

T6984 A,D,E Electronic Floating Control Thermostats

PRODUCT DATA



FEATURES

- PI (proportional and integral) control action provides accurate, stable room temperature control.
- T6984 models are used with Series 60 direct-coupled damper actuators such as ML6161 or ML684, or with Series 60 valve actuators such as VC6930 or M610.
- All models feature user-friendly set point knob.
- All models feature output status LEDs for installer check-out.
- Locking cover and range stops are standard.
- Night setback models feature selection of two different offset temperatures for use with central time switch control.
- Night setback models feature 2 1/2 hour local timed override.
- Heat/cool models feature automatic changeover with 3° or 5°F (1.5°C or 3°C) selectable Zero Energy Band (Z.E.B.) to meet requirements of ASHRAE 90.1.
- Heat/cool models have installer-definable setpoint at midpoint of Z.E.B., at heating setpoint, or at cooling setpoint.
- Reheat models feature fast/slow response selection to match heating system dynamics.
- DIP switch selectable 75°F (24°C) high limit for heating setpoint and low limit for cooling.
- T6984 features selectable motor timing from 20 seconds to 7 minutes.
- Horizontal and vertical covers included.

APPLICATION

These microprocessor-based thermostats provide proportional – integral (PI) individual room temperature control in zoned commercial Heating, Ventilating, and Air Conditioning systems. Typical applications include hydronic perimeter (heating and/or cooling), pressure dependent variable air volume, or a by-pass box with or without terminal reheat.

The T6984 family provides tri-state (floating) proportional temperature control. Optional features include automatic heat/cool changeover, reheat control, remote night setback with local timed override, and remote sensor on VAV models.

Contents

Specifications	2
Ordering Information	2
Installation	3
Wiring Diagrams	4-8
Control Operation	4-8
Setting	4-8
Checkout	8

SPECIFICATIONS

IMPORTANT: The specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the listed specifications. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

MODELS: T6984A,D,E with PI floating output

Table 1 — Model Specifications

Model	Output 1	Cool/Heat Changeover For Output 1	Output 2	Night Setback	Main Temperature Sensor *	Mode Selection Input
T6984A	Floating	-	-	-	Internal	-
T6984D	Floating	-	On/off	Dry Contact	Internal or remote	Jumper
T6984E	Floating	Dry contact	-	-	Internal or remote	-

* Remote sensor models are:
 272845 Remote wall mount sensor
 272847 Remote duct mount sensor

DIMENSIONS:

See Figure 1.

MOUNTING:

Mounts to single-gang NEMA-standard 2"x 4" electrical box, or directly to wall (requires 1 1/8" [35 mm] access hole for wiring, or 272846 mounting plate).

WIRING:

Four to eight 1/8" screw terminals suitable for 2 no. 18 AWG [1 mm²] wires each depending on model.

POWER SUPPLY:

19–30 Vac, 50–60 Hz, 2 VA, Class 2. (Does not include actuator power requirements.)

OPERATING AMBIENT:

32–104°F [0–40°C] at 5-95% Relative Humidity (non-condensing).

ACCURACY: 1°F (0.6°C)

PRECISION: ±0.5°F (0.6°C)

SETPOINT RANGE:

55–90°F [13–32°C] - T6984A & E

Heating: 55–75°F [13–24°C] - T6984D

Cooling: 75–90°F [24–32°C] - T6984D

* The maximum heating setpoint and minimum cooling setpoint is electronically limited to 75°F (24°C).

REMOTE SENSOR:

47 kΩ NTC thermistor [part nos. 272845 or 272847].

SWITCHED OUTPUT RATING:

0.5 A running, 1.1 A inrush, 24 Vac, protected with self-resetting electronic thermal fuse.

OPERATING PARAMETERS:

See Table 2 for installer selections.

APPROVALS:

Designed for Class II safety extra low voltage installation only. (100VA, 30V max.)

Case and cover meets UL 94-5V flammability requirements, and North American Standards for line voltage thermostat enclosures. Meets requirements of F.C.C. Part 15 Class B, IEC 801-3 for radio frequency interference.

