

Computerized Energy Management



Model 9312
Owner's/Installation Manual



*Helping you to use energy
more efficiently*

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Model 9312 Owner's/Installation Manual

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WARNING:

Energy Sentry® Demand Management Systems are required to be installed by a duly licensed and qualified electrician or electrical contractor, who is appropriately licensed in the jurisdiction where the demand management system will be installed.

Notice to Users

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, it may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient the receiving antenna.
2. Relocate the computer with respect to the receiver.
3. Move the computer away from the receiver.
4. Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington D.C. 20402, Stock No. 0004-0000-00345-4.

9312 Quick Start Guide

How to Decrease Your Electric Bill (and Increase Your Savings)

Open the keyboard door of the 9312 Control/Display Unit and press the Display Mode key until the left display reads “dL”. This is your demand limit. Press the Demand Limit and Decrease keys simultaneously to lower the demand limit by 1 or 2 KW, depending on how much you wish to save.

You may wish to double-check that the clock on your 9312 matches the clock setting on the meter. To do this, press the Display Mode key until the left display reads “CL” for “Clock”. Compare the time setting on the 9312 with the time shown on your electric meter. If a change is necessary, press the Increase or Decrease key until the time is correct.

How to Increase the Comfort of Your Home (and Increase Your Electric Bill)

Open the keyboard door of the 9312 Control/Display Unit and press the Display Mode key until the left display reads “dL”. This is your demand limit. Simultaneously press the Demand Limit and Increase keys and raise the system’s demand limit by 0.5 KW.

Wait one or two hours to give your home a chance to heat or cool. If the change you just made does not feel sufficient after that time, press the Demand Limit and Increase key to increase the system’s demand limit another 0.5 KW. Repeat until satisfied. Remember, for each KW that you increase the demand limit, it costs you additional money on your electric bill. Turn off all non-critical loads in your home to make more power available for heating or cooling.

Before you close the keyboard door, you may wish to double-check that the clock on your 9312 matches the clock setting on the meter. To do this, press the Display Mode key until the left display reads “CL” for “Clock”. Compare the time setting on the 9312 with the time shown on your electric meter.

If a change is necessary, press the Increase or Decrease key until the time is correct.

See System Operation on page 7 for a more detailed explanation.

Introduction and Overview of the 9312

Congratulations on your decision to purchase the Energy Sentry 9312 Demand Management System. As the owner of a home metered under the Time-Of-Use (TOU) Demand Billing Rate, you fall into a special group of consumers who can lower their monthly electric bills by reducing energy demand peaks and shifting energy usage to Off-Peak times. The Energy Sentry 9312 Demand Management System enables you to reduce these peaks while maintaining efficient use of energy. Your decision to purchase a 9312 represents a sound and intelligent investment which will repay you over the years to come in reduced electric bills, added convenience and peace of mind. The 9312 is the most advanced, user-friendly, and simplest to use demand management system on the market today.

The Time-Of-Use (TOU) Demand Billing Rate

Under the Energy (or flat) rate, you are billed for total energy used per month (total kilowatt-hour use) regardless of how or when you use this energy. Owner A in Figure 1 illustrates a typical daily energy use pattern. Notice the demand peaks in the morning and evening. Under the Energy Rate, these peaks do not affect Owner A's bill since he or she pays for the total Kwh use only.

Utility companies are concerned about these demand peaks since they increase the costs of supplying electricity to their customers. As a result, they have devised the TOU Demand Billing Rate, which is a preferred rate, to reward customers who control their peak usage of electricity in On-Peak times. Billing under the TOU Demand Rate works like this: Suppose you are heating or cooling your home, washing dishes, drying clothes and cooking a meal all at the same time. Chances are your home is at peak energy usage or drawing electricity from the electric company at or near the maximum rate. This peak energy usage is illustrated by the largest spike in Owner A in Figure 1.

Under the TOU Demand Rate, you pay for both total energy used (in Kwh like the Energy Rate) and for your peak demand during the On-Peak time over the billing period (highest average KW demand - see page 12 for definition). In addition, utilities offer reduced or no KW demand charges during the Off-Peak times.

When compared to the Energy Rate, the TOU Demand Rate offers a much lower charge for total Kwh used. However, since there is also a demand charge for the peak demand during the billing period, the savings could be offset if this demand peak is high.

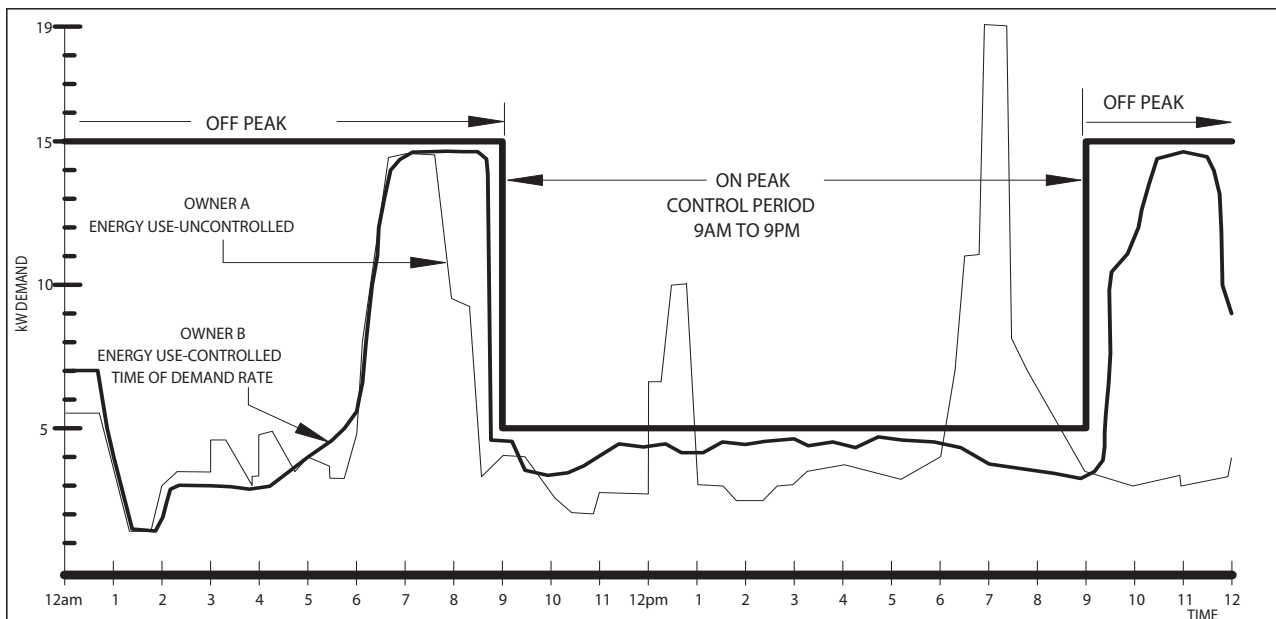
Now let's look at Owner B in Figure 1. In this case, Owner B is billed under the TOU Demand Rate. This person has controlled his or her peak demand during the On-Peak time and has consequently reduced the demand charge. The result will be a lower electric bill for using the same amount of electricity as Owner A. The key to Owner B's savings is in controlling the average energy usage by leveling the peak demand during the utility's On-Peak time.

Different Meters

TOU Demand Rates require a special electric meter which records not only the total energy (Kwh) consumed, just like the standard watt-hour meter, but also records the peak demand by tracking the energy usage over a 15, 30, or 60-minute demand interval, set by your utility company. Please contact your utility company to find the length of your demand interval. Once this demand peak is registered on the meter, a corresponding demand charge results, even if this peak occurred only once during the billing period.

In addition, a special TOU demand meter keeps track of the On-Peak and Off-Peak demand and the On-Peak and Off-Peak kilowatt-hour usage. Depending on the way your utility's TOU Demand Rate is structured, your meter may or may not record Off-Peak demand, thus you may

Figure 1: Load Profile - Owners A and B



or may not be billed for Off-Peak demand. On-Peak times vary from utility to utility; as well as, by season.

To benefit from your Energy Sentry 9312 Demand Management System you must have a demand measuring electric meter equipped with the TOU/Demand option and be billed on a TOU Demand Rate from your utility. Obtain a rate booklet or rate sheet from your utility company that describes your electric rate, the KW charges, On-Peak and Off-Peak hours, and how to read your electric meter. We recommend that you read your metered demand on the day prior to when the meter is read by the power company, to verify that your setting matches the meter's reading.

Where the 9312 Technology Comes In

You wouldn't need a 9312 to take advantage of TOU Demand Rates if you could go through your home and continuously turn off heating or cooling circuits and major appliances to level out peak demand whenever necessary. But remember, one slip in any one demand interval and your utility bill would reflect a high demand charge.

The 9312 takes over this difficult, continuous burden for you. The 9312 is one of the most sophisticated products available for controlling peak demand. When properly used, it can result in average monthly savings of up to 35% and as much as 50% during heavy-use months. The sole purpose of the 9312 is to efficiently allocate the usage of electricity to electrical loads so that demand peaks are kept below the level which you have set.

How the 9312 Works

The 9312 contains a microcomputer which turns certain circuits off when necessary to keep your home's peak demand below a limit that you preset. Not all circuits need to be controlled by the 9312. Circuits controlled usually include the air conditioning, all heating zones, the dryer, the water heater, or any other load with some thermal storage capacity or "thermal inertia".

In a typical all-electric home, the winter morning routine may involve turning up some thermostats, operating the range, water heater and other appliances. Normally, operation of these loads causes a morning peak (such as that illustrated in Figure 1) which registers on the demand meter. In the summer, a typical routine might include the water heater cycling on and off as needed, operating the range and later in the morning or early afternoon running the air conditioner or cooling systems in your home. In this case, these loads might cause an afternoon or evening peak. In both cases, the peak demand used by your home is caused by your use of electricity due to the season or weather; as well as other normal non-weather related uses of electricity.

Now, let's put the 9312 to work. The start time of the On-Peak period has just passed. The 9312 measures the amount of power being used by the home as you go about your daily business and it recognizes when the demand limit is about to be exceeded. It waits a few minutes to see

if these loads are going to turn off by themselves while it carefully calculates the average demand of the home. If the power consumption continues to exceed the demand limit, it begins to turn off loads. It turns off the least important load first, using the load control strategy that you set. As the power consumption drops, it then allows the most important loads to come back on first. There are several optional load control strategies. A typical strategy might provide power to a higher priority load such as the dryer and cut back on the heating or cooling loads in one or more rooms, or the water heater while the higher priority load is on. When the dryer turns off, the power it had been using is channeled back to the room heating or cooling, thus maintaining comfort but reducing peak demand. The end result is that while you have still used about the same amount of energy normally called upon by your lifestyle, this usage has been leveled out to reduce the On-Peak demand. This is illustrated by Owner B in Figure 1.

How the 9312 Saves

Now that we've examined how the 9312 enables you to use the energy you are accustomed to, but spreads this usage out by turning off non-critical loads for short periods of time, let's look at how this saves you money. Remember, the utility company helps you save by offering the TOU Demand Rate which is a lower rate per unit of total energy consumed (Kwh). You can save money under this rate if you control your peak energy usage to keep the corresponding demand charge low.

The following hypothetical examples illustrate how the Energy Sentry 9312 helps you save. Three cases are presented for a single residence. In all three cases the total energy consumption is the same. The differences are in the utility rate structure and whether or not an Energy Sentry 9312 is installed.

Case I is an all-electric home billed under the Energy Rate. This differs from the Demand Rate, in that there is a higher charge for total energy used and no charge for demand. Most homes not under the TOU Demand Rate are billed under the Energy Rate. Table 1 on the next page shows a monthly energy use of 3000 Kwh. Although rates vary from utility to utility, the electric bill based on an actual utility rate sheet for this energy usage level would be \$218.28.*

Case II is the same all-electric home billed under the TOU Demand Rate. This rate is structured such that 11:00 AM to 10:00 PM Monday through Friday is the On-Peak time during the summer schedule. The remaining 13 hours from 10:00 PM to 11:00 AM and weekends are the Off-Peak time when customers are not billed for Off-Peak demand. For example, let's assume that the energy usage remains at 3000 Kwh for the billing period and that 750 Kwh were used in the On-Peak times and the remaining 2250 Kwh were used during Off-Peak times. In this case, peak energy usage plays an important part in determining the total bill. Although energy use peaks will vary from month-to-month, a typical value for a high-use month might be 19 KW. Based on a total usage of 3000 Kwh, the electric bill based on actual utility rates would be \$201.54**. Compared to Case I (the standard Energy Rate), use of the TOU Demand Rate results in savings of approximately 8% for the same energy usage. The demand charge for the high peak demand during the On-Peak time

offsets most of the savings on energy costs. Only On-Peak demand is measured and billed under this rate.

