



4707 SE 17th Avenue
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TA/B170 Application Guide

Revised: 12/5/05
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PRODUCT	TA170, TB170 - all models
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General Description

The PECO Automation and Controls T170 microprocessor thermostat is a stand alone digital controller that supplies relay control of heat, cool, outside air and up to three fan speeds.

Various configurations can supply staged fan operation, cycled fan, continuous fan, controlled off and fan coil operation. Energy saving features include Occupancy Detection, Setback Operation and Door Switch Only Operation.

Ratings

Voltage Rating	Output Ratings				
	Inductive		Resistive Amps	Pilot Duty	HP
	FLA	LRA			
24 VAC	5.8	34.8	6.0	24 VA	NA
120 VAC	5.8	34.8	6.0	125 VA	¼
240 VAC	2.9	17.4	5.0	125 VA	¼
277 VAC	2.4	14.4	4.2	125 VA	¼
COMBINED LOAD CURRENT NOT TO EXCEED 20 AMPS MOUNT ONLY TO A GROUNDED METALLIC BOX LOW VOLTAGE WIRING IS CLASS 2					

Low voltage I/O connections are 3.5 VDC

Thermostat Operation

User Interface

System Button Selection

- OFF All thermostat outputs are off.
- AUTO The thermostat automatically selects heating or cooling mode depending upon the set point and room temperature. The appropriate HEAT or COOL indicator is enabled if demand exists. A 3°F dead-band is provided to prevent short cycling between heating and cooling modes. After changeover the control point automatically shifts so that the control off point equals the set point temperature.
- COOL The thermostat operates as a cooling only thermostat.
- HEAT The thermostat operates as a heating only thermostat.

UP / DOWN Button Selection

The UP / Down arrows are used for increasing and decreasing the control set point.

Fan Button Selection

In ON the fan outputs are continuously on. In AUTO the fan outputs cycle on and off with a demand. Some models are available with controlled off and/ or fan staging.



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Speed Button Selection

Fan speed is determined by manual selection of HI, MEDIUM or LO. If this button is held in for 5 seconds it will toggle the display scale from Fahrenheit and Celsius. Cycled or continuous operation is determined by setting FAN ON or FAN AUTO. This feature applies to TA170 models only. TB170 models have the staged fan feature.

F/C Button Selection

Models with staged fan do not have user access of fan speed setting. On these model the button function becomes a Fahrenheit / Celsius toggle.

Thermostat Inputs

Zone Temperature Remote Probe Input

This input allows remote location of temperature. When using this feature jumper JP1 must be pulled.

Pipe Sensor Input (Summer/ Winter Changeover)

This input will connect to a standard On-Off Aqua-stat or a 10K thermistor for installation in valve applications (fan coil). Refer to the Pipe Sensor Application Guide for more detailed information on this feature.

HEAT and COOL Output Operation based on Season

Table 1 and 2 show which outputs are active based on 2 or 4 pipe configuration. Table 3 shows the modes that are available by season. Fan and auxiliary heat outputs may cycle on and off, see the application guides for the specific model thermostat.

2-PIPE CONFIGURATION

	Winter	Summer	Ambiguous
Main Output	Heat	Cool	Cool
Secondary Output	Disabled	Disabled	Disabled

Table 1

4-PIPE CONFIGURATION

	Winter	Summer	Ambiguous
Main Output	Heat	Cool	Cool
Secondary Output	Disabled	Heat	Heat

Table 2

MODES AVAILABLE BY SEASON		
	2-Pipe Operation	4-Pipe Operation
Ambiguous	OFF-AUTO-COOL or OFF-AUTO-HEAT	OFF-AUTO-HEAT-COOL
Summer	OFF-COOL	OFF-AUTO-HEAT-COOL
Winter	OFF-HEAT	OFF-AUTO-HEAT

Table 3

Aqua-stat Operation

When an Aqua-stat is use it should be connected so that the input is open for Summer Mode and closed Winter Mode.

Pipe Sensor (Thermistor) Operation

With a 10K Thermistor connected the thermostat is looks for either Summer Mode (cold water) or Winter Mode (hot water) when there is a call for heating or cooling. Winter mode is either 15F above the set point or 80F. Summer mode is either 60F or 15F below the set point.

