th alarm
↓	ALARM X	18th alarm
↓	ALARM X	19th alarm
↓	ALARM X	20th alarm
↓	ALARM X	21st alarm
↓	ALARM X	22nd alarm
↓	ALARM X	23rd alarm
↓	ALARM X	24th alarm
↓	ALARM X	25th alarm
↓	ALARM X	26th alarm
↓	ALARM X	27th alarm
↓	ALARM X	28th alarm
↓	ALARM X	29th alarm
↓	ALARM X	30th alarm
↓	ALARM X	31st alarm
↓	ALARM X	32nd alarm

STATUS		
Keyboard Entry	Display	Description
2 STAT	MODES	Current operating modes
↓	MODE X	Mode 1
↓	MODE X	Mode 2
3 STAT	SETPOINT	Current operating set points
↓	OHSP X	Occupied heating set point
↓	OCSP X	Occupied cooling set point
↓	UHSP X	Unoccupied heating set point
↓	UCSP X	Unoccupied cooling set point
↓	SPSP X	Static pressure set point
↓	SASP X	Supply air set point
↓	CFSP X	Delta CFM set point
↓	HUSP X	Humidity set point
↓	AOSP X	Analog temperature control set point
↓	DOSP X	Discrete temperature control set point
↓	Q1SP X	Air quality 1 set point
↓	Q2SP X	Air quality 2 set point
↓	OASP X	Outdoor air velocity pressure set point

Table 13 — Keyboard Directory (cont)

STATUS			STATUS		
Keyboard Entry	Display	Description	Keyboard Entry	Display	Description
4 STAT	INPUTS	System inputs	X ENTR	IGV X	Inlet guide vanes forced (x = forced value)
↓	SPT X	Space temperature	↓	MIXD X	Mixed air damper
↓	SAT X	Supply air temperature	X ENTR	MIXD X	Mixed air damper forced (x = forced value)
↓	RAT X	Return air temperature	↓	HCV X	Heating coil valve
↓	OAT X	Outside air temperature	X ENTR	HCV X	Heating coil valve forced (x = forced value)
X ENTR	OAT X	Outside air temperature forced (x = forced value)	↓	CCV X	Cooling coil valve
↓	SP X	Static pressure	X ENTR	CCV X	Cooling coil valve forced (x = forced value)
↓	SFS X	Supply fan status	↓	SF X	Supply fan start/stop
↓	ENT X	Enthalpy switch status	X ENTR	SF X	Supply fan start/stop forced (x = forced value)
X ENTR	ENT X	Enthalpy switch status forced (x = forced value)	↓	HIR X	Heat interlock relay
↓	RH X	Relative humidity	X ENTR	HIR X	Heat interlock relay forced (x = forced value)
X ENTR	RH X	Relative humidity forced (x = forced value)	↓	EHS1 X	Electric heat stage 1
↓	FRZ X	Freezestat status	↓	EHS2 X	Electric heat stage 2
↓	MAT X	Mixed air temperature	↓	EHS3 X	Electric heat stage 3
↓	OARH X	Outside air relative humidity	↓	EHS4 X	Electric heat stage 4
X ENTR	OARH X	Outside air relative humidity forced (x = forced value)	↓	EHS5 X	Electric heat stage 5
↓	FLTS X	Filter status	↓	EHS6 X	Electric heat stage 6
X ENTR	FLTS X	Filter status forced (x = forced value)	↓	EHS7 X	Electric heat stage 7
↓	TEMP X	Temperature input	↓	EHS8 X	Electric heat stage 8 (NOTE: Only the actual number of heater stages applicable to the unit are provided.)
↓	RVP X	Return velocity pressure	↓	RFVC X	Return fan volume
↓	SVP X	Supply velocity pressure	X ENTR	RFVC X	Return fan volume forced (x = forced value)
↓	DHH X	Duct high humidity	↓	HUM1 X	Humidifier first stage
↓	EVAC X	Evacuation	X ENTR	HUM1 X	Humidifier first stage forced (x = forced value)
↓	PRES X	Pressurization	↓	HUM2 X	Humidifier 2nd stage
↓	PURG X	Smoke purge	X ENTR	HUM2 X	Humidifier 2nd stage forced (x = forced value)
↓	FSD X	Fire shutdown	↓	AOTC X	Analog temperature
↓	MTR X	Meter	X ENTR	AOTC X	Analog temperature forced (x = forced value)
↓	OAVP X	Outdoor air velocity pressure	↓	DOTC X	Discrete temperature
X ENTR	OAVP X	Outdoor air velocity pressure (x = forced value)	X ENTR	DOTC X	Discrete temperature forced (x = forced value)
↓	AQ1 X	Air quality 1	↓	DTCC X	Discrete time clock
X ENTR	AQ1 X	Air quality 1 (x = forced value)	X ENTR	DTCC X	Discrete time clock forced (x = forced value)
↓	AQ2 X	Air quality 2	↓	DXS1 X	DX cooling stage 1
X ENTR	AQ2 X	Air quality 2 (x = forced value)	↓	DXS2 X	DX cooling stage 2
↓	CUST X	Condensing unit status	↓	DXS3 X	DX cooling stage 3
X ENTR	CUST X	Condensing unit status (x = forced value)	↓	DXS4 X	DX cooling stage 4
↓	DXSD X	DX cooling shutdown	↓	DXS5 X	DX cooling stage 5
X ENTR	DXSD X	DX cooling shutdown (x = forced value)	↓	DXS6 X	DX cooling stage 6
5 STAT	OUTPUTS	System outputs	↓	DXS7 X	DX cooling stage 7
↓	IGV X	Inlet guide vanes	↓	DXS8 X	DX cooling stage 8

DX — Direct Expansion

Table 13 — Keyboard Directory (cont)

SCHEDULE		
Keyboard Entry	Display	Description
1 [SCHD]	OVRD X	Number of hours to extend occupied mode of schedule 1
2 [SCHD]	PERIOD 1	Define period 1 of time schedule 1
↓	OCC X	Start of occupied time
↓	UNO X	Start of unoccupied time
↓	MON X	Monday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	TUE X	Tuesday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	WED X	Wednesday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	THU X	Thursday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	FRI X	Friday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	SAT X	Saturday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	SUN X	Sunday flag
↓	HOL X	Holiday flag
3 [SCHD]		Time periods 2-8 of schedule 1 (same elements as period 1, schedule 1)
↓		
↓		
↓		
9 [SCHD]		
1 0 [SCHD]	OVRD X	Number of hours to extend occupied mode of schedule 2
1 1 [SCHD]	PERIOD 1	Define period 1 of time schedule 2
↓	OCC X	Start of occupied time
↓	UNO X	Start of unoccupied time
↓	MON X	Monday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	TUE X	Tuesday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	WED X	Wednesday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	THU X	Thursday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	FRI X	Friday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	SAT X	Saturday flag (x = entry code) (1 = yes, .0 or CLR = no)
↓	SUN X	Sunday flag
↓	HOL X	Holiday flag
1 2 [SCHD]		Time periods 2-8 of schedule 2 (same elements as period 1, schedule 2)
↓		
↓		
↓		
1 8 [SCHD]		

CV — Constant Volume
 DX — Direct Expansion
 VAV — Variable Air Volume

SERVICE CONFIGURATIONS		
Keyboard Entry	Display	Description
1 [SRVC]	LOG ON	Enter password to log on
1 1 1 1 [ENTR]	LOGGED ON	Log on okay
When finished with configuration, log off as follows:		
1 [SRVC]	LOGGED ON	Shows that configurations are available
↓	LOG OFF	
[ENTR]	LOGD OFF	Log off okay; configurations again password protected
2 [SRVC]	VERSION	Software version
↓	XXX-XX-X	Software version number
3 [SRVC]	FACT CFG	Factory configuration
↓	TYPE X	Unit type (0 = CV, 1 = VAV)
↓	COOL X	Cooling (0 = none, 1 = coil)
↓	DXST X	DX cooling stages 0-8 (enter number)
↓	HEAT X	Heating (0 = none, 1 = hot/steam, 2 = electric heat coil)
↓	EHST X	Electric heat stages 0-8 (enter number)
↓	MIXD X	Mixed air damper (0 = none, 1 = yes, 2 = 2-position)
↓	IAQT X	Indoor-air quality type
↓	MATP X	Mixed air temperature protection
↓	BUS X	Bus number (factory default set = 0)
↓	ADR X	Element address (factory set default = 1)
↓	PSW X	Password XXXX
4 [SRVC]	UNITS X	English/metric system (0 = English, 1 = metric)
5 [SRVC]	USER CFG	User configuration
↓	NTEN X	Nighttime free cooling configuration
↓	HUEN X	Humidity configuration
↓	OHEN X	Occupied heating configuration
↓	RSEN X	Space temperature reset configuration
↓	DLEN X	Demand limiting configuration
↓	FTEN X	Fan tracking configuration
↓	OAEN X	Constant outside air
↓	NPEN X	Night purge
↓	AQEN X	Indoor air quality
↓	IAQP X	Indoor air quality priority level
↓	OSEN X	Optimal start/stop configuration
↓	TSCH X	Timed override schedules
↓	TOVR X	Timed override values
6 [SRVC]	HEATCOIL	Configuration of heating coil
↓	MPG X	Master proportional gain
↓	MIG X	Master integral gain
↓	MDG X	Master derivative gain
↓	SMG X	Submaster gain
↓	SCV X	Submaster center value
↓	FOV X	Fan off value
↓	SMR X	Submaster reference value
X [ENTR]	SMR X	Submaster reference value forced

Table 13 — Keyboard Directory (cont)

SERVICE CONFIGURATIONS		
Keyboard Entry	Display	Description
7 <input type="button" value="SRVC"/>	COOLCOIL	Configuration of cooling (chilled water coil or DX)
<input type="button" value="↓"/>	MPG X	Master proportional gain
<input type="button" value="↓"/>	MIG X	Master integral gain
<input type="button" value="↓"/>	MDG X	Master derivative gain
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="↓"/>	SCV X	Submaster center value
<input type="button" value="↓"/>	HHL X	High humidity limit
<input type="button" value="↓"/>	SMR X	Submaster reference value
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMR X	Submaster reference value forced
8 <input type="button" value="SRVC"/>	DXCOOL	Configure DX cooling
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMG X	Submaster gain forced
<input type="button" value="↓"/>	MSR X	Minimum submaster reference
<input type="button" value="↓"/>	DX1G X	Stage 1 Time Guard® device
<input type="button" value="↓"/>	DX2G X	Stage 2 Time Guard
<input type="button" value="↓"/>	DX3G X	Stage 3 Time Guard
<input type="button" value="↓"/>	DX4G X	Stage 4 Time Guard
<input type="button" value="↓"/>	DX5G X	Stage 5 Time Guard
<input type="button" value="↓"/>	DX6G X	Stage 6 Time Guard
<input type="button" value="↓"/>	DX7G X	Stage 7 Time Guard
<input type="button" value="↓"/>	DX8G X	Stage 8 Time Guard
<input type="button" value="↓"/>	DX1T X	Stage 1 logic type
<input type="button" value="↓"/>	DX2T X	Stage 2 logic type
<input type="button" value="↓"/>	DX3T X	Stage 3 logic type
<input type="button" value="↓"/>	DX4T X	Stage 4 logic type
<input type="button" value="↓"/>	DX5T X	Stage 5 logic type
<input type="button" value="↓"/>	DX6T X	Stage 6 logic type
<input type="button" value="↓"/>	DX7T X	Stage 7 logic type
<input type="button" value="↓"/>	DX8T X	Stage 8 logic type
9 <input type="button" value="SRVC"/>	INLET GV	Configuration of inlet guide vanes
<input type="button" value="↓"/>	MPG X	Master proportional gain
<input type="button" value="↓"/>	MIG X	Master integral gain
<input type="button" value="↓"/>	MDG X	Master derivative gain
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="↓"/>	SCV X	Submaster center value
<input type="button" value="↓"/>	SMR X	Submaster reference value
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMR X	Submaster reference value forced

DX — Direct Expansion
OAVP — Outside Air Velocity Pressure

SERVICE CONFIGURATIONS		
Keyboard Entry	Display	Description
1 0 <input type="button" value="SRVC"/>	MIXADMPR	Configuration of mixed air damper
<input type="button" value="↓"/>	MPG X	Master proportional gain
<input type="button" value="↓"/>	MIG X	Master integral gain
<input type="button" value="↓"/>	MDG X	Master derivative gain
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="↓"/>	SCV X	Submaster center value
<input type="button" value="↓"/>	MDP X	Minimum damper position
<input type="button" value="↓"/>	SMR X	Submaster reference value
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMR X	Submaster reference value forced
<input type="button" value="↓"/>	DPSP X	Damper set point
<input type="button" value="X"/> <input type="button" value="ENTR"/>	DPSP X	Damper set point forced
<input type="button" value="↓"/>	OAE X	Outside air enthalpy
<input type="button" value="↓"/>	RAE X	Return air enthalpy
<input type="button" value="↓"/>	CNTRL X	Damper controlled by
1 1 <input type="button" value="SRVC"/>	ELECHEAT	Configuration of electric heat
<input type="button" value="↓"/>	MPG X	Master proportional gain
<input type="button" value="↓"/>	MIG X	Master integral gain
<input type="button" value="↓"/>	MDG X	Master derivative gain
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="↓"/>	SMR X	Submaster reference value
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMR X	Submaster reference value forced
1 2 <input type="button" value="SRVC"/>	NTFC	Configuration of nighttime free cooling (NTFC)
<input type="button" value="↓"/>	NTLO X	NTFC lockout temperature (minimum outside air temperature to operate NTFC)
1 3 <input type="button" value="SRVC"/>	NPURGE	Configuration of night purge
<input type="button" value="↓"/>	NPMN X	Night purge duration
<input type="button" value="↓"/>	NPDL X	Night purge low temperature damper position
<input type="button" value="↓"/>	NPDH X	Night purge high temperature damper position
<input type="button" value="↓"/>	MDP X	Minimum damper position
1 4 <input type="button" value="SRVC"/>	OAC	Configuration of constant outside air
<input type="button" value="↓"/>	MPG X	Master proportional gain
<input type="button" value="↓"/>	MIG X	Master integral gain
<input type="button" value="↓"/>	MDG X	Master derivative gain
<input type="button" value="↓"/>	SMG X	Submaster gain
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMG X	Submaster gain forced
<input type="button" value="↓"/>	OALV X	OAVP sensor low voltage point
<input type="button" value="↓"/>	OAHV X	OAVP sensor high voltage point
<input type="button" value="↓"/>	OALR X	OAVP sensor low voltage reference
<input type="button" value="↓"/>	OAHR X	OAVP sensor high voltage reference
<input type="button" value="↓"/>	PMF X	OAVP sensor probe multiplier factor
<input type="button" value="↓"/>	MDP X	Minimum damper position
<input type="button" value="↓"/>	SMR X	Submaster reference value
<input type="button" value="X"/> <input type="button" value="ENTR"/>	SMR X	Submaster reference value forced

Table 13 — Keyboard Directory (cont)

SERVICE CONFIGURATIONS		
Keyboard Entry	Display	Description
1 5 <small>SRVC</small>	AIRQUAL1	Configuration of indoor air quality and AQ sensor no. 1
↓	MPG X	Master proportional gain
↓	MIG X	Master integral gain
↓	XDP X	Maximum damper position
↓	Q1LV X	Air quality sensor 1 low voltage point
↓	Q1HV X	Air quality sensor 1 high voltage point
↓	Q1LR X	Air quality sensor 1 low voltage reference
↓	Q1HR X	Air quality sensor 1 high voltage reference
↓	MDP X	Minimum damper position
1 6 <small>SRVC</small>	AIRQUAL2	Configuration of indoor air quality and AQ sensor no. 2
↓	MPG X	Master proportional gain
↓	MIG X	Master integral gain
↓	XDP X	Maximum damper position
↓	Q2LV X	Air quality sensor 2 low voltage point
↓	Q2HV X	Air quality sensor 2 high voltage point
↓	Q2LR X	Air quality sensor 2 low voltage reference
↓	Q2HR X	Air quality sensor 2 high voltage reference
↓	MDP X	Minimum damper position
1 7 <small>SRVC</small>	AOSS X	Configuration of optimal start/stop
↓	BLDF X	Building factor
↓	UOCF X	24 hour occupied factor
↓	SETB X	Set point bias
↓	OSMT X	Maximum allowable stop time
1 8 <small>SRVC</small>	SPRESET	Configuration of space temperature reset
↓	RTIO X	Reset ratio X
↓	LIMIT X	Reset limit X
1 9 <small>SRVC</small>	LOADSHED	Configuration of loadshed
↓	LSGP X	Loadshed group number (1-16)
2 0 <small>SRVC</small>	FANTRACK	Configuration of fan tracking
↓	SVUL X	Supply velocity upper limit
↓	RVUL X	Return velocity upper limit
↓	SDAR X	Supply duct area
↓	RDAR X	Return duct area
↓	MPG X	Master proportional gain
↓	MIG X	Master integral gain
↓	MDG X	Master derivative gain
↓	SMG X	Submaster gain
↓	SCV X	Submaster center value
↓	SMR X	Submaster reference value
X ENTR	SMR X	Submaster reference value forced

SERVICE CONFIGURATIONS		
Keyboard Entry	Display	Description
2 1 <small>SRVC</small>	HUMIDITY	Configuration of humidity
↓	MPG X	Master proportional gain
↓	MIG X	Master integral gain
↓	MDG X	Master derivative gain
↓	SMG X	Submaster gain
↓	SCV X	Submaster center value
↓	SMR X	Submaster reference value
X ENTR	SMR X	Submaster reference value forced
2 2 <small>SRVC</small>	ALRMLIMIT	Configuration of alarm limits
↓	SPLO X	Space temperature low alarm limit/occupied
↓	SPHO X	Space temperature high alarm limit/occupied
↓	SPLU X	Space temperature low alarm limit/unoccupied
↓	SPHU X	Space temperature high alarm limit/unoccupied
↓	SALO X	Supply air temperature low alarm limit/occupied
↓	SAHO X	Supply air temperature high alarm limit/occupied
↓	SALU X	Supply air temperature low alarm limit/unoccupied
↓	SAHU X	Supply air temperature high alarm limit/unoccupied
↓	RALO X	Return air temperature low alarm limit/occupied
↓	RAHO X	Return air temperature high alarm limit/occupied
↓	RALU X	Return air temperature low alarm limit/unoccupied
↓	RAHU X	Return air temperature high alarm limit/unoccupied
↓	TLO X	Temperature input low alarm limit/occupied
↓	THO X	Temperature input high alarm limit/occupied
↓	TLU X	Temperature input low alarm limit/unoccupied
↓	THU X	Temperature input high alarm limit/unoccupied
↓	OATL X	Outside air temperature low alarm limit
↓	OATH X	Outside air temperature high alarm limit
↓	MATL X	Mixed air temperature low alarm limit
↓	MATH X	Mixed air temperature high alarm limit
↓	RHL X	Relative humidity low alarm limit
↓	RHH X	Relative humidity high alarm limit
↓	ORHL X	Outside air relative humidity low alarm limit
↓	ORHH X	Outside air relative humidity high alarm limit
↓	SPL X	Static pressure low alarm limit
↓	SPH X	Static pressure high alarm limit
↓	SVPL X	Supply velocity pressure low alarm limit
↓	SVPH X	Supply velocity pressure high alarm limit
↓	RVPL X	Return velocity pressure low alarm limit
↓	RVPH X	Return velocity pressure high alarm limit
↓	CFML X	Delta CFM x 100 low alarm limit
↓	CFMH X	Delta CFM x 100 high alarm limit
↓	Q1H X	Air quality sensor 1 high alarm limit
↓	Q2H X	Air quality sensor 2 high alarm limit

Table 13 — Keyboard Directory (cont)

QUICK TEST		
Keyboard Entry	Display	Description
1 TEST	INPUTS	Factory/field test of inputs
↓	SAT X	Supply air temperature
↓	OAT X	Outside air temperature
↓	SPT X	Space temperature
↓	RAT X	Return air temperature
↓	ENT X	Enthalpy switch status
↓	SFS X	Airflow switch status
↓	FRZ X	Freezestat
↓	SP X	Static pressure
↓	RH X	Return air relative humidity
↓	MAT X	Mixed air temperature
↓	OARM X	Outside air relative humidity
↓	FLTS X	Filter status
↓	TEMP X	Temperature input
↓	RVP X	Return velocity pressure
↓	SVP X	Supply velocity pressure
↓	DHH X	Duct high humidity
↓	EVAC X	Evacuation
↓	PRES X	Pressurization
↓	PURG X	Smoke purge
↓	FSD X	Fire shutdown
↓	MTR X	Wattmeter
↓	OAVP X	Outside air velocity pressure
↓	AQ1 X	Air quality 1
↓	AQ2 X	Air quality 2
↓	CUST X	Condensing unit status
↓	DXSD X	DX cooling shutdown

