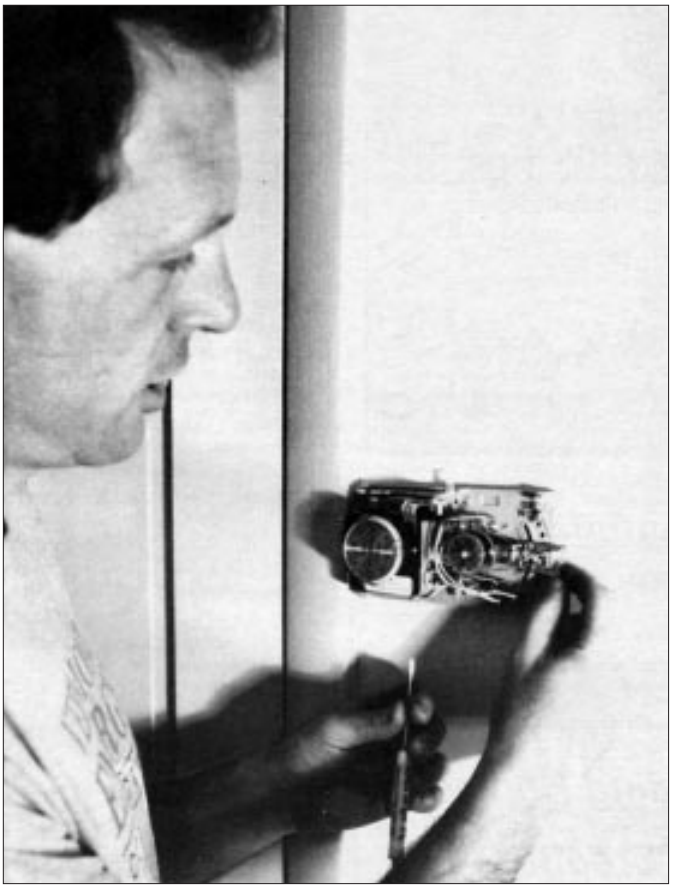
SHOPPING FOR SETBACK THERMOSTATS



A thermostat does two things: It senses the room temperature, and it regulates the heating system to maintain a selected temperature. But *how* it does these things can have a serious effect on both comfort and fuel use.

Most inexpensive thermostats allow wide temperature swings, making the room alternately too cool or too warm. Better quality thermostats have adjustable "anticipators" that turn the heating system off just before the desired temperature is reached to avoid overshooting the mark. When properly calibrated, anticipators control temperature swings so they are barely noticeable without allowing the heat to frequently turn on and off (short-cycling), which wastes fuel.

Another type of thermostat adjusts the temperature at predetermined times. Called a "clock" or "setback" thermostat, it reduces energy use and produces significant savings in homes with high heating bills. (The same is true of high cooling costs, although the savings is smaller.)

Setbacks Save Money

Setting back temperatures on a daily (or nightly) basis reduces the average indoor temperature and, in turn, reduces heating costs. The appeal of a setback thermostat is that it does the job automatically, without affecting comfort.

In an 8,000 heating-degree-day climate (like that in much of the northern U.S.), dropping the indoor temperature of a house from 68°F to 63°F twice a day will reduce the heating load by between 9% and 12% (see chart, next page). The effect on heating costs is equivalent to moving the house from northern Vermont to southern Connecticut.

Using a setback thermostat to achieve a five-degree reduction in average house temperature rarely means sacrificing comfort, particularly for a family who is away from home for much of the day. Night setbacks are even more economical because the outdoor temperature is lower and the heat load is higher at night.

A setback thermostat can save 10% to 30% on the energy bill. The higher the heating or air conditioning costs, the more savings are possible. If a house has a $1,000 annual heating cost, a setback thermostat can pay for itself very quickly. On the other hand, if the heating bill is only $300, a setback thermostat will produce a smaller dollar savings, though it will pay for itself over time.

If you are putting an addition on a large house with a zoned heating system, a setback thermostat in the new zone is an ideal way to minimize the increase in heating costs. They are also good for individual rooms that are not often used.