Summer Mode is the default operation and enables both Main (Cool) and Secondary (Heat) Output. Winter mode disables the Secondary Output and changes the Main Output to a Heat.



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Should the thermostat call for heating or cooling, and the pipe sensor reading is within 15°F of the ambient zone temperature, the mode is Ambiguous (not Summer and not Winter). The thermostat will start a three-minute purge timer and open the Main Output.

If mode is still ambiguous after the purge cycle (the ambient zone temperature is within 15°F of the pipe sensor temperature reading), the thermostat checks to see if the coil temperature is below 60°F or above 80°F.

- If yes, the unit has detected a non-ambiguous condition and will select either Summer (coil <60) or Winter (coil > 80) mode and resume normal operation.
- If no (the coil temperature is between 60 and 80°F) the thermostat will repeat the purge cycle until a non-ambiguous condition is sensed.

After detecting a non-ambiguous condition, the thermostat will wait for a 1 hour time period before checking and allowing another purge cycle to occur. The intent of this feature is to allow the pipe sensor of a two-way valve system to be up to 25 feet from the supply riser thus eliminating the need for 3 way valves.

Application Exceptions

Ambient conditions at the pipe sensor above 80F or below 60F can cause the control to enter an invalid season. This could occur with a pipe sensor located away from the thermostat in an uncontrolled plenum where the ambient at the pipe sensor is in excess of 15F of the thermostat sensed zone temperature.

If an invalid season is initiated, the occupant must create a heat or cool set point that causes the valve to open. For some applications this may require creating a heating demand when the occupant desires cooling.

If during the purge cycle the demand ceases to exist the purge cycle will be aborted.

Upon a change of season, the system mode of operation will be set to the last mode of operation for the new season and the current mode of operation will be saved for restoration to the old season. This ensures that the system mode of operation is always restored to the previous mode of operation for the particular season.

Purge Cycle Operation Sequence

1. Thermostat has a call for heat or cooling, a demand.
2. Thermostat checks the pipe sensor to verify water temperature.
3. If water is beyond 15F of set point, normal HVAC control occurs.
4. If water is not beyond 15F of set point the thermostat checks to see if the water is above 80F or below 60F.
5. If yes, normal HVAC control Occurs.
6. If no, thermostat opens main output (COOL) for three minutes.
7. After the three-minute purge cycle occurs the thermostat checks to see if the water temperature is more than 15F from set point, or above 80F or below 60F.
8. If Yes, Normal HVAC operation occurs.
9. If no, the valve is left open and the thermostat continues to look for a valid reading.

Conditions:

If at any time the demand goes away the thermostat will stop the purge cycle.

2-Pipe / 4-Pipe Operation

Normal operation is to have both the Main (Cool) and Secondary (Heat) outputs enabled for 4-Pipe configuration. Placement of a jumper will disable the Secondary output and change the thermostat operation to 2-Pipe configuration.



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2-Pipe Operation: A jumper should be placed on JP4 for 2-Pipe operation. In this configuration the thermostat will permanently disable the Secondary Output and disable the fan from cycling in an invalid mode. The Main Output configuration is dependent on the Pipe Sensor Input. With a pipe sensor connected the thermostat will automatically select heating or cooling depending on the sensed water temperature. If the Pipe Sensor Input is open (unconnected) the main output will cool only. If the pipe sensor input is shorted the main output will heat only. Normal thermostat default is for 4-pipe operation.

4-Pipe Operation: The JP4 Jumper should be removed for 4-pipe operation. In this configuration both the Main Output (COOL) and the Secondary Output (HEAT) are available. These will both cycle on depending on the mode of the thermostat. If the Pipe Sensor Input is open (unconnected) the thermostat will allow both heating and cooling functions. If the pipe sensor input is shorted the main output will heat only and the secondary output is disabled.