QUICK TEST		
Keyboard Entry	Display	Description
2 TEST	OUTPUTS	Factory/field test of outputs
↓	HCV X	Entering heating coil valve test
ENTR	HCV TEST	Testing heating coil valve
↓	CCV X	Entering cooling coil valve test
ENTR	CCV TEST	Testing cooling coil valve
↓	MIXD X	Entering mixed air damper test
ENTR	MIXD TEST	Testing mixed air dampers
↓	IGV X	Entering inlet guide vanes test
ENTR	IGV TEST	Testing inlet guide vanes
↓	SF X	Entering supply fan test
ENTR	FAN TEST	Testing supply fan
↓	HIR X	Entering heat interlock relay test
ENTR	HIR TEST	Testing heating interlock relay
↓	RFVC X	Entering return fan volume test
ENTR	RFVCTEST	Testing return fan volume
↓	HUM1 X	Entering humidifier stage 1 test
ENTR	HUM1TEST	Testing humidifier stage 1
↓	HUM2 X	Entering humidifier stage 2 test
ENTR	HUM2TEST	Testing humidifier stage 2
↓	AOTC X	Entering analog temperature control output test
ENTR	AOTCTEST	Testing analog temperature control output
↓	DOTC X	Entering discrete temperature control output test
ENTR	DOTCTEST	Testing discrete temperature control output
↓	DTCC X	Entering discrete time clock control output test
ENTR	DTCCTEST	Testing discrete time clock control output

DX — Direct Expansion

Table 13 — Keyboard Directory (cont)

QUICK TEST			HISTORY		
Keyboard Entry	Display	Description	Keyboard Entry	Display	Description
3 TEST	ELE HEAT	Factory/field test of electric heat	1 HIST	ALARMHST	Alarm history
↓	EHS1 X	Stage 1 test	↓	ALARM X	Latest alarm
ENTR	STG1 TST	Testing of electric heat stage 1	↓	ALARM X	Previous alarm
↓	EHS2 X	Stage 2 test	↓	ALARM X	Previous alarm
ENTR	STG2 TST	Testing of electric heat stage 2	↓	ALARM X	Previous alarm
↓	EHS3 X	Stage 3 test	↓	ALARM X	Previous alarm
ENTR	STG3 TST	Testing of electric heat stage 3	↓	ALARM X	Previous alarm
↓	EHS4 X	Stage 4 test	↓	ALARM X	Previous alarm
ENTR	STG4 TST	Testing of electric heat stage 4	↓	ALARM X	Previous alarm
↓	EHS5 X	Stage 5 test	↓	ALARM X	Previous alarm
ENTR	STG5 TST	Testing of electric heat stage 5			
↓	EHS6 X	Stage 6 test	2 HIST	MTMN/HIS	Maintenance history
ENTR	STG6 TST	Testing of electric heat stage 6	↓	MM.DD.YY	Latest service date
↓	EHS7 X	Stage 7 test			
ENTR	STG7 TST	Testing of electric heat stage 7			
↓	EHS8 X	Stage 8 test			
ENTR	STG8 TST	Testing of electric heat stage 8			
4 TEST	DXCOOL	Factory/field test of DX cooling			
↓	DXS1 X	Stage 1 test			
ENTR	STG1TEST	Testing DX cooling stage 1			
↓	DXS2 X	Stage 2 test			
ENTR	STG2TEST	Testing DX cooling stage 2			
↓	DXS 3 X	Stage 3 test			
ENTR	STG3TEST	Testing DX cooling stage 3			
↓	DXS4 X	Stage 4 test			
ENTR	STG4TEST	Testing DX cooling stage 4			
↓	DXS5 X	Stage 5 test			
ENTR	STG5TEST	Testing DX cooling stage 5			
↓	DXS6 X	Stage 6 test			
ENTR	STG6TEST	Testing DX cooling stage 6			
↓	DXS7 X	Stage 7 test			
ENTR	STG7TEST	Testing DX cooling stage 7			
↓	DXS8 X	Stage 8 test			
ENTR	STG8TEST	Testing DX cooling stage 8			
5 TEST	EXIT TEST	Exit quick test			
ENTR	TST CMPL	Test completed			

DX — Direct Expansion

STATUS FUNCTION — The status function shows the current status of alarm (diagnostic) codes, operating modes, set points, all measured system temperatures, output values, and input values. These subfunctions are defined on pages 78-80. Refer to Table 11 for additional information.

1 **STAT** (Alarms) — Alarms are messages that one or more faults have been detected. Each fault is assigned a code number which is reported with the alarm. (See Table 14 for code definitions.) The codes indicate failures that cause the unit to shut down, terminate an option (such as reset), or result in the use of a default value as the set point.

Up to 32 alarm codes can be stored at once. To view them in numerical sequence, press **1** **STAT** to enter the alarm display and then press **↓** to move to the individual alarm displays. Press **EXPN** after a code has been displayed and the meaning of the code will scroll across the screen. See Example 1.

If an input or output point which has generated an alarm resets (returns to a range within its limits), the alarm code is deleted from the list.

A historical sequence of the last 9 alarms can be found using the **HIST** key. See Display Functions, History Function section for more details.

2 **STAT** (Modes) — The operating mode codes are displayed to indicate the current operating status of the unit. (See Table 14)

To enter the MODES subfunction, press **2** **STAT** and use the **↓** key to determine if more than one mode applies. See Example 2 to read current mode with expansion.

Example 1 — Reading Alarm Codes

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
	TUE 12:45 MODE 23 3 ALARMS	Keyboard has not been used for at least 10 minutes; alternating summary display appears on screen
1 STAT	3 ALARMS	3 alarms detected
↓	ALARM 71	First alarm code
EXPN	SPACE TEMPERATURE LOW LIMIT	Explanation of alarm code
↓	ALARM 76	Second alarm code
EXPN	RETURN AIR TEMPERATURE HIGH LIMIT	Explanation of alarm code
↓	ALARM 83	Third alarm code
EXPN	RELATIVE HUMIDITY LOW LIMIT	Explanation of alarm code

The modes are explained below:

Temperature Reset (21) — Indicates that the unit is using temperature reset to adjust the supply-air set point. The set point is modified based on space temperature (VAV units only). Unit must be configured for space temperature reset (**1** **8** **SRVC**). (This mode is enabled by **5** **SRVC**.)

Demand Limit (22) — On CV (constant volume) units, this mode indicates that the fan is being held off by the Demand Limit option. On VAV units, it indicates that the maximum IGV position is being limited by the Demand Limit option. Units must be configured for demand limiting (**1** **9** **SRVC**). This mode is enabled by **5** **SRVC**, and is only available on units connected to the Carrier Comfort Network (CCN).

Unoccupied Heating (23) — Indicates that the space temperature is below the Unoccupied Heating set point and the unit is on. When the space temperature rises above the set point the unit is turned off.

Unoccupied Cooling (24) — 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.

Optimal Start (26) — Indicates that the unit is operating in the Optimal Start mode and is trying to achieve the Occupied set point. On VAV units this is referred to as morning warm-up. Unit must be configured for optimal start (**1** **7** **SRVC**). This mode is enabled by **5** **SRVC**.)

Unoccupied Mode (27) — Indicates that the unit is in the Unoccupied mode as determined by its time schedule. In this mode the unit is turned off.

Optimal Stop (29) — Indicates that the unit is being controlled to its expanded Occupied set points. The space temperature is allowed to drift to its expanded Occupied set points during the last portion of the Occupied period.

Unit must be configured for Optimal Start (**1** **7** **SRVC**).

Optimal Stop mode is only applicable to CV units.

Occupied Heating (30) — Indicates that the unit is in the Heating mode to satisfy its Occupied Heating set point.

Units must be configured for Occupied Heating (**5** **SRVC**).

Occupied Heating is available on VAV units only.

Example 2 — Reading Current Operating Modes

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
	TUE 12:45 MODE 31	Keyboard has not been used for at least 10 minutes; alternating summary display appears on screen.
2 STAT	MODE	Modes subfunction of status function
↓	MODE 31	Mode 31 is in effect
EXPN	OCCUPIED COOLING	Explanation of code 31
↓	MODE 22	Mode 22 is in effect
EXPN	DEMAND LIMIT	Explanation of code 22

NOTE: The first mode is the primary operating mode. The second mode is the secondary operating mode, if applicable.

Occupied Cooling (31) — Indicates that the unit is in the Cooling mode to satisfy its Occupied Cooling set point.

Occupied Fan Only (32) — Indicates that the unit is maintaining set point by using a mixture of outside and return air only. No mechanical heating or cooling is being used.

Nighttime Free Cooling (33) — Indicates that the supply fan is on and using outside air to precool the space served by the unit. Unit must be configured for nighttime free cooling (1 2 SRVC). (This mode is enabled by 5 SRVC).

Smoke Pressurization (34) — Indicates that the unit is in the Pressurization mode. This mode is issued from the fire system panel. Refer to Table 15 for the state of the items controlled.

Smoke Evacuation (35) — Indicates that the unit is in the Smoke Evacuation mode. This mode is issued from the system panel. Refer to Table 15 for the state of the items controlled.

Smoke Purge (36) — Indicates that the unit is in the Smoke Purge mode. This mode is issued from the fire system panel. Refer to Table 15 for the state of the items controlled.

Fire Shutdown (37) — Indicates that the unit is in the Fire Shutdown mode. This mode is issued from the fire system panel or local smoke detector. Refer to Table 15 for the state of the items controlled.

Quick Test (38) — Indicates that the unit is in the Quick Test mode. It allows the user to test all inputs and outputs connected to the PIC controller. All control routines are deactivated when the unit is in this mode. This mode can only be initiated manually when the supply fan status is OFF. (HOA switch is in OFF position.) In order to reactivate all the configured control routines, press 5 TEST and then press ENTR .

Timed Override (39) — Indicates that the unit operation has been extended by the user. Unit must be configured for Timed Override schedule and timed override hours (5 SRVC).

Table 14 — Display Codes

FORCE STATES	
Display	Description
1	Fire mode force
2	Internal safety force
3	Quick Test/Service tool force
4	HSIO/Building Supervisor force
5	Remote Building Supervisor force
6	Loadshed minimum offtime force
7	Data transfer force
8	BEST (Building Environmental Systems Translator) force
9	Temperature override force
10	Loadshed force
OPERATING MODES	
Display	Description
21	Temperature Reset in effect
22	Demand Limit in effect
23	Unoccupied Heating mode
24	Unoccupied Cooling mode
26	Optimal Start mode
27	Unoccupied mode
29	Optimal Stop mode
30	Occupied Heating mode
31	Occupied Cooling mode
32	Occupied Fan Only mode
33	Nighttime Free Cooling mode
34	Pressurization mode
35	Evacuation mode
36	Smoke Purge mode
37	Fire Shutdown mode
38	Quick Test mode
39	Timed Override mode
ALARMS	
Display	Description
60	Air quality 1 high limit
61	Air quality 2 high limit
62	Air quality/constant outside air suspended
63	(Not used)
64	DX cooling shutdown
65	Pressurization
66	Evacuation
67	Smoke purge
68	Fire shutdown
69	Service/maintenance required
70	Linkage failure
71	Space temperature low limit
72	Space temperature high limit
73	Supply-air temperature low limit
74	Supply-air temperature high limit
75	Return-air temperature low limit
76	Return-air temperature high limit
77	Mixed-air temperature low limit
78	Mixed-air temperature high limit
79	Outside-air temperature low limit
80	Outside-air temperature high limit
81	Static pressure low limit
82	Static pressure high limit
83	Relative humidity low limit
84	Relative humidity high limit
85	Fan status
86	Freezestat
87	Analog temperature control sensor low limit
88	Analog temperature control sensor high limit
89	Outside-air relative humidity low limit
90	Outside-air relative humidity high limit
91	Supply velocity pressure low limit
92	Supply velocity pressure high limit
93	Return velocity pressure low limit
94	Return velocity pressure high limit
95	Delta CCFM low limit
96	Delta CCFM high limit
97	Filter status
98	Duct high humidity

CCFM — Cfm x 100

Table 15 — State of Items Controlled

MODE	(DISPLAY CODE)	RETURN FAN	SUPPLY FAN	OUTDOOR-AIR DAMPER	RETURN-AIR DAMPER	EXHAUST DAMPER	SUPPLY FAN INLET GUIDE VANES (IGV)	RETURN FAN IGV	HEAT INTERLOCK RELAY	ELECTRIC HEAT ALL STAGES
Pressurization	(34)	Off	On	Open	Close	Close	Open to Static Pressure Set Point	Close	On	Off
Purge	(36)	On	On	Open	Close	Open	Open to Static Pressure Set point	Open to $\varnothing \Delta$ cfm	On	Off
Evacuation	(35)	On	Off	Close	Close	Open	Close	Open	Off	Off
Fire Shutdown	(37)	Off	Off	Close	Open	Close	Close	Close	Off	Off

3 **STAT** (Set point) — This subfunction displays the current operating system set points.

To view set points, depress **3** **STAT**, then use the **↓** key to display the occupied heat set point. Continue to depress **↓** to display all the various system set points. Table 13 shows the order of the various set points.

4 **STAT** (Inputs) — The inputs subfunction displays the readings at the various temperature sensors, fan status, static pressure sensors, enthalpy switch, and freezestat. It also allows the outside-air temperature sensor, enthalpy switch, return-air relative humidity sensor, outside-air relative humidity sensor, and filter status to be forced to a user determined value or status. The forced value overrides the value that the control system actually reads. This permits operation in the event of a faulty sensor.

To read a sensor, enter **4** **STAT**, then scroll to the desired sensor reading using the **↓** key. To force an input, see Example 3. Table 13 shows the order of the readouts.

Example 3 — Forcing An Input Value

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
4 STAT	INPUTS	System inputs
↓	SPT X	Space temperature
↓	SAT X	Supply air temperature
↓	RT X	Return air temperature
↓	MAT X	Mixed air temperature
↓	OAT 60	Outside air temperature
8 0 ENTR	OAT 80/FORCED	Outside air temperature value forced to 80. NOTE: Forced value toggles between value and word forced
CLR	OAT 60	Outside air temperature forced value removed. Display no longer flashes

5 **STAT** (Outputs) — The output subfunction displays or forces the output value percentage of the inlet guide vanes, mixed air damper and heating and cooling valves. It also displays or forces the ON/OFF status of the supply fan and heat interlock relay, displays the status of electric heat stages, and displays optional output status for return fan volume control, analog output temperature control, discrete output temperature control, discrete output time clock, and humidifier stages.

To read a system output value, enter **5** **STAT**, then scroll to the desired output using the **↓** key. To force a system output value, see Example 4. Table 13 shows the order of the output values.

Example 4 — Forcing An Output Value

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
5 STAT	OUTPUTS	System Outputs
↓	IGV X	Inlet guide vanes
↓	MIXD X	Mixed air damper
↓	HCV X	Heating coil valve
↓	CCV X	Cooling coil valve
↓	SF OFF	Supply fan off
1 ENTR	SF ON/FORCED	Supply fan forced ON. NOTE: Supply fan forced value toggles between value (SF ON) and word FORCED
CLR	SF OFF	Supply fan forced value removed. Display no longer flashes

HISTORY FUNCTION

1 **HIST** — Displays the 9 latest alarms generated by the unit in the order of their occurrence. If 9 alarms are displayed, the occurrence of a 10th alarm shifts the first alarm off the display.

2 **HIST** — Displays the latest service date on the local interface device. The last 2 service dates are displayed at the Building Supervisor.

TEST FUNCTION — The test function operates the Quick Test diagnostic program.

1 **TEST** — Displays the status of all inputs.

2 **TEST** — Tests the outputs.

3 **TEST** — Tests the electric heaters. Unit must be configured for electric heat to access this subfunction. See Example 5.

4 **TEST** — Tests the stages of direct expansion (DX) cooling. Unit must be configured for DX cooling to access this subfunction.

5 **TEST** — Takes the unit out of Quick Test.

NOTE: The unit must not be operating during the Quick Test function. Set HOA switch to OFF and follow the test procedure. Set HOA switch to AUTO only as required during testing.

To reach a particular test, enter its subfunction number and then scroll to the desired test by pressing **↓**. A test can be terminated by pressing **↓**; pressing **↓** after a test has started terminates the current test and advances the system to the next test. Once in the next step, you may start the test by pressing **ENTR**, advance past it by pressing **↓**, or back up by pressing **↑**. When testing is complete, exit the Quick Test by pressing **5** **TEST** and then **ENTR**; this **MUST** be done to restore the unit software to automatic control.

If the keyboard is not used for 10 minutes, the display returns to the rotating default display. Press **5** **TEST** and **ENTR** to exit Quick Test and then press **TEST** to restart the test procedure.

Example 5 — Using Quick Test

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
3 TEST	ELEC HT	Factory test of electric heat subfunction of test function
↓	EHS1	Stage 1 test
ENTR	STG1 TST	Pressing ENTR starts the fan test. Fan automatically starts. There is an 11-second delay while the inlet guide vanes open and the heat stage is enabled. When the electric heat stage should be running, the display shows EHS ON. Test remains on until another key is pressed
↓	EHS2	Pressing the down arrow key advances the system to stage 2 test. Any stage may be selected. Press the ↓ key until the desired stage is displayed, then press ENTR to start the test
5 TEST	EXIT TST	If no other test is desired, exit Quick Test. Fan shuts off, last electric heat stage shuts off, and IGVs close
ENTR	TST CMPL	Test is completed. Unit resumes automatic control

Programming Functions

SERVICE FUNCTION — The service function allows the operator to verify or change factory and field configurations. The service subfunctions are listed below. (See Table 13 for details.) Refer to Table 16 for configuration value ranges and defaults.

1 **SRVC** — Use this subfunction to log on before performing any subfunction in Factory Configurations (**3** **SRVC**), and to log off after completing service subfunctions. See Example 6.

Example 6 — Logging On and Logging Off Service Function

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
TO LOG ON:		
1 SRVC	LOG ON	Ready for password to be entered
1 1 1 1 ENTR	LOGGEDON	Operator can now use service functions
TO LOG OFF:		
↓	LOG OFF	Ready for operator to log off
ENTR	LOGD OFF	Logged off — password protection enabled

Table 16 — Service Configuration Ranges and Defaults

SERVICE SUBFUNCTION NUMBER	CONFIGURATION VALUE	RANGE	FACTORY DEFAULT VALUE
3	Unit Type (0 = CV, 1 = VAV)	0/1	0
	Cooling Type (0 = none, 1 = chilled water coil, 2 = DX)	0 to 2	1
	DX Cooling Stages	0 to 8	2
	Heating Type (0 = none, 1 = hot water/steam coil, 2 = electric heater)	0 to 2	1
	Electric Heater Stages	0 to 8	0
	Mixed Air Dampers (0 = none, 1 = analog, 2 = 2-position)	0 to 2	1
	Indoor-Air Quality Type (1 = single gas, 2 = differential/2 gases)	1/2	1
	Mixed-Air Temperature Protection	Yes/No	Yes
	Bus Number	0 to 239	0
	Element Address	0 to 239	1
4	Password	0 to 9999	1111
4	English/Metric System (0 = English, 1 = Metric)	0/1	0
5	Nighttime Free Cooling	Enabled/Disabled	Disabled
	Humidity Control (0 = none, 1 = analog, 2 = discrete)	0 to 2	0
	Occupied Heating	Enabled/Disabled	Disabled
	Space Temperature Reset	Enabled/Disabled	Disabled
	Demand Limit	Enabled/Disabled	Disabled
	Fan Tracking	Enabled/Disabled	Disabled
	Constant Outside Air	Enabled/Disabled	Disabled
	Night Purge	Enabled/Disabled	Disabled
	Indoor Air Quality	Enabled/Disabled	Disabled
	Indoor Air Quality Priority Level (high = 1, low = 2, none = 3)	1 to 3	2
	Adaptive Optimal Start/Stop	Enabled/Disabled	Disabled
	Timed Override Schedules	1 to 3	1
	(1 = Time schedule no. 1, 2 = Time schedule no. 2, 3 = Both)		
Timed Override Hours	0 to 4	0	
6	Heating Coil Master Proportional Gain	0 to 20.0	8.0
	Heating Coil Master Integral Gain	0 to 2.0	0.3
	Heating Coil Master Derivative Gain	0 to 20.0	0.0
	Heating Coil Submaster Gain	-20.0 to 20.0	-7.5
	Heating Coil Submaster Center Value (%)	0 to 100	50
	Heating Coil Fan "Off" Value (F)	35 to 65	40
7	Cooling Master Proportional Gain	0 to 20.0	8.0
	Cooling Master Integral Gain	0 to 2.0	0.3
	Cooling Master Derivative Gain	0 to 20.0	0.0
	Cooling Coil Submaster Gain	-20.0 to 20.0	-7.5
	Cooling Coil Submaster Center Value (%)	0 to 100	80
	Cooling High Humidity Limit (%)	0 to 99	99
8	DX Cooling Submaster Gain	2.0 to 25.0	*
	DX Cooling Minimum Submaster Reference	0 to 60	40
	DX Cooling Stage 1 Time Guard® Device (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 2 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 3 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 4 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 5 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 6 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 7 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 8 Time Guard (0 = disabled, 1 = enabled)	Enabled/Disabled	Enabled
	DX Cooling Stage 1 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal
	DX Cooling Stage 2 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal
	DX Cooling Stage 3 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal
	DX Cooling Stage 4 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal
	DX Cooling Stage 5 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal
DX Cooling Stage 6 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal	
DX Cooling Stage 7 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal	
DX Cooling Stage 8 Logic Type (0 = normal, 1 = inverted)	Normal/Inverted	Normal	
9	Inlet Guide Vanes Master Proportional Gain	0 to 5.0	0.5
	Inlet Guide Vanes Master Integral Gain	0 to 2.0	0.3
	Inlet Guide Vanes Master Derivative Gain	0 to 5.0	0.0
	Inlet Guide Vanes Submaster Gain	-10.0 to 10.0	5.0
	Inlet Guide Vanes Submaster Center Value (%)	0 to 100	50
10	Mixed-Air Damper Master Proportional Gain	0 to 20.0	8.0
	Mixed-Air Damper Master Integral Gain	0 to 2.0	0.3
	Mixed-Air Damper Master Derivative Gain	0 to 20.0	0.0
	Mixed-Air Damper Submaster Gain	-20.0 to 20.0	-7.5
	Mixed-Air Damper Submaster Center Value (%)	0 to 100	50
	Mixed-Air Damper Minimum Position (%)	0 to 100	10
11	Electric Heat Master Proportional Gain	0 to 20.0	8.0
	Electric Heat Master Integral Gain	0 to 2.0	0.3
	Electric Heat Master Derivative Gain	0 to 20.0	0.0
	Electric Heat Submaster Gain	0 to 15.0	5.0
12	NTFC Lock Out Temperature (F)	40 to 70	50

LEGEND

- CV** — Constant Volume
- DX** — Direct Expansion
- NTFC** — Nighttime Free Cooling
- VAV** — Variable Air Volume

*Value varies and is automatically calculated by the control. Override this feature by forcing the value.

