

RESIDENTIAL DEMAND CONTROLLER PROGRAM



INSTRUCTIONAL MANUAL

ENERGY SENTRY MODELS | 9312

Improving life with energy

BHP
Black Hills Power

Table of Contents:

Introduction	1
System Description	
Control/Display Unit	
How to Operate Your Demand Controller	2
Features for Alpha, ES, and 9212 Controllers	3
Setting the Demand Limit	7
Hints for Maximum Savings	
Load Shedding Sequence	8
Control of Clothes Dryer	
Stove Test (Systems Test)	9
Load Control Strategies	
Service of Heating/Air Conditioning, Water Heater and Clothes Dryer	10
If You Need Service	
Residential Demand Controller Customer Service Program	11
Charts & Tables	12

What is a kilowatt (kW)?

For BHP, the demand limit and usage is measured by kilowatts (kW). One kW is equal to 1,000 watts. For example, if you have ten 100-watt light bulbs on at one time, the demand is 1,000 watts or 1 kW. If they remain on for one hour, the energy used is one kilowatt-hour (kWh).

What is Demand?

For BHP, Demand is the rate at which electricity is used during a fifteen-minute period. As you turn on more lights, appliances, and electric heating equipment, you are increasing your individual Demand (rate-of-use).

Most households have their maximum electricity use from 4 p.m. to 8 p.m. This high residential demand, multiplied by all the homes in the area, is what puts the squeeze on Black Hills Power's (BHP) generators. If BHP can encourage enough customers to cut back on their maximum demand, it can limit the amount it must spend to meet an area's power requirements. The savings then can be passed on to customers who are helping by reducing the maximum rate at which they used electricity.

Introduction and Overview of Demand Control

Welcome to BHP's Residential Demand Controller Program. As the owner of a home metered under the Residential Demand Service Rate (Rate 14 and 16), you are now one of a growing number of customers who can lower their monthly electric bills by reducing energy demand peaks. The Energy Sentry demand controller enables you to reduce these peaks while maintaining efficient use of energy.

System Description

Your electronic unit controls only loads that are connected to your demand controller. Typically, only deferrable loads such as electric heaters, heat pumps, air conditioners, water heaters, hot tubs, and clothes dryer heating elements are controlled. These loads will vary depending on application and should be listed in the space provided inside the door of the Control/Display Unit. If you are in doubt as to what loads are controlled or want more information about the Residential Demand Service Rate, contact your local Black Hills Power Office (see back cover for office phone numbers).

Control/Display Unit (Panel)

The Control/Display Unit contains the Energy/Sentry micro-processor-based computer which automatically controls loads connected through the relays in the Relay Unit. This unit should be located in an easily accessible area in your home. Commands to switch these loads originate here and are based on the user-set demand limit and the actual demand as measured by the current transformers. The way in which the loads are switched is based upon the load control strategies programmed into your unit according to your requirements.

If power is lost due to utility power interruptions, the unit's EEPROM memory will remember the demand limit that you have set and will continue to perform demand control within that limit when power is restored.

Your Energy Sentry electrical demand controller consists of three basic components. These include the Control/Display Unit located in your home, the Relay Unit located next to your electrical panel, and if you have a heat pump, the remote relay box mounted on the electric furnace. This manual explains only the operation of the Control/Display Unit. See your Energy Sentry Installation Manual for details on the Relay, Unit, and Current Transformer, as well as other information about the system.

Maximum Value Feature

All of the model 9312 units are automatically installed with the Maximum Value feature included. The Maximum Value feature gives you three times the on-peak limit for greater flexibility of electrical usage during “off-peak” hours. Use as much electricity as you want in off-peak. You still pay the lower total usage rate, with no penalty for a higher demands. Your savings can be substantial. If you have any questions on the Maximum Value feature, call your local BHP office and we will be glad to assist you.

HOW TO OPERATE YOUR DEMAND CONTROLLER

Power Available

When the LED numbers in the “circuit on” area are lit, there is power available to that assigned load. Each number represents a relay that controls one or more assigned loads. When the number is not lit, power is unavailable.

The circuit assignment numbers should be recorded on the inside of the control panel door at the time of installation. A record of the loads controlled should be documented and filed in the back of your Installation Manual which was supplied by the electrician during installation.