Setbacks can offer dramatic energy savings when a single thermostat controls the temperature of the whole house. The savings potential is greater for families who go off to school and work, leaving the house vacant for most of the day. In states where electric heat is very expensive, setback thermostats can greatly reduce costs. Some states, notably California, have mandated the installation of setback thermostats in new construction.

Thermostat Types

There are three types of setback thermostats, most of which have an anticipator feature to control cycling of the heating system.

Electromechanical. The simplest setback thermostats have electromechanical devices to allow selection of time periods and temperatures. Temperature-adjustment time intervals are marked on a circular clock dial. High and low temperatures are usually set by positioning small levers on a temperature scale. Electromechanical thermostats are easy to set because the mechanical controls are uncomplicated and easy to understand just by looking at them.

Programmable. Clock thermostats that use microprocessors, programming keys, and digital LCD readouts to select and display temperature and time are called programmable setback thermostats. Programmable thermostats have more sophisticated features, but they are consequently more difficult to use.

Occupancy. The third type of setback thermostat is the occupancy or "step-up" thermostat. Its normal setting is below the comfort temperature. But an occupant entering the room can press a button to "step up" the temperature to the comfort setting. The higher room temperature is maintained for a period of time between 30 minutes and 12 hours, and the difference between high and low temperatures is limited to either 9°F or 18°F. Occupancy thermostats can be big energy savers in spaces that are expensive to heat and that are occupied on an irregular or infrequent basis.

Regular and electromechanical thermostats use bimetallic strips to

BY TIMOTHY MAKER

THE COST OF UPGRADING TO A SETBACK THERMOSTAT WILL BE REPAID MANY TIMES OVER IN ENERGY SAVINGS

sense temperature changes and either "snap-action" or "mercury-type" switches. The snap-action switch has a small magnet on the free end of the bimetallic strip that makes the switch close smartly when the sensor and switch contact are close together. One disadvantage is that the electrical contacts can corrode. The mercury switch has a small, sealed glass vial mounted on the free end of the bimetallic sensor. When the bimetallic strip coils or uncoils, the mercury sealed inside the vial flows from one end to the other to either make or break electrical contact. The mercury switch is free from the danger of corrosion, but it is more likely to get out of alignment or to be affected by dust accumulation.

Programmable or digital thermostats generally use solid-state electronic sensors and switching to control the heating system's on-off cycling.

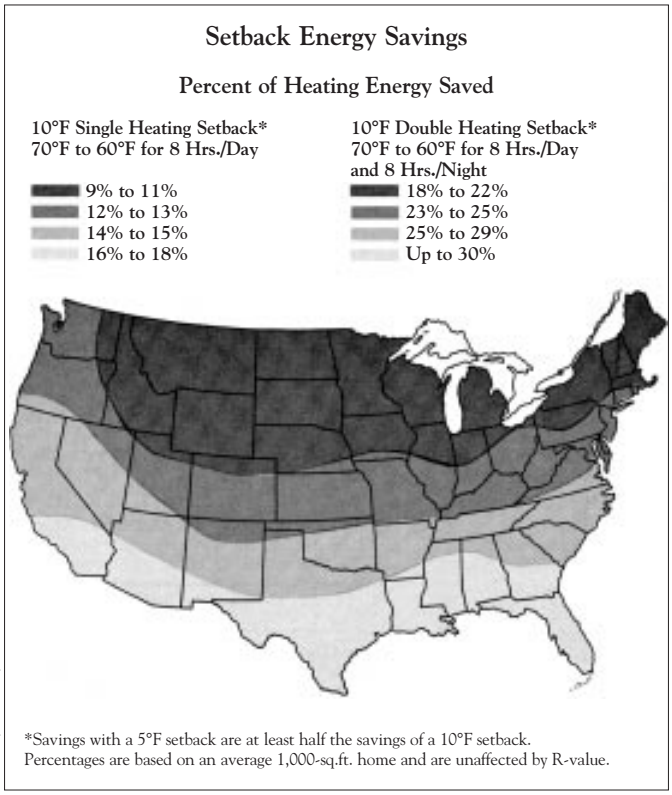
Selecting a Thermostat

The choice between an electromechanical and a programmable thermostat depends on the temperament of your clients. If they can't program their VCR, a programmable digital model is probably not a good match, and here's why. To set up a Honeywell T8090 *electromechanical* thermostat, for example, requires just six simple steps:

- open the front cover
- take out two red pins and two blue pins
- insert them in the slots around the clock dial to mark the beginning and end times of two daily setback periods
- move the red lever on the temperature scale to the comfort temperature
- move the blue lever to the setback or energy-saving temperature
- close the cover

The instruction manual for the Honeywell Chronotherm III *programmable* thermostat, on the other hand, takes 23 pages to explain how to do much the same thing. Granted, you have more control with a programmable thermostat, but it is at a cost of greater complexity.