Table 16 — Service Configuration Ranges and Defaults (cont)

SERVICE SUBFUNCTION NUMBER	CONFIGURATION VALUE	RANGE	FACTORY DEFAULT VALUE
13	Night Purge Duration (minutes)	5 to 240	15
	Night Purge Low Temperature Damper Position (% output)	0 to 100	10
	Night Purge High Temperature Damper Position (% output)	0 to 100	35
14	Constant Outside Air Master Proportional Gain	0.0 to 5.0	0.3
	Constant Outside Air Master Integral Gain	0.0 to 5.0	1.0
	Constant Outside Air Master Derivative Gain	0.0 to 5.0	0.0
	Constant Outside Air Submaster Gain	60 to 600	*
	OAVP Sensor Low Voltage Point	0 to 2	2
	OAVP Sensor High Voltage Point	5 to 10	10
	OAVP Sensor Low Voltage Reference	0.0 to 2.0	0.0
15	OAVP Sensor High Voltage Reference	0.01 to 5.00	0.05
	OAVP Sensor Probe Multiplier Factor	0.100 to 9.999	1.564
	Air Quality Sensor 1 Master Proportional Gain	0.01 to 1.00	0.10
	Air Quality Sensor 1 Master Integral Gain	0.01 to 1.00	0.03
	Air Quality Sensor 1 Maximum Damper Position (%)	0 to 100	50
	Air Quality Sensor 1 Low Voltage Point	0 to 2	2
	Air Quality Sensor 1 High Voltage Point	5 to 10	10
16	Air Quality Sensor 1 Low Voltage Reference	0 to 2000	0
	Air Quality Sensor 1 High Voltage Reference	0 to 2000	2000
	Air Quality Sensor 2 Master Proportional Gain	0.01 to 1.00	0.10
	Air Quality Sensor 2 Master Integral Gain	0.01 to 1.00	0.03
	Air Quality Sensor 2 Maximum Damper Position (%)	0 to 100	50
	Air Quality Sensor 2 Low Voltage Point	0 to 2	2
	Air Quality Sensor 2 High Voltage Point	5 to 10	10
17	Air Quality Sensor 2 Low Voltage Reference	0 to 2000	0
	Air Quality Sensor 2 High Voltage Reference	0 to 2000	2000
	Building Factor (%)	1 to 100	10
	24 hour Unoccupied Factor	0 to 99	15
18	Set Point Bias (F)	0 to 10	2
	Maximum Allowable Stop Time	0 to 120	60
	Reset Ratio	0 to 10	3
20	Reset Limit	0 to 20	10
	Supply Velocity Upper Limit (in. wg)	0 to 3.0	2.0
	Return Velocity Upper Limit (in. wg)	0 to 3.0	2.0
	Supply Duct Area	0 to 50	0
	Return Duct Area	0 to 50	0
	Fan Tracking Master Proportional Gain	0.0 to 2.0	0.5
	Fan Tracking Master Integral Gain	0.0 to 2.0	0.5
	Fan Tracking Master Derivative Gain	0.0 to 5.0	0.0
	Fan Tracking Submaster Gain	-20.0 to 20.0	10.0
	Fan Tracking Submaster Center Value (%)	0 to 100	50
21	Humidity Master Proportional Gain	0.0 to 10.0	2.0
	Humidity Master Integral Gain	0.0 to 2.0	0.3
	Humidity Master Derivative Gain	0.0 to 10.0	0.0
	Humidity Submaster Gain	-20.0 to 20.0	7.5
	Humidity Submaster Center Value (%)	0 to 100	50
22	Space Temperature Low Alarm Limit — Occupied (F)	-10 to 245	65
	Space Temperature High Alarm Limit — Occupied (F)	-10 to 245	80
	Space Temperature Low Alarm Limit — Unoccupied (F)	-10 to 245	45
	Space Temperature High Alarm Limit — Unoccupied (F)	-10 to 245	100
	Supply Air Temperature Low Alarm Limit — Occupied (F)	-10 to 245	45
	Supply Air Temperature High Alarm Limit — Occupied (F)	-10 to 245	120
	Supply Air Temperature Low Alarm Limit — Unoccupied (F)	-10 to 245	35
	Supply Air Temperature High Alarm Limit — Unoccupied (F)	-10 to 245	180
	Return Air Temperature Low Alarm Limit — Occupied (F)	-10 to 245	60
	Return Air Temperature High Alarm Limit — Occupied (F)	-10 to 245	90
	Return Air Temperature Low Alarm Limit — Unoccupied (F)	-10 to 245	35
	Return Air Temperature High Alarm Limit — Unoccupied (F)	-10 to 245	120
	Temperature Input Low Alarm Limit — Occupied (F)	-10 to 245	-10
	Temperature Input High Alarm Limit — Occupied (F)	-10 to 245	245
	Temperature Input Low Alarm Limit — Unoccupied (F)	-10 to 245	-10
	Temperature Input High Alarm Limit — Unoccupied (F)	-10 to 245	245
	Outside Air Temperature Low Alarm Limit (F)	-40 to 245	-40
	Outside Air Temperature High Alarm Limit (F)	-40 to 245	120
	Mixed Air Temperature Low Alarm Limit (F)	0 to 250	0
	Mixed Air Temperature High Alarm Limit (F)	0 to 250	250
	Relative Humidity Low Alarm Limit (%)	0 to 100	0
	Relative Humidity High Alarm Limit (%)	0 to 100	100
	Outside Air Relative Humidity Low Alarm Limit (%)	0 to 100	0
	Outside Air Relative Humidity High Alarm Limit (%)	0 to 100	100
	Static Pressure Low Alarm Limit (in. wg)	0 to 5.0	1.0
	Static Pressure High Alarm Limit (in. wg)	0 to 5.0	2.5
	Supply Velocity Low Alarm Limit (in. wg)	0 to 3.0	0.0
Supply Velocity High Alarm Limit (in. wg)	0 to 3.0	3.0	
Return Velocity Low Alarm Limit (in. wg)	0 to 3.0	0.0	
Return Velocity High Alarm Limit (in. wg)	0 to 3.0	3.0	
Delta CFM x 100 (CCFM) Low Alarm Limit	0 to 250	0	
Delta CFM x 100 (CCFM) High Alarm Limit	0 to 250	250	
Air Quality Sensor 1 High Alarm Limit (ppm)	0 to 2000	800	
Air Quality Sensor 2 High Alarm Limit (ppm)	0 to 2000	800	
23	Preheat Coil/AOTC Master Proportional Gain	0.0 to 20.0	5.0
	Preheat Coil/AOTC Master Integral Gain	0.0 to 2.0	0.3
	Preheat Coil/AOTC Master Derivative Gain	0.0 to 20.0	0.0
	Preheat Coil/AOTC Submaster Gain	-20.0 to 20.0	-5.0
	Preheat Coil/AOTC Submaster Center Value (%)	0 to 100 F	50
	Preheat Coil/AOTC Fan/Off Value (F)	35 to 65	40
24	Preheat Coil/AOTC Sensor	0 to 128	0
	Discrete Temperature Control Sensor	0 to 128	0
	Discrete Temperature Control Logic	0 to 1	0
26	Discrete Temperature Control Hysteresis (F)	0 to 20	2
	Service/Maintenance Limits (hours x 1000)	0 to 99	0
	Service/Maintenance Elapsed Hours (hours x 1000)	0 to 99	0

LEGEND

AOTC — Analog Output Temperature Control
OAVP — Outside Air Velocity Pressure

2 — Used to verify software version.

3 — Used to verify and change factory configuration. Requires password entry in 1 . See Example 7.

NOTE: When more than one unit is connected to the Carrier Comfort Network, 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 local interface device.

Example 7 — Reading and Changing Factory Configurations

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
3 <input type="button" value="SRVC"/>	FACT CFG	Factory configuration sub-function of service function
<input type="button" value="↓"/>	TYPE CV	Unit type is constant volume
<input type="button" value="EXPN"/>	UNIT TYPE IS CV	Explanation is scrolled across screen
1 <input type="button" value="ENTR"/>	TYPE VAV	Unit type is changed to VAV
<input type="button" value="↓"/>	COOL COI	Cooling type is coil
<input type="button" value="↓"/>	DXST 2	DX cooling stage quantity is 2
<input type="button" value="↓"/>	HEAT HCL	Heating type is hot water/steam coil
<input type="button" value="•"/> 0 <input type="button" value="ENTR"/>	HEAT NON	Changed to no heat unit
2 <input type="button" value="ENTR"/>	HEAT ELE	Changed to electric heat
1 <input type="button" value="ENTR"/>	HEAT COI	Heating type is changed back to hot water/steam coil
<input type="button" value="↓"/>	EHST 0	Electric heater stages = 0
N <input type="button" value="ENTR"/>	EHST N	Electric heater stages = N, where N = number of stages
<input type="button" value="↓"/>	MIXD ALG	Unit with mixed air dampers
<input type="button" value="•"/> 0 <input type="button" value="ENTR"/>	MIXD NON	Changed to without dampers
<input type="button" value="↓"/>	IAQT 1	Indoor air quality type is single gas sensor
<input type="button" value="↓"/>	MATP YES	Mixed air temperature protection enabled
<input type="button" value="↓"/>	BUS 0	Bus number = 0
<input type="button" value="↓"/>	ADR 1	Element address = 1
2 <input type="button" value="ENTR"/>	ADR 2	Element address changed to 2
<input type="button" value="↓"/>	PSW XXXX	Password

4 — Used to change the HSIO display of the measurements from English to Metric. See Example 8.

5 — Used to read or change factory configuration of user options. See Example 9.

Example 8 — Configuration of Measurements

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
4 <input type="button" value="SRVC"/>	UNIT 0	Measurements are displayed using English (0 = English, 1 = Metric)
1 <input type="button" value="ENTR"/>	UNIT 1	Measurements are now displayed using the Metric system
<input type="button" value="•"/> 0 <input type="button" value="ENTR"/>	UNIT 0	Measurements are returned to English

Example 9 — User Configurations

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
5 <input type="button" value="SRVC"/>	USER CFG	User configurations
<input type="button" value="↓"/>	NTEN DSB	NTFC is disabled
1 <input type="button" value="ENTR"/>	NTEN EN	NTFC is enabled
<input type="button" value="CLR"/> <input type="button" value="ENTR"/>	NTEN DSB	NTFC is disabled
<input type="button" value="↓"/>	HUEN 0	Humidifier control is none
1 <input type="button" value="ENTR"/>	HUEN 1	Unit changed to analog humidifier control
<input type="button" value="CLR"/> <input type="button" value="ENTR"/>	HUEN 0	Humidifier control is changed back to none
<input type="button" value="↓"/>	OHEN DSB	Scroll past occupied heating (disabled)
<input type="button" value="↓"/>	RSEN DSB	Space temperature reset (disabled)
<input type="button" value="↓"/>	DLEN DSB	Scroll past demand limiting (disabled)
<input type="button" value="↓"/>	FTEN DSB	Fan tracking (disabled)
<input type="button" value="↓"/>	OAEN DSB	Constant outside air (disabled)
<input type="button" value="↓"/>	NPEN DSB	Night purge (disabled)
<input type="button" value="↓"/>	AQEN DSB	Indoor air quality (disabled)
<input type="button" value="↓"/>	IAQP DSB	Indoor air quality priority level (disabled)
<input type="button" value="↓"/>	OSEN DSB	Optimal start is disabled
1 <input type="button" value="ENTR"/>	OSEN EN	Optimal start is enabled
<input type="button" value="CLR"/> <input type="button" value="ENTR"/>	OSEN DSB	Optimal start is disabled
<input type="button" value="↓"/>	TSCH 1	Time schedule No. 1 is enabled
2 <input type="button" value="ENTR"/>	TSCH 2	Time schedule No. 2 is enabled
1 <input type="button" value="ENTR"/>	TSCH 1	Time schedule is changed back to No. 2
<input type="button" value="↓"/>	TOVR 0	Time override value = 0 hrs
1 <input type="button" value="ENTR"/>	TOVR 1	Time override value = 1 hr
<input type="button" value="•"/> 0 <input type="button" value="ENTR"/>	TOVR 0	Time override value = 0 hrs

NTFC — Nighttime Free Cooling

6 **SRVC** — Used to read or change factory configuration of heating coil. See Example 10.

Example 10 — Configuration of Heating Coil

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
6 SRVC	HEATCOIL	Heat coil field configuration subfunction of service function
↓	MPG 8.0	Master proportional gain
N ENTR	MPG N	Master proportional gain value is changed to N, where N = new value within the allowable range
↓	MIG 0.3	Scroll past master integral gain
↓	MDG 0.0	Master derivative gain
N ENTR	MDG 0.0	Master derivative gain value remains 0.0 (old value is still displayed). N value is not within the allowable range
↓	SMG -7.5	Submaster gain
↓	SCV 50%	Submaster center value
↓	FOV 40	Fan off value
↓	SMR N	Display of submaster reference value
X ENTR	SMR X	The submaster reference value has been forced
CLR ENTR	SMR N	The submaster reference value force has been removed

NOTE: The subfunctions to configure the cooling coil **7** **SRVC**, inlet guide vanes **9** **SRVC**, mixed air damper **1** **0** **SRVC**, and electric heaters **1** **1** **SRVC**, are performed in the same manner as Example 10.

7 **SRVC** — Used to read or change factory configuration of cooling (chilled water coil or direct expansion).

8 **SRVC** — Used to read or change configuration of direct expansion cooling options.

9 **SRVC** — Used to read or change factory configuration of inlet guide vanes.

1 **0** **SRVC** — Used to read or change configuration of mixed air dampers.

1 **1** **SRVC** — Used to read or change configuration of electric heater.

1 **2** **SRVC** — Used to read or change factory configuration of Nighttime Free Cooling (NTFC) option.

1 **3** **SRVC** — Used to read or change configuration of night purge option.

1 **4** **SRVC** — Used to read or change configuration of constant outside air option and outside air velocity pressure sensor.

1 **5** **SRVC** — Used to read or change configuration of indoor-air quality option and AQ1 sensor.

1 **6** **SRVC** — Used to read or change configuration of indoor-air quality option and AQ2 sensor.

1 **7** **SRVC** — Used to read or change factory configuration of Adaptive Optimal Start/Stop.

1 **8** **SRVC** — Used to read or change factory configuration of space temperature reset. See Example 11.

1 **9** **SRVC** — Used to read or change loadshed group and number. See Example 12.

Example 11 — Configuration of Space Temperature Reset

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
1 8 SRVC	SPCRESET	Space temperature reset field configuration subfunction of service function
↓	RTIO 3	Reset ratio set at 3
N ENTR	RTIO N	Ratio changed to N, where N = new value within the allowable range
↓	LIMT 10	Reset limit set at 10
N ENTR	LIMT N	Reset limit changed to N, where N = new value between 0 and 20

Example 12 — Configuration of Loadshed

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
1 9 SRVC	LOADSHED	Loadshed field configuration subfunction of service function
↓	LSGP 1	Loadshed group 1
2 ENTR	LSGP 2	Loadshed group changed to 2

2 **0** **SRVC** — Used to read or change field configuration of fan tracking. See Example 13.

2 **1** **SRVC** — Used to read or change factory configuration of humidity control.

2 **2** **SRVC** — Used to read or change factory configuration of alarm limits. See Example 14.

2 **3** **SRVC** — Used to read or change field configuration of analog temperature control. See Example 15.

2 **4** **SRVC** — Used to read or change field configuration of discrete temperature control. See Example 16.

Example 13 — Configuration of Fan Tracking

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 0 SRVC	FANTRACK	Fan tracking field configuration subfunction of service function
↓	SVUL 1.5	Supply velocity upper limit = 1.5 in. wg
2 . 0 ENTR	SVUL 2.0	Supply velocity upper limit changed to 2.0 in. wg
↓	RVUL 1.5	Scroll past return velocity upper limit (1.5 in. wg)
↓	SDAR 0	Supply duct area = 0
8 ENTR	SDAR 8	Supply duct area changed to 8 sq ft. (Enter whole numbers; decimals not accepted)
↓	RDAR 6	Scroll past return duct area (6 sq ft)
↓	MPG 0.5	Scroll past master proportional gain
↓	MIG 0.5	Scroll past master integral gain
↓	MDG 0.0	Master derivative gain
4 ENTR	MDG 4	Master derivative gain changed to 4
↓	SMG 10	Scroll past submaster gain
↓	SCV 50	Scroll past submaster gain center value
↓	SMR N	Submaster reference value (calculated and updated by the software)
X ENTR	SMR X	Submaster reference value forced to X value
CLR ENTR	SMR N	Submaster reference value force is removed

Example 14 — Configuration of Alarm Limits

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 2 SRVC	ALRMLIMIT	Alarm limit field configuration of subfunction of service function
↓	SPLO 65	Scroll past space temperature low limit (occupied mode)
↓	SPHO 80	Scroll past space temperature high limit (occupied mode)
↓	SPLU 45	Scroll past space air temperature low limit (unoccupied mode)
↓	SPHU 100	Scroll past space air temperature high limit (unoccupied mode)
↓	SALO 45	Supply-air temperature low limit set at 45 F (occupied mode)
N ENTR	SALO N	Supply-air temperature low limit changed to N, where N = new value within allowable range (-10 F to 245 F)

Example 15 — Configuration of Analog Temperature Control

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 3 SRVC	AO CTRL	Analog temperature control configuration subfunction of service function
↓	MPG 5.0	Scroll past master proportional gain
↓	MIG 0.3	Scroll past master integral gain
↓	MDG 0.0	Scroll past master derivative gain
↓	SMG -5.0	Scroll past submaster gain
↓	SCV 50	Scroll past submaster center value
↓	FOV 40	Scroll past fan OFF value
↓	SEN 0	Controlling temperature sensor (none configured)
1 ENTR	SEN 1	Controlling temperature sensor configured to sensor 1. Sensor codes as follows:
		1 - Supply-air temperature sensor (standard)
		2 - Outdoor-air temperature sensor (standard)
		3 - Mixed-air temperature sensor (optional)
		6 - Space temperature sensor (standard)
		7 - Return-air temperature sensor (standard)
		34 - Other optional sensor
↓	SMR X	Submaster reference value
N ENTR	SMR N	Submaster reference value forced to N value
CLR ENTR	SMR X	Force removed from submaster reference value. Display shows last value prior to force

Example 16 — Configuration of Discrete Temperature Control

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 4 SHVC	DO CTRL	Discrete temperature control configuration subfunction of service function
↓	SEN 1	Controlling temperature sensor configured to sensor 1. Sensor codes as follows: 1 - Supply-air temperature sensor (standard) 2 - Outdoor-air temperature sensor (standard) 3 - Mixed-air temperature sensor (optional) 6 - Space temperature sensor (standard) 7 - Return-air temperature (standard) 34 - Other optional sensors
34 ENTR	SEN 34	Controlling temperature sensor is 34, where sensor 34 is one of 2 optional sensor types (space temperature sensor or duct temperature sensor)
↓	TYP 0	Discrete output control logic (0 = normal logic, 1 = reverse logic)

2 5 SHVC — Used to read service history. See Example 17.

2 6 SHVC — Used to read or change field configuration of service maintenance alarm duration and to read elapsed time. See Example 18.

2 7 SHVC — Used to read timed override history. See Example 19.

NOTE: The 1 key is used to enable or turn on certain functions; the CLR key is used to disable these functions. The . key may also be used to disable the functions.

SET POINT FUNCTION — Set points are entered through the keyboard. Set points can be changed within the upper and lower limits, which are fixed. See Table 17.