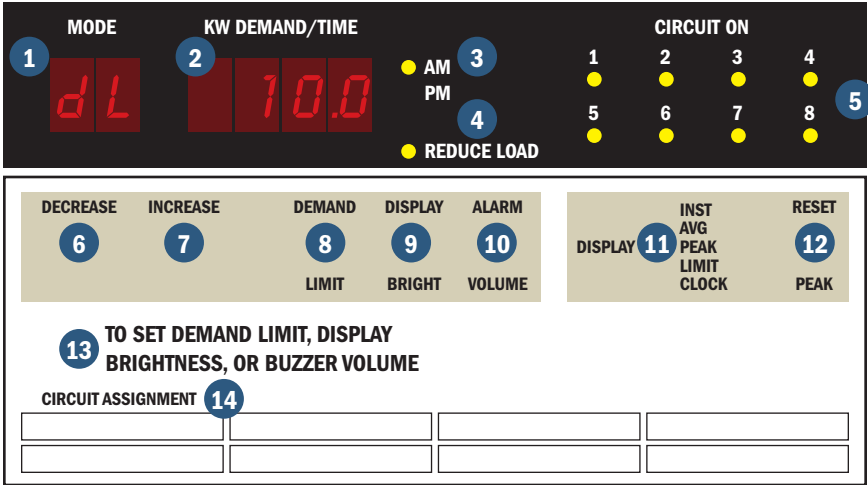
Each number represents a relay that can switch up to two circuits at a time.

Your demand controller will control up to 16 points in the “circuit on” area. Older units only had 8 points.

If the display LED’s are not lit, check the appropriate 15 amp breaker in the main circuit panel to see if it is on. If power is on and the LED’s are still not lit call your local BHP office for service.

Features For 9312 Controller:

Each indicator and key serves a specific purpose in providing you with the necessary information and control to minimize peak energy usage. Each of these indicators and keys have been numbered and are described on the following pages.



- 1 **Mode:** This indicator displays which mode the demand controller is currently in. It will be in one of these mode demand limit (dl), peak demand (pd), clock (cl), instantaneous demand (id), and average demand (ad).
- 2 **kW Demand/Time:** This indicator displays total household demand, which includes both controlled and uncontrolled loads. kW Demand/Time may be displayed as Instantaneous, Average, Peak, or current time depending upon the desired display mode.

Instantaneous kW Demand (id): When this mode is selected, the kW Demand/Time display will indicate Instantaneous demand showing changes in demand of controlled and uncontrolled loads as they occur. This is useful for determining how much energy is required to operate various loads so that an understanding of your energy requirements may be achieved. Your actual demand may be compared to the typical residential appliance ratings given in Table 2.

Average kW Demand (ad): In this mode, the kW Demand/Time display will indicate your Average demand over a running 15 minute interval selected in the system programming mode. This is similar to the average demand interval used by your utility meter and is therefore, approximately equal to the demand level your meter is presently recording. The (ad) will be lit when in this mode.

Peak kW Demand (pd): In this mode the kW Demand/Time display will indicate the highest actual average Peak Demand-since-reset. This indicator is intended to allow you to monitor your daily or weekly peaks in order to gain an understanding of how and when these peaks occur. In this way, energy use patterns may be modified, if desired, to minimize these peaks. It should be noted that if this indicator is reset only when the utility meter is reset, the peak values should be approximately the same as the reading on the meter. A difference between the utility meter peak and Peak kW Demand may occur, however, due to different average demand intervals used by the utility, varying line voltages, power outages, measurement accuracy and other factors. The utility meter will be the indication used in determining your electric bill Demand charge. The Peak light will be on when in the Peak kW Demand mode.

Demand Limit (dl): In this mode the kW Demand/Time display will show the current home demand limit set point. The function is adjustable using the demand limit key and the decrease increase keys. The demand limit in the home may have to be adjusted due to the weather or life style.

