

SPECIFIER'S GUIDE

FOR HVAC DESIGNERS & FACILITIES MANAGERS

REDUCE COSTS AND IMPROVE CONTROL WITH ENVIRO-TEC[®] SSR BASED, TIME PROPORTIONAL ELECTRIC HEAT CONTROL

Today's higher outdoor air quantities demand larger electric heaters to meet design heating loads. The traditional method of step control results in either increased first costs and maintenance costs if many steps are used, or increased energy costs if few steps are used.

Many designers do not consider discharge air temperature control with staged electric heat. Now, however, time proportioning the power to the electric heater essentially provides continuously variable heat output to exactly meet the needs of the system. Each of these points will be discussed in this article.

HOW DOES TIME PROPORTIONING WORK?

Essentially, the power to the electric heater is switched on and off rapidly. The higher the ratio of "on" time to "off" time, the higher the discharge tempera-

ture of the air leaving the heater. For the purpose of providing an illustration, let's assume this "on" and "off" switching is done based on one hundred cycles of the incoming AC power. For example, if very little heat is required, the heater would be energized for one cycle and off

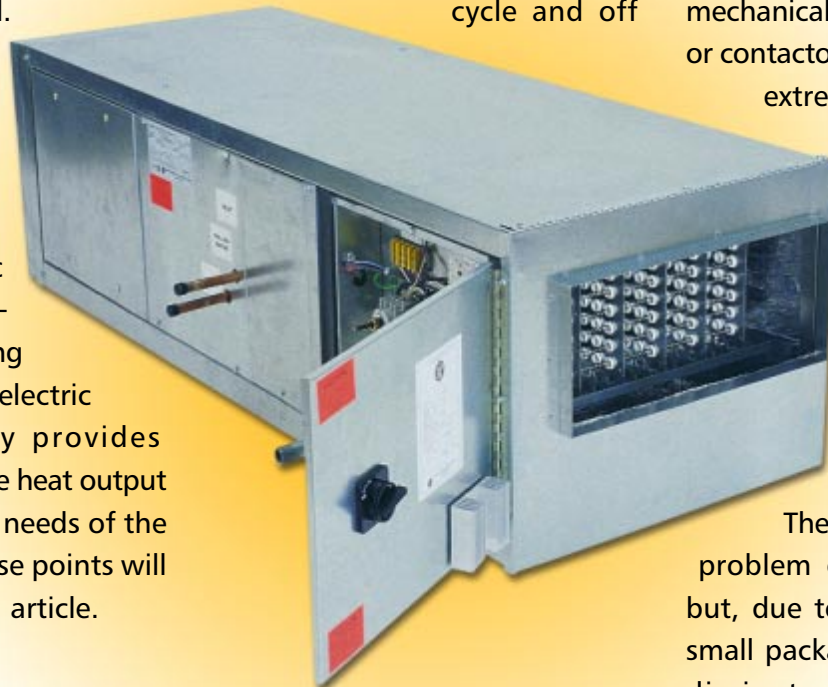
for ninety-nine cycles; if fifty percent of the capacity of the heater were required, the heater would be energized for fifty cycles, and off for fifty cycles; and so forth.

Of course, if this rapid switching were done with an electro-mechanical device such as a relay or contactor, the device would be extremely noisy and wear out rapidly.

WHAT IS AN SSR?

Early versions of time proportioned heater controls used SCR's or triacs, which are types of electronic switches.

These devices avoided the problem of mechanical wear, but, due to the nature of their small packages, were unable to dissipate heat well, causing reliability problems. The SSR (Solid State Relay) was designed to solve this problem. Although it uses essentially the same technology as the other devices, the SSR features silicon wafers up to ten



Electric heaters are a factory mounted and wired option on ENVIRO-TEC[®] air handling units. Single point power connections are standard; dual point power connections are available. Air handler and heater are cETL listed as an assembly. The solid state relay provides stable space temperature under widely varying load conditions.

times larger than the older devices with equal current ratios, and heat dissipating areas over twenty times the size of the older devices. The latest versions of SSR's feature three phase, 480 volt control in a single package, greatly reducing the number of connections required, which further enhances reliability.