Example 17 — Service History Configuration

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 5 SHVC	SERVHIST	Service history configuration subfunction of service function
↓	SDAY 2	The unit had 2 starts within the last 24 hours
↓	ST 20	The unit had a total of 20 starts since the unit was manufactured
↓	FH 240	The fan has run for 240 hours since unit manufacture.
↓	4.06.30	The unit was last started on Thursday at 6:30 am
↓	4.19.00	The unit was last stopped on Thursday at 7:00 pm

Example 18 — Service/Maintenance Alarm Configuration

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 6 SHVC	SRV/MTN	Service/Maintenance alarm configuration subfunction of service function
↓	SMAL 2	Service/Maintenance alarm limit is 2000 hrs (hours x 1000)
5 ENTR	SMAL 5	Service/Maintenance alarm limit is changed to 5000 hrs (This represents the cumulative number of hours the fan must be energized before a service/maintenance alarm is generated) (NOTE: Entering a . disables the alarm function)
↓	SMEH 3	Service/Maintenance elapsed hours is 3000 (This is the amount of time elapsed from the start of the service/maintenance alarm interval)

Example 19 — Timed Override History

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
2 7 SHVC	OVRDHIST	Timed override history subfunction of service function
↓	OHR 3	Within the current 24 hour period (beginning at midnight), the unit operated for 3 hours in the timed override mode (mode 39)

1 SET — Displays system set points. See Table 13 for sequence of set points.

2 SET — Displays demand limit set points.

3 SET — Displays time of day and day of week.

4 SET — Displays Daylight Savings Time.

5 SET — Displays holidays (month, day, and duration).

Table 17 — Set Point Ranges and Defaults

SET POINT	ALLOWABLE RANGE	DEFAULT
Occupied Heating Set Point (F)	40 to 90	68
Occupied Cooling Set Point (F)	45 to 99	78
Unoccupied Heating Set Point (F)	40 to 90	55
Unoccupied Cooling Set Point (F)	70 to 99	90
Static Pressure Set Point (in. wg)	0 to 5.0	1.5
Supply-Air Temperature Set Point (F)	35 to 65	55
Delta CFM Set Point	0 to 250	0
Humidity Set Point (%)	0 to 100	40
Analog Temperature Control Set Point (F)	40 to 100	40
Discrete Temperature Control Set Point (F)	-40 to 245	0
Air Quality Sensor 1 Set Point (ppm)	0 to 2000	650
Air Quality Sensor 2 Set Point (ppm)	0 to 2000	650
Outside Air Velocity Pressure Set Point (in. wg)	0.0 to 5.0	0.08

Reading and Changing Set Points — Example 20 shows how to read and change system set points. Other set points can be changed by following the same procedure. Refer to Table 13 for the display sequence of set points in each sub-function. To adjust any parameter after enabling the function, press until desired parameter is displayed. Key in new value and press . If input is within the allowable range, the display shows the parameter and new value. If the input is not within the allowable range, the old value remains displayed.

Example 20 — Reading and Changing System Set Points

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
	SETPOINT	System set points
	OHSP 68.0	Present occupied heating set point is 68.0
	OHSP 70.0	Key in 70 and press ENTR, display shows new occupied heating set point is 70, which is within the allowable range
	OCSP 78.0	Present occupied cooling set point is 78.0
	OCSP 78.0	Key in 30 and press ENTR, display still shows occupied cooling set point as 78.0 because 30 is not within the allowable range. See Table 15
	OCSP 75.0	Key in 75 and press ENTR, display shows new occupied cooling set point is 75.0, which is within the allowable range

Reading and Changing Time and Date Display — Time is entered and displayed in 24-hour (military) time. The day of the week is entered as a number: 1 = MON, 2 = TUE...7 = SUN. The month is also entered as a number: 1 = JAN, 2 = FEB...12 = DEC. The key is used as the colon when entering the time and date. See Example 21.

Reading and Changing Daylight Savings Time — Example 22 shows how to read and change daylight savings time. The month is entered as a number: 1 = January, 2 = February...12 = December. The day of week and time of day are entered as explained in Reading and Changing Time and Date Display above.

Example 21 — Setting of Time and Date

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
	TIME	Time display subfunction of set point function
	MON 16:00	Current setting is Monday, 4:00 pm
	TUE 13:05	New setting of Tuesday, 1:05 pm is entered and displayed
	JAN 01 96	Current setting is January 1, 1996
	FEB 27 96	New setting of February 27, 1996 is entered and displayed

Example 22 — Setting Daylight Savings Time

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
	DAYLIGHT	Daylight savings time field configuration of set point function
	ENM X	Month when daylight savings time begins
	ENM 4	Daylight savings time configured to start Month 4 (April)
	END X	Day of month when daylight savings time begins
	END 16	Daylight savings time configured to start on the 16th of the month
	ENT X	Time of day when daylight savings time begins
	ENT 2.00	Daylight savings time configured to start at 2:00 am on the 16th of April
	LVM X	Month when daylight savings time ends
	LVM 11	Daylight savings time configured to end Month 11 (November)
	LVD X	Day of month when daylight savings time ends
	LVD 12	Daylight savings time configured to end on the 12th of November
	LVT X	Time of day when daylight savings time ends
	LVT 2.00	Daylight savings time configured to end at 2:00 am on November 12

Reading and Changing Holidays — Example 23 explains how to set holidays. Up to 18 holiday periods can be set for one calendar year. When the calendar year changes the holidays must be reconfigured for the new year.

Example 23 — Setting of Holidays

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
5 SET	HOLIDAY	Holiday field configuration subfunction of set point function
↓	NEW	First holiday configuration
0 7 . 0 4 . 0 1	JUL 04 01	The first holiday is configured to start Month 7 (July), day 4 (July 4) and last for one day
1 1 . 2 3 . 0 2	NOV 23 02	The second holiday is configured to start Month 11 (November), day 23 and last for 2 days.

SCHEDULE FUNCTION — Two schedules are provided with the PIC system. Schedule I automatically switches the unit from an occupied mode to an unoccupied mode. Schedule II automatically changes the optional discrete output from occupied to unoccupied mode.

Each schedule consists of from one 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. 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. If an occupied period is to extend past midnight, it must be programmed in the following manner: Occupied period must end at 24:00 hours (midnight); a new occupied period must be programmed to begin at 00:00 hours on the next day.

The time schedule can be overridden to keep the unit or optional discrete output in the occupied mode for 1, 2, 3, or 4 hours on a one-time basis.

The air handler can be configured for an applicable holiday/shutdown schedule. This function can only be used if the PIC is connected to the Carrier Comfort Network. The network will send a holiday message (flag) to the unit on the appropriate holiday. The unit then uses the schedule that has been set for the holiday period. The unit automatically returns to its normal schedule after the holiday period is complete.

Figure 75 shows a Schedule I example for an office building with the unit operating on a set point schedule. The schedule is based on building occupancy with 3-hour off-peak cool down period from midnight to 3 am following weekend shutdown. To learn how this sample schedule can be programmed, see Example 24. The same scheduling procedures can be used to set optional discrete output Schedule II. Subfunctions 2 [SCHD] through 9 [SCHD] define schedule of air handler (Schedule I). Subfunctions 1 [1] [1] [SCHD] through 1 [8] [SCHD] define schedule of optional discrete output (Schedule II).

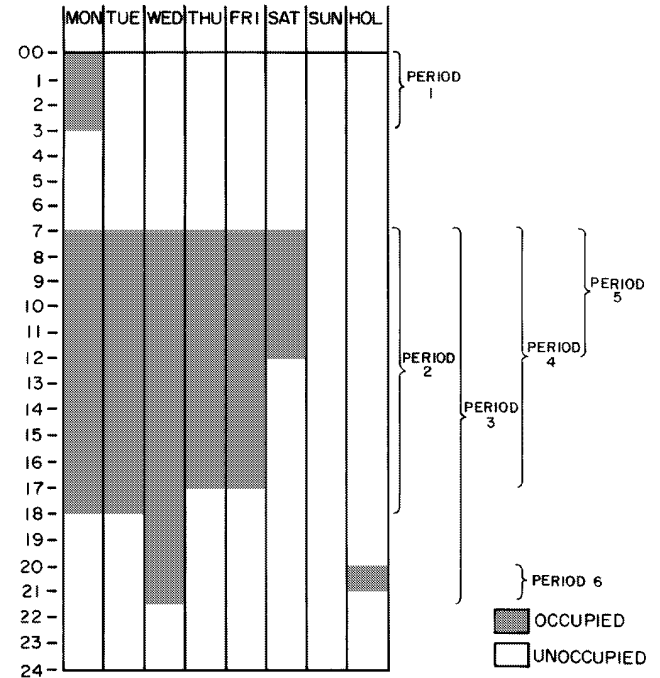


Fig. 75 — Schedule I Sample Time Schedule

Example 24 — Using the Schedule Function

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENT
PROGRAMMING PERIOD 1:		
2 [SCHD]	PERIOD 1	Define schedule period 1
↓	OCC 00.00	Start of occupied time. For this example, first period should start here (at midnight) so no entry is needed
↓	UNO 00.00	Start of unoccupied time (end of period). For this example, period 1 should end at 3:00 am
3 [.] [0] [0] [ENTR]	UNO 3.00	Period 1 ends at 3:00 am
↓	MON NO	Monday is not flagged for period 1. To put period 1 into effect on Monday, Monday must be flagged yes
1 [ENTR]	MON YES	Monday is now flagged for period 1 to be in effect
↓	TUE YES	For this example, period 1 is to be in effect on Monday only. All other days must be checked to be sure that they are flagged no. If any day is flagged yes, change to no
[.] [ENTR]	TUE NO	Tuesday is now flagged no for period 1

Example 24 — Using the Schedule Function (cont)

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENT
PROGRAMMING PERIOD 2:		
For this example, period 2 is used on Monday and Tuesday.		
3 [SCHD]	PERIOD 2	Define scheduling period 2
↓	OCC 00.00	Start of occupied time
7 [.] [0] [0] [ENTR]	OCC 7.00	Occupied time will start at 7:00 am
↓	UNO 00.00	Start of unoccupied time (end of period) for this example, period 2 should end at 18:00 (6:00 pm)
1 [8] [.] [0] [0] [ENTR]	UNO 18.00	Period 2 ends at 18:00 (6:00 pm)
↓	MON NO	Monday is not flagged for period 2. To put period 2 into effect on Monday, Monday must be flagged yes
1 [ENTR]	MON YES	Monday is now flagged for period 2 to be in effect
↓	TUE NO	Tuesday is not flagged for period 2. To put period 2 into effect on Tuesday, Tuesday must be flagged yes
1 [ENTR]	TUE YES	Tuesday is now flagged for period 2 to be in effect
↓	WED YES	For this example, period 2 is to be in effect only on Monday and Tuesday. All other days must be checked to be sure that they are flagged no. If a day is flagged yes, change to no
[.] [ENTR]	WED NO	Wednesday is now flagged no for period 2

Example 24 — Using the Schedule Function (cont)

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENT
PROGRAMMING PERIOD 3:		
For this example, Period 3 is used on Wednesday only.		
[4] [SCHD]	OCC 00.00	Start of occupied time
[7] [.] [0] [0] [ENTR]	OCC 7.00	Occupied time will start at 7:00 am
[↓]	UNO 00.00	Start of unoccupied time (end of period 3). For this example, period 3 should end at 21:30 (9:30 pm)
[2] [1] [.] [3] [0] [ENTR]	UNO 21.30	Period 3 ends at 21:30 (9:30 pm)
[↓]	MON NO	Check to be sure that Monday and Tuesday are flagged no for period 3
[↓]	TUE NO	
[↓]	WED NO	Wednesday is flagged no. Change to yes
[1] [ENTR]	WED YES	Wednesday is now flagged yes for period 3
[↓]	THU NO	Check to be sure that all other days are flagged no
[↓]	FRI NO	
[↓]	SAT NO	
[↓]	SUN NO	
[↓]	HOL NO	

Period 4 and 5 can be programmed in the same manner, flagging Thursday and Friday yes for period 4 and Saturday yes for period 5. For this example, periods 7 and 8 are not used; they should be programmed OCC 00.00, UNO 00.00.

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

To extend an occupied mode beyond its normal termination for a one-time schedule override, program as shown below:

[1] [SCHD]	OVRD 0	Override is set for 0; enter the number of hours of override desired
[3] [ENTR]	OVRD 3	Unit will now remain in occupied mode for an additional 3 hours

Example 24 — Using the Schedule Function (cont)

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENT
PROGRAMMING PERIOD 6:		
For this example, Period 6 is used for holiday only.		
[5] [SCHD]	OCC 00.00	Start of occupied time
[2] [0] [.] [0] [0] [ENTR]	OCC 20.00	Occupied time will start at 20:00 (8:00 pm)
[↓]	UNO 00.00	Start of unoccupied time (end of period 6). For this example, period 6 should end at 21:00 (9:00 pm)
[2] [1] [.] [0] [0] [ENTR]	UNO 21.00	Period 6 ends at 21:00 (9:00 pm)
[↓]	MON NO	Check to be sure that Monday through Sunday are flagged no for period 6
[↓]	TUE NO	
[↓]	WED NO	
[↓]	THU NO	
[↓]	FRI NO	
[↓]	SAT NO	
[↓]	SUN NO	
[↓]	HOL NO	Holiday is flagged no. Change to yes
[1] [ENTR]	HOL YES	Holiday is now flagged yes for period 6

CONTROL OPERATING SEQUENCE

Constant Volume and Variable Air Volume Units

TWO-POSITION DAMPER CONTROL — Two-position damper control opens or closes field-supplied and installed two-position outdoor-air dampers in order to provide minimum outdoor air ventilation.

If the supply fan is OFF, the damper is closed. If the supply fan is ON, the control determines if the unit is in the OCCUPIED mode. If unit is in the OCCUPIED mode, the dampers open. If unit is in the UNOCCUPIED mode, the dampers close.

FILTER STATUS CONTROL — This control sequence monitors one or more airflow switches which measure the differential pressure between the upstream and downstream side of a filter.

When the filter becomes dirty or needs to be replaced, the airflow switches send a discrete signal to the processor module. This, in turn, generates an alarm at the Local Interface Device or Building Supervisor.

FAN CONTROL — The supply fan is started or stopped based on the occupancy schedule, adaptive optimal start, nighttime free cooling, unoccupied heating, unoccupied cooling, demand limiting, night purge, or timed override.

The start of an occupied period is determined by either the occupancy schedule or optimal start. If optimal start is not selected, the supply fan starts at the occupied time entered in the occupancy schedule. If optimal start is selected, the fan starts at the calculated start time. The fan stops at the unoccupied time entered in the occupancy schedule. (Timed override may be used to extend the occupied period between 1 and 4 hours.)

During the unoccupied period, whenever the space temperature falls below the unoccupied heating set point or rises above the unoccupied cooling set point, the supply fan energizes and runs until the space temperature returns to within the required limits.

The supply fan can also run between the hours of 3:00 am and 7:00 am when the unit is in the Nighttime Free Cooling mode to pre-cool the space prior to the Occupied period.

Constant volume units that are subject to demand limiting stop the supply fan whenever a loadshed command is received from the CCN Loadshed option. The supply fan remains OFF until the loadshed command is cleared or the internal maximum loadshed timer expires.

NIGHTTIME FREE COOL (NTFC) — Nighttime free cooling is used to start the supply fan to precool the building's interior using outside air. This delays the need for mechanical cooling when the system enters the Occupied mode.

The system determines if the outside conditions (temperature and enthalpy) are suitable for outside cooling. If so, the supply fan is energized and the dampers modulate open. Once the space has been sufficiently cooled, the fan stops.

If the outside air conditions are not suitable, the fan remains OFF.

The unit must have mixed-air dampers to operate NTFC.

NTFC is scheduled to run only between the hours of 3:00 am and 7:00 am.

NIGHT PURGE — During the unoccupied period, this feature starts the fans and opens the mixed-air dampers to remove stagnant air and airborne pollutants from the building space.

If the current time is within the configured night purge duration, the control reads the outdoor air temperature and determines the mixed-air damper position. If the outdoor air temperature is less than the configured NTFC lockout temperature, the system sets the mixed-air dampers at the configured low temperature position. If the outdoor-air temperature is greater than the NTFC set point, or the enthalpy is high, the system sets the dampers at the configured high temperature position.

When the outside-air temperature is below the NTFC set point and the low temperature night purge damper position is set to zero, night purge is not performed. Also, when the outside air temperature is above the NTFC set point and enthalpy is high, if the high temperature night purge damper position is set to zero, night purge is not performed.

Night purge ends when the occupied time period begins.

QUICK TEST — The Quick Test is initiated and controlled at the local interface device (HSIO). It allows the service person or building owner to test all inputs and outputs of the PIC controls. When used, it displays all current values of input channels and allows the user to exercise all output channels.

Quick test suspends all process algorithms and forces all outputs with a service priority.

All service forces are removed when Quick Test is exited and control is returned to the process algorithms.

ANALOG OUTPUT TEMPERATURE CONTROL/PREHEAT COIL CONTROL — The analog output temperature control adjusts an analog output to a fixed set point, based on any analog temperature sensor connected to the unit. (Applicable sensors are: space temperature sensor, outside-air temperature sensor, mixed-air temperature sensor, supply-air temperature sensor, and return-air temperature sensor.)

If the fan is ON, the control identifies the controlling temperature sensor, reads the sensor and compares the temperature to the configurable set point. It then calculates the temperature required to satisfy the conditions.

The calculated value is compared to the actual temperature and the corresponding output is modulated to the required position.

The preheat coil control adjusts the steam or hot water valve. The valve is modulated to raise the temperature of incoming outside air. The control uses a sensor downstream from the preheat coil to monitor the air temperature.

If the supply fan is OFF, the heating valve is modulated to maintain the desired minimum duct temperature (fan off value).

If the supply fan is on and the entering-air temperature is below the set point value, the heating valve is modulated to obtain the desired leaving-air temperature.

DISCRETE OUTPUT/ANALOG INPUT CONTROL — The discrete output is controlled as a function of a temperature sensor connected to the 39L or 39NX unit. (Applicable sensors are: space temperature sensor, outside-air temperature sensor, mixed-air temperature sensor, supply-air temperature sensor, and return-air temperature sensor.) The discrete output is turned ON/OFF as required to maintain the user configured set point.

The controlling sensor is identified and its value is read. The control determines which user-configurable control logic (normal or reverse) is required.

The control compares the sensor value to the configured set point.

If normal logic is used, the discrete output is turned ON when the sensor value is equal to or greater than the set point. This output is turned OFF when the sensor value is less than the set point decreased by a user configurable hysteresis.

If reverse logic is used, the discrete output is turned ON whenever the sensor value is less than the set point. This output is turned OFF when the sensor value is greater than the set point increased by a user configurable hysteresis.

DISCRETE OUTPUT, TIMECLOCK CONTROL — This control sequence turns ON an output channel when the current time of day is greater than or equal to the Occupied time and less than the next Unoccupied time. This discrete output is OFF at all other times. The output can be used for lighting control, pump control, or to control other devices which have to be ON during the Occupied period and OFF during the Unoccupied period. This control sequence operates under its own time schedule (Schedule II).

Using the local interface device or building supervisor, the output may be overridden to extend the occupied period between 1 and 4 hours.

The control determines the output that is under time-clock control. The current time of day is compared to the Occupied time and to the next Unoccupied time. If the current time of day is equal to or within the Occupied time period, the discrete output is turned ON. If the current time of day is equal to or within the Unoccupied time period, the discrete output is turned OFF.

HUMIDITY (ANALOG OUTPUT) CONTROL — The humidity analog output control adjusts the steam valve of the steam grid humidifier. The valve is modulated to maintain the desired space or desired return-air humidity set point, depending on whether a wall-mounted or duct-mounted humidity sensor is used. A duct high humidity switch is also monitored and provides a user adjustable high limit safety.

If the supply fan is OFF, the steam valve is held closed.

If the supply fan is ON, and the unit is in the Unoccupied mode, the valve is held closed.

If the supply fan is ON and the unit is in the Occupied mode, the system determines the status of the duct high humidity switch. If the duct humidity is above the switch set point, the valve is held closed. If the duct humidity is less than the switch set point, the control reads the humidity sensor, compares the value to the set point and modulates the output as required to satisfy conditions.

HUMIDITY (DISCRETE OUTPUT) CONTROL — The humidity control sequentially adjusts a 2-stage humidifier. The humidifier is controlled to maintain a desired space or return-air humidity, depending on whether a wall-mounted or duct-mounted humidity transmitter is used.

The first stage of humidification energizes the humidifier spray pump (if applicable) along with the first stage of the humidifier. The second stage of humidification energizes the second stage of the humidifier.

A duct high humidity switch is also monitored and provides a user adjustable duct high humidity limit safety.

If the fan status is ON and the unit is in the Occupied mode, the control reads the space or return-air humidity sensor. If the humidity is 2% less than the humidity set point, the first stage is turned ON.

If the humidity is 5% less than the humidity set point, both stages are turned ON.

As the humidity increases, the stages are turned OFF as follows: When the humidity is within 2% of the set point, the second stage of the humidifier is turned OFF. When the humidity is greater than or equal to the set point, both stages are turned OFF. If the high humidity switch is tripped, all stages of the humidifier are turned OFF.

INDOOR-AIR QUALITY (IAQ) — This function maintains the correct occupied ventilation rate using CO₂ as an indicator of occupancy level or controls the levels of volatile organic compounds (VOCs) or other indoor air pollutants by modulating the mixed air dampers. Varying quantities of outdoor air are admitted during the Occupied period to maintain the ventilation rate at its set point or pollutants at or below the configured set points of the air-quality (AQ) sensors. See Fig. 76.

CO₂ sensors are available from the factory as options for field installation. VOC or other types of sensors can be field-supplied and installed. Sensors used with the IAQ feature can be configured several different ways:

- One sensor can be installed in either the space or return air stream to continuously monitor a single gas.
- Two sensors (monitoring the same gas) can be installed in different locations to provide separate inputs. For example, one sensor can be located in an occupied space and another in the return air duct, or each sensor can be installed in a different occupied space.
- Two sensors (typically VOC sensors monitoring the same gas) can be installed inside and outside the occupied space for comparative measurements. The control is configured to modify the damper position based on the value of the sensor in the occupied space, but before admitting outside air, the control performs a *differential check* to determine if the value of the sensor measuring the outside air is higher. If the outside sensor has a higher value, the damper does not change position.