Clock (cl): In this mode the kW Demand/Time display will show the current time. *This time may be up to an hour fast or an hour slow due to time changes. Do not set the current time due to the time is set to the meter if you believe the time is not correct please give BHP a call and we will assist you with any questions.*

- 3 **A.M. P.M. LED** will only be present when the demand controller is in the clock mode.
- 4 **Reduce Load:** The “Reduce Load” indicator will come on and the alarm buzzer will sound when all controlled loads have been turned off, but actual demand is still above the limit. When this occurs, you may either reduce uncontrolled demand, increase the limit if needed, or turn the buzzer off. By turning the buzzer off, you may exceed the demand setting on your controller.
- 5 **Circuits On:** These indicators, when lit, tell you which control circuits are on. A “Circuits On” indication does not necessarily mean that the controlled load is on, but rather the load is free to go on if the thermostat calls for it.
- 6 **Decrease Key:** This key operates in conjunction with the Demand Limit key (10), Display Bright key (11), and the Buzzer Volume key (12) and is used to decrease the functions controlled by these keys.
- 7 **Increase Key:** This key operates in conjunction with the Demand Limit key (10), Display Bright key (11), and the Buzzer Volume key (12) and is used to increase the functions controlled by these keys.
- 8 **Demand Limit Key:** This key is used to set the demand limit and is used in conjunction with the Decrease key (8) or Increase key (9) and allows you to adjust the demand limit up or down to the level which best suits your particular energy requirements.

- 9 Display Brightness Key:** This key is used to adjust the display brightness and is used in conjunction with the Decrease key (8) or Increase key (9) to set the display brightness for the best visibility under existing lighting conditions.
- 10 Buzzer Volume Key:** This key is used to control the alarm buzzer volume in conjunction with the Decrease key (8) or Increase key (9) and allows you to adjust buzzer volume to meet various sound conditions.
- 11 Display Key:** This key allows you change the mode display to Instantaneous, Average, Peak, or clock modes.
- 12 Reset Peak Key:** This key allows you to reset the highest average peak- demand-since-reset, as described above. Once this peak is reset, the highest actual peak demand from the time of reset will be recorded for display.
- 13 Control Panel Instruction:** These instructions, printed on the front panel of the Control Panel, enable you to make all appropriate control settings.
- 14 Circuit Assignments:** This space is used to record the loads controlled by the 9312. A record of the loads controlled should be documented and filed in the back of your Installation Manual which was supplied to you by the electrician.

System Operation

Please carefully read the following instructions concerning system operation, as they will enable you to maximize efficient energy use and minimize your electric bill.

Step 1, Turning ON the Unit: Your 9312 should already have been turned on by the installing electrician. If not, there should be a breaker in your electrical load center labeled “9312 Energy Sentry Demand Controller” or similar. If this breaker is off, it should be turned on. If you cannot locate a breaker labeled “9312,” you should call your local BHP office.

Step 2, Setting Your Demand Limit: Please refer to the Control/Display Unit pictured on page 3 for this and all succeeding steps. To set demand limit:

1. Depress and hold Demand limit key (8).
2. Simultaneously depress the Decrease key (6) or Increase key (7) until the desired demand limit is reached. The numbers in the kW Demand/Time display (2) will count down or up.
3. Release keys at the desired setting.

Because of the way you are billed by your utility company under the demand rate, you can change the kW Demand limit on your Control/Display Unit to the changing season or when conditions warrant. For best results, you should set the lowest practical demand limit within the suggested range for your home, lifestyle, or process. Typical demand limit ranges, by month, for an average all electric home are listed on page 12 - Table 1.

Step 3, Monitoring Your Actual Demand: To select Instantaneous, Average, Peek, or clock readout of Actual kW Demand:

1. Press Display key (11) once for each display change desired.
2. The Instantaneous (id), Average (ad), Peak (pd) or, clock (cl) indicating light will come on and the Mode display (2) will indicate the reading selected.
3. The kW Demand /Time display will show current value.

Step 4, Reset Peak: This step is optional depending upon the time interval for which a record of your highest average peak is desired. To reset peak:

1. Place mode display on the Peak mode (pd)– (step 3).
2. Press and release Peak Reset key (12). A zero will be displayed in kW Demand/Time display (2). This value will increase to your maximum average peak demand starting from the time of reset.