Pipe Sensor Operation for 2/4-Pipe Operation- a pipe sensor can be connected to either a 2 or 4 pipe configuration. The Pipe sensor is used to determine the water temperature in the Main coil, which should be connected to the Primary output. Following is a table that shows the output operation depending on the sensed water temperature:

Configuration	Water Temperature	Output Operation	
		Main Output (Blue Wire)	Secondary Output (Red Wire)
2-PIPE	Cold	Cooling ONLY The fan will not cycle on with a Heating demand	Disabled
	Hot	Heating ONLY The fan will not cycle on with a cooling demand.	Disabled
4-PIPE	Cold	Cooling	Heating
	Hot	Heating ONLY The fan will not cycle on with a cooling demand.	Disabled

Occupancy Sensor and Door Switch Inputs

Install jumper JP3 for this feature to operate. This feature is primarily a hotel room system for reducing HVAC operation when a room is unoccupied.

The Occupancy sensor is a low-level switch that is open when there is occupancy and closed when unoccupied. The Door Switch is a low-level switch that is open when the door is open and closed when the door is closed.

Occupancy will be determined by the use of an Occupancy Sensor and a Door Switch.

OCCUPANCY OPERATION is as follows:

In an Occupied State the thermostat operates normally and looks for a door Close.

On a Door Close the thermostat starts a two-minute timer in which to look for occupancy. If the occupancy sensor remains unoccupied and the timer expires, the thermostat enters into the unoccupied state. If the occupancy sensor transitions from unoccupied to occupied while the timer is running the thermostat will remain in Occupied State.

In the Unoccupied State the thermostat sets heating and cooling set points to setback values, as determined by factory or user settings. In this mode the fan is automatically set to cycle with demand. Thermostat continues to monitor the occupancy sensor and will go to the occupied state if it sees occupancy. Any occupancy detection, including a door open, will set the operation to occupied.



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On a door open signal the thermostat waits for a door close. If the door is open for more than 2 minutes the thermostat turns the HVAC system outputs to OFF. During this two-minute period, if a button is pressed on the keypad, the time delay is extended to 10 minutes. The time delay can only be extended once. Once the HVAC outputs are transitioned to off, a door closure is required to re-enable the outputs.

Sequence of operation:

FROM UNOCCUPIED MODE

1. From un-occupied mode any occupancy detection will change the mode to Occupied Mode.
2. On a Door Open HVAC System is turned On.
3. A 2-minute Door Open Timer is started.
4. If Door Open Timer expires the HVAC system is turned off until there is a door closure.
5. On a door closure a 2-minute occupancy timer is started during which time the system looks for occupancy.
6. If occupancy detection occurs the system will go to occupied mode.
7. If there is no occupancy detection the system remains in the unoccupied mode.
8. The HVAC system uses the setback limits to regulate heating and cooling.

FROM OCCUPIED MODE

1. During occupied mode the system regulates at the user set point values.
2. The system waits for a door open.
3. On a Door Open a 2-minute Door Open Timer is started.
4. If Door Open Timer expires the HVAC system is turned off until there is a door closure.
5. On a door closure a 2-minute occupancy timer is started during which time the system looks for occupancy.
6. If occupancy detection occurs the system will stay in or return to the occupied mode.
7. If there is no occupancy detection the system is change to unoccupied mode.

Door Switch Only Operation

Install jumper JP3 for this feature to operate. Install a Door and/ or series Window Switch to the door switch input. The thermostat will disable the HVAC outputs if this input circuit is open for longer than 2-minutes.

Setback Input

Jumper JP3 must be removed from the circuit board for this feature to operate.

This input is a low-level On-Off switch. In the open position no action is taken. If this input is closed the thermostat Heat and Cool Set Point Limits are used for thermostat control functions. These values are configurable in the Service menu. The Fan is set to Cycle with demand at the lowest available speed. Setback differential is 3F.

Setback can be factory configured as minimum heating and cooling levels. This setback condition is called Controlled Off. In this configuration thermostat off is disabled if the ambient temperature falls below the setback heat or cool set point.

In setback the digit will override the Continuous Set point Display and display the ambient temperature along with the setback icon.

In Controlled Off Setback, no setback input, the display stays in the default display.

Any key press will override the Setback Input for 1 hour and return to current thermostat settings. Key presses will not affect the Controlled Off operation



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Setback Set Points

Setback set points are factory default of 55F Heating and 90F cooling. The range is 50-90F. There will be a forced 8F separation between heating and cooling so that as one value is changing the other is pushed to maintain the separation. In setback, fan cycles on with demand regardless of user setting.