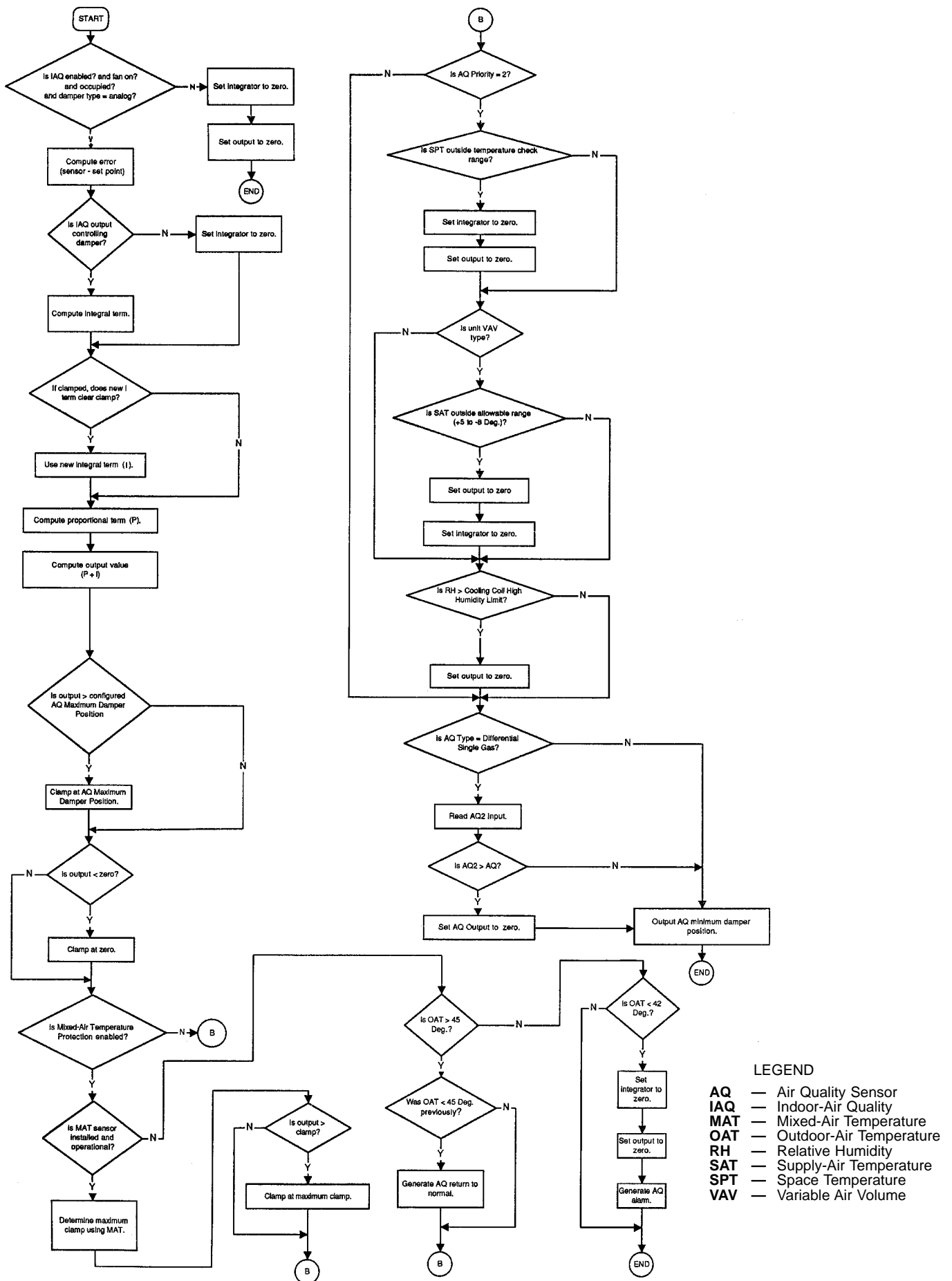
Systems with One AQ Sensor — During the unoccupied period, the minimum damper position maintained by the IAQ control is 0. During the occupied period, the control

reads the AQ1 sensor input and compares it to the configured set point. The control then calculates the minimum damper position to maintain the set point. If no other control is attempting to adjust the dampers to a more fully open position than the IAQ control, the damper is adjusted to the position determined by the IAQ control. Otherwise, the damper is positioned by the superseding control routine or at its configured minimum position.

Systems with Two AQ Sensors (Separate Readings) — The preceding sequence for the AQ1 sensor also applies to the AQ2 sensor, but the damper position is determined by either the AQ1 or the AQ2 sensor according to which sensor value demands the more fully open damper position.

Systems with Two AQ Sensors (Differential Check) — If differential sensing is configured for two VOC sensors, the control reads the AQ2 (outside air) sensor to determine if its value is greater or less than that of the AQ1 (indoor air) sensor. If the AQ2 value is greater than the value of the AQ1 sensor, the mixed-air damper position is set to 0. If the AQ2 value is less than the AQ1 value (by at least 1% of the configured minimum sensor value), the control uses the AQ1 value to modulate the dampers and maintain the AQ set point.

IAQ System Protection — To protect the system against coil freeze-up in cold climates or high heat and humidity in warm climates, the system provides several user-selectable features to override or modify the IAQ functions. An adjustable maximum position for the mixed-air damper is provided for each AQ sensor, and a selection is available to maintain the minimum mixed-air temperature at approximately 45 F. Space temperature and humidity protection can temporarily suspend IAQ functions until the temperature and humidity conditions return to the desired set points. On VAV systems during cooling, the IAQ function can be limited to maintain the required supply-air temperature.



- LEGEND**
- AQ** — Air Quality Sensor
 - IAQ** — Indoor-Air Quality
 - MAT** — Mixed-Air Temperature
 - OAT** — Outdoor-Air Temperature
 - RH** — Relative Humidity
 - SAT** — Supply-Air Temperature
 - SPT** — Space Temperature
 - VAV** — Variable Air Volume

Fig. 76 — Indoor-Air Quality (IAQ) Control Operation

SMOKE CONTROL — When the 39L or 39NX 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 air-handling unit. Each mode must be energized individually from the approved building fire alarm system, and the corresponding alarm is then generated at the local interface device or Building Supervisor.

The system must include a separate return fan and an exhaust air damper with a 4 to 20 mA actuator.

The building fire alarm system must provide 4 normally-open dry contact closures and a double-pole, double-throw (DPDT) relay (24 vac coil, contacts rated 10 amps at 240 vac) for the Fire Shutdown mode.

Fire Shutdown Mode — The fire alarm system must provide a normally-open dry contact closure which, when activated, energizes the Fire Shutdown mode.

When the Fire Shutdown mode is energized, the supply and return fans stop, the outside and exhaust air dampers close, and the return-air dampers open.

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, when activated, energizes the Evacuation mode. When the Evacuation mode is energized, the supply fan shuts down, the return fan starts, the outside-air and return-air dampers close, and the exhaust air dampers open.

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, when activated, energizes the Pressurization mode. When the Pressurization mode is energized, the supply fan starts, the return fan shuts down, the outside dampers open, and the exhaust and return-air dampers 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, when activated, energizes the smoke purge mode.

When the smoke purge mode is energized, the supply fan starts, the return fan starts, the outside air and exhaust air dampers open and the return-air dampers 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.

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 time of occupancy. The control uses outdoor-air temperature, space temperature, occupied

set point, and a 'K' factor in minutes/degrees to calculate a start time offset, which is the time in minutes that the system should be started in advance of the occupied time. The control monitors its results and adjusts the K factor to assure that the Occupied set point is achieved at time of occupancy.

Constant Volume Units Only

HEATING COIL CONTROL — The heating coil control adjusts the steam or hot water valve. The valve is modulated to prevent the space temperature from falling below the desired set point.

If the supply fan is OFF, the heating valve is modulated to maintain a desired minimum duct temperature (fan off value).

If the fan is ON, the system reads the space sensor and computes the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature and the heating coil valve modulates to the required position.

CHILLED WATER COIL COOLING CONTROL — The cooling coil control adjusts the chilled water valve. The valve is modulated to prevent space temperature from exceeding the desired set point. The valve holds its normal position if the space temperature is below the set point or the supply fan is OFF.

If the fan is ON, the control reads the humidity sensor (if supplied) and compares the value to the high humidity limit.

If the humidity is higher than the high humidity limit, the chilled water valve fully opens.

If the humidity is below the high humidity limit, the control reads the space temperature sensor and computes the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature and the chilled water valve modulates to the position required to maintain desired conditions.

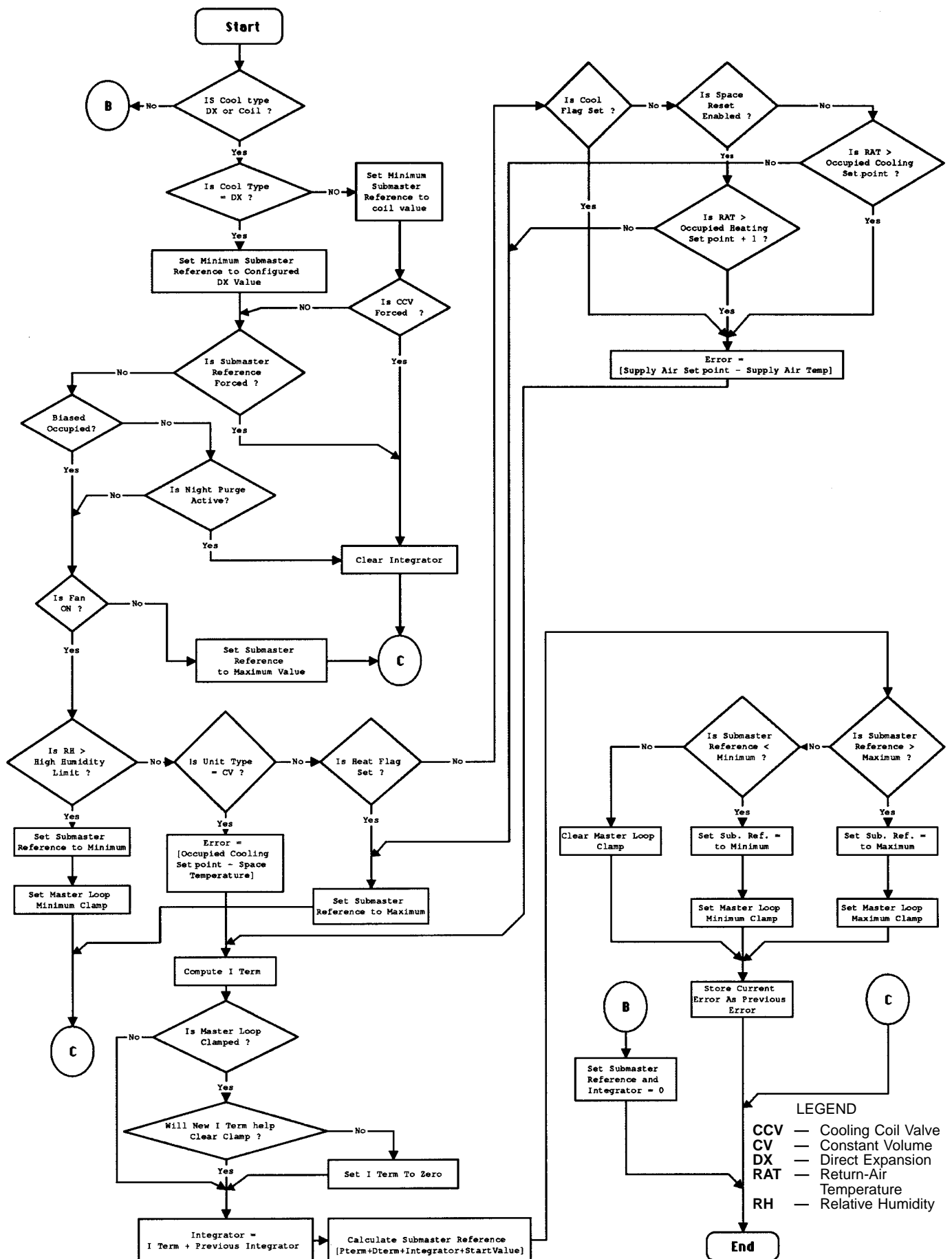
See Fig. 77 for cooling coil operation flow chart.

DIRECT EXPANSION COOLING CONTROL — The direct expansion (DX) cooling control regulates the DX cooling system. The DX cooling stages are energized and deenergized to prevent the space temperature from exceeding the desired set point. The stages remain off if the space temperature is below the set point or the supply fan is OFF.

If the supply fan is ON, the control reads the humidity sensor (if supplied) and compares the value to the high humidity limit. If the humidity is higher than the high humidity limit, the DX cooling stages are energized to maintain a minimum supply-air temperature. If the humidity is below the limit, the control reads the space temperature sensor and computes the supply-air temperature required to satisfy conditions.

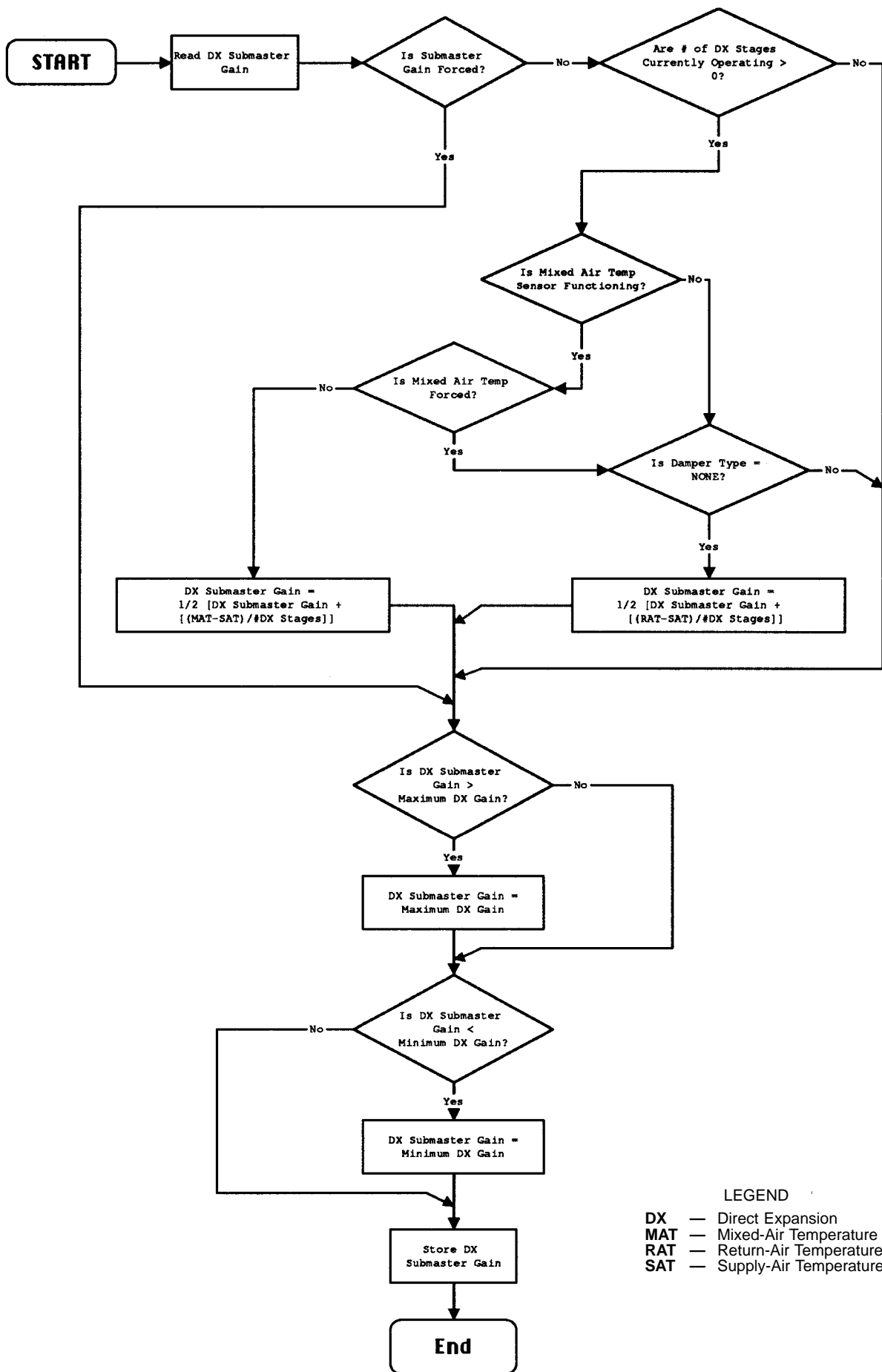
Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature and the required DX cooling stages are energized to maintain the desired conditions.

See Fig. 77 for cooling operation and Fig. 78 for DX submaster gain operation. For more complete information, refer to the Application Data book for Product Integrated Controls with DX Cooling.



LEGEND
 CCV — Cooling Coil Valve
 CV — Constant Volume
 DX — Direct Expansion
 RAT — Return-Air Temperature
 RH — Relative Humidity

Fig. 77 — Cooling (DX and Chilled Water) Control Operation



LEGEND
 DX — Direct Expansion
 MAT — Mixed-Air Temperature
 RAT — Return-Air Temperature
 SAT — Supply-Air Temperature

Fig. 78 — DX Submaster Gain Control Operation

MIXED-AIR DAMPER CONTROL—The mixed-air damper control adjusts modulating outside-air, return-air, and exhaust-air dampers. When outside air conditions are unsuitable for atmospheric cooling, the dampers are held to an adjustable minimum outside air position. When outside air conditions are suitable for atmospheric cooling, the mixed-air dampers are modulated to maintain a space temperature that is between the heating and cooling set points in an effort to minimize the need for heating or mechanical cooling. The damper set point is automatically adjusted as a function of outdoor-air temperature or can be set to a fixed value by the user.

If the supply fan is OFF, the mixed-air dampers are kept closed to outside air and open to return air.

If the fan is ON, the system checks to see if the system is in the HEAT mode. If system is in the HEAT mode, the mixed-air dampers are held in the minimum position.

If the system is not in the HEAT mode, it determines if the outside conditions are suitable for atmospheric cooling. The control compares the outdoor-air temperature to the space temperature. If the outdoor-air temperature is less than the space temperature, the system does either an enthalpy check (using an outside-air enthalpy switch) or a differential enthalpy check. (Return-air temperature is compared to return-air relative humidity for return-air differential enthalpy. Outside-air temperature is compared to outside-air relative humidity for outside-air differential enthalpy.)

The control then determines if the outdoor-air temperature is below the Nighttime Free Cool Lockout (NTLO). If so, the damper set point is changed to 1.0 degree less than the Occupied Cooling set point, allowing the system to use return air during the heating mode.

If the outdoor-air temperature is higher than 68 F, the control sets the damper set point to 1.0 degree higher than the Occupied Heating set point to provide cooling, allowing the system to use outside air.

If the outdoor-air temperature is higher than NTLO but less than 68 F, the system sets the damper set point halfway between the Occupied Heating and Occupied Cooling set points to provide ventilation.

If outside conditions are suitable, the control compares the space temperature to the damper set point and computes the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the mixed-air temperature sensor value (if installed), otherwise the supply-air temperature sensor determines the damper position. The damper adjustment rate is limited to 5% per minute if the outside-air temperature is less than 40 F. This rate limit prevents nuisance low temperature thermostat tripping.

ELECTRIC HEATER CONTROL — Electric heater staging regulates the electric heater. The heater is staged to prevent the space temperature from falling below the desired set point. (The number of heat stages is factory set for each unit's heater.)

If the supply fan is OFF, all stages of electric heat are turned off.

If the fan is ON, the control reads the space temperature sensor and calculates the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature to determine the number of heat stages required to satisfy conditions. The required stages are energized one at a time, with 2-second intervals between stages.

ADAPTIVE OPTIMAL STOP—Optimal stop allows the 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, which is the time in minutes prior to the scheduled unoccupied time, during which expanded 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 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.

TWO-STEP DEMAND LIMITING (Available on Units Connected to the Carrier Comfort Network Only) — If the Demand Limit option is enabled, the control receives and accepts redline alert and loadshed commands from the Network Loadshed option. See the CCN Loadshed manual for additional information.

When a redline alert is received, the Control decreases the Occupied Heating set point by 2° F and increases the Occupied cooling set point by 2° F.

When a loadshed command is received, the supply fan turns OFF.

The maximum loadshed timer prevents the system from remaining in loadshed, should the control lose communications with the Loadshed option. If the timer expires before the loadshed command is cleared by the Loadshed option, the control clears the loadshed command itself and returns to normal control. The loadshed timer is factory set at 60 minutes.

Variable Air Volume Units Only

CONSTANT OUTSIDE AIR (OAC) — During Occupied periods, this feature provides a continuous flow of outside air into the building. The OAC control modulates the mixed-air damper to a configurable minimum open position to ensure outside air is admitted. During Unoccupied periods, the control signals the dampers to fully close.