Another advantage of the SSR is zero voltage switching. In other words, the power to the heater is only switched on and off when the AC waveform is crossing zero volts.

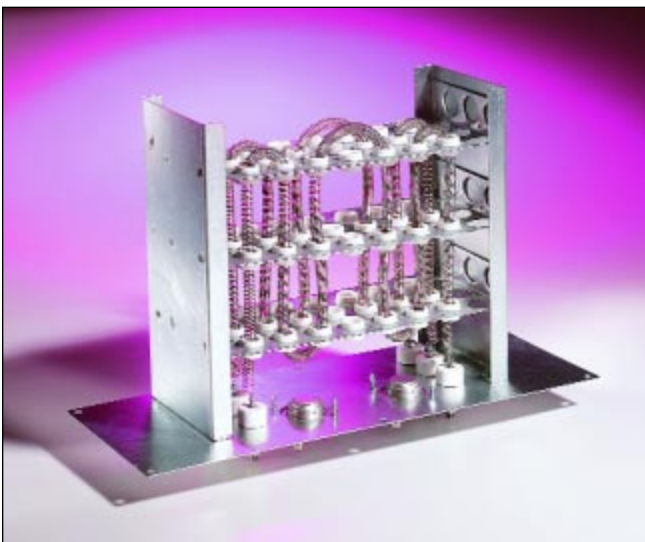
This switching method not only greatly reduces stress on system components, it also avoids voltage transients which are generated

when the power is switched on or off at the peak of the AC voltage. Most older time proportioned controls, and many current ones, do not use this switching method.

DOES TIME PROPORTIONED HEAT REDUCE COSTS AND IMPROVE CONTROL?

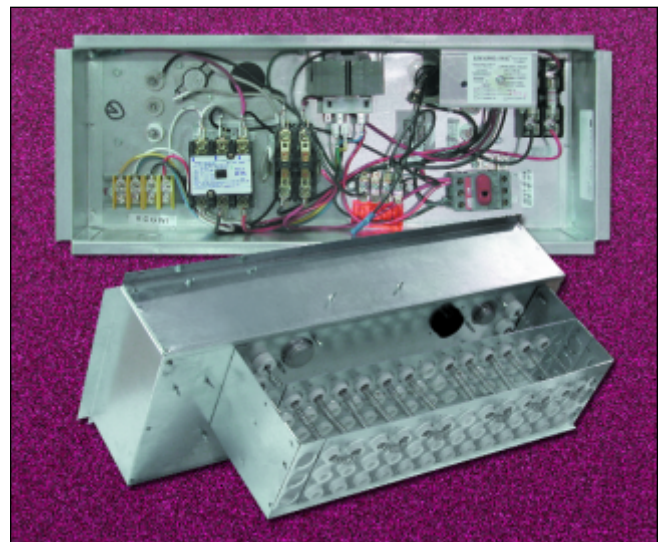
With only a limited number of steps of electric heat, chances are that the heating requirements at a given point in time will not match the incremental capacity of the number of stages available. For instance, in the case of a two step heater, if the actual output requirement of the heater is sixty percent, the second stage will need to be switched on (one hundred percent output) and off (fifty percent output) in an effort

to maintain the desired temperature control. Consequently, the space or discharge temperature (depending on the heater application) is mostly either too warm or too cool. Not only is energy wasted when the space is too warm, but, since it takes more energy to heat a space to a desired temperature than to maintain it at the temperature, energy is wasted when the space is reheated after cooling. This energy loss can be reduced by switching the steps on and off more rapidly, but, as discussed early, this reduces the life of the system components. Also, occupants may find the "clicking" associated with energizing and de-energizing magnetic contactors annoying.



VERTICAL HI-RISE FAN COIL ELECTRIC HEAT

Electric heat is available in a wide variety of kW and voltage configurations. Options include door interlock disconnects and low voltage controls. Controls and electric heat components on all ENVIRO-TEC® products are factory mounted and wired, and ETL listed as an assembly.



DIRECT DRIVE BLOWER COIL ELECTRIC HEAT

Premium quality materials such as stainless steel element hardware, Ni-Chrome wire elements, and high temperature rated wiring exceed typical industry quality standards. Control and electric heat configurations on all ENVIRO-TEC® products are with single point power and are ETL listed as an assembly.