With electromechanical setback thermostats, you choose one set of times and temperatures that applies uniformly to every day of the week (this feature is called 24-hour programming). The programmables, on the other hand, typically allow you to set weekday and weekend programs separately (called "5+2-day" thermostats). Some allow you to use a different program for every day of the week (called "7-day" thermostats). The temperature settings are also flexible. For example, a digital thermostat might be programmed to bring a house up to 70°F at 6:30 a.m., drop it to 65°F at 9:00 a.m., drop it again to 60°F between noon and 5:00 p.m., and then keep it at 70°F until 10:00 p.m., before resuming a nighttime setting of 58°F.



Courtesy of Honeywell

Setback thermostats can reduce heating costs significantly, depending on geographic location, the number of temperature changes per day, and the amount of the setback. The percentages provided here are unaffected by R-value.

Setbacks for Special Cases

The Hunter Fan Company Air Stat 5+2-day programmable thermostat controls a room air conditioner and plugs into an ordinary receptacle.

Air conditioning, electric heat, and heat pumps can all be controlled with setback thermostats, but they require special equipment.

Air Conditioning

Automatic clock thermostats do the same thing for cooling as for heating, except that the temperature is "set up" to achieve savings. Generally, there is less potential for savings with air conditioning because annual cooling costs in hot climates are less than heating costs in cold climates. In the Northeast, for example, a $700 annual heating cost is typical, while in Florida, the normal cooling bill might be only $400. A study of air conditioning usage by the Florida Solar Energy Center did not find dramatic savings with the use of clock thermostats.

Nevertheless, most setback thermostats have a switch for manual selection of "heating" or "cooling." Some need to have temperatures reprogrammed to switch seasonally from heating to cooling. Other models (called "heating and cooling" thermostats) allow you to program both modes at once, and switch between them automatically. This is an important feature in climates that have both heating and cooling needs within a single 24-hour period.

Electric Heat

Some manufacturers feel that, because electric heat has a slow response time, setback thermostats will have trouble maintaining comfort levels, so they do not recommend their use. In addition, electric heat generally requires "line-voltage" thermostats (either 240-volt or 120-volt) rather than the low-voltage (24-volt) thermostats used with most furnaces, boilers, and air conditioners.

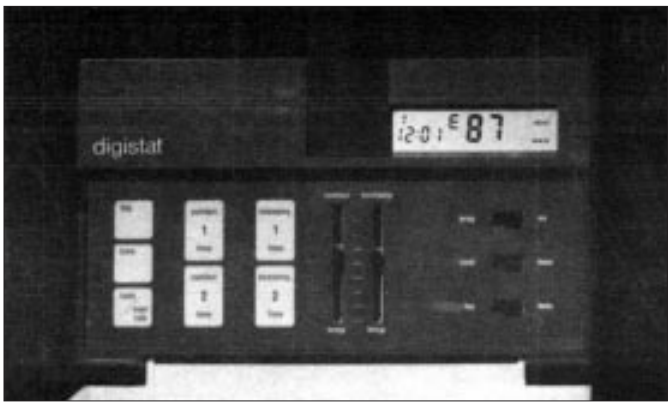
Most manufacturers do not have line-voltage models. It is possible to combine a 24-volt thermostat with a transformer and relay so that it can be used for electric heat, but this is expensive and rarely done. The only manufacturers I know of who make line-voltage setback thermostats are Honeywell, Clark, and Cadet. Clark pioneered its occupancy thermostats in line-voltage models for electric baseboard heat.