To monitor the outside airflow during Occupied periods, the OAC control reads the outside-air velocity pressure (OAVP) sensor, compares its value to the OAVP set point, and adjusts the mixed-air dampers to the position required to achieve the configured velocity pressure.

If a control routine (other than OAC) or the configured minimum damper position require the dampers to be more fully open than the OAC setting, that routine or position overrides the OAC control. To protect against coil freeze-up in colder climates, the PIC provides selectable low temperature protection to limit the minimum mixed-air temperature to approximately 45 F.

See Fig. 79 for OAC control flowchart.

HEATING COIL CONTROL — The heating coil control adjusts the steam or hot water valve. Heat is primarily used for morning warm-up or Occupied Heating with the valve modulated to maintain desired return-air temperature.

If the supply fan is OFF, the heating valve is modulated to maintain a desired minimum duct temperature (fan off value).

If the fan is ON, the system determines if it is in the morning warm-up mode. If it is, the return-air sensor is read and compared to the Occupied Heating set point. If heating is required, the control calculates the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature and the heating coil valve modulates to the required position.

The heat interlock relay is energized whenever there is a need for heat.

Once morning warm-up is completed, heat is activated again unless Occupied Heat has been selected.

During cooling or fan-only operation, heat can also be provided to maintain the supply-air temperature when the amount of cold outside air admitted by the IAQ or OAC controls causes the temperature to fall below the supply-air set point.

CHILLED WATER COIL COOLING CONTROL — The cooling coil control adjusts the chilled water valve. The valve is modulated to maintain desired supply-air temperature set point. The valve is held in its normal position whenever the system is in Nighttime Free Cooling or whenever the supply fan is OFF.

If the fan is ON, the control reads the humidity sensor and compares the value to the high humidity limit.

If the humidity is higher than the humidity limit, the chilled water valve fully opens.

If the humidity is below the high humidity limit, or if no humidity sensor is supplied, the control reads the supply-air sensor and computes the supply-air temperature required to satisfy conditions, provided that return-air temperature is greater than the Occupied Cooling set point.

Once the required supply-air temperature has been calculated, it is compared to the current supply-air temperature and the chilled water valve modulates to the position required to maintain desired conditions.

See Fig. 77 for cooling operation flowchart.

STATIC PRESSURE CONTROL — The static pressure control adjusts the inlet guide vanes (IGVs) or the supply-fan motor inverter in a variable air volume system in order to maintain the duct static pressure set point.

If the supply fan is OFF, the IGVs remain closed or the minimum signal is sent to the inverter.

If the fan is ON, the system reads the duct static pressure sensor and computes the static pressure required to satisfy conditions. The system compares the duct static pressure to the computed value and calculates the required signal that is output to the IGV actuator or the inverter.

FAN VOLUME CONTROL — Fan volume control adjusts the inlet guide vanes or inverter in a VAV system. The return fan IGVs or inverters are modulated to maintain a constant differential cfm value between the supply and return fans in the system.

If the supply fan is OFF, the return fan inlet guide vanes are closed and no signal is sent to the return fan inverter.

If the supply fan is ON, the control reads the supply fan differential pressure transmitter and computes the supply cfm. The desired return cfm is calculated by subtracting the differential cfm set point from the calculated supply cfm. The return cfm is read and the return fan differential pressure required to satisfy conditions is calculated.

The calculated return fan differential pressure is compared to the current differential pressure. The signal required to satisfy conditions is sent to the return fan inlet guide vane actuator or return fan inverter.

DIRECT EXPANSION COOLING CONTROL — The direct expansion (DX) cooling control regulates the DX cooling system. The DX cooling stages are energized and deenergized to maintain the desired supply-air temperature set point. Whenever the system is in Nighttime Free Cooling mode or whenever the supply fan is off, the DX cooling stages remain off.

If the supply fan is on, the control reads the humidity sensor (if supplied) and compares the value to the high humidity limit. If the humidity is higher than the high humidity limit, the DX cooling stages are energized to maintain a minimum supply-air temperature. If the humidity is below the limit, the control reads the space temperature sensor and computes the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the actual supply-air temperature and the required DX cooling stages are energized to maintain the desired conditions.

See Fig. 77 for cooling operation and Fig. 78 for DX submaster gain operation. For more complete information, refer to the Application Data book for Product Integrated Controls with DX Cooling

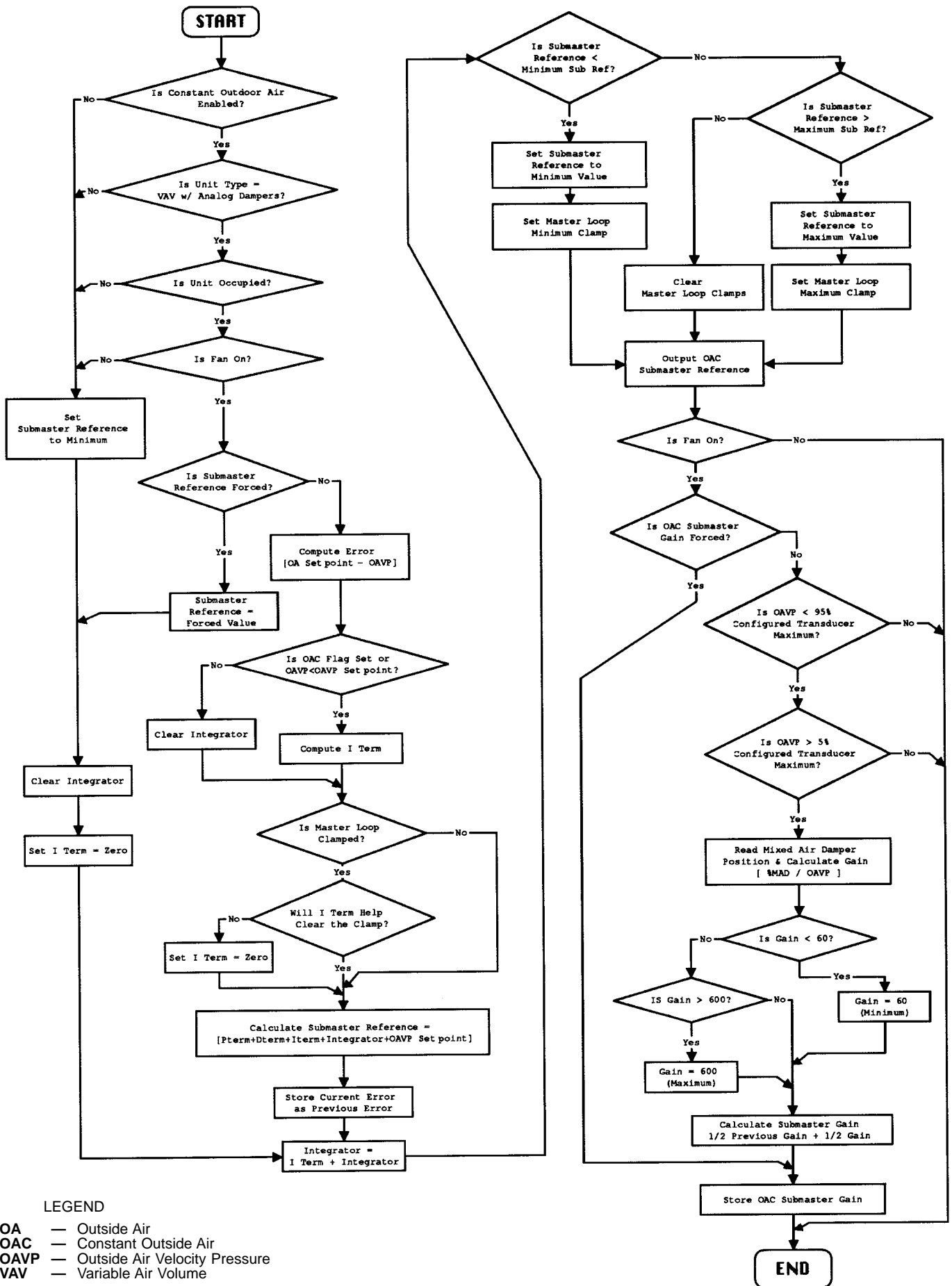
ELECTRIC HEATER CONTROL — Electric heater staging regulates the electric heater. The heater is primarily used for morning warm-up or Occupied Heating, with the heater staged to maintain desired return air temperature. (The number of heat stages is factory set for each unit heater.)

If the supply fan is OFF, all stages of electric heat are turned off.

If the fan is ON, the control determines if the system is in morning warm-up. If it is, the return-air sensor is read and compared to the Occupied Heating set point. If heat is required, the control calculates the supply-air temperature required to satisfy conditions.

Once the required supply-air temperature has been calculated, it is compared to the supply-air temperature to determine the number of heat stages required to satisfy conditions. The required stages are energized sequentially with 2-second intervals between stages and the heat interlock relay is energized. For VAV units, the number of stages turned on is limited by the PIC IGV output.

Once the morning warm-up is completed, heat is not activated again unless OCCUPIED HEAT has been selected.



LEGEND

- OA — Outside Air
- OAC — Constant Outside Air
- OAVP — Outside Air Velocity Pressure
- VAV — Variable Air Volume

Fig. 79 — Constant Outside Air (OAC) Control Operation

SPACE TEMPERATURE RESET — The space temperature reset is used to reset the supply-air temperature set point upward as the space temperature falls below the Occupied Cooling set point. As space temperature falls below the cooling set point, the space temperature is reset upward as a function of the reset ratio. The reset ratio is the degrees of change in supply-air temperature per degree of space temperature change. A reset limit specifies the maximum number of degrees the supply-air temperature may be raised. Both the reset ratio and the reset limits are user adjustable.

When the fan is ON, and the system is in the Occupied mode, the control reads the space temperature sensor and computes the reset value. If the reset value is greater than the reset limit, the control uses the reset limit as the reset value. The modified supply air temperature set point is determined by adding the reset value to the configured supply air temperature set point. This value is then used by the cooling coil algorithm.

TWO-STEP DEMAND LIMITING (Available on Units Connected to the Carrier Comfort Network Only) — If the Demand Limit option is enabled, the control receives and accepts redline alerts and loadshed commands from the Network Loadshed option. See the CCN Loadshed manual for additional information.

When a redline alert is received, the system limits the maximum volume (percent of fully open IGVs) per the user-defined demand limit no. 1 set point.

When a loadshed command is received, the maximum volume is limited per the user-defined demand limit no. 2 set point.

The maximum loadshed timer prevents the system from remaining in Loadshed, if the control loses communications with the Loadshed option. If the timer expires before the

loadshed command is cleared by the Loadshed option, the control clears the loadshed command itself and returns to normal control. The loadshed timer is factory set at 60 minutes.

MIXED-AIR DAMPER CONTROL — The mixed-air damper control modulates the outside-air, return-air, and exhaust-air dampers. When outside-air conditions are unsuitable for atmospheric cooling, the dampers are held at the minimum adjustable outside-air position. The mixed-air dampers are modulated to maintain a mixed-air temperature equal to supply-air temperature set point minus 3° F. The dampers can also be modulated to maintain a user-configured mixed-air temperature set point.

If the supply fan is OFF, the mixed-air dampers are held closed to outside air and held open to return air. If the supply fan is ON, and the system is not in the HEAT mode, the system determines if outside-air conditions are suitable for atmospheric cooling. The outside-air temperature is compared to the space temperature. If the outside-air temperature is less than the space temperature, the system performs either an enthalpy check using an outside-air enthalpy switch or a differential enthalpy check.

If the outside conditions are suitable, the control uses the mixed-air sensor to maintain the discharge temperature (whenever the mixed-air sensor option is installed). If the sensor is not provided or fails, the control uses the supply-air sensor to modulate the dampers and achieve the set point.

When the outside temperature is less than 40 F, the mixed-air damper opening rate is limited to 5% per minute to protect against nuisance low temperature thermostat tripping and coil freeze-up. Rate limiting is off when the dampers are closed.

START-UP

Initial Check

IMPORTANT: Do not attempt to start unit, even momentarily, until the following steps have been completed.

1. Verify unit has been installed per the Installation, Start-Up, and Service Instructions shipped inside the unit.
2. Verify that all auxiliary components (valves, sensors, etc.) have been installed and wired to the PIC control box.
3. Verify that the motor starter and HOA switch have been installed and wired.

NOTE: HOA switch must be in OFF position.

4. Check to be sure area around unit is clear of construction dirt and debris.
5. On VAV units, verify that the static pressure probe and associated piping have been installed.
6. Verify that:
 - Chilled water valve is in its normal position.
 - Hot water/steam valve is in its normal position.
 - Outside-air damper is closed.
 - Return-air damper is open.
 - Inlet guide vanes are closed (VAV units).
7. Set control configurations. Units are shipped with applicable controls programmed to the default values shown in Table 16.
8. Set unit set points. Units are shipped with the set point default values shown in Table 17. If a different set point is required, change as shown in the following example:

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
1 SET	SETPPOINT	System set points
↓	OHSP 68.0	Present occupied heat set point is 68.0
5 9 ENTR	OHSP 59.0	Key in 59 and press ENTR, display shows new occupied heat set point is 59
↓	OCSP 78.0	Present occupied cooling set point is 78.0
7 0 ENTR	OCSP 70.0	Key in 70 and press ENTR, display shows new occupied cooling set point is 70

Unit is shipped with the NTFC, Demand Limit, Temperature Reset, Optimal Start, Occupied Heating, and Fan Tracking functions disabled. If these functions are desired, refer to Control Operation, Programming Functions section beginning on page 81.

9. Check tightness of all electrical connections.
10. Turn on control power by turning the ON/OFF switch located in the PIC control box to ON.
11. Perform Quick Test to make sure controls are operating properly. See the following section.

Quick Test — The Quick Test feature allows the service technician to individually test all inputs and outputs of the control system. See Tables 18-22.

The test function operates the Quick Test diagnostic program. The test subfunctions energize the valves, dampers, and inlet guide vanes (VAV units).

To start Quick Test, set HOA switch to OFF. Verify supply fan stops. Quick Test does not operate if supply fan status is ON.

A test can be terminated by pressing . Pressing after a test has started advances the system to the next test. Once the next test is displayed you can start the test by pressing , advance past it by pressing , or back up by pressing . The unit remains in Quick Test until and then are pressed. At that time the unit reverts to automatic control.

If the keyboard is not used for 10 minutes, the display automatically returns to the rotating default display. You must press and to exit Quick Test and then press to restart the procedure.

Table 18 — Test of Input Signals

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
1 TEST	INPUTS	Field testing of inputs (X = current value. All temperatures should be ± 2 degrees F from actual)
↓	SAT X	Verify that the supply-air temperature sensor reading agrees with the actual temperature.
↓	OAT X	Verify that the outdoor-air temperature sensor reading agrees with the actual temperature.
↓	SPT X	Verify that the space temperature sensor reading agrees with the actual temperature.
↓	RAT X	Verify that the return-air temperature sensor reading agrees with the actual temperature.
↓	ENT X	Verify proper enthalpy reading. Move the knob on the enthalpy switch from A to D (or D to A) and verify that the display readout changes.
↓	SFS OFF	Verify that the supply fan status is OFF when the supply fan is OFF.
↓	SFS ON	Verify that the supply fan status is ON when the supply fan is ON. (Unit may be started by placing the HOA switch in the HAND position.)
↓	FRZ NRM	Verify that the low limit thermostat reads Normal. If not, reset the low limit thermostat.
↓	SP 0.0	Verify that the static pressure reads 0.0 in. wg with the fan OFF and HOA switch set at OFF (VAV units).

Listed below are steps which must be used to verify different options. If the unit is not equipped with MAT, RH, OARH, or FLTS, proceed with the testing of the inputs to the Option Module. If the unit is equipped with any of these options, proceed with their respective testing as follows. If an option is not present, press ↓ for the next available option.

↓	RH XX	Verify that the relative humidity reading agrees with the actual relative humidity, checked with the local weather bureau.
↓	MAT X	Verify that the mixed-air temperature sensor reading agrees with the actual temperature.
↓	OARH XX	Verify that the outdoor-air relative humidity reading agrees with the actual relative humidity, checked with the local weather bureau.
↓	FLTS NRM	Verify that the filter status reads Normal.

Listed below are steps which must be used to verify the inputs to the Option Module. If the unit is not equipped with the Option Module, proceed with the testing of the outputs (Table 19). If the unit is equipped with the Option Module, proceed with the testing as follows. If an option is not present, press ↓ for the next available option.

↓	TEMP X	Verify that the temperature sensor reading agrees with the actual temperature measured.
↓	RVP X	Verify that the return velocity pressure is 0 with the return fan OFF.
↓	SVP X	Verify that the supply velocity pressure is 0 with the supply fan OFF.
↓	DHH NRM	Verify that the duct high humidity switch reads Normal when the adjustment knob is set to the maximum set point or contacts are open. Verify that it reads ALM when contacts are shorted.
↓	EVAC NRM	At Terminal Block 3, short Terminals 5 and 8. Verify that the display changes to EVAC ALM. Verify the following: <ul style="list-style-type: none"> • Supply fan is OFF • Outside and return dampers (if applicable) close • Exhaust damper (if applicable) opens • Return fan starts • Supply fan inlet guide vanes close (VAV units only) • Return fan inlet guide vanes open (VAV units equipped with return fans) • Heat interlock Relay is OFF (VAV units)
↓	PRES NRM	At Terminal Block 3, short Terminals 3 and 8. Verify that the display changes to PRES ALM. Verify the following: <ul style="list-style-type: none"> • Supply fan is ON • Outside air damper (if applicable) opens • Exhaust and return dampers (if applicable) close • Return fan stops • Supply fan inlet guide vanes open (VAV units) • Return fan IGVs close (VAV units equipped with return fan) • Heat Interlock Relay is ON (VAV units)
↓	PURG NRM	At Terminal Block 3, short Terminals 4 and 8. Verify that the display changes to PURG ALM. Verify the following: <ul style="list-style-type: none"> • Supply fan is ON • Outside air and exhaust dampers (if applicable) open • Return damper (if applicable) closes • Return fan is ON • Supply fan IGVs open (VAV units) • Return fan IGVs open (VAV units equipped with return fan) • Heat Interlock Relay is ON (VAV units)

Table 18 — Test of Input Signals (cont)

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
↓	FSD NRM	At Terminal Block 3, short Terminals 1 and 2. Verify that the display changes to FSD ALM. Verify the following: <ul style="list-style-type: none"> • Supply fan is OFF • Outside air and exhaust dampers (if applicable) close • Return fan is OFF • Supply fan IGVs close (VAV units) • Return fan IGVs close (VAV units equipped with return fan) • Heat Interlock relay is OFF (VAV units)
↓	MTR XXX	If applicable, verify that the display increments following the connected pulse-type meter measuring power.
↓	OAVP 0.00	Verify that the velocity pressure reads 0.00 in. wg with the fan OFF and the mixed-air damper closed (0 setting).
↓	AQ1 XXX	Verify the displayed value using field-supplied instrumentation located near the sensor.
↓	AQ2 XXX	Verify the displayed value using field-supplied instrumentation located near the sensor.
↓	CUST EN	Verify condensing unit lockout operation by rotating thermostat so display changes to CUST DSB. Reverse thermostat to change setting back to CUST EN and reenable unit.
↓	DXSD NRM	Verify that the direct expansion cooling shutdown value is normal.

Proceed with the testing of the outputs options (Table 19).