Humidity Input

Provision has been made for one 0-5 VDC humidity input. This feature is currently under development.

Thermostat Outputs

Six relay outputs are provided for control as follows:

- Heat Output - This output is enabled with a demand for heating.
- Cool Output - This output is enabled with a demand for cooling.
- Fan High, Medium and Low Outputs - These outputs are enabled by manual user selection or through Auto Fan Selection microprocessor operation.
- Outside Air Output - This output is enabled anytime the thermostat is on, including in fan only operation. This output is OFF if the control is in setback.

Fan Operation

Fan operation can be either continuous or cycled with demand. User selection of continuous only, cycled only or cycled and continuous is available. High, Medium and Low are available for three speed versions. High and Low are available for two speed versions. No fan speed will be displayed for single fan speed models. On models configured for staged fan the fan speed button becomes an F/C toggle.

The selections available are determined at thermostat configuration.

Standard Fan Configuration

User may have any or all of the following selections available:

- Fan On for fan continuous
- Fan Auto for fan cycled
- Fan High
- Fan Medium
- Fan Low
- Fan Off

Staged Fan Configuration

User may have any or all of the following selections available:

- Fan On for fan continuous
- Fan Auto for fan cycled
- Fan Off

See the staging operation diagram below.

With FAN ON selected fan operation is continuous. In low fan speed, fan is not cycled with demand.

With FAN AUTO selected fan operation cycles off with demand.

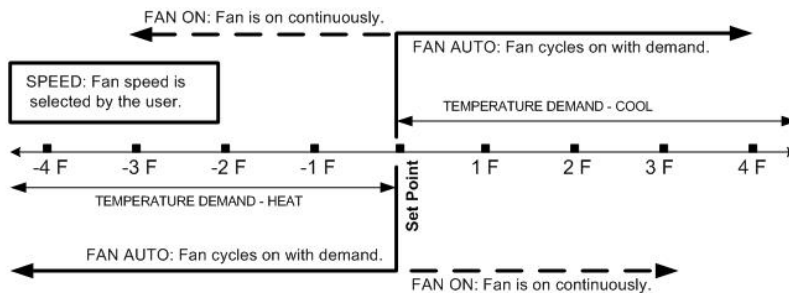
If only two fan speeds are available High speed will operate beyond 4F of set point. Low fan speed default will be set to continuous operation. If FAN AUTO is enabled and selected then Low speed is cycled off with demand.

Fan speed will increase if the set point is not obtained within 10 minutes. Once it has increased it will stay in higher speed until set point is reached.

T170 STANDARD and STAGED FAN OPERATION

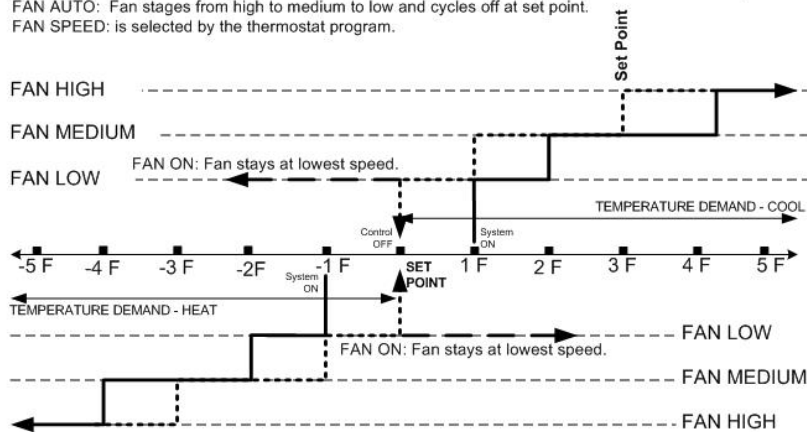
Standard Fan Operation

FAN ON: Fan is on continuously and is not dependant on a heat or cool demand.
 FAN AUTO: Fan cycles on with a heat or cool temperature demand and cycles off with the heat or cool output.
 FAN SPEED: High, medium or low is selected by the user.



Staged Fan Operation

With Temperature Demand:
 FAN ON: Fan stages from high to medium to low and stays continuously on in the lowest available speed.
 FAN AUTO: Fan stages from high to medium to low and cycles off at set point.
 FAN SPEED: is selected by the thermostat program.