ACCESSORIES:

272845 - Remote sensor (wall mounted).

272846 - Adaptor mounting plate for British standard, European, or double-gang NEMA electrical boxes, or for surface mounts.

272847 - Remote sensor (duct mounted).

Table 2 - Option Settings

Parameter	Selection	T6984 Model		
		A	D	E
Motor Timing	20; 30; 60; 90; 120; 150; 240 or 420	•	•	•
Night Setback	5°F (3°C) heat/cool offset, or 10°F (5°C) setback/cooling shutdown		•	
Zero Energy Band	3°F (1.5°C); or 5°F (3°C)		•	
Setpoint Definition	Heating; Cooling or H/C midpoint		•	
Output 2 Cycle Time	7.5 or 15 minutes		•	

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the Tradeline Catalog or price sheets for complete ordering number, or specify—

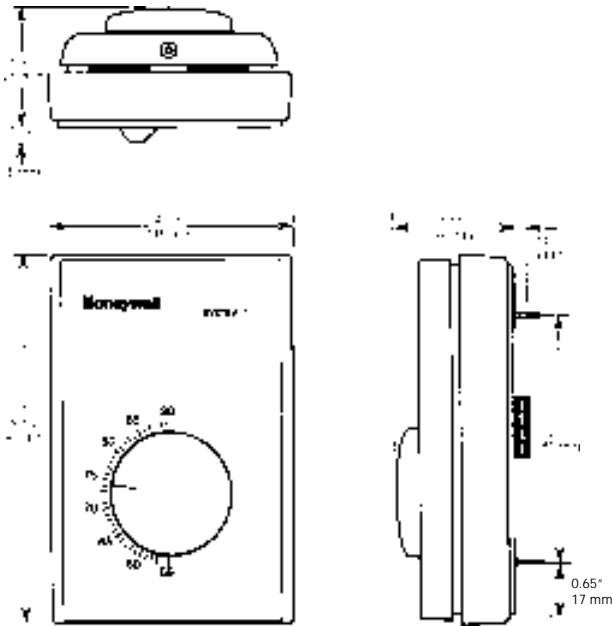
1. Order number.
2. Accessories, if desired.
3. Order additional system components and system accessories separately.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

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Fig. 1 – Dimensions in inches (mm)



INSTALLATION

Location

Install the thermostat about 5 ft. (1.5 m) above the floor in an area with good air circulation at average temperature conditions.

Do not install thermostat where it may be affected by:

- drafts, or dead air spots behind doors and in corners.
- hot or cold air from ducts.
- radiant heat from sun or appliances.
- concealed pipes and chimneys.
- unheated (cooled) areas such as an outside wall behind the thermostat.

Mounting

The thermostat can be mounted directly on the wall with or without a wallplate or on a standard single gang electrical box, or on a double gang box with 272846 adaptor plate.



CAUTION

Disconnect power supply to prevent electrical shock or equipment damage.

Wiring

- Typical wiring connections are shown in Fig.2 to Fig.7. Wiring connections may be made to the screw terminal block with 2-18AWG or 1-14AWG, solid or stranded copper wires. Connect the system wires to the thermostat terminals. Push excess wire back into hole. Plug hole to prevent drafts.
- Auxiliary screw terminal strip may be used in a junction box when the application requires multiple wires to be brought down at the thermostat. This can make troubleshooting, startup and servicing easier.

DIP Switch Settings

T6984 thermostats must be configured for proper operation by setting DIP switches.

T6984A,D,E

Selectable motor timing: 20, 30, 60, 90, 120, 150, 240, 420 seconds.

T6984D

Output 2 time constant: 7.5 or 15 minutes.