LEGEND

- HOA** — Hands/Off/Automatic
- IGV** — Inlet-Guide Vane
- VAV** — Variable Air Volume

Table 19 — Test of Output Signals

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">TEST</div> </div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> </div>	<p>OUTPUTS</p> <p>HCV %</p> <p>HCV TEST</p> <p>CCV %</p> <p>CCV TEST</p> <p>MIXD %</p> <p>MIXD TEST</p>	<p>Field testing of outputs. (Set HOA switch to OFF.)</p> <p>Press ENTR if unit is equipped with a hot water or steam valve. Otherwise press ↓</p> <p>Verify that the hot water or steam valve strokes to its 100% position.</p> <p>The hot water or steam valve returns to its 0% position. Press ENTR if unit is equipped with a chilled water valve. Otherwise press ↓</p> <p>Verify that the chilled water valve strokes to its 100% position.</p> <p>The chilled water valve returns to its 0% position. Press ENTR if unit is equipped with mixed-air dampers. Otherwise press ↓</p> <p>Verify that the outdoor-air damper strokes to its 100% position. Proceed with the applicable Constant Volume or Variable Air Volume portion of the test.</p>
For Constant Volume Units:		
<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">5</div> <div style="border: 1px solid black; padding: 2px 5px;">TEST</div> </div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> </div>	<p>IGV %</p> <p>SF X</p> <p>FAN TEST</p> <p>EXIT TST</p> <p>TST CMPL</p>	<p>If so equipped, verify that the outdoor-air damper returns to its 0% position. (Set the HOA switch to AUTO.)</p> <p>Supply fan will be turned ON automatically. If unit is equipped with the Option Module, proceed with the Option Output portion of the test (Table 20). If the unit does not have an Option Module, proceed to the electric heater portion of the test (Table 21). If unit does not have an Option Module or electric heater, proceed as follows:</p> <p>Test is now complete. The unit is back under normal automatic control.</p>
For Variable Air Volume Units:		
<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">5</div> <div style="border: 1px solid black; padding: 2px 5px;">TEST</div> </div> <div style="border: 1px solid black; padding: 2px 5px;">ENTR</div> </div>	<p>IGV %</p> <p>IGV TEST</p> <p>SF X</p> <p>FAN TEST</p> <p>HIR X</p> <p>HIR TEST</p> <p>EXIT TST</p> <p>TST CMPL</p>	<p>If so equipped, verify that the outdoor-air damper returns to its 0% position.</p> <p>Verify that the IGVs stroke to their 100% position. Close the door of the fan section. Turn the HOA switch to AUTO.</p> <p>The IGVs return to their 0% position.</p> <p>The supply fan is turned ON automatically.</p> <p>The supply fan stops.</p> <p>Using an ohmmeter across the HIR relay contacts (refer to component arrangement label for location), the reading should be less than 10 ohms. If the unit is equipped with the option module, proceed with the option output portion of the test (Table 20). If unit does not have an option module, proceed to the electric heater portion of the test (Table 21). If unit does not have an option module or electric heater, proceed as follows:</p> <p>Test is now complete. The unit is back under normal automatic control.</p>

Table 20 — Test of Output Options Using Option Module

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
↓	RFVC X	
ENTR	RFVCTEST	Verify that the return fan IGVs stroke to their fully open position.
↓	HUM1 %	The return fan IGVs should close.
ENTR	HUM1TEST	Verify that the return fan IGVs, if so equipped, return to their fully closed position. If equipped with single-stage analog humidification control, verify that the modulating valve goes to its fully open position. If equipped with two stages of humidification, use an ohmmeter to verify that the reading across the 1st stage normally-open relay contacts is less than 10 ohms.
↓	HUM2 %	Verify that the reading across the 1st stage normally-open relay contacts is greater than 1000 ohms.
ENTR	HUM2TEST	If equipped with two stages of humidification, use an ohmmeter to verify that the reading across the 2nd stage normally open relay contacts is less than 10 ohms.
↓	AOTC %	If equipped with two stages of humidification, verify that the reading across the 2nd stage humidification normally open relay contacts is greater than 100 ohms.
ENTR	AOTCTEST	Verify that the analog device connected to this output strokes to its 100% position.
↓	DOTC X	Verify that the analog device connected to this output strokes to its 0% position.
ENTR	DOTCTEST	Using an ohmmeter, verify that the reading across the DOTC (Discrete Output Temperature Control) normally open relay contacts is less than 10 ohms.
↓	DTCC X	Using an ohmmeter, verify that the reading across the DOTC normally open relay contacts is greater than 1000 ohms.
ENTR	DTCCTEST	Using an ohmmeter, verify that the reading across the DTCC (Discrete Timeclock Control) normally open relay contacts is less than 10 ohms. Proceed with the testing of electric heat stages (Table 21). If the unit is not equipped with electric heat, exit the Quick Test mode as described below:
5 TEST	EXIT TST	
ENTR	TST CMPL	Test is now completed. The unit is back under normal automatic control.

Table 21 — Electric Heater Test

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
		NOTE: Only the configured number of stages are tested and appear on the display.
3 TEST	ELE HEAT	Entering field test of electric heater. (Set the HOA switch to AUTO.)
↓	EHS1 X	
ENTR	STG1 TST	The fan starts. If equipped, the IGVs open to 30%. After an 11-second delay, the 1st stage of heat is turned ON.
↓	EHS2 X	The 1st stage of heat is turned OFF.
ENTR	STG2 TST	After a 2-second delay, the 2nd stage of heat is turned ON.
↓	EHS3 X	The 2nd-stage of heat is turned OFF.
ENTR	STG3 TST	After a 2-second delay, the 3rd stage of heat is turned ON.
↓	EHS4 X	The 3rd stage of heat is turned OFF.
ENTR	STG4 TST	After a 2-second delay, the 4th stage of heat is turned ON.
↓	EHS5 X	The 4th stage of heat is turned OFF.
ENTR	STG5 TST	After a 2-second delay, the 5th stage of heat is turned ON.
↓	EHS6 X	The 5th stage of heat is turned OFF.
ENTR	STG6 TST	After a 2-second delay, the 6th stage of heat is turned ON.
↓	EHS7 X	The 6th stage of heat is turned OFF.
ENTR	STG7 TST	After a 2-second delay, the 7th stage of heat is turned ON.
↓	EHS8 X	The 7th stage of heat is turned OFF.
ENTR	STG8 TST	After a 2-second delay, the 8th stage of heat is turned ON.
5 TEST	EXIT TST	The fan and preceding stage of heat shut OFF.
ENTR	TST CMPL	Test is complete. The unit is back under automatic control.

Table 22 — Direct Expansion (DX) Cooling Test

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS/ACTION
NOTE: Only the configured number of stages are tested and appear on the display.		
4 TEST	DX COOL	Entering field test DX cooling coil. (Set the HOA switch to AUTO.)
↓	DXS1 X	
ENTR	STG1 TST	The fan starts. If fan has IGVs, the IGVs open to 30%. After an 11-second delay, the 1st stage of DX cooling is turned ON.
↓	DXS2 X	The 1st stage of DX cooling is turned OFF.
ENTR	STG2 TST	After a 2-second delay, the 2nd stage of DX cooling is turned ON.
↓	DXS3 X	The 2nd stage of DX cooling is turned OFF.
ENTR	STG3 TST	After a 2-second delay, the 3rd stage of DX cooling is turned ON.
↓	DXS4 X	The 3rd stage of DX cooling is turned OFF.
ENTR	STG4 TST	After a 2-second delay, the 4th stage of DX cooling is turned ON.
↓	DXS5 X	The 4th stage of DX cooling is turned OFF.
ENTR	STG5 TST	After a 2-second delay, the 5th stage of DX cooling is turned ON.
↓	DXS6 X	The 5th stage of DX cooling is turned OFF.
ENTR	STG6 TST	After a 2-second delay, the 6th stage of DX cooling is turned ON.
↓	DXS7 X	The 6th stage of DX cooling is turned OFF.
ENTR	STG7 TST	After a 2-second delay, the 7th stage of DX cooling is turned ON.
↓	DXS8 X	The 7th stage of DX cooling is turned OFF.
ENTR	STG8 TST	After a 2-second delay, the 8th stage of DX cooling is turned ON.
5 TEST	EXIT TST	The fan and preceding DX cooling stage shut OFF.
ENTR	TST CMPL	Test is complete. The unit is back under automatic control.

Electronic Valve Actuator Field Test — The electrically operated valve actuators supplied with 1/2-in. to 1 1/4-in. valve assemblies are a hydraulic, linear-piston type. The actuators supplied with the 1 1/2-in. to 3-in. valve assemblies are an electro-mechanical type. Both types of actuators contain a spring as part of the valve assembly. The spring returns the stem to its normal position whenever there is a loss of power or signal. Both actuators contain an internal solid-state drive which accepts a proportional 4 to 20 mA signal generated by the controller.

An increase in signal proportionally extends the actuator shaft and pushes the valve stem down. A decrease in signal retracts the actuator shaft and lifts the valve stem up. Valve construction determines normal valve flow, either stem-up open, or stem-up closed. On 3-way mixing valves, stem-up allows flow from port B to port AB.

Perform field test for actuator as follows:

1. Verify actuator is powered by 24 vac at the WHITE/BLUE and BLACK actuator wires.
2. Use a digital milliamp meter to verify the mA signal and proper polarity at the input signal leads, +RED and -GREEN. A digital volt meter with a minimum of 2-place accuracy may be used to determine signal value, see Table 23.
3. Enter the heating coil valve or cooling coil valve Quick Test, retract the actuator shaft and completely lift valve stem.
4. While still in Quick Test, press **ENTR**. The actuator shaft should extend completely, pushing valve stem down. Exit Quick Test procedure.

Table 23 — Digital DC Volt Meter vs DC Milliamp Meter

DC MILLIAMPS	DC VOLTAGE
4	.33
8	.57
12	.99
16	1.32
20	1.65

NOTE: The internal solid-state drives of the factory-supplied electronic actuators impose a 82.5 ohm impedance to the signal current loop. A proportional voltage, ranging from 0.33 vdc at 4 mA to 1.65 vdc at 20 mA will be present.

CONTROL LOOP CHECKOUT

⚠ CAUTION

Checkout and adjustment of control loops should only be performed by certified Carrier Comfort Network technicians. The following checkout procedure is offered as a guide and presumes the user has obtained basic knowledge of controls through CCN training.

To Check Operation of Analog Outputs — The control algorithms of the 39L and 39NX use the master/submaster loop concept. The master loop monitors the master sensor (the sensor which tries to maintain the desired set point), and calculates the submaster reference required to do so. The submaster loop monitors the submaster sensor and controls the output to the controlled device. These algorithms require a number of gain values to function properly. The 39L and 39NX come with preset default values. However, it may be necessary to adjust several of these values to achieve stable control. These values are submaster loop gain (SMG), submaster loop center value (SCV), master loop proportional gain (MPG) and, in some cases, master loop integral gain (MIG).

To verify or adjust submaster default values, perform the following for each controlled device (control loop):

1. Verify that controlled devices (cooling coil valve [CCV], heating coil valve [HCV]) are properly piped and wired.
2. Using the local interface device, force each controlled device fully open and fully closed. Make sure the actuators move smoothly. Sticky or sloppy actuators result in poor control. They must be corrected, otherwise it may be impossible to obtain stable control.
3. Verify that all appropriate energy sources are available: hot water, chilled water, steam, etc.
4. Verify that the system is in the Occupied mode and the supply fan is running.
5. Verify that the supply fan status indicates ON. If the fan status is OFF, the control algorithms hold the controlled devices at the failsafe position.
6. Verify that all forces have been removed.
7. Table 24 indicates recommended starting values for SMG, MPG, and MIG for constant volume and variable air volume units. Verify that these values have been entered.
8. Verify/adjust the SMG. If the SMG is too large, the loop tends to oscillate (hunt). If it is too small, the loop reacts too slowly.

Verify or adjust the SMG as follows:

- a. Using the local interface device, force the submaster reference of the control loop to a value above or below the actual sensor reading. Verify that the actuator responds correctly. If the actuator drives in the wrong direction, go to the submaster gain (SMG) for the control loop and reverse the sign of the gain. For example: If the submaster loop gain is 5.0, change it to -5.0.

Table 24 — Recommended Gain Starting Values

GAIN	VALUE	
	CV	VAV
HCV MPG	8.0	0.3*
HCV MIG	0.3	1.5*
HCV SMG†	-7.5	-7.5
CCV MPG	8.0	0.3*
CCV MIG	0.3	1.0*
CCV SMG**	-7.5	-7.5
MIXD MPG	8.0	0.5*
MIXD MIG	0.3	1.5*
MIXD SMG	-7.5	-7.5
IGV MPG	—	0.5
IGV SMG	—	5.0
EH MPG	8.0	8.0
EH SMG	5.0	5.0
PREHEAT/AO MPG	1.0	0.3
PREHEAT/AO MIG	0.8	0.8
PREHEAT/AO SMG†	-3.0	-3.0
PREHEAT/AO SCV††	100%	100%*
RFVC MPG	—	0.5
RFVC SMG	—	10.0
HUM MPG	2.0	2.0
HUM SMG	7.5	7.5

*Differs from default value; change the default value to obtain the recommended starting value shown.

†Values shown are for normally-open valves. If normally-closed valves are used, see Step 8.

**Values shown are for normally-closed valves. If normally-open valves are used, see Step 8.

††Values shown are for normally-open valves. If normally-closed valves are used, subtract initial value specified from 100% to obtain the correct value. Example:

$$100\% - (\text{SCV N.O.}) = (\text{SCV N.C.})$$

$$100\% - 100\% = 0\%$$

- b. Observe the operation of the controlled device for a few minutes. If the device oscillates every few seconds around the forced value, then lower the SMG by small amounts until the output steadies. If the output to the device responds to a change in temperature in small increments, then increase the SMG in small amounts until the output steadies.

NOTE: Do not be alarmed if the submaster sensor stabilizes at a value greater than or less than the forced value. This is termed the submaster droop offset and is normal.

9. It is not necessary to adjust the submaster loop center value, as the master loop will adjust the submaster reference as required to satisfy its set point. However, it may be desirable to keep the submaster droop to a minimum. This is most often required for heating coil loops, (especially on steam coils where the control valve has a tendency to be oversized).

If the submaster droop is too large, adjust the SCV as follows:

If the submaster droop is positive (actual value greater than reference value), the SCV should be decreased for HCV and IGV loops and increased for CCV and MIXD loops. If the submaster droop is negative (actual value less than reference value), the SCV should be increased for HCV and IGV loops and decreased for CCV and MIXD loops.

10. Once the submaster loop is adjusted, remove all forces and proceed with verification and adjustment of master loop.

11. To check the master loop, create an error in the master loop. For example: Change the actual space temperature to a value less than the heating set point or greater than the cooling set point.

Observe system (loop) response for 10 to 20 minutes to verify stable control. After 10 minutes if the output continues to swing full open to full closed, lower the MPG and observe again. Do this until the loop operation is stable. After 10 minutes, if the loop does not seem to respond (little change in submaster reference), increase the MPG and observe again. Do this until stable operation is achieved.

12. Once you are satisfied with loop operation, remove all forces which may have been initiated during this procedure.

13. Repeat steps 1-12 until all loops have been checked.

VALVE TROUBLESHOOTING

General — To facilitate troubleshooting the valve, it may be necessary to disassemble the electronic actuator from the valve body.

All 1/2-in. Through 1 1/4-in. Electric Hot Water/Steam Valve Assemblies

— A high-temperature linkage extension is supplied to help insulate the hydraulic actuator from heat. See Fig. 80. Mount valves so that valve stem is at a 35° to 45° angle from vertical. See Fig. 81.

To remove the actuator from the high-temperature valve linkage extension or from the 2-way normally-open valve mounting nut, proceed as follows:

1. Secure the high-temperature linkage extension or 1⁵/₈-in. valve mounting nut to prevent turning.
2. Turn the actuator base (by hand) counterclockwise off the high-temperature linkage extension mating threads or off the mating threads of the valve mounting nut. *Do not exert force on the upper housing!* If necessary, a 1⁵/₈-in. open-end wrench may be applied on the flats provided on the actuator base.
3. Separate hydraulic actuator from linkage extension or valve mounting nut. On assemblies using the linkage extension, retain the white spacer (now loose inside the actuator base) for reassembly later.

To reassemble the hydraulic actuator to the valve body:

1. On valve assemblies equipped with high-temperature linkage extension, insert the white spacer inside the actuator base.
2. Secure the high-temperature linkage extension or valve mounting nut to prevent turning.
3. Turn the actuator base (by hand) clockwise onto the high-temperature linkage extension or valve mounting nut until secure. *Do not exert force on the upper housing!* If necessary, a 1⁵/₈-in. open-end wrench may be applied on the flats provided on the actuator base. The actuator may be rotated as desired to facilitate wiring connections.

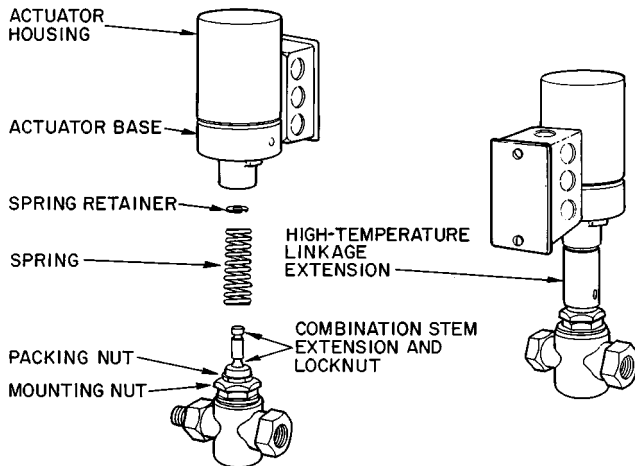


Fig. 80 — Valve Assemblies, 1/2-in. to 1 1/4-in., Typical Linkages

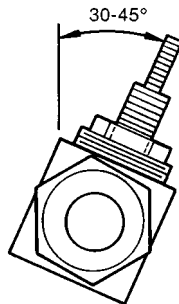


Fig. 81 — Valve Mounting Angle

All 1 1/2-in. Through 3-in. Valve Assemblies (See Fig. 82) — To remove the electro-mechanical actuator from the valve body, proceed as follows:

1. Electrically power the actuator by turning circuit breaker to ON. Using the local interface device, force an output of 10% (see Example 25), or enough to begin to move the valve stem down, releasing stem pressure. It may be necessary to slightly adjust the signal value up and down to create a rocking motion on the valve stem. This will permit easier connecting pin removal.
2. Remove the 2 self-tapping screws that secure the actuator base to the linkage mounting bracket. Turn the power to OFF and remove actuator assembly.

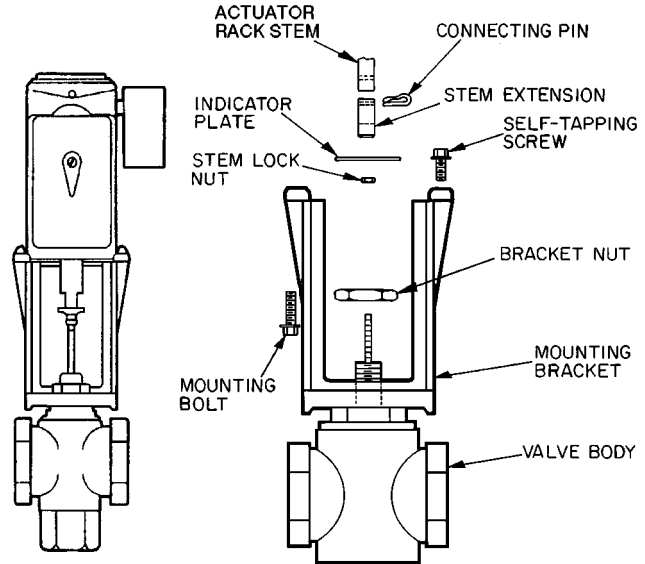


Fig. 82 — Valve Assemblies, 1 1/2-in. to 3-in., Typical Linkages


Example 25 — Forcing An Output

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
5 STAT	OUTPUTS	System outputs
↓	IGV %	Scroll past Inlet Guide Vane status
↓	MIXD %	Scroll past Mixed-Air Damper status
↓	HCV %	Heating Coil Valve status
1 0 ENTR	HCV 10/FORCED	Heating Coil Valve is forced 10% (Display flashes continuously)
CLR ENTR	HCV %	10% force is removed from heating coil valve (Display stops flashing)








NOTE: Electric heat and DX cooling stages cannot be forced. All other outputs under 5 STAT can be forced.

TO REASSEMBLE ACTUATOR TO VALVE BODY:

All 2-way normally-open valves:

1. Push the valve stem completely down and close seat valve.
NOTE: It may be necessary to shut down the system pump to ensure valve stem is closed.
2. Loosen locknut and screw stem extension down fully on valve stem to adjust stem extension for proper closure.
3. Attach actuator to valve linkage mounting bracket and secure with self-tapping screws.
4. Make all necessary electrical connections.
5. Electrically power actuator by turning circuit breaker to ON. Turn HOA switch to OFF position. Perform the heating coil valve quick test to stroke the actuator to its full extended position. See Example 26. Leave the unit in test mode and proceed to Step 6.
6. Screw the stem extension up until its hole aligns with the hole in the actuator piston.
7. Screw the stem extension 2 full turns farther up into the actuator piston.
8. While still in Quick Test, press  to retract actuator piston and align holes to insert connecting pin. Exit Quick Test.
9. Tighten the locknut against the stem extension.

**Example 26 — Heating Coil Valve Test
(2-Way Normally Open)**










KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
 	OUTPUTS	Entering factory test of outputs
	HCV %	Entering heating coil valve test
	HCV TEST	The hot water/steam valve strokes to 100%
 	EXIT TST	Exit Quick Test
	TST CMPL	Test completed

NOTE: For more complete instructions on the Quick Test procedure, see Quick Test in the Start-Up section, pages 103-108.

All 2-way normally-closed and 3-way mixing valves:

1. Raise the valve stem completely up and close valve seat.
NOTE: It may be necessary to shut down the system pump to ensure valve stem is closed.
2. Loosen locknut and screw stem extension down fully on valve stem to adjust stem extension for proper closure.
3. Attach actuator to valve linkage mounting bracket and secure with self tapping screws. The actuator should be fully retracted with no power or signal present.
4. Screw the stem extension up until its hole aligns with the hole in the actuator piston.
5. Screw the stem extension down 2 full turns away from the actuator piston.
6. Turn circuit breaker to ON. Electrically connect the actuator. Using the cooling coil valve quick test, extend the actuator piston to align holes and insert the connecting pin. See Example 27. After inserting connecting pin, exit Quick Test.
7. Tighten the locknut against the stem extension to secure to stem.

**Example 27 — Cooling Coil Valve Quick Test
(2-Way Normally Closed)**

KEYBOARD ENTRY	DISPLAY RESPONSE	COMMENTS
 	OUTPUTS	Entering factory test of outputs
	HCV %	Scroll past heating coil valve test by pressing  key
	CCV %	Cooling coil valve test
	CCV TEST	Cooling coil valve actuator piston extends (Insert connecting pin)
 	EXIT TEST	Exit factory test
	TST CMPL	Test completed

NOTE: For more complete instructions concerning the Quick Test procedure, see Quick Test in the Start-Up section, pages 103-108.

CONTROL MODULE TROUBLESHOOTING

⚠ CAUTION

To prevent electrical shock and equipment damage, turn off all power to the PIC control box before removing or replacing modules.