Step 5, Adjusting Display Brightness: Display brightness may be varied according to existing lighting conditions as follows:

1. Depress and hold Display Bright key (9).
2. After five seconds, simultaneously depress Decrease key (6) or Increase key (7) until the desired intensity is reached.
3. Release keys at the desired display intensity.

Step 6, Adjusting Buzzer Volume: Buzzer volume may be varied depending upon the desired alarm level as follows:

1. Depress and hold Buzzer Volume key (10).
2. After five seconds, simultaneously depress Decrease key (6) or Increase key (7). The Buzzer will come on and beep about 6 times at each level.
3. Release keys at the desired volume.

NOTE: *If the user desires to turn off the Buzzer; hold the Buzzer Volume and Decrease keys down until the buzzer stops.*

Step 7, If the Alarm Buzzer Sounds: The alarm buzzer in your Control/Display Unit sounds and the Reduce Load indication (4) will come on when the 9312 has done all it can do to reduce your electrical demand and actual demand is still greater than the demand limit. That is, all circuits that your 9312 has control over have been turned off, but due to high base load, this is not enough. In this situation, your demand limit may be unrealistically low for the level of comfort or appliance use you desire. Loads within minimum “on” times (such as heat pump or air conditioning compressor) may cause the buzzer to temporarily sound until the particular “on” time has elapsed.

To silence the Buzzer, turn off some unnecessary appliance or load or, if necessary, increase the kW Demand Limit one number at a time until the buzzer stops. If you choose to turn off an uncontrolled load, you may monitor your actual demand in the Instantaneous mode in order to see the effect of each load on overall demand (see page 12 - Table 2).

If the alarm buzzer sounds too often, or if heating or cooling levels are inadequate, you may have to increase your demand limit or change your load control strategy. Increase the kW Demand Limit by one and note whether that change solves the problem before increasing the limit further. It may take as long as one hour for the new level to be reached.

Setting the Demand Limit

There are no fixed demand settings that will be suitable for everyone. The level of energy (demand) that is required to satisfy comfort, economy, and convenience will vary widely with the uniqueness of each house, but even more so by the occupants.

In arriving at the best demand setting for you, we recommend that you start with the lowest kW that you think you will need during the present billing period. The unit has a demand limit setting range of 2 to 30 kW.

If you need more energy to maintain comfort, just increase the kW, but not more than one or two kW at a time. If, after a few hours, this is not enough, increase it by one or two more kW again until you are comfortable.

It is important to remember that once the meter increases its peak demand will not come down until the meter is reset to zero each month by the meter reader. Table 1 on page 12 shows typical kW Values by Month and gives you some guidelines for setting your demand limit by seasons.

Hints for Maximum Savings

When the setting is to be decreased (for example from 10 in February - for heating - to 8 in March for less heating), the setting should be changed 5 days before your utility meter is read.

When the setting is to be increased (for example, from 6 in May to 7 in June for air conditioning), the setting should be changed after your utility meter is read.

Meter readings are taken on various days of the month and depend on the billing interval you happen to be on with BHP. You can check past bills to determine this date, or call BHP directly. To help you set your demand limit based on appliance load, see Page 12 - Table 2: Typical Residential Appliance Ratings or contact your local BHP office.

You can help greatly in increasing the effectiveness of your unit, and may increase your savings, by trying to avoid turning on two or more major appliances at the same time. For example, homeowners should try to avoid using the electric range while other appliances are operating.

Load Shedding Sequence

When your power consumption average starts to approach the demand setting, the controller sheds the first load. If necessary, additional loads will be shed to keep the average demand below the demand setting. Loads are shed according to the priority strategy selected; either the fixed priority strategy, the rotating strategy, or a combination. See the Installation Manual for an explanation on how to select the load control strategy or call your local BHP office.

The load shedding priority selected is based on the type of heating and cooling equipment and the design of your house. If desired, the priorities may be easily changed by your dealer or electrician.

Control of Clothes Dryer

The clothes dryer is usually one of the last circuits the load controller sheds. When the dryer is shed, the dryer motor continues to tumble clothes. Only the heating element is cut off during this brief period. This means that when you are set at 5 or 6 kW and cooking a large meal, the dryer will be shed when the oven element (4.5 kW) is on. When the oven element is off, the dryer element is restored. This may result in your clothes being slightly damp at the end of the drying period and may require longer drying times. If your dryer has a dampness control, BHP recommends using it.