Case III again uses the same all-electric home billed under the TOU Demand Rate. The energy usage is 3000 Kwh which is the same as Case I and Case II. Let's assume that 750 Kwh were used in the On-Peak times and 2250 Kwh were used during Off-Peak times. Let's assume that an Energy Sentry 9312 Demand Management System is installed and that the On-Peak demand limit set by the homeowner is 5 KW. Let's also assume that the Off-Peak demand is not used for billing purposes. Based on this peak demand and energy consumption, the electric bill is reduced to \$112.23**. This means a savings of 48.5% over the standard Energy Rate in Case I and a savings of 44.3% over the uncontrolled TOU Demand Rate in Case II. Installing an Energy Sentry 9312 could result in a savings of up to 50% of your monthly utility bill during the heavy use months with an average annual savings of 35%. The added bonus is that you don't have to reduce your overall consumption to save. Rather, just let your Energy Sentry 9312 level out your usage during On-Peak times.

Note: Depending on the application of the 9312, the savings are based on the utility rates in effect, the On-Peak and Off-Peak hours, the proportion of energy consumed during On-Peak and Off-Peak times, and the demand limit.

Superior Features of the 9312

Real-Time Control

The 9312 contains a real-time clock which allows the demand management system to take advantage of TOU Demand Rates available from some utilities and modify the control strategy accordingly. This feature enhances the money savings and comfort capabilities of the 9312. The 9312 automatically adjusts for changes in daylight-saving

time, holidays, and up to 4 seasonal On-Peak/Off-Peak time schedules.

Daylight-Saving Time

The daylight-saving time settings mentioned in the next paragraph apply only to those 9312 Demand Management Systems with Version 3.1 (or later) software.

The 9312 contains three specific daylight-saving time programs. The system can be set for the pre-2007 daylight-saving time schedule (where daylight-saving time begins on the first Sunday in April and ends on the last Sunday in October); the new daylight-saving time schedule which was initiated in March 2007 (where daylight-saving time begins on the second Sunday in March and ends on the first Sunday in November); or it can be set to recognize NO daylight-saving time schedule. The latter is helpful for customers in areas that do not utilize daylight-saving time.

Deluxe Digital Display Capability

The 9312 incorporates a 6-digit display for clear and simple user information presentation. It displays all system settings and real-time measurements; as well as, the current time. All system modes are displayed by easy-to-read mnemonics, two letter symbols representing the current information on the display. In addition, sixteen LED indicators show the on/off status of each individual control point. See Appendix B for a listing of all system settings and displays.

8 or 16 Separate Control Points

High peak demands occur when many electrical loads are used simultaneously. The 9312 can control up to 16 individual electric loads on eight separate control points using one Relay Unit or it can control up to 32 individual electric loads on 16 separate control points using two Relay Units. The controlled appliances can be turned off for brief periods of time with little or no interruption to

Table I - Customer Bill Comparison

	Case I Uncontrolled All-Electric Home-Energy Rate	Case II Uncontrolled All-Electric Home-TOU Demand Billing Rate (summer)	Case III Energy Sentry Controlled All-Electric Home-TOU Demand Billing Rate (summer)
Energy Use per month	3000 Kwh	3000 Kwh	3000 Kwh
Peak Demand during month	N/A	19 KW	5 KW
Electric Bill	\$218.28	\$201.54	\$112.23
Savings over Energy Rate		\$16.74 (7.7%)	\$106.05 (48.5%)
Savings over Uncontrolled TOU Demand Rate			\$89.31 (44.3%)

* Based on Virginia Power Company rate Schedule 1 Energy rate, effective January 1, 2007. Does not include taxes, miscellaneous charges, fees, or adjustments.

** Based on Virginia Power Company Summer rate Schedule 1S TOU-Demand rate, effective January 1, 2007. Does not include taxes, miscellaneous charges, fees, or adjustments.

your lifestyle. These loads usually consist of heating or cooling circuits, dryer heating elements and hot water heaters. These loads represent 60% to 80% of your total connected electrical load. With eight or sixteen separate control points, the 9312 provides maximum utilization of energy. That's because the loads which are turned on and off are smaller, permitting a more regular and even demand level. This results in greater energy efficiency and comfort.

Microcomputer for Maximum Flexibility

Use of a microcomputer allows the 9312 to precisely measure KW power demand and accurately compute and control the average KW demand. In addition, by using a microcomputer, the 9312 can be adapted to any user lifestyle or load requirement by allowing unlimited flexibility in choosing load control strategies, Minimum On/Off-Times and other control system settings.

EEPROM Non-Volatile Memory for Maximum Reliability

Energy Sentry's EEPROM memory "remembers" all system settings, even when power is lost to your unit. In this way utility power interruptions do not affect the settings in your 9312. The system's 10-year non-volatile memory retains settings for 10 years in absence of power, and if power is lost, timekeeping continues for 10 years ensuring that the system clock is always accurate.

Choice of Load Control Strategies

The choice of load control strategies, made possible by the use of a microcomputer, offers unlimited flexibility as to how loads may be controlled. This means the 9312 can be adapted to almost any application, requirement, or lifestyle. You or your dealer can individually set the priority of each controlled load to create the optimum load control strategy for a particular home and lifestyle.

Minimum On/Off-Times to Protect Heat Pumps and Air Conditioners Loads

All control points of the 9312 can be programmed with Minimum On and Off-Times, each variable from zero to 20 minutes. This feature allows the 9312 to be used with heat pump and air conditioning compressor loads by providing time-delay protection.

Auto-Limit Function

The 9312's Auto-Limit Function allows automatic changes of the demand limit up to 12 times per year. You may find this useful in changing their demand limit as desired throughout the year to reflect the seasonal increases or decreases in energy use. The Auto-Limit function helps to automatically adjust for these changes so you don't have to remember to do it manually. You can override these changes at any time; however, any previously set changes will still remain in effect.

System Description

Your Energy Sentry 9312 Demand Management System consists of three basic components: the Control/Display Unit, Relay Unit(s) and the Current Transformers. The System Diagram in Figure 3 in the Installation Manual shows how these components are connected to control loads at the circuit breaker panel. Your 9312 controls only those loads which are connected to it. However the total demand from all household loads are measured continuously. These loads will vary depending on application and should be listed in the space provided at the end of this manual; as well as, on the keyboard label inside the door of the Control/Display Unit. If you are in doubt as to which loads are controlled, ask your electrician or the authorized dealer who installed your 9312.

The basic function of your 9312 in controlling these loads is to keep the total electrical demand below a peak value set according to your desired level of comfort and minimum load requirements. Each of the components which make up the 9312 has a separate and unique function in accomplishing this task described below:

Control/Display Unit

The Control/Display Unit is located inside the home usually in a convenient location like the family room, kitchen, or main hallway. It is used to set or change system settings and monitor system operation and contains an audible alarm to indicate that the demand limit is about to be exceeded. A 6-digit display provides system information and the current time. There are 7 push-button keys that control all functions of the display. By pressing a key or a combination of keys, you can change the display mode and program all system settings.

The Control/Display Unit is the "brain" of the 9312 and it contains a microcomputer which automatically controls loads connected to the relays in the Relay Unit. 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 loads are switched based upon the load control strategies programmed into your unit according to your requirements. These strategies will be discussed in more detail later.

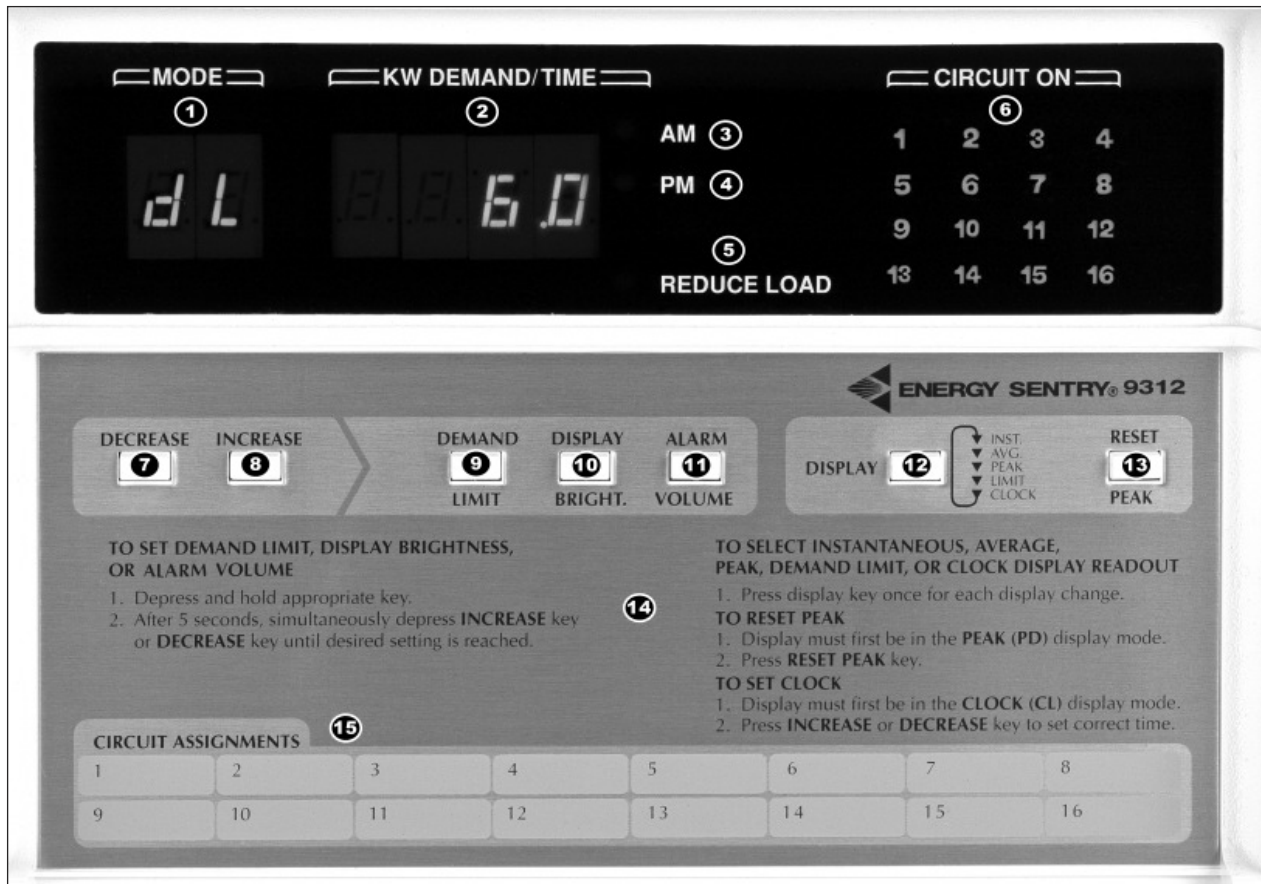
Relay Unit

Either one or two Relay Units may be used with the 9312. Each Relay Unit consists of up to eight power switching relays. This unit is mounted next to the main circuit breaker panel and contains the Data/Link PC Board used in communicating with the Control/Display Unit. An expanded system, one that has 16 power switching relays, requires two Relay Units.

Current Transformers

Two Current Transformers (CT's), usually mounted inside the circuit breaker panel to monitor total electrical usage. They tell the microcomputer in the Control/Display Unit how much electricity your home is using for all loads, not just those controlled by the 9312. By monitoring the total usage, controlled loads may be turned on and off to keep total demand below the limit you set.

Figure 2: Control/Display (C/D) Unit



System Operation

Figure 2 shows the front panel of the C/D Unit. 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 below.

Mode Display (1): This two-digit indicator displays the 9312's mode which has been selected to be displayed in the Mode display. Instantaneous demand (id), Average demand (Ad), Peak demand (Pd), Demand Limit (dL) and Clock (CL) modes are selected here. One of these modes is selected at a time, by using the Display Mode key (12).

KW Demand/Time Display (2): This indicator displays the KW demand or time information depending on the mode selected in the Mode Display (1) above.

AM Indicator (3): When the Clock (CL) mode is selected in the Mode Display (1), the AM indicator lights when all clock and time settings between midnight and noon are shown in the KW Demand/Time Display (2).

PM Indicator (4): When the Clock (CL) mode is selected in the Mode Display (1), the PM indicator lights when all clock and time settings between noon and midnight are shown in the KW Demand/Time Display (2).

Reduce Load Indicator (5): The Reduce Load indicator will come on and the alarm will sound (if the alarm is

turned on) when all controlled loads have been turned off by the 9312, but demand is still approaching the demand limit. When this occurs, you must either reduce the uncontrolled demand or increase the demand limit as suggested in the operating instructions.

Circuit On Indicators (6): These indicators, when lit, tell you which control points are enabled. A Circuit On indication does not necessarily mean that the controlled load is actually on, but can go on if the thermostat (or start switch for the dryer) calls for it.

Decrease Key (7): This key operates in conjunction with the Demand Limit key (9), Display Bright key (10), and the Alarm Volume key (11) and is used to decrease the functions controlled by these keys.