Heat Pumps

Dual-stage heat pumps require a special setback thermostat, and the major manufacturers all have heat pump models. The dual-stage heat pump thermostat is more complex because it must control the compressor as well as the backup electric resistance heater. When the thermostat calls for a return from the setback temperature to the higher comfort temperature, it starts the compressor stage earlier and brings the heat back on slowly to keep the expensive resistance heat from turning on.

— *T. M.*

Cadet C-500



Digistat Simplestat

There is a wide range of options among programmable thermostats. In general, the more a thermostat tries to do, the more difficult it will be to program and use.

Occupancy thermostats represent the greatest change in the way a user looks at the basic function of temperature control. The idea of pressing a button when you want heat is a departure from the norm for many homeowners. However, occupancy thermostats are capable of delivering the greatest savings on a big heating bill. They are particularly well suited for vacation homes, parts of a large house that are infrequently used, motels, meeting rooms, and rental spaces where the landlord pays the bill but does not control the thermostat.

Battery backup. Because all programmable setback thermostats have some sort of clock function, they may lose their programs in a power outage. To guard against this, some are battery powered. Those that use 24-volt wires from the heating system to get operating power have battery backup in case of a power outage.

Compatibility. You must be careful to select a thermostat model that is compatible with the heating or cooling equipment (see "Setbacks for Special Cases," previous page). Usually this is not a problem when replacing an existing low-voltage thermostat with a new setback thermostat — just use the existing wiring. In new installations, however, you must make an informed decision whether to wire for battery-assisted operation, battery only, "power-stealing," or more complex wiring (such as for multistage heat pumps). Some sophisticated heating and cooling equipment, such as pulse furnaces, may have other special compatibility problems and should be installed according to the manufacturer's instructions.

Setback Sampler

Most thermostats are sold through electrical or plumbing supply houses. Some are intentionally marketed to the retail or "do-it-yourself" trade and are available from national building supply or hardware chains.

The *Grainger* catalog (5959 W. Howard St., Niles, IL 60648; 708/647-8900) carries Honeywell and White Rogers thermostat products at good prices. The non-profit Energy Federation Inc. (EFI) carries some White Rogers, Honeywell, and Clark thermostats, marketing wholesale specifically to weatherization agencies, utility conservation programs, and non-profits. An EFI subsidiary, Ecological Innovations, has a limited retail selection of setback thermostats in their Energy and Resource Conservation Products Catalog. To order either catalog, call 800/876-0660.

The manufacturers listed here are among the leaders in the setback thermostat field. In reviewing their products, one of my criteria was how easy it is to understand and use the thermostats. On a programmable, for instance, although a large number of keys might represent advanced features, it might also mean more complexity, more user confusion, and a higher likelihood that the thermostat will intimidate some people.

Thermostats with outer covers are shown here with the cover opened to reveal the programming keys. The prices listed represent approximate cost to the trade. Multistage and heat-pump programmable thermostat prices are not listed, but expect to pay top dollar.

Cadet Manufacturing (2500 W. Fourth Plain Blvd., Vancouver, WA 98660; 800/442-2338) sells line-voltage thermostats (manufactured by Eaton/Mears) for electric heat, including the *Cadet C-500* ($65 to $75). The simple controls consist of a regular thermostat dial to set comfort temperature, and a clock dial for selecting setup and setback times. Unlike most electromechanicals, there are no removable time pegs to lose: The time dial is set by depressing radial actuators with the tip of a pencil or other slim object. Both the 24-hour and 7-day models are preprogrammed to set temperature back 9°F.

Clark & Company (P.O. Box 10, Underhill, VT 05489; 802/899-2971) invented and, as far as I know, is the only manufacturer of occupancy thermostats. The original Clark is the line-voltage *Model C-1* for electric heat. There are only two user controls: a dial to select comfort temperature and a "comfort" button to call for heat. There are internal settings to select either 9°F or 18°F of setback and to set the duration of the comfort period. These thermostats have been successfully used to control electric heating costs in vacation homes and public housing. Clark now makes low-voltage models for gas and oil heating (*Model C-2*), for air conditioning (*Model C-6*), and for heating and air conditioning combined (*Model C-4*). Any of the four models is available for between $95 and $115. The *Clark Clock* (Model C/Cb100) line-voltage thermostat (about $75) functions more like a regular electromechanical clock thermostat for electric heat and comes in 24-hour and 7-day models.