NOTE: *If the dryer cannot be restarted (or stops) each time the demand controller sheds, contact BHP. The dryer may require a specific rewiring change to operate correctly. BHP will assist you in ensuring that the rewiring is done properly.*

CAUTION: *If you purchase a new dryer or if you move into a home with a demand controller already installed, your dryer may not work properly. Since dryers are not all wired the same, the dryer wires in the circuit breaker panel, may have to be reversed (see note above).*

Load Control Strategies

Your demand controller is the most versatile electric demand controller available on the market today. It offers a virtually unlimited number of load control strategies, allowing you to maximize adaptability to load requirements and user lifestyles. These strategies include the Fixed Priority strategy, the Rotating strategy, and a wide range of combination strategies.

In addition to these strategies, all circuits may be assigned minimum On and Off times variable up to 15 minutes. This is designed specifically for heat pump and air conditioning compressors requiring time delay protection. Even though this feature is available on all circuits, BHP recommends programming minimum on-off times for heat pumps and A/C units only.

Changing Load Control Strategies: When your control unit was installed, the strategy most appropriate to your home's requirements was selected (most common is the Fixed Priority Strategy). If your home's requirements have since changed, or if you would like to change your load control strategy, refer to your Installation Manual for detailed instructions, or contact BHP.

Service of Heating/Air Conditioning, Water Heater and Clothes Dryer

When technicians service any electrical equipment that is controlled by the controller, they should be advised that you have a demand controller. They should also be warned not to disconnect the controller wiring or leave its power supply (circuit breaker) off. Otherwise, they may unknowingly disable your controller which could result in a very high electric bill. Damage could result to your controller or air conditioner by incorrect rewiring of your controller's remote air conditioner or heat pump relays. The Energy Sentry demand controller simply acts as another switch on the water heater, dryer, or heating/cooling equipment. It cannot cause damage or premature failure of the equipment it is connected to when it is installed and set correctly. Nor can it cause a higher electric bill than you would have had without a controller.

When the power to the control unit is off at the breaker panel, power will be available to all controlled loads. Without power, the control unit cannot control your demand.

The power must be restored to the controller. Contact BHP to check your meter to assure your demand did not exceed the set point while the control unit was off.

If You Need Service

Your Energy Sentry demand controller has been carefully assembled and tested at the factory. Only components having a high degree of reliability and long life have been used in its manufacture. In the event that a failure does occur, your control unit has been designed so household appliances will continue to function.

The only difference is that there will be no demand control, and high demand peaks can occur. If a malfunction should occur, you may turn off the unit at the breaker labeled "Demand Controller," located in the load center (breaker panel). You may control your demand manually, if desired, to avoid unnecessary demand peaks as follows:

1. Heat or cool only those rooms which are occupied by keeping the thermostat set only while you are in each room.
2. When cooking meals, all heating or cooling zones should be turned off.
3. Avoid using appliances simultaneously.
4. You may monitor your highest demand peak on the utility meter to determine the effectiveness of manual control.
5. Assure nothing else is connected to the demand controller circuit breaker; i.e., chest freezer, refrigerator, etc.

BHP's Residential Demand Controller Customer Service Program

Although the demand controller equipment is owned and operated by you, the customer, Black Hills Power offers a variety of Residential Demand Controller Service Programs that assist with instruction and maintenance of the unit:

INSTRUCTIONAL ASSISTANCE: If you need additional information about your demand control equipment or instructional information, BHP will send you information, at no cost. BHP also offers free personal instructions. Simply contact your local BHP office for scheduling an instructional session with us.

SERVICE CHECKS: BHP offers a FREE service check and inspection of your demand control equipment after the unit is installed by the electrician or if you are not sure the unit is operating properly. A BHP Serviceman will test the unit to insure that the equipment is working correctly and review with you any equipment malfunctions or operation procedures that are identified. Before contacting BHP, we recommend that you refer to and review your operators manual.

STANDARD WARRANTY/REPAIR: BHP will warranty the demand control equipment up to three years after the installation date. BHP will order and replace any parts that are under warranty at no cost to you. Please allow at least two weeks for ordering parts. If you are not sure if your unit is under warranty, contact your local BHP office.