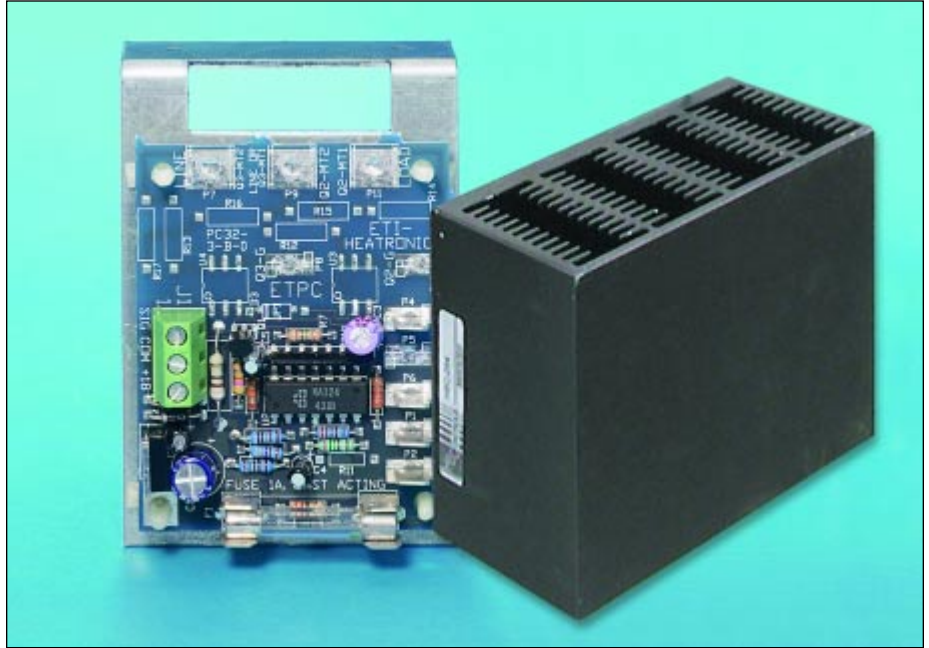
Adding more steps will also help reduce this energy loss, but at a greater first cost and increased maintenance due to an increased number of components. The cost of time proportioned control is actually less than four steps of control using magnetic contactors, or two steps of control using mercury contactors. Also, most DDC controllers cannot handle more than two or three steps of electric heat on fan powered terminals.

WHAT OPTIONS DOES ENVIRO-TEC® OFFER WITH ITS TIME PROPORTIONED ELECTRIC HEAT?

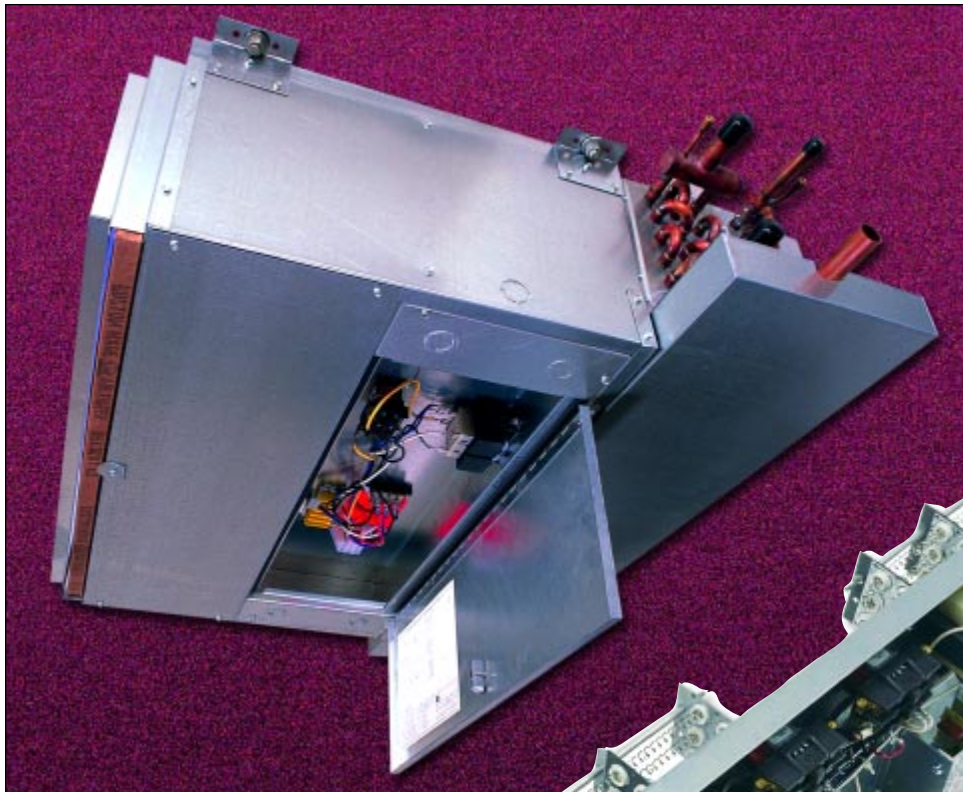
ENVIRO-TEC® Time Proportioned Electric Heat is available in either single or three phase with line voltages up to 480 VAC. Input