Increase Key (8): This key operates in conjunction with the Demand Limit key (9), Display Bright key (10), and the Alarm Volume key (11) and is used to increase the functions controlled by these keys.

Demand Limit Key (9): This key is used to set the demand limit and is used in conjunction with the Decrease key (7) or Increase key (8) and allows you to adjust the demand limit up or down to the level which best suits your particular energy requirements. During Off-Peak times, the On-Peak demand limit may be checked by simply pressing this key from any display mode. The On-Peak demand limit will be displayed in the KW Demand/Time Display and may be adjusted up or down by also pressing the Increase key (8) or Decrease key (7).

Display Brightness Key (10): This key is used to adjust the display brightness and is used in conjunction with the Decrease key (7) or Increase key (8) to set the display brightness for the best visibility under existing lighting conditions.

Alarm Volume Key (11): This key is used with the Decrease key (7) or Increase key (8) to control the alarm volume and allows you to adjust the volume to high, medium, low or off to meet various sound conditions.

Display Mode Key (12): This key allows you to select the display mode desired in the Mode display and KW Demand/Time display windows. Each press of the key rotates between Instantaneous, Average or Peak demand limit and Clock modes.

Reset Peak Key (13): When in Peak demand mode, this key allows you to reset the highest average (peak) demand recorded since the last reset. This can be reset at any time and is for owner information only.

Control Panel Instructions (14): These instructions, printed on the Control/Display Unit, enable you to make all appropriate demand control and time setting changes.

Circuit Assignments (15): This space is used to record the loads controlled by each circuit of the 9312 and is filled in using the information supplied by the installer or dealer in the back of this manual.

Basic Operation

Your 9312 has been designed for ease of operation and to provide efficient energy use. Please carefully read the following instructions concerning basic 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 circuit breaker in your circuit breaker panel labeled “9312” or “Energy Sentry”. If this circuit breaker is off, it should be turned on. If the circuit breaker cannot be located, call the installing electrician.

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

1. Press and hold the Display key (12) until “dL” shows in the Mode Display (1).
2. Press and hold the Demand Limit key (9).
3. Simultaneously press the Decrease key (7) or the Increase key (8) until the desired demand limit is reached. The numbers in the KW Demand/Time Display (2) will count up or down as you push these buttons.
4. Release keys at the desired setting.

There is no single On-Peak demand setting that will be suitable for everyone. The level of demand required to satisfy comfort, economy, and convenience will vary with the uniqueness of each house, its occupants’ energy use, and the utility’s averaging period.

To arrive at the best demand setting for you, requires some trial and error (see Table 2). The 9312 has a demand limit setting range of 2.0 to 49.5 KW in .5 KW increments.

A good starting demand limit is 5 KW. If you need more energy to maintain comfort, increase the KW level by only .5 KW. If, after an hour or two, this is not enough, increase it by .5 KW again until you are comfortable. Don’t expect instantaneous results. Thermal recovery of a home may take several hours. However, you can help by turning off all non-critical loads in your home. Once the demand limit is increased, you will be billed a higher rate.

Note: Remember that once the meter registers peak demand, it will not come down until it is reset to zero each month by the meter reader. (See “Hints for Maximum Savings” on page 11).

Because you are billed under a TOU Demand Rate, you should change the KW Demand Limit on your Control/Display Unit once a month or seasonally as appropriate. Typical demand limit ranges, by month, for an average all-electric home are listed in Table 2.

Table 2: Typical KW Values by Month

Month	Summer (A/C)	Winter (Heating)
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 KW	5-6 KW
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

Step 3, Monitoring Your Actual Demand: To select Instantaneous (id), Average (Ad) or Peak demand (Pd):

1. Press Display key (12) once for each display change desired.
2. The Mode Display (1) will show which demand mode is selected: Instantaneous demand (id), Average demand (Ad), or Peak demand (Pd). As you scroll through this Main Loop, you will also see the Demand Limit (dL) and Clock (CL) displays.

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. Press the Display key until the Mode Display reads “Pd” for Peak demand (See Step 3).
2. Press and release the Peak Reset key (13). A zero will briefly be displayed in the KW Demand/Time Display (2). This value will then jump to the current average which becomes your new peak. As the average increases, the peak demand will also increase and be recorded.

Step 5, Adjusting Display Brightness: Display brightness may vary with existing lighting conditions. Set as follows:

1. Press and hold the Display Bright key (10).
2. Simultaneously press the Decrease key (7) or the Increase key (8) until the desired intensity is reached.
3. Release keys at the desired display intensity.

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

1. Press and hold Alarm Volume key (11).
2. Simultaneously press the Decrease key (7) or the Increase key (8). The alarm will come on and beep about 6 times at each volume level.
3. Release keys at the desired volume.

Note: If you desire to turn off the alarm, hold down the Alarm Volume key (11) and Decrease key (7) until the alarm stops.

Step 7, If the Alarm Sounds: The alarm in your Control/Display Unit sounds and the Reduce Load Indicator (6) will come on when the 9312 has done all it can do to reduce your electrical demand, but the actual demand is still greater than the demand limit. That means 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 with Minimum On-Times may cause the alarm to temporarily sound until the particular On-Time has elapsed.

To silence the alarm, turn off some unnecessary appliances or, if necessary increase the demand limit 0.5 KW at a time until the alarm 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 Table 3).

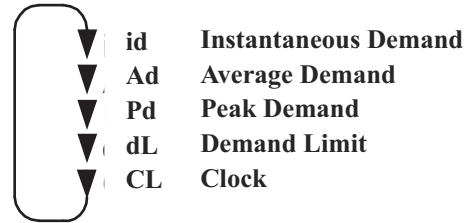
Important: Only your uncontrolled loads or your controlled loads currently under a Minimum On-Time can initiate the over-limit alarm. Minimum On-Times are described on page 14.

Table 3: Typical Residential Appliance Ratings

Stove	
Large Burner	1.5-2KW
Small Burner	1-1.4KW
Oven or Broiler	5KW
Self Clean (Bake & Broil on together)	10KW
Refrigerator	1.5-2KW
Dryer	4.5-6KW
Freezer	1.5-2KW
Microwave	1.5KW
Water Heater	3-6KW
Lighting	0-1.4KW
Dishwasher	1.2KW
Waffle Iron	1.2KW
Toaster	1.1KW
Hair Dryer	2KW
Room Air Conditioner	0.9KW
Vacuum	0.7KW
Blender	0.3KW
Mixer	0.15KW
Television	0.12-0.2KW
(instant on is 0.3 KW consumption continuously)	
Central Air Conditioning (depending on home size)	3-8KW
Heat Pump	3-25KW

Display/Settings Sequence

The 9312 contains 2 display sequence loops: the Main Loop and the System (or Installation) Loop. The Main Loop contains the following:



To step through the Main Loop, press the Display Mode key (12) to change to next system setting in the loop.

The System Loop contains system information which is usually set only when the 9312 is installed. All system settings in the System Loop are listed in Appendix B. To enter the System Loop from the Main Loop, hold down Alarm Volume key (11) and Reset Peak key (13) simultaneously for 5 seconds. If settings are changed, the new settings are automatically saved.

Load Control Strategies & Load Shedding Sequence

When your total power consumption starts to exceed the demand limit setting, the 9312 turns off (sheds) the lowest priority load which is available. If necessary, additional loads will be shed to keep the average demand below the demand limit setting. Loads are shed according to the load control strategy selected: the fixed priority strategy, the rotating strategy, a combination, or by the Priority 17 strategy. See Section 12 in the Installation Manual for an explanation on how to select a load control strategy described below:

Fixed Priority Strategy: When this strategy is selected, up to sixteen circuits are turned on and off in order of priority from 1 through 16, where loads controlled by priority level 1 have the highest priority. Loads controlled by priority level 16 are the first off and the last on. The on and off decision is made and implemented every 1-minute. This strategy is useful when low priority loads may be turned off without significantly interrupting energy use needs. Minimum On and Off-Times may be assigned to each circuit. Chart A shows an example of this strategy.

Rotate Strategy: For this strategy, all sixteen circuits are assigned an equal but rotating priority, which turns off loads sequentially every 1-minute as required to maintain demand below the limit. The first load previously turned off is turned on at the beginning of each 1-minute interval. This way Off-Time of rotating loads is minimized.

The rotate strategy is particularly useful where equal priority rotation may serve several heating loads, minimizing the Off-Time of each load during rotation. Thus, the reduction in demand is shared by several loads and the

desired comfort level is maintained throughout the home. Minimum On and Off-Times, usually not required under this strategy, may be assigned to each circuit if required.

Combination Strategies: Since the 9312 allows the user to program an independent priority for each control point, a virtually unlimited number of combination load control strategies can be selected. One or more groups of rotating loads, with or without fixed priority loads are possible. One combination is shown in Chart B.

In addition to these strategies, all circuits may be assigned Minimum On and Off-Times variable up to 20 minutes. This is a particularly attractive feature because heat pump and air conditioning compressors requiring time delay switching may be controlled under a strategy to best fit your application, lifestyle or use pattern.

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.

Priority #17: The 9312 allows the use of a special strategy called Priority 17. If a control point is programmed to Priority 17, the loads connected to that relay are held off during On-Peak Times and run only during Off-Peak Times. This works especially well for water heaters because it moves them to a low cost time and prevents competition between loads during the more expensive On-Peak Time.

Changing Load Control Strategies

When your 9312 was installed, the strategy most appropriate to your existing load requirements was selected. If your load requirements have since changed, or if you would like to change your load control strategy, see Section 12 or contact your dealer.

Control of Clothes Dryer

The clothes dryer is usually one of the last circuits the 9312 sheds. When the dryer is shed, the dryer motor continues to tumble clothes. Only the heating element is turned off during this brief period. This means that when your demand limit is set at 5 or 6 KW and you are cooking a large meal, the dryer will be shed when the oven is on because the oven takes apx. 3 KW-4.5 KW. When the oven is off, the dryer element is restored. This may result in slightly longer drying times.

Note: If the dryer motor stops each time it is shed, it is not properly wired to the 9312. Have your electrician make the correction.

Caution: If you purchase a new dryer or if you move into a home with a 9312 installed, your dryer may not work properly. Since not all dryers are the same, the dryer wires in the circuit breaker panel may need to be reversed.

Chart A - Heat Pump/Air Conditioner Home

Load Control Strategy: Fixed Priority

Control Point	Priority	Shed Sequence	Load	Load Size
1	1 (Highest)	Last	Dryer	5.5 KW
2	2	Seventh	Compressor #1	3.0-7.0 KW
3	3	Sixth	Compressor #2	3.0-7.0 KW
4	4	Fifth	Water Heater	4.5 KW
5	5	Fourth	Strip Heat #1 Elec. Furnace	5.0 KW
6	6	Third	Strip Heat #2 Elec. Furnace	5.0 KW
7	7	Second	Strip Heat #3 Elec. Furnace	5.0 KW
8	8 (Lowest)	First	Strip Heat #4 Elec. Furnace	5.0 KW

Chart B - Baseboard Heated Home

Load Control Strategy: Combination Fixed/Rotate

Control Point #	Priority	Shed Sequence	Load	Demand
1	1 (Highest)	Last	Dryer	5.5 KW
2	2	Second	Water Heater Heat	4.5 KW
3	3 (Lowest)*	First*	Living Room	3.5 KW
4	3 (Lowest)*	First*	Basement Heat	4.0 KW
5	3 (Lowest)*	First*	Entry Heat	1.5 KW
6	3 (Lowest)*	First*	Bedroom Heat	2.0 KW
7	3 (Lowest)*	First*	Bedroom Heat	2.0 KW
8	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. The #1 priority load is shed last, if necessary.

Systems Test

To verify that the 9312 is measuring demand and shedding loads properly, make the following test:

1. Turn off all household loads or as many as possible. Leave the 9312 on. Note level of Instantaneous demand. Make sure it is less than 2 KW.
2. Set the demand limit (dL) to 2 KW.
3. Look at the back of this manual or on the part of the C/D United labeled Circuit Assignment to verify the number of loads you have connected to your 9312. Whatever number of loads you have connected, make sure that same number of LED indicators are lit in red in the Circuit On Display.

Turn on oven and all top elements of your stove. Please take all necessary precautions to prevent damage or injury from the hot surfaces on the stove top. Do not leave elements on more than the brief amount of time it takes to run this test.
4. The system will shed (turn off) all controlled loads. This can be observed by watching the LED indicators on the right side of the display. This may take just a few minutes. The A/C may take longer to turn off if the unit is programmed with a Minimum On-Time (maximum time will be 20 minutes).
5. When all available loads have shed, the alarm will sound indicating that your demand is still above 2 KW because the stove and oven are still on. Turn off all stove elements and oven. Once all loads have shed, the Instantaneous demand display (id) should drop to near zero.
6. Raise the demand limit (dL) to the maximum demand setting. (Leave the demand limit at this level only long enough to complete this test as a high peak demand may occur.)
7. Return the demand limit to your normal demand setting once you see the loads beginning to restore.
8. All loads will restore according to the control strategy and when Minimum Off-Times have elapsed (it may take the A/C up to 20 minutes). This can be observed by watching the enabled LED indicators. Instantaneous demand will increase as each load is restored. If all steps are completed, the 9312 is working properly.