General — The processor module (PSIO master), option module (PSIO slave) and relay module (DSIO) all perform continuous diagnostic evaluations of the condition of the hardware. Proper operation of these modules is indicated by LEDs (light-emitting diodes). The PSIO LEDs are located on the top of the module, and the DSIO LEDs are on the front of the module. See Fig. 83.

RED STATUS LED — If the LED is blinking continuously at a one-second rate, the module is operating normally. If the LED is lighted continuously, there is a problem that may require replacement of the module.

If the red LED is off continuously, check the power supply to the module. If there is no input power, check the fuses. If a fuse is blown, check for shorted wiring or for a non-functional module. If the fuses are not blown, check for a bad transformer or open secondary of the transformer.

GREEN COMMUNICATIONS LEDs — On a PSIO module, the green LED closest to the COMM connectors indicates the status of communications between modules. When used, the other green LED on the module indicates the status of external CCN communications.

The green LED that indicates module communications should blink continuously whenever the power is on. If the green LED is not blinking, check the red LED. If the red LED is normal, check the module address switches as shown in Fig. 82. The correct addresses follow:

- Processor Module (PSIO Master) — 01 (factory default)
- Option Module (PSIO Slave) — 31
- High-Voltage Relay Module (DSIO for Electric Heat or DX Control) — 19
- High-Voltage Relay Module (DSIOs for Electric Heat and DX Control) — 49

If all of the preceding modules *except* the processor module indicate communication failure, check the COMM plug on the processor (PSIO master) module for proper seating and check the communications bus wiring as shown in Fig. 69 on page 65. If the condition persists even though plug connections and wiring are correct, replace the processor module as described in the Module Replacement section.

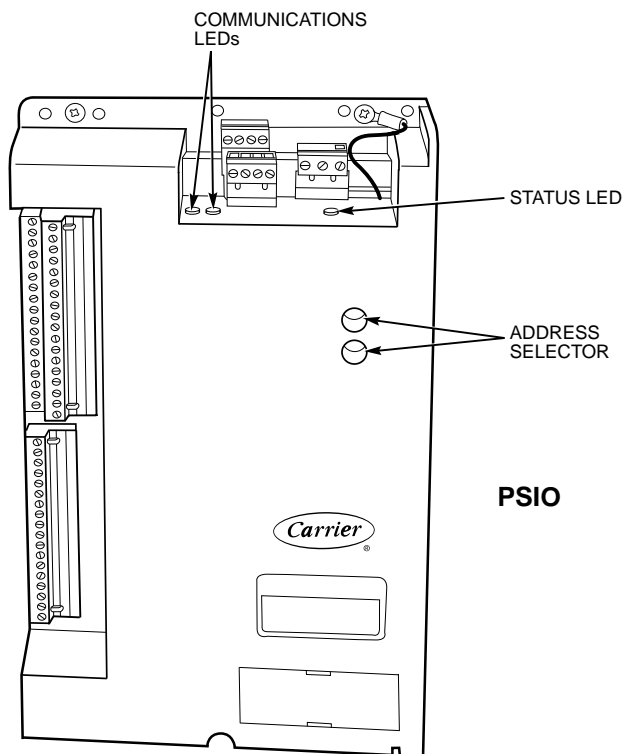
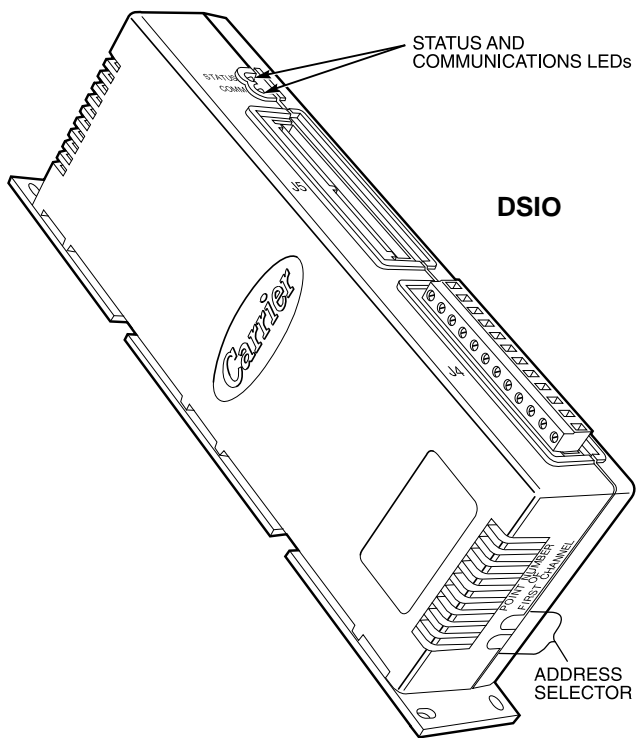


Fig. 83 — Module Address Selector Switch and LED Locations

If only the PSIO slave or DSIO module indicate communication failure, check the affected module for proper seating. If the condition persists even though connections are correct, replace the module as described in the following section.

Module Replacement (PSIO, DSIO) — The PSIO master module controls the standard unit functions, the PSIO slave module controls many optional functions, and the DSIO module controls electric heat and/or DX cooling. If the module LEDs are not blinking and the unit or features associated with the module do not work, the module may need to be replaced. Before replacing an inoperative module, check to ensure that:

- The PIC control box power is on
- Power at the processor module is between 18 and 24 vac
- No fuses are blown
- All connections are firmly in place

If all of the preceding conditions exist, and the module LEDs are not blinking, the module needs to be replaced.

Before replacing a processor (PSIO) module, *store the configuration data from the old module on hard copy*. The new processor module can be preconfigured or configured in the field.

After obtaining a new module, field-replace the inoperative module as follows:

1. Turn off all power to the fan motor starter and PIC control box.

⚠ CAUTION

To avoid electrical shock and equipment damage, always disconnect all power to the control box before replacing PIC modules.

2. Open the control box door.
3. Refer to Fig. 5-7 for control box component arrangements. Disengage all connectors from the module.
4. Use a screwdriver to remove the mounting screw securing the module to the control box. Remove the module.
5. Install the replacement module and replace the mounting screw.
6. Reinstall all connectors. Verify that each connector is in the correct location.
7. Turn on the power to the PIC control box and motor starter.
8. If you are replacing a *PSIO master module* that is not preconfigured, use the local interface device (HSIO) or Building Supervisor to reset the date and time and change the module's default settings. The original PSIO master module was factory configured to match the unit in which it was shipped. A replacement PSIO master module must have the Factory Configuration () defaults changed in the field to match the configuration of the unit in which it is being installed. Other settings may also need to be reconfigured to match the unit configuration and/or the original module's settings.
9. Perform the Initial Check, run the Quick Test, and verify that the unit is operating correctly as described in the Start-Up section on page 103.
10. Close the PIC control box door.

UNIT TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Unit does not run	PIC control is OFF	Check for correct power or blown fuses (F2). Correct any deficiencies.
	Faulty connections	Check LEDs on control module (PSIO). If LED is not solidly illuminated, check for loose connections. If all wires and connectors are secure, replace PSIO module as described on page 112.
	PIC control has incorrect time	Verify control shows correct time. If incorrect, enter correct time.
	Supply fan HOA switch in OFF position Safety controls are tripped	Verify HOA switch is in the AUTO position. Check low-temperature thermostat and high-pressure switch (VAV units only). Reset switches if necessary.
	PIC control left in Quick Test (Display shows Mode 38)	Using the local interface device, exit Quick Test. Press 5 TEST, and then ENTR to exit.
	Unit is configured for and is currently in Demand Limit Mode (CV units only)	Verify that unit should be in the Demand Limit mode. If not, cycle power to PIC to release unit from Demand Limit mode.
	Unit is in Smoke Evacuation or Fire Shutdown mode (Display shows 35 or 37)	Verify that unit should be in one of these modes. If not, check for shorted input on Fire Shutdown or Evacuation.
	Minimum inverter set point too low (VAV units only)	Adjust minimum to 20% at 4 mA signal and 100% at 20 mA signal.
No heat	No fan status	Check status of SFS (4 STAT). If SFS is OFF, check supply fan status switch for proper operation. Switch must be ON for heat coil to function properly.
	Heat coil valve (HCV) is forced closed	Check status of HCV (5 STAT). If HCV is forced, remove force and check operation.
	NO hot water or steam available, no power if electric heat	Check source and correct any problems found.
	Electric heater safety tripped	Reset heater safety. Check for proper operation.
	No power to valve	Check for blown fuse (F6). Replace if necessary. If fuse is intact, check for proper connections. Check transformer output.
	No power to electric heater control	Check for blown fuse (F5). Replace if necessary. If fuse is intact, check for proper connections. Check transformer output.
	Incorrect reading from space temperature sensor, supply-air temperature sensor, or return-air temperature sensor (VAV units)	Check status of sensor readings for accuracy. Replace sensor if defective.
	Configuration error	Check configuration for proper heating set point and Submaster Gain (SMG). An improper SMG can cause the heating valve to be held closed.
Overheating	Heat coil valve (HCV) is forced open	Check status of HCV (5 STAT). If HCV is forced, remove force and check operation.
	Incorrect reading from space temperature sensor, supply-air temperature sensor, or return-air temperature sensor (VAV units)	Check status of sensor readings for accuracy. Replace sensor if defective.
	Configuration error	Check configuration for proper heating set point and Submaster Gain (SMG). An improper SMG can cause the heating valve to be held open.
No cooling	No fan status	Check status of SFS (4 STAT). If status is OFF, check switch for proper operation. Supply fan status switch must be ON for cooling coil to function properly.
	Cooling coil valve (CCV) is forced closed	Check status of CCV (5 STAT). If CCV is forced, remove force and check operation.
	No chilled water available	Check source of chilled water. Correct any problems found.
	No power to cooling coil valve	Check for blown fuse (F3). Replace if necessary. If fuse is intact, check for proper connections. Check transformer output.
	Incorrect reading from space temperature sensor, supply-air temperature sensor, or return-air temperature sensor (VAV units)	Check status of sensor readings for accuracy. Replace sensor if defective.
	Configuration error	Check configuration for proper cooling set point and Submaster Gain (SMG). An improper SMG can cause the CCV to be held closed.
Overcooling	Cooling coil valve (CCV) is forced open	Check status of CCV (5 STAT). If CCV is forced, remove force and check operation.
	Incorrect reading from space temperature sensor, supply-air temperature sensor, or return-air temperature sensor (VAV units)	Check status of sensor readings for accuracy. Replace sensor if defective.
	Configuration error	Check configuration for proper cooling set point and Submaster Gain (SMG). An improper SMG can cause the CCV to be held open.

LEGEND

CV — Constant Volume
VAV — Variable Air Volume

UNIT TROUBLESHOOTING (cont)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Mixed-air dampers will not operate	No fan status	Check status of SFS (4 STAT). If supply fan status switch is OFF, check switch for proper operation.
	Mixed-air dampers forced closed to outside air	Check status of MIXD (5 STAT). If MIXD is forced, remove force and check operation.
	No power to damper actuator	Check for blown fuse (F7). Replace if necessary. If fuse is intact, check for proper connections. Check transformer output.
	Incorrect reading from space temperature sensor or supply-air temperature sensor	Check status of sensor readings for accuracy. Replace sensors if defective.
	Configuration error	Check configuration for proper SMG and MDP (minimum damper position). If MDP is set to zero, then dampers will stay closed when enthalpy is unsuitable. An improper SMG can cause the MIXD to be held to the MDP setting. Check for proper damper set point. If damper set point is forced to incorrect value, remove force.
Unit not maintaining desired static pressure (VAV units only)	No fan status	Check status of SFS (4 STAT). If SFS is OFF, check supply fan status switch for proper operation.
	Inlet guide vanes (IGVs) forced closed	Check status of IG V (5 STAT). If IGVs are forced, remove force and check operation.
	No power to IG V actuator(s)	Check for blown fuse (F4). Replace if necessary. If fuse is intact, check for proper connections. Check transformer for proper output.
	Loose IG V linkage	Check IG V linkage for tightness and proper adjustment.
	Incorrect reading from static pressure transducer	Check status of sensor reading for accuracy. If reading is in error, check for plugged sensing line and check sensor calibration. Replace sensor if defective.
	Configuration error	Check configuration for proper static pressure set point. Also, check SMG. An improper SMG can cause the IGVs to be held closed.
High-Pressure Switch keeps tripping unit OFF (VAV only)	IGVs forced open	Check status of IG V (5 STAT). If IGVs are forced, remove force and check operation.
	High-Pressure Switch (HPS) is incorrectly set or defective	Using squeeze bulb, check trip point of HPS. Adjust as required. Check for plugged lines. Replace if defective.
	Static pressure sensor reads incorrectly	Using local interface device and squeeze bulb with gage, verify static pressure reading is correct. Adjust or replace sensor as required.
	Configuration error	Check configuration for proper static pressure set point. Check SMG. An improper SMG can cause the IGVs to be held open.
Individual actuators do not function	No power, blown fuse	Check fuses of specific actuator for function failure. Fuses are as follows: F1 — PSIO control module F2 — Power F3 — Cooling coil F4 — IGVs — supply fan F5 — DSIO or option module F6 — Heating coil F7 — Mixed-air dampers F8 — Smoke control or return-air damper F9 — Exhaust-air damper F10 — IGVs — return fan F11 — 39NX sizes 74, 92; 2nd IG V actuator, supply fan F12 — 39NX sizes 74, 92; 2nd IG V actuator, return fan F13 — Preheat coil
	Linkage is jammed or binding	Using manufacturer's instructions, correct and adjust linkage. Check operation.
	No control signal	Using Quick Test and a voltage meter set to measure current, verify that the proper control signal (4 to 20 mA) is being sent to the actuator. Refer to wiring diagram for appropriate terminals.
Oscillating output (HCV, CCV, IG V, MIXD, etc.)	Incorrect submaster gain	Using Control Loop Checkout procedure, page 108, adjust the SMG until the output steadies.
	Input sensor is fluctuating (supply-air temperature sensor, static pressure transducer)	Verify sensor reading. If reading is fluctuating, determine cause (i.e., loose connections, partially plugged static pressure sensing lines). Correct or replace sensor if necessary.
Sensor not reading correctly	Loose connections	Verify all connections are secure.
	Sensor out of calibration	Voltage type sensors (i.e., static pressure, space temperature, outdoor-air temperature, return-air temperature, relative humidity, and velocity pressure) can be calibrated using manufacturer's instructions.
	Defective sensor	If a sensor cannot be calibrated and its reading is considered unacceptable, replace sensor. Once sensor is replaced, verify new sensor is reading correctly.

UNIT TROUBLESHOOTING (cont)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Constant outside air (OAC) malfunctioning	OAC not enabled	Enable OAC.
	Fan status is OFF	Verify fan is operating and supply fan status is correct. Supply fan status must be ON to allow OAC control.
	According to occupancy schedule, building is unoccupied	Verify that current time and date are correct and reconfigure occupancy schedule.
	Incorrect unit type	Change unit type to VAV (1). OAC not available for CV units.
	Outside-air velocity pressure (OAVP) sensor not functioning	Verify 24 vac power at sensor input and correct voltage at sensor output. Verify that pneumatic tube from sensor to probe is unblocked and correctly connected to the probe. Verify that high-pressure side of probe faces the airflow. Correct problems as necessary.
	OAVP sensor not configured	Configure OAVP sensor for correct voltage and pressure output ranges.
	OAVP value does not match that of measurement equipment	Verify above corrective action; adjust the probe multiplication factor (PMF) so that the OAVP reading matches that of the measurement device. (OAVP value = sensor value/PMF).
Indoor-air quality (IAQ) features malfunctioning	IAQ not enabled	Enable IAQ.
	According to occupancy schedule, building is unoccupied	Verify that current time and date are correct and reconfigure occupancy schedule.
	IAQ priority level is incorrect	Verify that priority level is set at 1 or 2 and correct if necessary. (Level 3 provides no IAQ control, only alarm functions.)
	Set point too high	Adjust set point to correct (lower) level.
	Air quality (AQ) sensors not operating	Ensure that power and control wiring are correct. Verify 24 vac power at sensor input and correct voltage at sensor output.
	AQ sensors not configured	Ensure that sensor voltage range and output values are correctly configured.
	IAQ type set incorrectly	Set IAQ type to 1 for a single sensor or two sensors used for differential comparison. Set IAQ type to 2 for two sensors used for separate readings.
	IAQ functions suspended because priority level is 2 and the conditions below apply:	—
	Space temperature is too high or too low	Control will resume when space temperature recovers.
	Space relative humidity is greater than cooling coil high humidity limit (CCHHL)	Ensure that CCHHL is set correctly. Control will resume when the relative humidity drops below CCHHL.
	For VAV units only; supply-air temperature (SAT) is greater than the sum of cooling coil master reference (CCMR) plus 5 F, or SAT is less than (CCMR–8 F) for 4 minutes or more	Control will resume when SAT control recovers. This is normal operation during conditions of high or low outside-air temperature (OAT)
	Mixed-air temperature (MAT) sensor is forced, open, or shorted; OAT is less than 45 F; MAT protection is enabled	Normal operation will resume when the MAT sensor is operating correctly or when OAT is greater than 45 F. If OAT is greater than 45 F, remove force from, repair, or replace the MAT sensor.

METRIC CONVERSION CHART

METRIC TECH	X	= ENGLISH UNIT	X	= SI UNIT
Area				
cm ²			100	mm ²
cm ²	0.1550	in ²	645.2	mm ²
m ²			1.0	m ²
m ²	10.76	ft ²	0.09290	m ²
Length				
μ m			1.0	μ m
μ m	39.37	micro-inch	0.0254	μ m
mm			1.0	mm
mm	0.03937	in.	25.4	mm
mm	0.003281	ft	304.8	mm
m			1.0	m
m	3.281	ft	0.3048	m
m	1.094	yd	0.9144	m
Mass				
g			1.0	g
g	0.03527	oz	28.35	g
kg			1.0	kg
kg	2.205	lb	0.4536	kg
tonne, Mg			1.0	tonne, Mg
tonne, Mg	1.102	U.S. ton (2000 lb)	0.9072	tonne, Mg
Power				
kcal/h			1.163	W
kcal/h	3.968	Btu/h	0.2931	W
HP metric			0.7355	kW
HP metric	0.9863	HP (550 $\frac{ft \cdot lb}{s}$)	0.7457	kW
Mcal/h			1.163	kW
Mcal/h	0.3307	Ton refr.	3.517	kW
Pressure				
mm w.g. 4°C			9.806	Pa
mm w.g. 4°C	0.03937	in H ₂ O 39.2°F	249.1	Pa
mm Hg 0°C			0.1333	kPa
mm Hg 0°C	0.03937	in Hg 32°F	3.386	kPa
kg _f /cm ²			98.07	kPa
kg _f /cm ²	14.22	psi	6.895	kPa
mH ₂ O	3.281	ft H ₂ O	2.989	kPa

METRIC TECH	X	= ENGLISH UNIT	X	= SI UNIT
Temperature Interval				
°C			1.0	K
°C	1.8	°F	0.5556	°C
Velocity				
m/s			1.0	m/s
m/s	3.281	ft/s	0.3048	m/s
m/s	196.9	ft/min	0.00508	m/s
Volume				
mm ³			1.0x10 ⁻⁶	L
mm ³	6.102x10 ⁻⁵	in. ³	0.01639	L
L			1.0	L
L	0.03531	ft ³	28.32	L
m ³			1.0	m ³
m ³	1.308	yd ³	0.7646	m ³
L	0.2642	U.S. gal	3.785	L
L	2.113	U.S. pint	0.4732	L
mL, cm ³			1.0	mL
mL, cm ³	0.03381	U.S. oz	29.57	mL
Volume/Time				
m ³ /h			0.2778	L/s
m ³ /h	0.5886	ft ³ /min	0.4719	L/s
m ³ /h	4.403	U.S. gal/min	0.06309	L/s
L/h			2.778x10 ⁻⁴	L/s
L/h	4.403x10 ⁻³	U.S. gal/min	0.06309	L/s
(m ³ /h)/ (1000 kcal/h)	1.780	cfm/ton	0.1342	L/s · kW
METRIC TECH CONVERSION FACTOR = ENGLISH UNIT CONVERSION FACTOR = SI UNIT				
Temperature				
°C			°C + 273.15	K
°C	(°C x 1.8) + 32	°F	(°F - 32) ÷ 1.8	°C

PREFIXES		
M	MEGA-	10 ⁶
k	KILO-	10 ³
d	DECI	10 ⁻¹
c	CENTI	10 ⁻²
m	MILLI	10 ⁻³
μ	MICRO	10 ⁻⁶

LEGEND	
m	METER
cal	CALORIE
kg	KILOGRAM (mass)
kgf	KILOGRAM — FORCE
kp	KILOGRAM — FORCE
L	LITER
°C	DEGREES CELSIUS
K	KELVIN
W	WATT
Pa	PASCAL
J	JOULE
N	NEWTON
h	HOUR

UNITS	
cP	CENTIPOISE
cSt	CENTISTOKE
HP metric =	(PS, CV, ch) METRIC HORSEPOWER
mm w.g.	MILLIMETERS WATER GAUGE
mm CE	MILLIMETERS WATER GAUGE
mm Hg	MILLIMETERS MERCURY
tonne =	1000 kg
kcal =	fg FRIGORIE
bar =	100 kPa