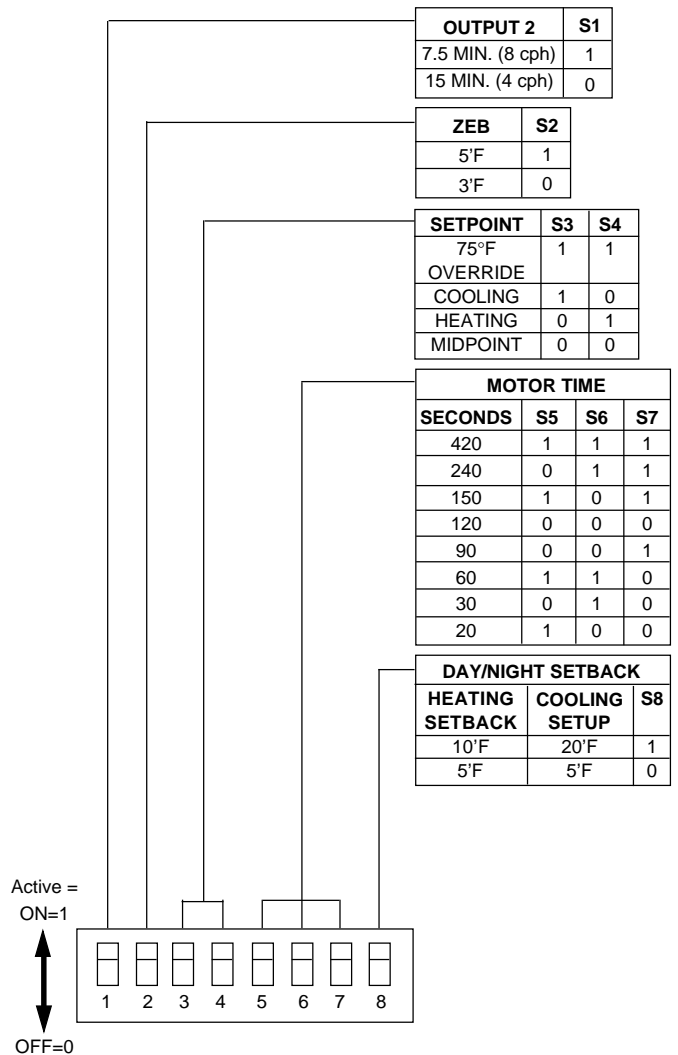
Zero energy band (ZEB): 3°F (1.5°C) or 5°F (3°C)

Setpoint adjustment: cooling centered, heating centered with limit Override for Commissioning.

T6984D

Night setback amount: see Table 2 for complete listing of Option Settings.