The ***Digistat*** line (American Stabilis, P.O. Box 2017, Lewiston, ME 04241; 207/784-9389) of digital thermostats includes two programmable clock models. The *Simplestat* ($85 to $90) is a 7-day programmable with manual slides to select comfort and setback temperatures. It uses keys to program the day and time functions and has a "copy" feature to speed programming of days with identical schedules. The high-tech 7-day *HP2001* ($150 to $160) has "lifetime memory," which preserves the program even if the backup battery fails, and a communications port, which allows you to track heating system performance and reprogram the thermostat remotely, via a modem.

Clark Model C-2

Honeywell (1985 Douglas Dr. North, Golden Valley, MN 55422; 800/345-6770, ext. 7177) has the most complete line of regular, elec-

Honeywell T8600 Chronotherm III

tromechanical, and programmable thermostats. The *T87* ($20 to $30) sets the standard for reliable, durable 24-volt thermostats. The *T8090*, a 24-hour electromechanical ($70 to $100), is simple and nicely designed, and recent improvements reduce the chances of losing the programming pegs.

Honeywell's top-of-the-line 5+1+1-day (separate programming capabilities for Saturdays and Sundays) and 7-day *T8600* series of *Chronotherm III* programmables ($85 to $125) are very sophisticated and have a wide array of features. Despite Honeywell's efforts to simplify programming and key labeling, some people may be intimidated by the number of keys under the T8600 cover. For example, there are five different arrow buttons for setting day, time, and temperature (several other companies use just two). As with most programmables, there is a programming guide on the inside of the fold-down cover. The T8600 boasts "Adaptive Intelligent Recovery" (the thermostat "teaches" itself how long it takes to bring the house up to comfort temperature) and claims to deliver a higher level of comfort because it senses both air and wall temperature. The *T8601* is made specifically for new construction and includes a 24-volt wire.

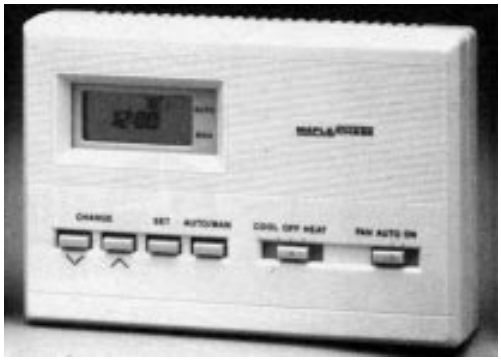
Honeywell also makes the thermostat many electric utilities have been looking for: the *T498S/T* line-voltage 5+2-day programmable for electric heat ($40 to $60). Honeywell sells mostly to wholesalers and through a trained dealer network, but their retail line sells under different names, such as Magic-Stat.

Hunter Fan Company (2500 Frisco Ave., Memphis, TN 38114; 901/745-9222) has a very nice line of simple, low-cost programmables with interesting features. The *Set 'n Save I* ($25 to $35), *Set 'n Save II* ($35-$45), and *Auto Temp* ($50-$65) models represent Hunter's "good-better-best" approach to retail and wholesale marketing. Basic programming procedures are the same for all three, but with each model there is an added layer of sophistication and extra features. Both Set 'n Save models have 5+2-day programming, but the model II also displays heating system runtime. The Auto Temp has separate Saturday and Sunday programs and "flexible-day programming," which allows you to rearrange "weekday" and "weekend" periods to any days desired. Hunter also makes a heat pump model and a plug-in programmable 5+2-day *Air Stat* (about $40) for room air conditioners. Hunter specializes in selling retail to the do-it-yourself market.