Sunne Controls/ MAC 4/12/04

Thermostat Controlled Off

This thermostat can be factory configured for Controlled Off. In this configuration the control will allow the user to select OFF but will override OFF if temperature drifts beyond the setback set points. This control will function in the Setback mode until temperature is within the heating and cooling setback set points.



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Range Limits

Set point range limits are factory set at 50 – 90 F and can be changed by user selection or factory configuration. If the low value is increased beyond the current high value, the high value is reset to the current low value. If the high value is decreased beyond the current low value, the low value is reset to the current high value. Both values are allowed to be the same.

Non Volatile Memory:

The sensor will have non-volatile memory for storage of operation modes, last programmed user set point(s), and product configurations.

Fan Power Up

Anytime the fan is energized it should transition through high speed for 0.25 seconds.

Output Operation

T170 OUTPUT OPERATION BY SYSTEM SETTING						
State	Fan Switch	System Switch	Heat/ Cool Operation	Fan Operation	OA Damper Operation #1 (standard)	OA Damper Operation #2 (optional)
1	ON	AUTO	H/C cycles with demand	Fan ON continuous	OA damper ON	OA damper cycles ON with demand
2	AUTO	AUTO	H/C cycles with demand	Fan cycles with demand		
3	ON	HEAT	Heat cycles with demand	Fan ON continuous		
4	AUTO	HEAT	Heat cycles with demand	Fan Cycles with demand		
5	ON	COOL	Cool cycles with demand	Fan ON continuous		
6	AUTO	COOL	Cool cycles with demand	Fan Cycles with demand		
7	ON	OFF	H/C OFF	Fan ON continuous	OA damper OFF	OA damper OFF
8	AUTO	OFF	H/C OFF	Fan OFF		



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SERVICE MENU

Access to the Service Menu:

- Hold the UP Arrow and DOWN Arrow buttons down for 5 seconds.
- Current display icon will be turned off.
- Service Menu numbers 1 through 9 are available. The SYSTEM button is used to scroll to the item to be changed.
- The UP and DOWN buttons adjust the selection.

SERVICE MENU FUNCTIONS

1 - F/C DISPLAY SELECTION

At this feature the F and C are illuminated. The selected icon will be flashed. The Up or Down Arrow button can be depressed to toggle between F or C.

2 - CONTINUOUS SET POINT DISPLAY

At this feature, either the F or C icon, current digits and the SETPOINT icon will be displayed. If the Continuous set point display is enabled the SETPOINT icon will flash. The Up or Down Arrow button will toggle between continuous display of set point and display of zone temperature.

3 - FAN OFF DELAY

The FAN, OFF and digits are displayed. Digits represent the number of seconds the fan will stay on after the heating and cooling outputs are turned off. The Up or Down Arrow button can be depressed to increase / decrease value from 0-255 seconds.

4 - RANGE LIMIT LO

The display reads the current minimum range setting, SETPOINT icon and LO icon. The Up or Down Arrow button can be depressed to increase / decrease value.

5 - RANGE LIMIT HIGH

The display reads the current maximum temperature range adjustment, SETPOINT icon and LO icon. The Up or Down Arrow button can be depressed to increase / decrease value.

6 - SETBACK HEAT

The display reads current temperature range adjustment, the SETBACK icon and the HEAT icon. The Up or Down Arrow button can be depressed to increase / decrease value.

7 - SETBACK COOL

The display reads current Cool setback value, the SETBACK icon and the COOL icon. The Up or Down Arrow button can be depressed to increase / decrease value.

8 - ZONE TEMPERATURE OFFSET

The display reads ones and tenths (0.0) with leading minus sign. The Up or Down Arrow button can be depressed to increase / decrease value +/- 9F. Increments are made in 1F and 0.5C.

9 - KEYPAD LOCKOUT

The ON and OFF icons are displayed. The enabled icon is flashing. OFF is the default. ON disables the keypad except for entry into the service menu. The Up or Down Arrow button can be depressed to increase / decrease the value.

Note: These values are stored and recalled in the event of a power failure.

TROUBLE SHOOTING GUIDE

Coming Soon....