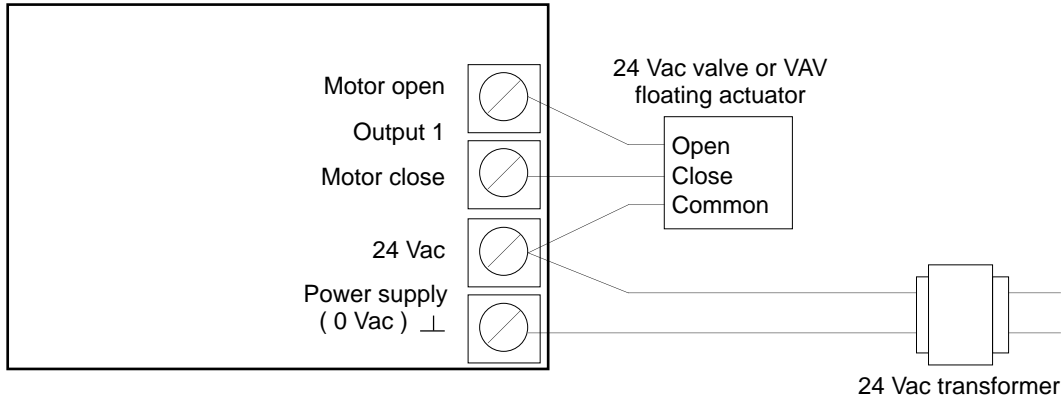
Table 3 — DIP Switch Definition



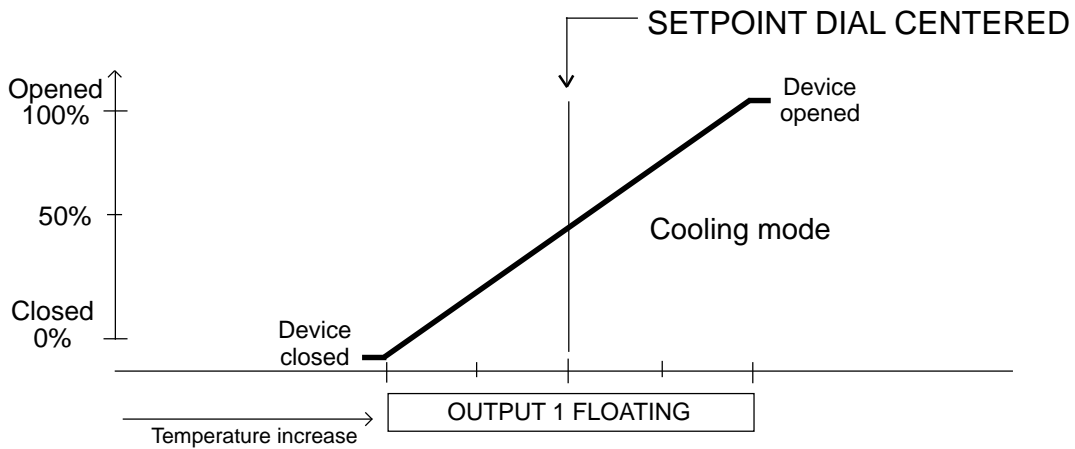
T6984A

Output 1 floating	Output 2 on/off	Mode input jumper	Changeover input for Out 1	Day/night mode (NSB)	Remote sensor option	75°F setpoint limit
Cooling or Heating						

WIRING



SEQUENCE



DIP SWITCH SETTINGS

ON = 1
OFF = 0

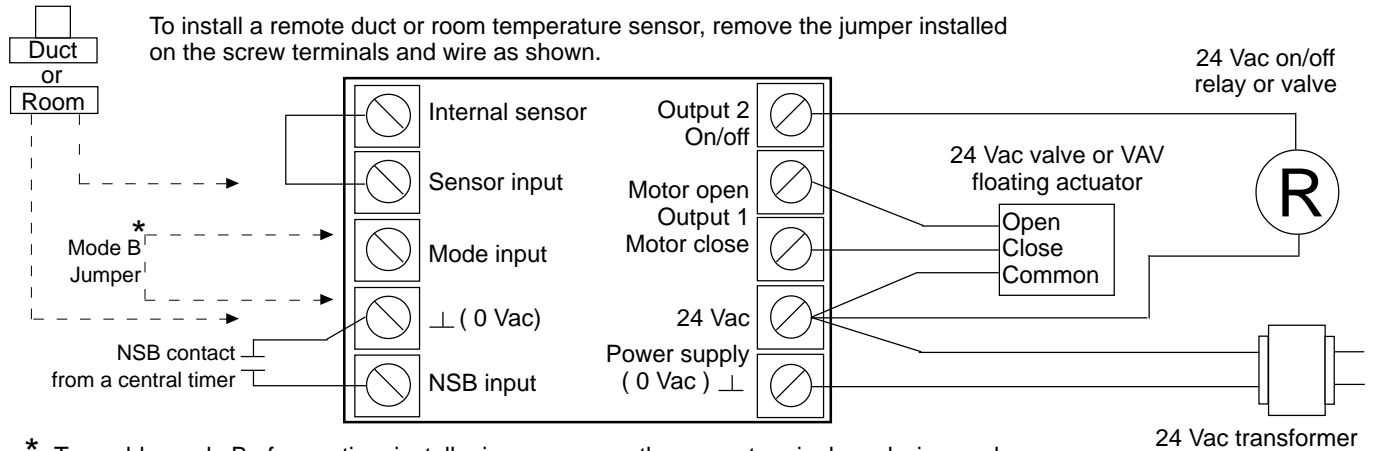
5 6 7

MOTOR			
SECONDS	S5	S6	S7
420	1	1	1
240	0	1	1
150	1	0	1
120	0	0	0
90	0	0	1
60	1	1	0
30	0	1	0
20	1	0	0

T6984D

Output 1 floating	Output 2 on/off	Mode input jumper	Changeover input for Out 1	Day/night mode (NSB)	Remote sensor option	75°F setpoint limit
Cooling	Heating	Mode A		√	√	√
Heating	Cooling	Mode B				