Hints for Maximum Savings

When the demand limit setting is to be decreased (i.e. from 10 KW to 8 KW), the setting should be decreased BEFORE your utility meter is read. In addition, when the demand setting is to be increased (i.e. from 6 KW to 7 KW), the setting should be increased AFTER your utility meter is read. Check past bills or call the utility company directly to determine this date.

You can help increase the effectiveness of your 9312 by trying to avoid turning on two or more major appliances at the same time (i.e. dry clothes at times when the range is not in use). This will assist the 9312 in controlling demand and it will increase the comfort level of your home.

Shifting use of all loads possible to Off-Peak times will help to reduce your On-Peak energy usage charge and increase your savings. In most TOU Demand Rates, the On-Peak demand and energy charges are substantially more costly than the Off-Peak charges. Consult your utility to determine your On and Off-Peak times.

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

When technicians service any electrical equipment that is controlled by the 9312, they should be advised that you have a demand management system. They should also be warned NOT to disconnect the 9312 wiring or its circuit breaker off. Otherwise, they may disable your 9312 which could result in a very high electric bill. If your 9312 is turned off by service technicians, avoid using heating/cooling systems, the dryer and water heater until power to the demand management system is restored.

The Energy Sentry 9312 cannot cause damage or premature failure of the equipment when it is installed and set correctly. Nor can it cause a higher electric bill than you would have had without a demand management system.

When the power to the 9312 is off at the circuit breaker panel, power will be available to all controlled loads. Without power, the 9312 cannot control your demand. This is why the power must be restored to the 9312 after a service call.

If You Need Service

Your Energy Sentry 9312 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 9312 has been designed so household appliances and loads 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 9312 at the circuit breaker labeled "9312" or "Energy Sentry," located in the circuit 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 appropriately only while you are in each room.
2. When cooking meals, all heating or cooling zones, as well as the water heater and dryer should be turned off.
3. Avoid using appliances simultaneously. For example, do not use the dryer, water heater and range at the same time.
4. You may monitor your highest demand peak on the utility meter to determine the effectiveness of manual control.
5. Since there are no user serviceable parts or components in the 9312, refer all service to the authorized Energy Sentry dealer as described in the Warranty. You can log on to our web site www.brayden.com/dealerinfo.html to find a dealer near you.

Appendix A — Glossary

The following terms are used throughout this manual. They are defined here to assist you in understanding their meaning and use.

Average Demand: The average rate of electric usage during the demand averaging period. The average demand is calculated by dividing the total number of kilowatt-hours used by the number of hours in the averaging period. For example, if 2 Kwh's were used during an averaging period of 15 minutes, the average demand would equal 2 divided by .25 (15 minutes) or 8 KW.

Averaging Period: An interval of 15, 30 or 60 minutes over which the average demand is calculated. The 9312 should be set to the same averaging period as the utility's demand meter. (Same as Demand Interval)

Customer Charge: A flat charge on an energy bill used to help the utility company recover fixed costs associated with serving a customer. It is independent of the demand or consumption of the energy provided. Also called monthly service charge or basic charge.

Declining Block Rate: A method of charging for electric service used by electric utilities based on total energy consumed (Kwh) and cost per Kwh. The cost per Kwh is usually reduced in steps as total Kwh use increases.

Demand: The rate of usage of electrical power, expressed in KW (or kilowatts).

Demand Rate: A method of charging for electric service where the cost of electricity used is based on both total energy consumed (Kwh) and peak demand (KW).

Demand Charge: A charge that recovers some of the utility's capital and operating costs based on the customer's highest average use during the billing period. It appears on an electric bill, along with the customer charge and the energy charge.

Demand Interval: Same as Averaging Period (see above).

Demand Limit: The set point, expressed in KW, is the maximum energy is allowed to be consumed. As this limit is approached, the Energy Sentry begins shutting off pre-determined loads to control peak demand.

Demand Meter: A utility meter which measures both total energy consumed in Kwh and the highest peak demand in KW.

Energy Charge: This charge is for the energy consumed during the billing period. It appears on the electric bill, along with the customer charge and the demand charge.

Energy Rate: A method of charging for electric service where the cost of electricity is based only on Kwh consumption multiplied by a fixed cost per Kwh. Cost per Kwh remains the same regardless of the number of Kwh's used. Also called Flat Rate. Under this rate, demand is not measured, recorded, or billed.

Instantaneous Demand: The electricity in kilowatts currently being drawn by the electrical service of a building at any instant in time.

Kilowatt (KW): 1,000 watts.

Kilowatt Hour (Kwh): The basic measurement of electric energy consumption as metered by the electric utility. (If you were to turn on ten 100 watt lights for one hour, you would have consumed one kilowatt hour of electrical energy.)

Load: The amount of electricity required by a particular energy consuming device or group of devices. Usually expressed in watts or kilowatts.

Minimum Off-Time: The minimum time that a control point must be shut off before it can be restored by the 9312. The Minimum Off-Time can be set from 0 to 20 minutes. Any control point having a heat pump or air conditioner compressor or other motor load connected to it should have a Minimum Off-Time of at least 4 minutes. Resistive loads should not have Minimum Off-Times.

Minimum On-Time: The minimum time that a control point must be restored before it can be shed by the 9312. The Minimum On-Time can be set from 0 to 20 minutes. Any control point having a heat pump or air conditioner compressor or other motor load connected to it should have a Minimum On-Time of at least 5 minutes.

Peak Demand: The highest usage in any demand interval within the billing period.

Priority: The relative importance of each controlled load to all other controlled loads, as assigned in the 9312. As the demand approaches the demand limit, the 9312 uses the priority of each load to determine which load(s) to shed first. A load with a priority of "1" is the highest priority and is shed last and restored first. A load with a priority of "8" is the lowest priority and is shed first and restored last. Loads of equal priority will rotate being shed and restored.

Time-Of-Use Demand Rate: A method of charging for electric service used by electric utilities which charges a higher price for Kwh's used in On-Peak periods, and a lower price for Kwh's used in the Off-Peak periods. The demand peak is usually monitored and recorded only in the On-Peak periods. The cost of electricity is based on both total energy consumed (Kwh) and demand peak (KW). Depending on the particular utility and rate, one or more On-Peak periods, varying in length, may exist during a 24 hour period.

Watt: A measure of electrical power or rate of doing work. It is analogous to horsepower where one horsepower is equivalent to approximately 746 watts.

Appendix B — 9312 Display Settings & Program Sequence

Explanation of Main Loop Display Modes

This applies 9312's with Version 3.3 or later software.

Instantaneous Demand (id): The current demand presently being drawn by the electrical service of the home or building. 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 rates given in Table 3 on page 9.

Average Demand (Ad): The average demand which has accrued over the last 15, 30 or 60-minute interval, as set by the averaging period "AP" in system programming mode of the 9312. This should be the same as the averaging period of the utility's demand meter.

Peak Demand (Pd): The interval with the highest average demand (Ad) which has occurred (since last reset) during the On-Peak periods. This is the demand level which has been set on the electric meter and consequently, the demand that you will be billed for. To reset, set the 9312 to "Pd" mode and press the Reset Peak key. 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.

On-Peak Demand Limit (dL): The current demand limit which is in effect. Adjustable from 2.0 KW to 49.5 KW in the 40 KW demand range (4 KW to 99 KW in the 80 KW demand range -- see demand ranges on Page 14). During the On-Peak period(s), the On-Peak demand limit will be displayed, and can be changed. During the Off-Peak periods, the Off-Peak demand will be displayed. While Off-Peak, the On-Peak demand limit can be viewed by simply pushing the demand limit key. The On-Peak limit must be less than the Off-Peak limit.

Clock (CL): The current time between midnight (12:00 AM) and 11:59 PM of the next night. "AM" and "PM" LEDs indicate appropriate time of day.

Explanation of System Loop Display Modes

To enter System Loop, press the Alarm Volume and Reset Peak keys for 5 seconds. The display will change to the first System Loop setting: dE. To move to the next mode, press the Demand Limit key. Use the Increase or Decrease keys to change the current mode's value. To escape from the System Loop at any time, press Display Mode key. If no keys are pressed within 2 minutes, the display will automatically return to the Main Loop.

To enter the Auto-Limit Loop, you must first be in the System Loop in any mode except "dr". Push the Alarm Volume and Reset Peak keys again until the first setting "d1" is displayed. Release keys.

Temperature (dE): The current temperature, in (dE)rees Fahrenheit, inside the 9312's C/D Unit.

Day of Week (do): The current day of the week. 1=Sunday, 2=Monday, 3=Tuesday, 4=Wednesday, 5=Thursday, 6=Friday, 7=Saturday.

Date (Month & Day) (dA): The current month and day of the month. Setting range from 1/1 to 12/31.

Year (Yr): The current year.

Auto Daylight-Saving Adjust (dS): Allows the 9312 to be programmed to automatically adjust the clock (CL) for daylight-saving time. Set to "0" in areas where daylight-saving time is not used. Set to "1" for the pre-2007 daylight-saving time schedule where daylight-saving time begins on the first Sunday in April and ends on the last Sunday in October. Set to "2" for the new daylight-saving time which began in March of 2007. In this mode, daylight-saving time begins on the second Sunday in March and ends on the first Sunday in November.

Number of Seasons (ns): This sets the number of seasons from 0-4 allowing up to four different seasonal time schedules per year. This needs to be the same number of seasons as defined by the electric rate.

Note: Only summer and winter schedules shown below.

Winter 1 On-Peak Time (A1): The start time of the first daily peak period and when the On-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Winter 1 Off-Peak Time (A2): The end time of the first daily peak period and when the Off-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Winter 2 On-Peak Time (A3): The start time of the second daily peak period and when On-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Winter 2 Off-Peak Time (A4): The end time of the second daily peak period and when Off-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Winter Start Date (Ad): The date that the winter rates go into effect, and the date the above winter timers A1 through A4, are effective. A setting of 0/0 causes winter times A1 through A4 to be ignored.

Summer 1 On-Peak Time (S1): The start time of the first daily peak period and when the On-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Summer 1 Off-Peak Time (S2): The end time of the first daily peak period and when the Off-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Summer 2 On-Peak Time (S3): The start time of the second daily peak period and when On-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Summer 2 Off-Peak Time (S4): The end time of the second daily peak period and when Off-Peak demand limit is initiated. Programmable from 12:00 AM to 11:59 PM.

Summer Start Date (Sd): The date that the summer rates go into effect, and the date the above summer timers S1 through S4, are effective. A setting of 0/0 causes summer times S1 through S4 to be ignored.

Saturday/Sunday On/Off Peak (SS): Sets weekends to On-Peak or Off-Peak depending on the local utility's rate. If your utility has On-Peak periods on weekends, set to "on". If weekends are Off-Peak, set to "oFF".

Holiday (Hx): where "x" is Holiday 1 through 9. The first four holidays are date-specific holidays or holidays that occur on the same date each year. These holidays are set by date (month and day of month) in any order. The defaults are H1: New Year's Day (1/1); H2: Fourth of July (7/4); H3: Christmas Day (12/25); and H4: Undefined (0/0).

Holidays 5-9 are dual purpose holidays which can be date-specific (same date each year - as described above) or holiday-specific (same day each year). The defaults are H5: President's Day (3rd Monday in February); H6: Memorial Day (1st Monday in June); H7: Labor Day (1st Monday in September); H8: Thanksgiving Day (4th Thursday in November); and H9: Friday after Thanksgiving (4th Friday in November). To enable these holidays as Off-Peak days, set them to oFFP and the system will not control On-Peak demand levels on these days. To use H5-H9 as date-specific holidays, set the holiday to the desired date. If used in the date-specific mode, the pre-assigned holidays will no longer be Off-Peak days.

If the utility company doesn't recognize a holiday that is listed above as Off-Peak, disable the holiday by setting it to onP for On-Peak and the 9312 will continue to manage demand levels on these days.

Off-Peak Peak Demand (oP): The highest average demand (Ad) which has occurred (since last reset) during the Off-Peak periods. This is helpful in determining how high uncontrolled demand peaks can be. To reset, set the 9312 to "oP" mode, press the Reset Peak key.

