Consulting, Resource, Education, Training, and Support Services for Home Inspectors

"A candle loses no light when it lights another candle."

Residential Electrical System Demand Controllers

Inspectors occasionally encounter residential electrical systems that incorporate demand controllers. While inspection standards do not require that demand controllers be inspected, it is still useful to understand how demand controllers work and to be able to speak knowledgeably about them to customers.

A demand controller is a device that controls the **rate** of electrical use (the demand for electrical power) over a given period of time.

The following analogy is from the website of Brayden Automation Corporation www.brayden.com/demandcontroller.html. Think of it this way. I have restaurant that seats fifty people and every day at noon, one hundred and fifty people show up for lunch. I have a peak demand for meals at noon. I can't be very efficient because I have neither the seating nor the staff to accommodate one hundred and fifty diners.

So, I set up a meeting with all one hundred and fifty patrons and tell them that if they all continue to insist on eating precisely at noon, I'll be forced to expand to build a restaurant that's three times the size of my current facility, enlarge my kitchen, hire a lot more help, and raise the price of my meals. However, if all of my customers will agree to split up their lunch times so that fifty of them come at 11:30, fifty at noon, and fifty at 12:30, I can accommodate all of them by spreading out the demand and continuing to keep the price of my meals as low as possible.

A similar challenge faces electrical service providers who experience periods of peak demand for electricity. If too many customers use power all at the same time, demand peaks occur in the provider's system. More power is required during demand peaks than the system is designed to or sometimes capable of generating causing brownouts. Then, during low demand periods, the generation facility sits idle or operates inefficiently.

Many electrical service providers offer "demand rates" to customers to encourage them to level out their rate of electrical use. When users level out their rate of electrical use, the efficiency of the service provider's system increases and both the user and the service provider save money. To be able to take advantage of these demand rates requires the installation of a demand controller in a home's electrical system. The microcomputer technology that is incorporated into modern demand controllers provides the ability to customize a **load control strategy** giving modern controllers a significant advantage over earlier controllers.

In order to prevent the electrical use during any given period from exceeding the preset demand limit, a demand controller regulates the electrical use of the devices and equipment that typically consume the highest amount of electricity. In doing so the demand for electricity is spread more uniformly over a twenty-four hour period. The devices and equipment that consume the most electrical power in a typical home are those that operate on 220-240 volts (nominal) such as electric storage type water heaters, central, electric air conditioners, electric heating systems, electric clothes dryers, electric pool and spa heaters, and electric ranges and ovens.

A specific **load control strategy** programmed into a demand controller is used to regulate loads. A load control strategy is simply a way of establishing each load's importance in relation to all the other loads being controlled by the demand controller. The sequence in which loads are shed and restored (turned off and back on) is important. The **load control strategy** is the single most important factor in the efficiency of a demand control system.

There are three primary load control strategies: priority (fixed), rotating, and a combination of fixed and rotating.

Fixed Priority Strategy

A **fixed priority strategy** not only sheds the least important loads first and the most important load last, the last load shed is also the first load to be restored. For instance, with electric baseboard heating, a **fixed priority strategy** has the advantage of keeping high priority rooms at the desired temperature while low priority areas will experience small temperature drops during peak demand periods.

When the rate of total electrical use for a home is projected to exceed the previously determined demand limit setting, the controller looks for the lowest priority load (in the assigned priority of the loads available to be shed) and sheds it. The demand controller turns it off for a maximum predetermined period of time. If necessary, to keep from exceeding the demand limit, the controller will shed more loads in ascending priority. The off/on decision regarding which loads to shed or restore is made and carried out every minute.

In a **fixed priority strategy**, load control can be enhanced by assigning "on" times or "off" times of up to twenty minutes to specific loads. This is useful for controlling heat pump and air conditioner compressors that typically require time-delay protection.

Rotating Strategy

In a **rotating strategy**, an equal distribution of power is provided to all controlled loads. This strategy may be desirable where all rooms are occupied and all require an equal share of power. A rotating strategy might be preferable in a home with electric baseboard heating and a gas water heater and gas clothes dryer. It's a useful strategy when there are several heating loads and you don't want any single load to remain off for too long at a time.

Here, since the reduction in demand is equally shared by several loads, desired comfort levels are maintained throughout the home. Loads are turned off and on sequentially every minute, as necessary, to keep demand below the demand limit. At the beginning of each one-minute interval, the first load previously turned off is turned on. A microcomputer in the demand controller keeps track of which load has been off the longest and will restore power to it as soon as it is able to do so, based on its programming.

Unlike a fixed priority strategy, a **rotating strategy** does not usually require minimum on and off times but they can be assigned if desired.

Combination Fixed/Rotate Strategy

A **combination load strategy** is the most versatile and powerful strategy because there are so many possible combinations. A combination load strategy allows groups of rotating loads to be programmed with or without fixed priority loads. This can result in the maximum efficiency and energy cost savings.

Combination Fixed/Rotate Strategy

Baseboard-Heated Home

Priority	Shed Sequence	Load	Demand
1 (Highest)	Last Load Shed	Dryer (Heating Element Only)	5.5 KW
2	2nd	Water Heater	4.5 KW
3 (Lowest)*	1st*	Living Room Heat	3.5 KW
3 (Lowest)*	1st*	Basement Heat	4.0 KW
3 (Lowest)*	1st*	Entry Heat	1.5 KW
3 (Lowest)*	1st*	Bedroom Heat	2.0 KW
3 (Lowest)*	1st*	Bedroom Heat	2.0 KW
3 (Lowest)*	1st*	Family Room Heat	3.0 KW

*NOTE: *With the rotating strategy, the shedding sequence begins with the load that has been restored the longest. When all #3 priority loads are shed, the #2 priority load is shed next. The #1 Priority load is shed last, if necessary.*

Keep in mind when you're inspecting that if the home has a functioning demand controller and also has a heat pump or central air conditioning, the demand controller may affect when you are able to operate these systems. If the demand controller has turned them off, you will have to wait until the controller restores power to operate them and complete your inspection.

In determining the period of time that a heat pump or central air conditioner will remain off, the time delay built into the compressor circuitry will have been taken into consideration. This built-in time delay protects the compressor by permitting the refrigerant pressures in the system to equalize before the compressor resumes operation.

For an excellent source of information on residential electrical system demand controllers, visit the website of the Brayden Automation Corporation at: www.brayden.com/demandcontroller.html