WIRING

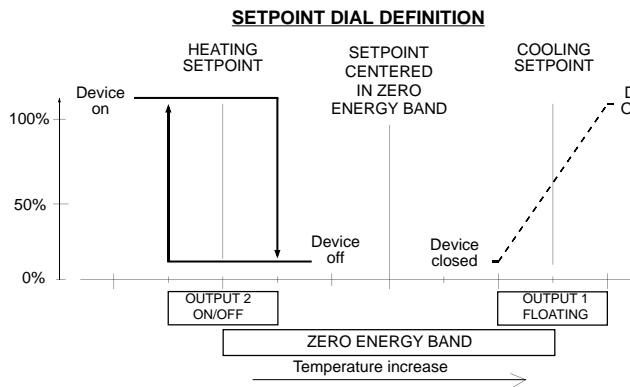


* To enable mode B of operation, install a jumper across the screw terminals and wire as shown.

SEQUENCE

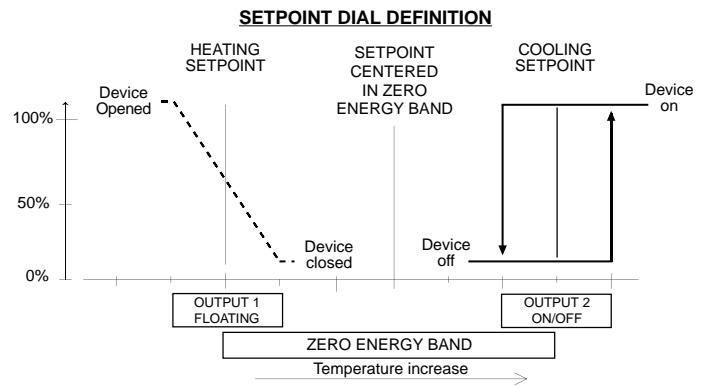
Mode A (mode jumper not installed)

Output 1 floating in cooling mode
Output 2 output in heating mode



Mode B (mode jumper installed)