Off-Peak Limit (oL): The demand limit during the time the 9312 is in an Off-Peak period. Adjustable from 2.0 KW to 49.5 KW in the 40 KW demand range, 4KW to 99 KW in the 80 KW demand range, or to oFF, oFF2, oFF3, oFF4, or oFF5. oFF2-oFF5 are multipliers of the On-Peak demand limit as defined by the rate structure of the utility (i.e. if oFF2 is used, the Off-Peak demand limit is two times the demand limit set during On-Peak times). If your utility does not meter demand during Off-Peak periods, set the Off-Peak limit to oFF. The 9312 will not control during Off-Peak periods when set to oFF. For proper system operation, the Off-Peak demand limit must be greater than the On-Peak demand limit. The demand limit set here will be displayed in the Display mode (dL) in the Main Loop ONLY during Off-Peak periods.

Maximum Instantaneous (HL): This setting controls the highest instantaneous load that the 9312 will allow. This setting is used in conjunction with generators or when there is a restriction on the maximum instantaneous demand that may be drawn. When the instantaneous demand exceeds the HL setting, the system will respond by shedding one or more loads within 4 seconds. The HL setting must be greater than the demand limit setting to operate properly. It is not recommended to use the HL mode in normal demand control applications. To disable this setting, set to oFF.

Number of Relays (Loads) Connected (nr): This setting tells the 9312 how many relays are installed, starting from Control Point #1 and counting up to #16. This setting turns off unused control points. The number programmed into

this setting should be equal to the number of relays and all relays should be on consecutive control points starting with #1. Only control points enabled at this setting will appear in subsequent settings for priorities, Minimum On-Times and Minimum Off-Times. Furthermore, only enabled control points Circuit On LED indicators will be lit on the Control/Display Unit.

Priority (Pr): The priority of each load relative to all other loads connected to the 9312, where 1 is the highest priority and 16 is the lowest. Each control point (x) is adjustable from a priority of 1 to 17. However, the normal priority range is 1 to 16. Loads connected to relays with a priority of 17 are turned off during ALL On-Peak periods and restored only during Off-Peak periods.

Minimum On-Times (on): This sets the 0 to 20 minute Minimum On-Time for each control point (x). Any control point having a heat pump or air conditioner compressor or other motor load connected to it should have a Minimum On-Time programmed of at least 5 minutes. Minimum On-Times should be as short as possible and should not be used unless necessary because they restrict the 9312's ability to control demand. Use of Minimum On-Times may cause the meter's demand to exceed the set demand limit of the demand management system.

Minimum Off-Time (oF): This sets the 0 to 20 minute Minimum Off-Time for each control point (x). Any control point having a heat pump or air conditioner compressor or other motor load connected to it should have a Minimum Off-Time programmed in of at least 4 minutes.

Demand Control Algorithm (dC): This setting selects one of four demand control algorithms which defines the amount of risk the 9312 system will take in controlling loads and still be able to maintain the demand limit. Algorithm #1 is the most conservative and tries at all costs to maintain the demand limit. Algorithm #4 is the least conservative and uses the demand limit more as a guideline rather than an absolute limit.

Averaging Period (AP): This sets the demand averaging interval to 15, 30 or 60-minutes. This should coincide with the utility's averaging period of its demand meter.

Demand Range (dr): Sets the demand range to either 40KW for 200 Amp CT's or 80KW for 400 Amp CT's. The system default is 40KW for 200 Amp CT's (400 Amp CT's are optional and installed only by special order).

Setting the System Loop

To enter the System Loop from the Main Loop, hold down the Alarm Volume and Reset Peak keys simultaneously for 5 seconds. Once the display reaches the first System Loop setting (dE), release keys. To step through System Loops settings, press the Demand Limit key repeatedly until the desired setting is reached. All settings are listed on pages 15 and 16. Press the Increase or Decrease keys until the desired value is reached on the display for that particular setting. Release keys and step to the next System Loop setting desired by pressing the Demand Limit key again. If keys are not pressed within 2 minutes, the display will return to the Main Loop. To escape from the System Loop, press the Display key and you will jump back into the Main Loop.

System Display/Programming Modes

The 9312's Main and System Loops are shown below. These settings apply to those units with Version 3.1 software.

Main Loop	Description	Allowable Range
id	Instantaneous Demand	N/M
Ad	Average Demand	N/M
Pd	Peak Demand	N/M*
dL	On-Peak Demand Limit	2.0-49.5 (4-99 in 80 KW Mode)
CL	Clock - Current Time	12:00 a.m.-11:59 p.m.
System Loop	Description	Allowable Range
dE	Temperature - degrees	N/M
do	Day of the Week	1-7
dA	Date - Month/Day	1/1-12/31
Yr	Year	1992-2090
dS	Auto Daylight-Saving Adjust	0, 1, 2
ns	Number of Seasons	0-4
A1	Winter 1 Start Time	12:00 a.m. - 11:59 p.m.
A2	Winter 1 End Time	12:00 a.m. - 11:59 p.m.
A3	Winter 2 Start Time	12:00 a.m. - 11:59 p.m.
A4	Winter 2 End Time	12:00 a.m. - 11:59 p.m.
Ad	Winter Start Date	0/0-12/31
U1	Spring 1 Start Time	12:00 a.m. - 11:59 p.m.
U2	Spring 1 End Time	12:00 a.m. - 11:59 p.m.
U3	Spring 2 Start Time	12:00 a.m. - 11:59 p.m.
U4	Spring 2 End Time	12:00 a.m. - 11:59 p.m.
Ud	Spring Start Date	0/0-12/31
S1	Summer 1 Start Time	12:00 a.m. - 11:59 p.m.
S2	Summer 1 End Time	12:00 a.m. - 11:59 p.m.
S3	Summer 2 Start Time	12:00 a.m. - 11:59 p.m.
S4	Summer 2 End Time	12:00 a.m. - 11:59 p.m.
Sd	Summer Start Date	0/0-12/31
F1	Fall 1 Start Time	12:00 a.m. - 11:59 p.m.
F2	Fall 1 End Time	12:00 a.m. - 11:59 p.m.
F3	Fall 2 Start Time	12:00 a.m. - 11:59 p.m.
F4	Fall 2 End Time	12:00 a.m. - 11:59 p.m.
Fd	Fall Start Date	0/0-12/31
SS	Saturday/Sunday On/Off-Peak	on/offF
H1	Holiday 1	0/0-12/31
H2	Holiday 2	0/0-12/31
H3	Holiday 3	0/0-12/31
H4	Holiday 4	0/0-12/31
H5	Holiday 5 (President's Day)	0/0-12/31, oFFP, onP
H6	Holiday 6 (Memorial Day)	0/0-12/31, oFFP, onP
H7	Holiday 7 (Labor Day)	0/0-12/31, oFFP, onP
H8	Holiday 8 (Thanksgiving Day)	0/0-12/31, oFFP, onP
H9	Holiday 9 (Friday after Thanksgiving)	0/0-12/31, oFFP, onP
oP	Off-Peak Peak Demand	N/M*
oL	Off-Peak Limit	2-49.5, 4-99, oFF, oFF2, oFF3, oFF4, oFF5
HL	High Instantaneous Limit	2-49.5, 4-99, oFF
nr	# of Relays (Loads) Connected	1 to 16
Pr_1	Priority - Load #1	1 to 17
Pr_2	Priority - Load #2	1 to 17
Pr_3	Priority - Load #3	1 to 17
Pr_n	Priority - Load #n	1 to 17
on_1	Minimum On-Time for Load #1	0-20 minutes
on_2	Minimum On-Time for Load #2	0-20 minutes
on_3	Minimum On-Time for Load #3	0-20 minutes
on_n	Minimum On-Time for Load #n	0-20 minutes
oF_1	Minimum Off-Time for Load #1	0-20 minutes
oF_2	Minimum Off-Time for Load #2	0-20 minutes
oF_3	Minimum Off-Time for Load #3	0-20 minutes
oF_n	Minimum Off-Time for Load #n	0-20 minutes
dC	Demand Control Algorithm	1-4
AP	Averaging Period	15, 30 or 60-minutes
dr	Demand Range	40 or 80

*Can reset to 0 but the recorded number is non-modifiable

Auto-Limit Loop	Description	Allowable Range
d1	Start Date - Period 1	0/0-12/31
L1	On-Peak Demand Limit Period 1	2.0-49.5
o1	Off-Peak Demand Limit Period 1	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d2	Start Date - Period 2	0/0-12/31
L2	On-Peak Demand Limit Period 2	2.0-49.5
o2	Off-Peak Demand Limit Period 2	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d3	Start Date - Period 3	0/0-12/31
L3	On-Peak Demand Limit Period 3	2.0-49.5
o3	Off-Peak Demand Limit Period 3	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d4	Start Date - Period 4	0/0-12/31
L4	On-Peak Demand Limit Period 4	2.0-49.5
o4	Off-Peak Demand Limit Period 4	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d5	Start Date - Period 5	0/0-12/31
L5	On-Peak Demand Limit Period 5	2.0-49.5
o5	Off-Peak Demand Limit Period 5	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d6	Start Date - Period 6	0/0-12/31
L6	On-Peak Demand Limit Period 6	2.0-49.5
o6	Off-Peak Demand Limit Period 6	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d7	Start Date - Period 7	0/0-12/31
L7	On-Peak Demand Limit Period 7	2.0-49.5
o7	Off-Peak Demand Limit Period 7	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d8	Start Date - Period 8	0/0-12/31
L8	On-Peak Demand Limit Period 8	2.0-49.5
o8	Off-Peak Demand Limit Period 8	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
d9	Start Date - Period 9	0/0-12/31
L9	On-Peak Demand Limit Period 9	2.0-49.5
o9	Off-Peak Demand Limit Period 9	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
dA	Start Date - Period A (10)	0/0-12/31
LA	On-Peak Demand Limit Period A	2.0-49.5
oA	Off-Peak Demand Limit Period A	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
dB	Start Date - Period B (11)	0/0-12/31
Lb	On-Peak Demand Limit Period B	2.0-49.5
ob	Off-Peak Demand Limit Period B	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
dC	Start Date - Period C (12)	0/0-12/31
LC	On-Peak Demand Limit Period C	2.0-49.5
oC	Off-Peak Demand Limit Period C	2.0-49.5, oFF, oFF2, oFF3, oFF4, oFF5
nd	# of Days of Offset	1-9

Installation Manual

1.0 Introduction

This manual contains instructions for the installation, checkout, and programming of the Energy Sentry 9312 Demand Management System. In order to ensure proper installation and warranty coverage, please read this manual thoroughly before proceeding with the installation.

Note: All wiring must be installed in accordance with national and local electrical codes.

Important: If the 9312 is to be connected to a heat pump compressor or air conditioning compressor, please refer to Appendix B for Minimum On/Off-Times.

2.0 Tools & Materials Required

2.1 Tools Required

- Flat blade type screwdriver
- Phillips head screwdriver
- Drywall Knife
- Standard crimping tool (needed if optional crimp-on spade terminals are used)
- Amp-Clamp Current Sensor (if available)
- Digital Volt Meter (required for trouble shooting only)

2.2 Materials Required (not provided)

• Four 1/4" x 1" lag bolts and/or appropriate hardware for mounting Relay Unit.

• 15 Amp single pole circuit breaker for the 9312's 120 VAC Power Supply.

• Sufficient length of 4 Conductor Control Cable -Energy Sentry P/N - 0715-0009, or Belden #9156 or equivalent. This cable has 4-#18 AWG Conductors, 300V rated. Do not use thermostat wire as it may cause the 9312 to read power incorrectly. Use of thermostat wire may void warranty.

• Sufficient length of appropriate hookup wire (#14 AWG) to connect 120 volt power and ground from the circuit breaker panel to Relay Unit.

• Sufficient conduit, #10 AWG or #12 AWG wire (depending on load size), and associated hardware to connect the circuit breaker panel to Relay Unit (if required).