options include wall or duct thermostats, or inputs for control by others. Input options include 0-135Ω, 4-20 mA, 2-10 VDC, 6-9 VDC or PWM (pulse width modulation).

For further information on this or any other product, contact your ENVIRO-TEC® representative or visit www.enviro-tec.com.



SSR ELECTRIC HEAT CONTROLLER AND RELAY



HORIZONTAL FAN COIL ELECTRICAL ENCLOSURE

The bottom hinged electrical enclosure provides access to a spacious electrical compartment. This compartment houses all electric heat and control components. Terminal strips are furnished for simple power and control wiring connections. Multiple knockouts allow wiring entries from either side of the compartment.

ENVIRO-TEC® SINGLE ZONE ELECTRIC HEAT VAV CORRECTS COMMON INDUSTRY HEATER PROBLEMS

The SDR-EH breaks new ground in single duct VAV electric heater design. The patented FlowStar™ sensor permits modulation to lower airflow levels than all other sensors in the industry. This minimizes the energy expended for heat in many applications. The FlowStar™ probe provides a control signal that is 2.75 times the signal provided by the traditional Pitot tube sensor.



Historically, heater elements placed downstream of a VAV damper have experienced two major problems:

- Elements fail prematurely due to hot spots resulting from an uneven air velocity profile over the heater face
- Heaters suffer rapid nuisance cycling of the contactors and elements because the airflow switch probe is located on the low pressure (downstream side) of the VAV damper

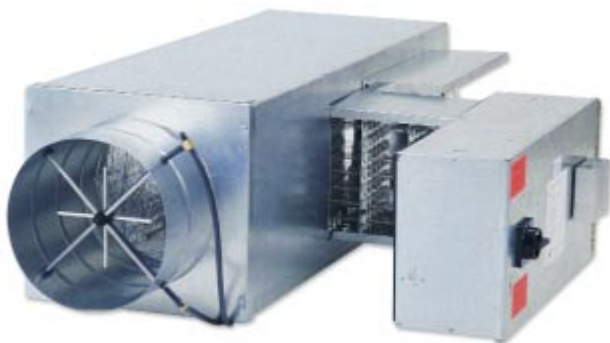
ENVIRO-TEC's unique electric heat VAV terminal, the SDR-EH, solves these problems. The heater

elements are located midway between the air inlet and the damper. This design provides uniform airflow over the face of the electric heater at all damper positions. Element life is extended, reducing repair cost, discomfort, and inconvenience.

With the heater elements located on the high pressure side of the VAV damper, the airflow pressure switch receives a reliable pressure signal even at minimum damper positions. This arrangement provides greater safety, as well as enhanced reliability.

The SDR-EH design permits tremendous flexibility when selecting KW, voltage, phase, balanced or unbalanced circuiting and method of control.

With over 100,000 of these electric heat terminals installed, this design concept is "tried and true." The SDR-EH from ENVIRO-TEC® raises the standard of excellence in electric heat VAV design.



The FlowStar™ probe is visible in the inlet of the SDR-EH. The elements, partially removed for this photo, are midway between the inlet and damper.



The outlet end of the SDR-EH reveals the VAV damper. Heater elements are well upstream of the damper in an area of uniform airflow.