Output 1 floating in heating mode
Output 2 on/off in cooling mode



DIP SWITCH SETTINGS

SETPOINT DIAL DEFINITION		
DEFINITION	S3	S4
75°F OVERRIDE	1	1
HEATING DIAL	0	1
COOLING DIAL	1	0
CENTERED H/C	0	0

ZERO ENERGY BAND	
ZEB	S2
5°F (3°C)	1
3°F (1.5°C)	0

OUTPUT 2 ON/OFF	
CYCLES/HOUR	S1
FAST 8 CPH	1
SLOW 4 CPH	0



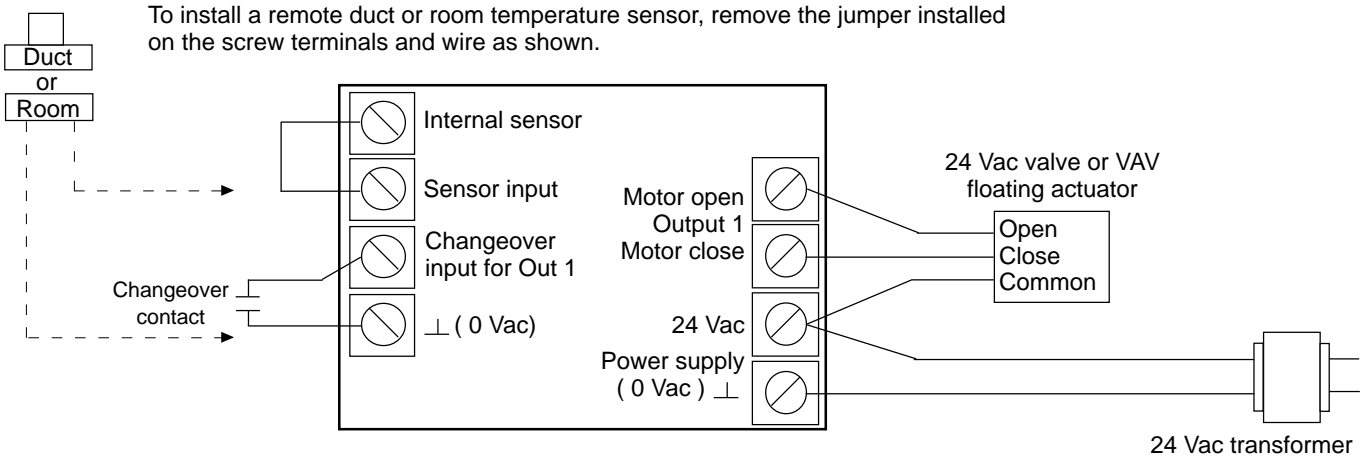
MOTOR			
SECONDS	S5	S6	S7
420	1	1	1
240	0	1	1
150	1	0	1
120	0	0	0
90	0	0	1
60	1	1	0
30	0	1	0
20	1	0	0

DAY/NIGHT SETBACK		
HEAT SETBACK	COOL SETUP	S8
10°F (5°C)	20°F (10°C)	1
5°F (3°C)	5°F (3°C)	0

T6984E

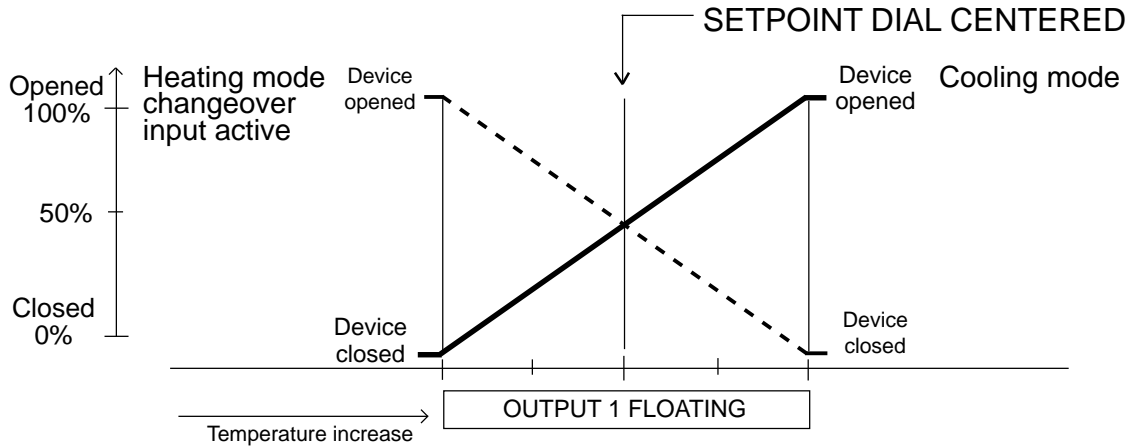
Output 1 floating	Output 2 on/off	Mode input jumper	Changeover input for Out 1	Day/night mode (NSB)	Remote sensor option	75°F setpoint limit
Cooling and/or Heating			√		√	

WIRING



To reverse operation of output 1 to heating, install changeover contact across the screw terminals and wire as shown.

SEQUENCE



DIP SWITCH SETTING

SECONDS	MOTOR		
	S5	S6	S7
420	1	1	1
240	0	1	1
150	1	0	1
120	0	0	0
90	0	0	1
60	1	1	0
30	0	1	0
20	1	0	0

Output 1, Proportional Tri-state Floating Output (T6984 All)

Main output of the thermostat. On the T6984 series that output is PI modulating floating type.