3.0 Pre-Installation System Check List

3.1 Parts Check

Check package contents to ensure it contains the following parts:

Quantity	Part Number	Description
1	FG9341A	9312 Control/Display Unit
2	8420-3028	200 Amp Current Transformer
		or
	8420-3029	400 Amp Current Transformer
1	FG9302A-XXXIXXX	Relay Unit: 1 of 2 types
		Surface Mount Indoor NEMA1
		or
	FG9302A-XXXRXXX	Rain Tight Outdoor NEMA 3R
* For an expanded system (32 control points) 2 Relay Units are required		
4	9000-02101	Control/Display Unit Mounting Clips
4	2520-1001	Control/Display Unit Mounting Screws
1	09000-67102	Control/Display Unit Mounting Template
1	09312-94100A	Owner's/Installation Manual

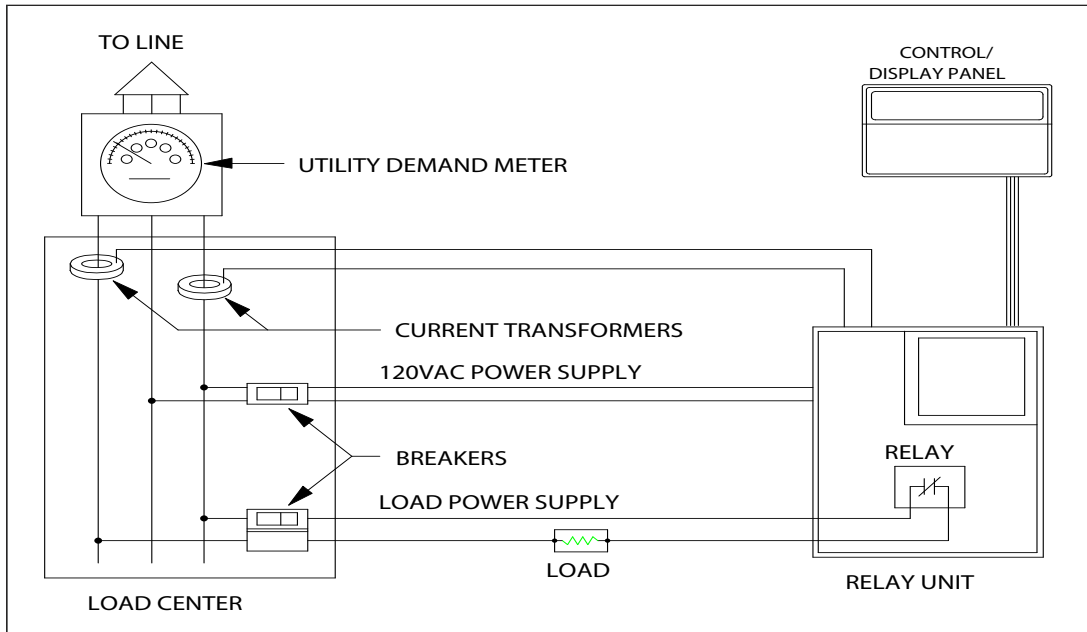
Note: Digits marked with "X" may vary depending with the number and type of relays, system size, type of enclosure, alarm, and current transformer options.

Note: Notify your Energy Sentry dealer if any parts are missing.

3.2 System Overview

The Energy Sentry 9312 Demand Management System consists of three general pieces. They are: the Control/Display (C/D) Unit, the Relay Unit, and the Current Transformers. Figure 3 shows the General System Configuration. The C/D Unit mounts inside the home, usually in a general living area such as the kitchen, hallway, or family room. The Relay Unit mounts next to the circuit breaker panel. The Current Transformers mount in the circuit breaker panel around the main incoming feeder cables.

Figure 3: 9312 Systems Diagram



4.0 Locating C/D Unit

4.1

Have the homeowner indicate their preference as to where the C/D Unit should be mounted. The installer needs to look for a convenient and accessible way to run the control cable from the location of the Relay Unit to the location of C/D Unit. This is normally done through an unfinished basement, crawl space, or an attic. The control cable is routed through an “outside” wall from the garage or wherever the circuit breaker panel is located. It can alternately be run through an attic and then dropped down into an interior wall or strung through a crawl space and brought up through an interior wall.

4.2

The C/D Unit **must not** be mounted on an exterior wall or any wall which is exposed to the outside air or which may have drafts running through it.

4.3

Follow the instructions on the Control/Display Unit mounting template enclosed to locate and mark the hole cutout and screw locations for the C/D Unit as shown in Figure 4. Be careful to locate the hole between studs -- C/D Unit will only recess in the wall correctly between studs because of the unit's depth.

4.4

Drill screw holes first with 1/8” drill.

4.5

Cut C/D mounting hole with drywall knife being careful not to make it too large.

4.6

Install the four C/D Unit mounting clips (P/N 09000-02101) by pressing them onto the drywall, in position over the mounting holes. In most cases, they should stay in place by themselves. If necessary, pinch the sides together with a pair of pliers so that the clips grab the drywall snugly. Align the clips with the screw holes located and marked earlier.

4.7

Do not mount C/D Unit yet. Continue to Section 5.

5.0 Locating and Mounting Relay Unit

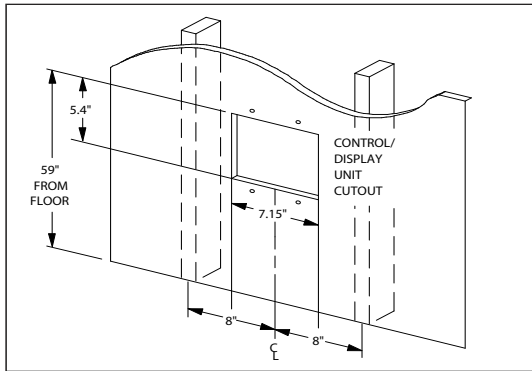
Caution: Remove relay plate before mounting enclosure to avoid vibration, shock, or impact (such as hammering) which may damage the enclosed electronics. Also, avoid metal chips or other debris, which may damage the enclosed electronics.

5.1 General Relay Unit Types

Surface Mount Relay Unit (P/N 9302A-XXXIXXX) “SM”

This Relay Unit is equipped with a 18” x 12” x 4”* NEMA 1 screw cover box with a cover of the same size. It should be surface mounted on a finished wall or recessed in an unfinished stud wall such that future finishing will leave the unit flush mounted. Four screw holes (for 1/4” screws) are provided in each corner on the rear wall of the unit. Screws, lag bolts, or nails could be used to mount unit to adjacent studs.

Figure 4: Locating and Mounting the Display Panel



Rain Tight Relay Unit (P/N 9302A-XXXXXXX) “RT”

This Relay Unit is provided with a 15” x 12” x 4”* NEMA 3R Rain-tight enclosure. Four holes for mounting are provided: two located directly below the chassis which hold the electronics and two located at the bottom center of the enclosure. This unit is surface mounted with four 1/4” x 2” lag bolts or other appropriate hardware.

Expansion Relay Unit (P/N 9302X-XXXXXXX)

This unit is used in an expanded system. Loads 9 through 16 are controlled with this unit.

*Relay Unit size may vary depending on number of relays and other factors.

5.2 General Mounting Procedure

5.2.1

Mount enclosure(s) in an upright vertical position near the circuit breaker panel, with the top of the enclosure being no higher than 6’ above the ground. Use four 1/4” x 1” lag bolts and appropriate mounting hardware to secure the unit. The studs for the relay plate must be on the upper part of the box. (Mounting bolts not provided.)

Caution: Outdoor enclosures (NEMA 3R) should be mounted where they will receive the least possible amount of direct sunlight. Flush mount and surface mount enclosures (NEMA 1) must be mounted indoors only.

5.2.2

Connect the Relay Unit(s) to the circuit breaker panel with metal conduit to be run from the appropriate knockout(s), if required. A 1-1/4” conduit must be installed to accommodate up to sixteen load wires size #10-#12 AWG and three #14 AWG wires for 120V power to unit. An additional conduit must be run for all Class 2 voltages, including four #18 AWG Current Transformer wires, remote relays, and wiring to the low voltage relays on the Data/Link PC Board. This conduit must use a knockout that enters in the Class 2 voltage compartment. This compartment is found on the right side of the relay box.

A separate conduit may also be required for the control cable (0.375” diameter).

5.2.3

If installing an Expansion Relay Unit, follow the procedure in paragraph 5.2.2.

5.2.4

Vacuum out all dry wall dust, metal chips, wood chips, and other foreign objects which may affect operation of the system.

6.0 Running Control Cable

After the location of the Control/Display Unit and the Relay Unit(s) have been determined and mounted, run the control cable from the Relay Unit to the C/D Unit, leaving sufficient cable length for a 12” service loop at both the C/D Unit and the Relay Unit.

To avoid any possible interference, do not run control cable next to or parallel to any high voltage (Class 1) Wires.

Caution: Control cable must **not** run through the main circuit breaker panel.

7.0 Wiring Control Cable to C/D Unit

7.1

Remove cover from C/D Unit by pulling the cover outward first on one side and then on the other side. Be extremely careful not to damage the hinge posts which protrude out approximately 1/2” on each side of the bottom front of the unit.

7.2

Pass the control cable through the square hole in the rear of the enclosure, and through the 3/8” diameter hole in the Data/Link PC Board. Strip cable jacket back about 3 to 4 inches. Strip insulation approximately 1/2” off of each wire end.

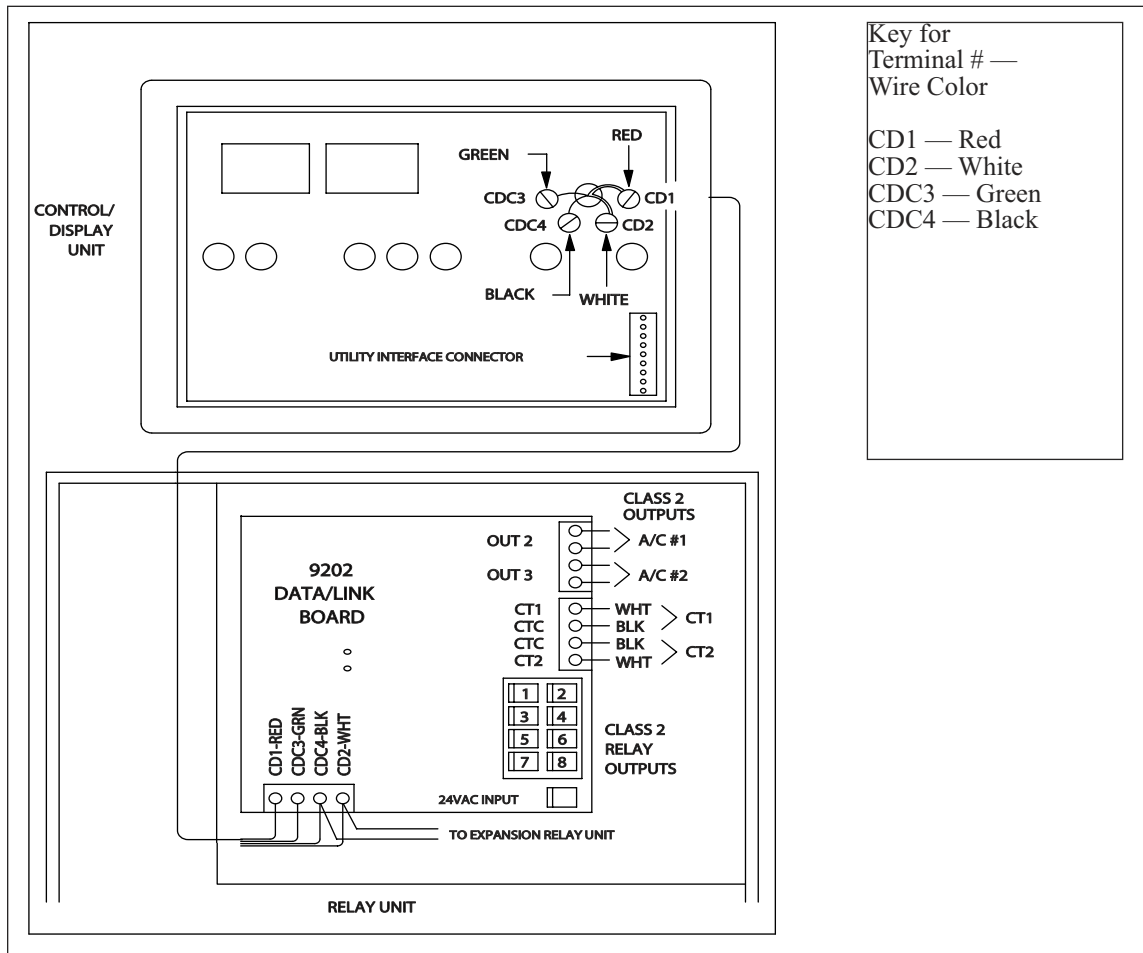
7.3

The control cable consists of 4 #18 AWG conductors. These are typically Black, White, Green and Red. Connect the wires as shown in Table 4 (on page 21) and in Figure 5 on the next page.

7.4

Ensure the Red/Green conductors are connected to the top two screw terminals. Red to terminal CD1. Green to terminal CDC3. The White/Black conductors are connected to the bottom two terminals. White to terminal CD2. Black to terminal CDC4. Refer to Figure 5 or wiring diagram on Relay Unit cover.

Figure 5: Wiring the Control Cable



8.0 Mounting C/D Unit

8.1

After all wire connections have been made and screws tightened, pull excess cable back through the rear of the C/D Unit so that cable does not stick up through the front of the board.

8.2

Place the C/D Unit in the cutout hole and align the four mounting holes in the plastic housing so they line up with the four mounting clips installed earlier.

8.3

With the four #6 x 1-1/4" Flat head sheet metal screws provided (P/N 2520-1001), use a Phillips head screwdriver to insert the screw through the plastic housing, through the hole in the short side of the C/D Unit mounting clips, through the drywall and into the small hole on the long side of the mounting clip. The sheet metal screw will thread through the small hole and tighten the C/D Unit enclosure to the wall. Repeat this procedure with the other three screw's positions.