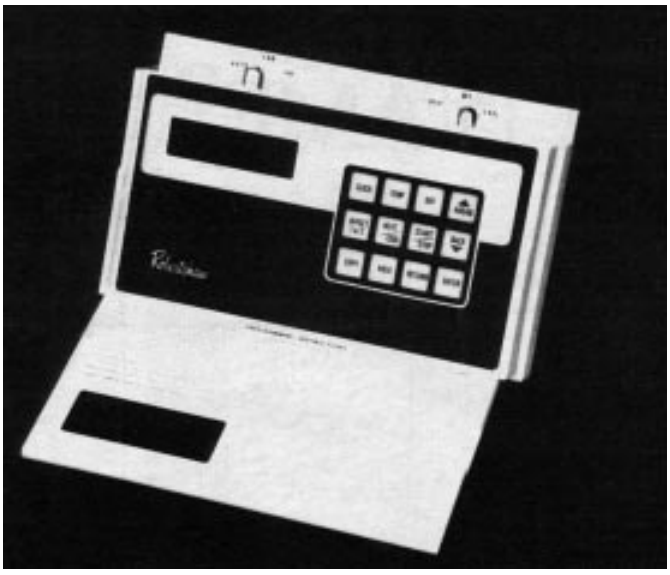
The ***Maple Chase Saverstat*** line (2820 Thatcher Rd., Downers Grove, IL 60515; 800/445-8299) is my favorite for elegant simplicity. The *Saverstat Standard 0960* costs about $43 and offers four weekday time and temperature changes and two for the weekend, plus the ability to store heating and cooling programs simultaneously. The *Saverstat Deluxe 0970* costs about $79 and offers easy 7-day programming. Arrow keys on the outside allow for quick programming changes without opening the cover. Maple Chase also has a line of heat pump programmables. Maple Chase sells through a dealer network, not retail.

The ***Robertshaw*** line (Lux Products, 4440 Sigma Rd., Suite 117, Dallas, TX 75244; 800/468-1317) sells for between $40 and $90, and is only available through retail stores. The *T33-1042* "quartz" electromechanical can be adjusted from the face of the panel, with no cover to open. It has removable time clips, which snap onto the edge of an exposed quartz clock dial, and uses levers to select comfort temperature and amount of setback. The *TX2 Easy Stat* is a 5+2-day programmable with just six programming keys. The *TX1000 Energy Manager* adds a 5+1+1-day variation. The top-of-the-line *T60-1044* is a 7-day programmable and can be installed without the cover, exposing a compact 12-key pad right on the front of the thermostat.

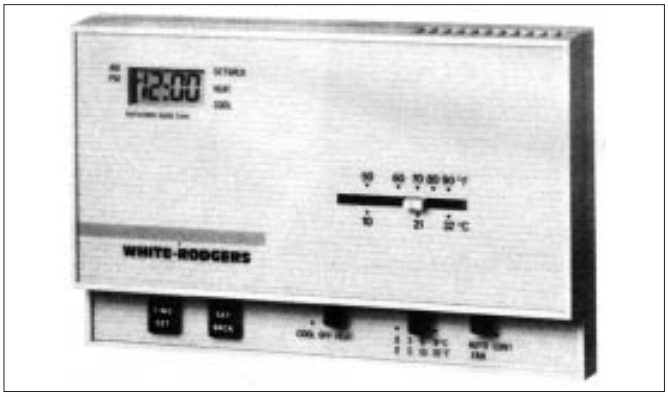
Hunter Set 'n Save II



Saverstat Standard 0960



Robertshaw T60-1044



White Rogers 1F60-22

White Rogers (9797 Reavis Rd., St. Louis, MO 63123; 314/577-1300), like Honeywell, has a soup-to-nuts line of regular, electromechanical, and programmable thermostats for all applications. The *Series 1F76* electromechanicals (less than $70) are straightforward 24-hour thermostats. White Rogers has a simple "economy" model, the 24-hour *Series 1F60* (less than $50), which allows the user to manually select the comfort temperature and the setback temperature using mechanical levers, but programs time intervals digitally.

White Rogers' line of digital programmables begins with the no-frills 5+2-day *1F93* (under $75). Their top-of-line *1F90/1F97* models ($80 to $130, depending on the features) have either 5+2- or 7-day programming capabilities and other features. One option is the Energy Management Recovery program, which achieves comfort temperature at the set time, rather than beginning the heat recovery at the set time. For a programmable with a lot of features, the White Rogers 1F90/1F97 thermostat is particularly easy to operate. White Rogers also has a retail line, marketed under the Emerson name.

Once you have become familiar with different types of thermostats, it might be a good idea to keep samples of your favorite models to enhance your sales presentation. Since traditionally the hvac sub selects the thermostat, be sure that your sub knows about the products you are promoting and feels comfortable installing them. ■

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