That signal uses a set of two, 24 Vac non-isolated electronic contacts for the control of floating damper actuator and floating valve actuator. One contact is to open the end device, the other to close the end device. The actuator will open and close to multiple position according to demand. When the demand and the temperature is satisfied, the thermostat will stop moving the actuator and will leave to its last position until the demand changes again.

Internal status LED's indicate the action of the output.

The green LED indicates that the actuator is opening or opened.

The yellow LED indicates that the actuator is closing or closed.

The electronic contacts (triacs) are rated at 1.1A max. in rush and 0.5A. running. These outputs are protected with self-resetting thermal fuses. In the event of an overload or short circuit, the self-resetting fuse will reduce the load to a very low level. If the power is removed or the overload or the short disappears, the fuse will return to its normal state and allow normal operation.

Motor Timing Definition. Modulating Floating Output Only (T6984 All)

It is important when using T6984 and floating actuator that motor timing DIP switch setting matches the actual maximum stroke time. The motor timing setting is normally the same as the running time that the actuator may take to complete full stroke or maximum rotation.

(Adjust S5, S6 & S7 for timing of: 20, 30, 60, 90, 120, 150, 240, or 420 seconds)

For optimum control, select a DIP switch timing setting which is equal or slightly shorter than the actual maximum running time. For VC6930 actuators, use a 30s setting rather than the 120s full-stroke timing.

Mode Input (T6984D only)

Model T6984D have a mode input. This thermostat is designed to operate and function in 2 distinct modes of operation depending on the application requirements.

This input is not a changeover input for output 1. Installing a jumper on the mode input will reverse modulating output 1 to operate as a heating only output & the on/off output 2 as a cooling only output. (see the control sequence section for each thermostat)

Heat/Cool Changeover of Output 1 (T6984E only)

Models T6984E have the possibility of changeover for output 1. Automatic changeover is used on systems were a valve or a VAV unit may have cold and hot water or air in the same

system depending on the season. Output 1 is cooling (Direct Acting) by default when the changeover input is not activated. Activating the changeover input reverses the function of output 1 to heating mode so that the thermostat can use the end device as a heating device instead of a cooling device.

A common contact may be used for multiple thermostats.

For the T6984E only a single, common dry contact can be used for changeover.

A common contact may be used for multiple thermostats.

Main Temperature Remote Sensor (T6984D & E)

All thermostats have their internal sensing device (Thermistor) mounted internally in the thermostat. On the T6984D & E models, it is possible to install a remote room or remote duct return sensor at a different location than the thermostat.

See wiring diagram for each model on how to wire the sensor.

The remote sensor are not to be used for supply control applications.

Zero Energy Band (T6984D)

Thermostats which have cooling and heating outputs (T6984D) have 2 distinct setpoints: one for heating; the other for cooling (See the control curves section for each model). When the room temperature is between these setpoints neither heating nor cooling outputs are working and the room temperature is in the Zero Energy Band. When the room temperature drops below the heating setpoint, output 2 output will energize. When the room temperature rises above the cooling setpoint, output 1 will energize.

2 settings values are available for Zero Energy Band: 3°F(1.5°C) or 5°F(3°C) can be adjusted with dip switch (S2).

Setpoint Dial Definition (T6984D only)

Because these thermostats have 2 distinct setpoints; one for heating the other for cooling, the thermostat setpoint knob need to be defined as being either:

- The true heating setpoint
- The true cooling setpoint
- Or centered in the middle of the Zero Energy Band.

This can be adjusted with dip switch (S3 & S4). (See the control curves section for each model)

75°F (25°C) Setpoint Limitation (T6984D only)

Model with a reheat output have setpoint limitation capability compatible with ASHRAE 90.1. Both heating and cooling setpoints are internally limited to 75°F (24°C). The cooling setpoint cannot go below 75°F while the heating setpoint cannot go above 75°F. This setpoint limit can be overridden for system checkout by setting the DIP switches S3=1 and S4=1.

NSB Day/Night Mode (T6984D only)

An energy saving mode by which the actual setpoints are modified to different values than the ones adjusted on the dial. The cooling setpoint will go up and the heating setpoint will go down. This mode is energized with a dry contact from a remote time clock.