8.4

When all four screws have been installed, the C/D Unit should be securely fastened to the wall. Line up the front cover bezel assembly with the enclosure, making sure that the hinge posts line up with the slots that they insert into. Press the assembly gently onto the enclosure. You will hear and feel it snap into place if it has been aligned correctly.

9.0 Wiring Control Cable to Relay Unit

9.1

Run cable through an unused knockout at the bottom of Relay Unit and secure with cable clamp. Leave approximately 6" to 12" of control cable in the Relay Unit for a service loop.

Note: Control cable must **not** run through the circuit breaker panel. Conduit may be required for the control cable.

9.2

Strip back the outer jacket of the control cable about 4 inches.

9.3

Attach the control cable to the Relay Unit and the Data/Link PC Board as follows:

9.3.1

Run the cable up the right side of the relay box.

9.3.2

Strip each conductor back 1/4".

9.3.3

Connect wires to terminal strip in the lower left hand corner of Data/Link PC Board as shown in Figure 5 or the wiring diagram on Relay Unit inside cover or in Table 4.

Table 4: Relay Unit Connections

Terminal Name	Wire Color
CD1	Red
CDC3	Green
CDC4	Black
CD2	White

9.3.4

If you are installing an Expanded Relay Unit, run a control cable between each Relay Unit. Only one pair of wire is required. Connect terminals CD2 to CD2, and terminals CDC4 to CDC4 on each Data/Link PC Board.

10.0 Wiring 120 VAC Power Supply to Relay Unit

10.1

Install a single-pole 120 volt 15 Amp circuit breaker in the circuit breaker panel for the 9312 and mark it "Energy Sentry" or "9312".

Caution: Ensure the 15 Amp circuit breaker is OFF before connecting power supply.

10.2

Run a 120 volt supply line (14 AWG copper, 600 volt insulation, with ground line) from the separate 120 volt, 15 Amp single-pole breaker just installed in the circuit breaker panel into the Relay Unit through the conduit.

10.3

Connect 120 volt supply to the white and black wires of the power transformer on the left side of the relay plate.

10.4

Connect the ground line to the ground bus in the circuit breaker panel and to the grounding lug on the left side of the relay plate.

10.5

Repeat instructions 10.2 through 10.4 for an Expanded Relay Unit. Both Relay Units **MUST** be phased the same.

Caution: Leave circuit breaker off until installation is complete.

11.0 Installing & Wiring Current Transformers

Caution: Installation of Current Transformers may need to be coordinated with the local utility company.

11.1

Disconnect main power to the circuit breaker by removing the meter or by a main disconnect switch.

11.2

When power is off, install Current Transformers around main feeder cables between the meter and the main circuit breaker as shown in the wiring diagram on Relay Unit or in Figure 3 on page 18. The Current Transformers must be installed in the same direction.

Note: Ensure that the red dot or polarity mark of both Current Transformers are facing the same direction (i.e. both toward meter or both toward loads).

11.3

Run current transformer leads into Relay Unit via the conduit if Current Transformers are installed within circuit breaker panel and cut the black/white twisted pair of each to a sufficient length to connect to the 4 position terminal block on the right hand side of the Data/Link PC Board. Leave about 8"-12" extra. **Do not run leads next to or parallel to high voltage (Class I) wiring to the extent possible.**

11.4

Strip each conductor back 1/4".

11.5

Connect black and white wires to 4 position terminal block as follows:

Table 5: Current Transformer Connections To Relay Unit

Terminal Name	Wire Color
CT1	White-from CT1
CTC	Black-from CT1
CTC	Black-from CT2
CT2	White-from CT2

11.6

Route current transformer wires and the control cable around the right side of the Data/Link PC Board and box to avoid close proximity to high voltage wires. Current transformer leads must enter the relay box in the Class 2 compartment.

12.0 Creating a Load Schedule & Making Load Assignments

The 9312 is shipped from the factory ready to operate under the Combination Load Control Strategy with preset 8 and 5-minute Minimum On/Off-Times on Circuits 2 and 3. Changes in load control strategy, Minimum On/Off-Times, and other system information may be made through the front panel of the Control/Display Unit. However, all components of the 9312 must first be installed and verified operating properly as set forth in Section 17.

Caution: Ensure all circuits to be controlled are turned off at the appropriate circuit breaker in the circuit breaker panel before proceeding with any wiring.

Warning: When controlling heat pump and air conditioning compressor loads, a Minimum Off-Time of at least 4 minutes must be programmed. Minimum Off-Times are available on all circuits. (Some manufacturer's may require longer Minimum Off-Times for compressor protection. Check with manufacturer.) When installation is complete Minimum On and Off-Times can be programmed in Section 18.

12.1

Prepare a load schedule identifying which loads will be connected to which circuits. The following are examples only. Your application may be different and require a variation of these examples. Contact your Energy Sentry Dealer for application assistance.

12.1.1

For Electric Baseboard Or Radiant Ceiling Heat Homes:

Example Only. It is recommended that for best results with these types of heating systems, the loads be connected as follows:

Example 1: Load Control Strategy: Combination

Circuit #	Load	Priority
1	Dryer	1
2	Hot Water Heater	2
3	Heat #1	3
4	Heat #2	3
5	Heat #3	3
6	Heat #4	3
7	Heat #5	3
8	Heat #6	3

12.1.2

For Homes With Heat Pumps Without Compressor Connected

Example Only. In some heating climates it may be preferable not to connect the heat pump compressor to the 9312. Check with your local utility and/or heating contractor to determine whether your compressor should be controlled. If you decide to control your compressor, please refer to section 12.1.3. Electric forced air furnace heat strips should be controlled. Electric furnaces usually have from two to five stages of heat which is controlled by a "sequencer". The sequencer usually uses a fixed priority scheme to turn on and off these heat strips as required. Heat strips should be controlled individually with remote relays on the 240 VAC line. (See Section 16). The following general load schedule is typical of this application:

Example 2: Load Control Strategy: Fixed Priority

Circuit #	Load	Priority
1	Dryer	1
2	Heat #1 (1A)	2
3	Hot Water Heater	3
4	Heat #2 (1B)	4
5	Heat #3 (2A)	5
6	Heat #4 (2B)	6
7	Heat #5 (3A)	7
8	Heat #6 (3B)	8

This schedule may be altered as necessary to suit the needs of the particular home and user. This is an example only. For application assistance, contact your Energy Sentry representative.

12.1.3

For Homes With Heat Pumps With Compressor Connected:

Example Only. When assigning loads for homes with heat pumps or air conditioners with the 24VAC thermostat control loops connected, thermostats must be connected to Circuits 2 and 3 as discussed above.

Example 3: Load Control Strategy: Combination

Circuit #	Load Schedule A	Priority
1	Dryer	1
2	Compressor A/C	2
3	Heat #1	3
4	Water Heater	3
5	Heat #2	4
6	Heat #3	5
7	Heat #4	6
8	Heat #5	7

Example 4: Load Control Strategy: Combination - Dual Compressor

Circuit #	Load Schedule B	Priority
1	Dryer	1
2	Comp.A (A/C#1)	2
3	Comp.B (A/C#2)	2
4	Water Heater	3
5	Heat #1 A	4
6	Heat #1 B	5
7	Heat #2A	6
8	Heat #2B	7

This schedule may be altered as necessary to suit your application. Circuits with compressors must have Minimum On and Off-Times enabled. See Appendix B for System Programming Procedure.

12.2

Use the form on Page 27, Section 20.0 to create the load schedule for your application.

13.0 Wiring Power Relays to Heat Circuits & Hot Water Heater

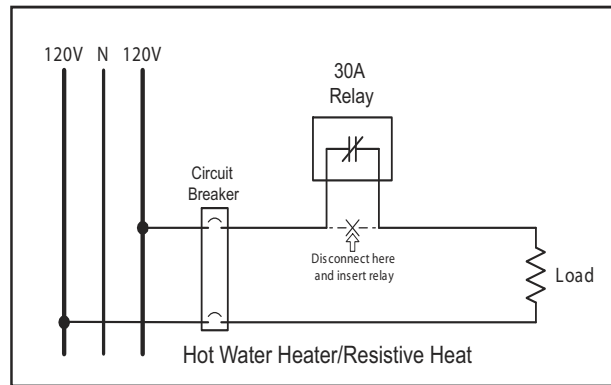
13.1

Turn off all circuit breakers of loads which are going to be connected to the 9312.

13.2

Heat circuits and the hot water heater are connected to the circuit breaker panel as shown in Figure 6. Each of these loads is connected by two wires to a 240 VAC double-pole circuit breaker.

Figure 6: Typical Power Relay Interconnection



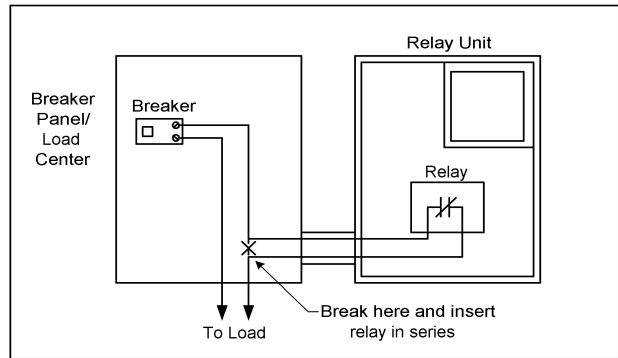
13.3

The relay is inserted in series with the load on one side of the load only as shown in Figure 6. It does not matter which side the relay is inserted on.

13.4

Disconnect one of the two wires (either one) from the circuit breaker of each load and wire-nut this lead to a short length of #10 or #12 AWG wire (depending on circuit breaker size) which runs into the Relay Unit. Wire-nut this length of wire to one lead of the relay's contact. With another short length of the appropriately sized wire, wire-nut it to the other lead of the relay's contact. Connect that same wire back to the circuit breaker's terminal where the first wire was originally removed as shown in Figure 7.

Figure 7: Power Relay Interconnection Schematic



13.5

Repeat this procedure for the remaining heat circuits and hot water heater(s). Heat circuits are normally on 20 Amp circuit breakers and require #12 AWG wire. Hot water heaters are normally on 30 Amp circuit breakers and require #10 AWG wire. All Energy Sentry relays are equipped with #10 AWG red lead wire.

14.0 Wiring Power Relays to Dryer

14.1

Turn off the dryer's circuit breaker.

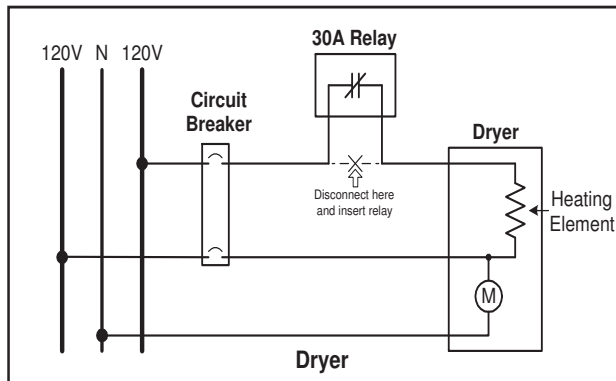
14.2

The dryer is connected to a 30 Amp, 240 VAC double-pole circuit breaker in the circuit breaker panel (see in Figure 8).

14.3

The relay is inserted in series on the heating element side of the load only as shown in Figure 8. The motor of the dryer is NOT connected to the Energy Sentry. Care must be taken to insure that the dryer is connected properly since improper connection may damage the dryer.

Figure 8: Typical Clothes Dryer Interconnection



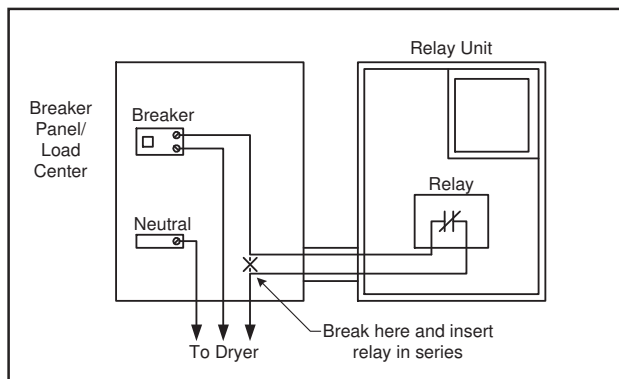
14.4

Remove one of the two wires from the dryer's circuit breaker and wire-nut (cap) this wire so that it will not short to anything. Turn on dryer's circuit breaker and attempt to start the dryer. If the dryer starts, the detached wire is the correct wire to attach to the power relay. To verify this, turn off the dryer and the dryer's circuit breaker and reattach this wire to the circuit breaker. Remove the opposite phase wire from the circuit breaker the wire-nut (cap) this wire. Turn circuit breaker on and start the dryer again. This time the dryer's motor should NOT start. If it does (dryer starts with either wire disconnected), your dryer may require some internal wiring modifications before it can be connected to the 9312. To do this, contact dryer manufacturer or consult dryer wiring diagram.