NON-WARRANTY REPAIRS: Repairs that are not under the standard manufacturers warranty guidelines are subject to a service labor charge, including parts. These service repair charges will vary based on the parts and labor to repair the equipment. Standard cost for service charge is on a per- hour basis. Contact BHP for details on non-warranty service and equipment costs.

EXTENDED WARRANTY: BHP offers an extended warranty on demand control equipment. Contact your local BHP office for details.

CHARTS & TABLES

What is a Kilowatt (kW)?

The demand limit and usage displayed on the demand controller is measured by kilowatts (kW). One kW is equal to 1,000 watts. For example, if you have ten 100 watt light bulbs on at one time, the demand is 1,000 watts or 1 kW. If they remain on for one hour, the energy used is one kilowatt-hour (kWh).

Table 1: Typical kW Values by Month*

Month	Summer (A/C) Area	Winter (Heating) Area
January	4-6 kW	7-10 kW
February	4-6	7-10
March	5-7	6-9
April	5-8	5-7
May	6-10	5-6
June	6-10	5-6
July	6-10	5-6
August	6-10	5-6
September	6-8	5-7
October	5-7	6-8
November	4-6	7-9
December	4-6	7-10

Settings will vary with lifestyle, home construction and climate. *Typical settings for heat pumps will be 10-10% higher.

Table 2: Typical Residential Appliance Ratings

Stove	1.5 – 2.0 kW	Room A/C	0.9 kW
Self Clean	5.0 kW	Vacuum	0.7 kW
Refrigerator	1.5 – 2.0 kW	Blender	0.3 kW
Dryer	4.5 – 6.0 kW	Mixer	0.15 kW
Freezer	1.5 – 2.0 kW	Television	0.12 – 0.2 kW
Water Heater	3.0 – 6.0 kW	Central A/C	3.0 – 8.0 kW
Lighting	0.0 – 1.4 kW	Hair Dryer	1.0 kW
Dishwasher	1.2 kW	Toaster	1.1 kW
Waffle Iron	1.2 kW		

Chart A: Baseboard Heated Home**Load Control Strategy:** Combination Fixed/Rotate

Priority	Shed Sequence	Load	Demand
1 (highest)	Last	Dryer (heating elements only)	5.5 kW
2	Second	Water Heater	4.5 kW
3 (lowest)	First*	Living Room Heat	3.5 kW
3 (lowest)	First*	Basement Heat	4.0 kW
3 (lowest)	First*	Entry Heat	1.5 kW
3 (lowest)	First*	Bedroom Heat	2.0 kW
3 (lowest)	First*	Bedroom Heat	2.0 kW
3 (lowest)	First*	Family Room Heat	3.0 kW

*NOTE: Shedding sequence of rotating loads begins with the load which has been restored the longest. When all #3 priority loads are all shed, the #2 priority load is shed next, #1 priority load is shed last, if necessary.

Chart B: Typical Heat Pump/Air Conditioner Home**Load Control Strategy:** Fixed Priority

Priority	Shed Sequence	Load	Demand
1 (highest)	Last	Dryer (heating elements only)	5.0 – 5.0 kW
2	Seventh	Compressor #1	3.0 – 7.0 kW
3	Sixth	Compressor #2	3.0 – 7.0 kW
4	Fifth	Water Heater	4.5 kW
5	Fourth	Strip Heat #1 Electric Furnace	5.0 kW
6	Third	Strip Heat #2 Electric Furnace	5.0 kW
7	Second	Strip Heat #3 Electric Furnace	5.0 kW
8 (lowest)	First	Strip Heat #4 Electric Furnace	5.0 kW

For more information contact your local Black Hills Power office or call 721-3200.

Belle Fourche	723-2460
Custer	673-4455
Deadwood/Lead.....	722-2420
Hill City	574-2541
Hot Springs/Edgemont.....	745-3120
Newcastle/Upton.....	307-746-2726
Newell.....	456-2896
Rapid City.....	721-3200
Spearfish	722-2400
Sturgis	720-2440



www.blackhillspower.com

409 Deadwood Avenue
PO Box 1400
Rapid City, SD 57709
Fax: 605-721-2577