Table 5

2 Different setup & setback value can be adjusted with a DIP switch

S8 = 1	10°F (6°C) heating setpoint setback	20°F (12°C) cooling setpoint setup (equivalent to cooling shut down)
S8 = 0	5°F (3°C) heating setpoint setback	5°F (3°C) cooling setpoint setup

The system LED on the thermostat cover on these models will flash to indicate that the thermostat is in night mode. The night mode can be overridden for 2.5 hours for each thermostat individually by pressing the button switch on the thermostat cover. This will bring back the thermostat to the day mode setpoints.

A second press of this button restores the thermostat to day mode setpoints.

A common NSB timer contact may be used for multiple thermostats.

Output 2 On/Off (T6984D only)

A 24 Vac on/off output which is normally used to control reheat in a zoned system. Example: electric base board or duct heater relay, on/off 24 Vac hydronic valve, etc..

This output can also be used for cooling applications with the mode jumper installed (See the control curves for T6984B)

There is a status LED mounted internally that indicates the action of the output. The red LED indicates that the output electronic contact (triac) is energized.

This electronic contact (triac) is rated at 1.1A max. in rush and 0.5 A. running. This electronic contact (triac) is protected with a PTC self- resetting fuse. In the event of an overload or a short circuit, the PTC self-resetting fuse will reduce the load to a very low level. If the power is removed or the overload or the short disappears, The PTC fuse will return to its normal state and allow normal operation.

CPH (Cycles per Hour):

It is possible to fix the number of time per hour the reheat end device will be energized. Those setting are adjusted with dip switch. (S1)

2 different settings are possible:

4 cycles per hour or 8 cycles per hour

Table 4

Use the following setting for the following reheat device applications:

4 cycles per hour	8 cycles per hour
Anything using a gas fired or oil fired terminal reheat device	N.C. 24 Vac thermal valve (Hot wax thermal body valve)
Any gear driven end device valve or damper actuator	Hydronic heating with package boiler at 170°F (75°C) supply water temp.
Properly sized electric base board strip	Oversized capacity electric base board strip
Properly sized electric duct heater	Oversized capacity electric duct heater

CHECKOUT

Service LED

All thermostats have internal service LED & a system status Led on the cover. The internal service LED are colored lights that can be viewed from the side of the thermostat they are energized and the system status LED is the one mounted on the cover. (See the checkout & start up procedures section)

Table 6 - System Status LED's

Thermostat operation can be confirmed with the System status LED on the thermostat cover.

Model	Color	Explanation
T6984A	green	High intensity = Demand for cooling. Low = no demand.
T6984D	red	Flashing = Night setback/set-up activated.
T6984E	green	High intensity = Demand for cooling (heating if changeover is activated). Low = no demand.

Table 7 - Internal Service LED's

A	D	E	Color	Indication when
▪	▪	▪	green	Motor/valve is opening
▪	▪	▪	yellow	Motor/valve is closing
	▪		red	On/off output 2 is closed (load energized)

Test Condition:

1. No contact changeover input and changeover sensor disconnected. No wire on mode input.
2. T6984D: set DIP switch S3 and S4 to "ON" position to remove 75°F (24°C) limitation.
3. Room temperatures must be between 60-80°F

Table 8

Rotate Knob to:	Green	Yellow	Red (reheat models only) T6984D
Minimum Position	ON	OFF	OFF
Maximum Position	OFF	ON	ON

The NIGHT setback feature can be temporarily overridden for 2-1/2 hours by depressing the override button on the thermostat cover.

Power-up sequence:

When power is first applied to the thermostat, a 24V pulse equal to the motor travel time is applied to the actuator in order to bring it to the full closed position. This synchronizing sequence is required since the thermostat has no way of knowing the actuator position.

After the actuator is closed and synchronized:

The open/close pulses to the actuator will be sent depending on the settings of the DIP switch. The thermostat will then position the actuator exactly, using timed voltage pulses. **The thermostat will not respond to setpoint demands until this reset sequence is complete.**

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