14.5

Turn off the circuit breaker and remove the correct wire. With the correct wire removed, the dryer motor should start. Run two short lengths of #10 AWG wire between the circuit breaker panel and the Relay Unit. Wire-nut the disconnected wire to one of the short lengths of wire in the circuit breaker panel. Wire-nut the other end of this wire to one red lead of the relay's contact. Wire-nut the relay's other red lead to the other short length of wire that returns into the breaker panel. Connect the other end of the wire back to the dryer's circuit breaker as shown in Figure 9.

Figure 9: Dryer Interconnection Schematic



15.0 Wiring Low-Voltage Relays to Heat Pumps & Air Conditioners

15.1

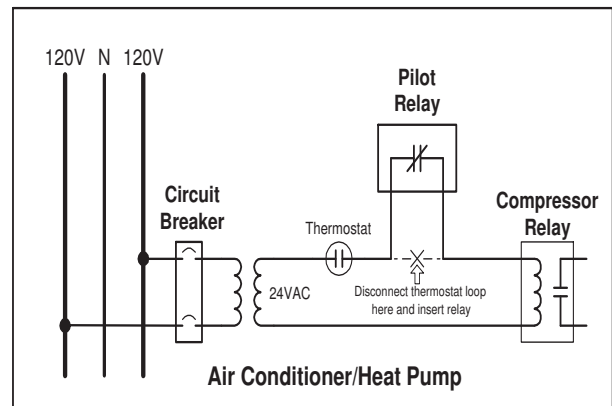
Turn off all circuit breakers for heat pumps, air conditioners, air handlers, or electric furnaces.

15.2

Connecting air conditioners and/or heat pump compressors to the Energy Sentry unit is normally accomplished by inserting a 3 Amp low voltage signal relay in series with the low voltage 24 VAC thermostat control loop as shown in Figure 10. (Generalized Drawing). This can be done in one of two ways: 1) Use the low voltage relays on the Data/Link PC Board for Circuits #2 and #3 or 2) Use remote low voltage relays.

Normally the relay is inserted in the common (usually red) wire. In heat pumps, this allows the compressor to be shed in both heating and cooling modes and also causes the blower and any auxiliary heat to be shed at the same time. In the event that breaking the red wire is incompatible with an electronic thermostat, the relay will be inserted in the compressor relay (yellow). It is strongly recommended that auxiliary electric strip heat in air handlers be controlled separately using remote power or signal relays.

Figure 10: Typical Low Voltage Load Interconnection



16.0 Connecting the 9312 to an Electric Furnace

When connecting an air handler with heat strips or furnace to the 9312, the most effective method is to install a Remote Relay Unit at the air handler or furnace. (Available from Brayden Automation Corporation - P/N FG9291A). This Relay Unit contains 2 to 6 relays for connection to each individual heat strip in the furnace. These relays are connected to the Main Relay Unit by means of paired cable, normally one pair per relay. For example, for 4 remote relays, an #18 AWG eight conductor cable is required. Twisted pairs are recommended for this applica-

tion for convenience in identifying pairs. Relay connector pigtails should be connected in the Main Relay Unit to the multi-conductor cable. At the Remote Relay Unit, relay leads are wire-nutted to the multi-conductor cable as show in Figure 11.

16.1

Determine the staging sequence of the electric furnace. For example, many furnaces have 3 stages of heat. Stages #1 and #2 often consist of two 5 KW heating elements and Stage #3 has another 5 KW heating element.

16.2

The heating elements of Stage #1, Heat 1A and Heat 1B, are wired to Relays #2 and #4. The heating elements of Stage #2, 2A and 2B, are wired to Relays #5 and #6. Finally, the heating element of Stage #3 is wired to Relay #7. The dryer would be wired to Relay #1 and water heater to Relay #3. See Section 12.1.2 for an example.

16.3

Run the multi-conductor cable from the Main Relay Unit to the Remote Relay Unit. Use the relay connector pigtails (P/N 09000-65001) to connect each conductor pair to the relay outputs plugs in the Main Relay Unit. In the Remote Relay Unit, wire-nut the opposite end of these conductors to the relay's coil terminals. Make sure the color code is observed. Orange wire of each relay should go back to the top pin of each 2-pin relay output jack.

16.4

Wire the remaining relays similar to the first making sure that each relay is connected with a pair of wires. **DO NOT COMMON ANY WIRES TOGETHER**

17.0 System Checkout

17.1 Prior to Test:

- Turn off ALL circuit breakers in the circuit breaker panel.
- Turn on thermostats/switches for controlled loads.

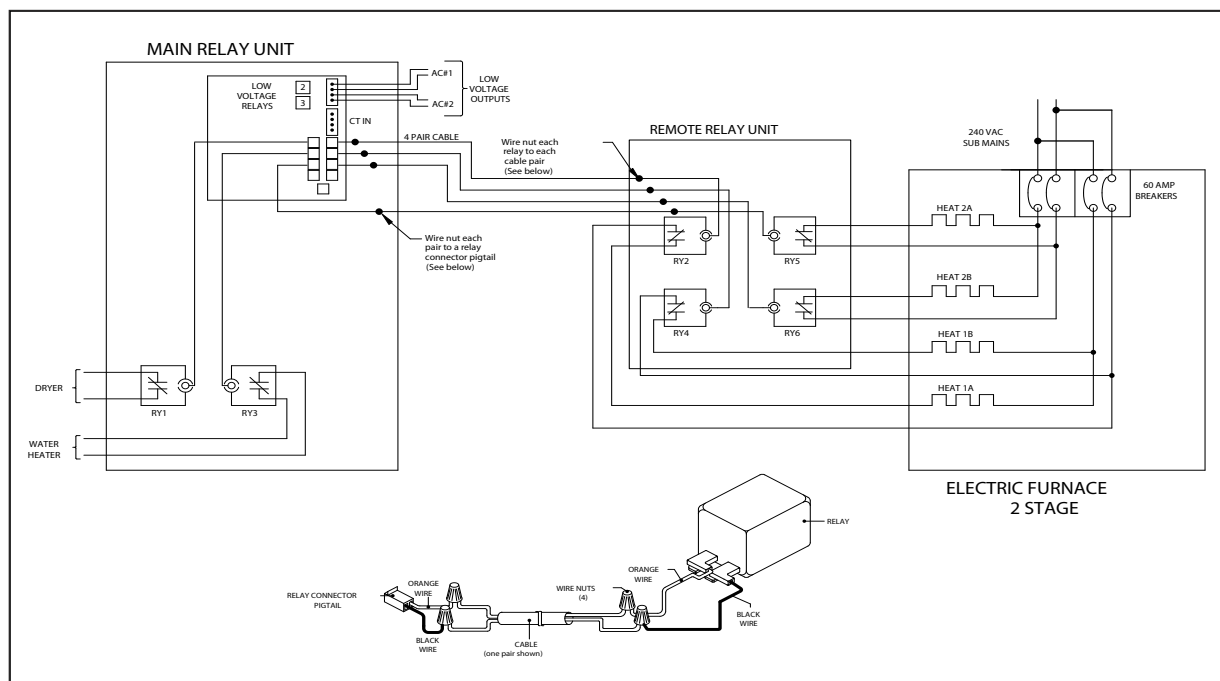
17.2 Initial Operation Test:

- Ensure all circuit breakers in the circuit breaker panel are off.
- Turn on the 9312 circuit breaker.
- Control/Display Unit should turn on, beep once, and light up with "id" showing in the Mode display. If the unit fails to light up, turn power off immediately. Check wiring and connections to make sure that the unit is wired properly. Pay close attention to remote relay wiring to ensure there are no short circuits. Power-up the unit again. If problems still arise, call your Energy Sentry Dealer.
- All sixteen Circuit On LED indicators should be off and all relays shed after power-up. The first relay will turn on about 8 seconds after power-up. Every 1 minute thereafter one circuit indicator light will come on, except if relays are held open by a Minimum Off-Time.

17.3 Power Off-Test

- Set demand limit to 2 KW according to the instructions on the front panel of the Control/Display Unit.

Figure 11: Electric Furnace/Air Handler Application



- b. Place Mode display in the Instantaneous (id) mode.
- c. Turn on a large (greater than 5 KW) uncontrolled load such as the kitchen range. Leave all controlled loads off.

Caution: Please take all necessary precautions to prevent damage or injury from the hot surfaces on the stove top. Do not leave elements on more than the brief amount of time it takes to run this test.

- d. Within 3 minutes, all Circuit On LED indicators on the Control/Display Unit should turn off (unless Minimum On-Times are programmed) and the alarm should sound.
- e. Increase the demand limit setting 1 KW at a time until the alarm stops. The demand limit should be slightly larger than the amount of KW of the uncontrolled load. This verifies that the unit is measuring power properly.
- f. Turn off the uncontrolled load.

17.4 Power On-Test

- a. Ensure all circuit breakers in the circuit breaker panel are off except for the 15 AMP circuit breaker labeled “Energy Sentry” or “9312”.
- b. Set the demand limit to a number 2-3 times higher than the estimated demand limit of the installation (i.e. if you intend to control at 6 KW, set the 9312 to 12-18 KW).
- c. This demand limit will allow all of the circuits to be restored in about 1 minute per circuit, once the restoring process begins.
- d. Turn on each controlled load circuit, one at a time. **Immediately proceed to 17.5 Shed Test without delay.**

Caution: Do not leave controlled loads on for more than a few minutes as this may cause the electric meter to register a high demand peak.

Note: If Minimum On and Off-Times have been programmed into the unit, then loads controlled under these times will switch only when the appropriate time intervals have elapsed.

17.5 Shed Test

- a. Set demand limit to 2 KW
- b. The unit will begin to shed loads (because all the controlled loads are causing a high instantaneous demand) starting with the lowest priority load and ending with the highest priority load. Once all loads are shed, the alarm will sound because the demand level is most likely still above the demand limit of 2 KW. When this happens, set the demand limit to its normal level (apx 6-8 KW or whatever it may be for your specific home at that time of the year) and the alarm should stop.

17.6

Restore household loads to the desired condition. The circuit breaker marked “Energy Sentry” or “9312” should be left on with the desired demand limit set into the Control/Display Unit.

18.0 System Programming

The system programming mode of the 9312 is designed to give the user ultimate flexibility in “tailoring” the 9312’s operation to the user’s exact requirements. In this mode, the user programs the 9312 through the Control/Display front panel and answers a series of questions which tell the system: 1.) Day, Month, and Year; 2.) On-Peak and Off-Peak controlling times; 3.) How many relays are connected to the system; 4.) What load control strategy (priorities) it will operate under; and 5.) The Minimum On/Off-Times for all 16 control points, if times are required.

Appendix B explains the different settings and includes a list of the settings as they occur. **It is the user’s responsibility to maintain the correct time-of-day, day-of-week, date, holiday, and all other system settings which affect the system’s proper operation.** It is recommended to check the time at least once a month and adjust as necessary.

19.0 Wrap-Up

19.1

The Energy Sentry 9312 should now be ON and all circuit breakers for loads controlled by the Energy Sentry should also be on.

19.2

The 9312 should now be set with the proper system settings. Air conditioners and heat pump compressors must have Minimum Off-Times of at least 4 minutes.

19.3

Control/Display Unit should display Instantaneous (id), Average (Ad), and Peak demand (pd) power readings. Circuit On LED indicators should show which loads are enabled.

19.4

Relays in Relay Unit(s) should be turning loads on and off as necessary.

19.5

Replace cover on the 9312’s Relay Unit and on the circuit breaker panel.

19.6

Record the following information in the spaces provided in Section 20:

- Load priorities
- Load control strategy selected
- Household circuit or load assignments
- Minimum On/Off-Times for all circuits if changed, otherwise write zero.
- Date of installation
- Name of Energy Sentry Dealer or installing electrical contractor.

- Complete the Warranty Card and drop in mail to Brayden Automation Corporation 6230 Aviation Circle, Loveland, CO 80538. The Warranty Card must be sent in for proper registration of unit. Warranty is not valid unless the Warranty Card has been received and unit has been registered.

19.7

Leave the owner's manual in a convenient location near the Control/Display Unit. If install is new construction, place manual in kitchen drawer with appliance manuals.

19.8

This concludes the installation of the Energy Sentry 9312 Demand Management System.

Thanks for choosing Energy Sentry!

20.0 Required Warranty Information

Installing Electrician: Fill out applicable information on this page.

1. Strategy selected (check applicable strategy):

Fixed Rotating Combination

Control Circuit	Household Circuit Assignment/Description	Priority (if applicable)	Minimum On/Off Time
1	_____	_____	mins on _____ /off _____
2	_____	_____	*mins on _____ /off _____
3	_____	_____	*mins on _____ /off _____
4	_____	_____	mins on _____ /off _____
5	_____	_____	mins on _____ /off _____
6	_____	_____	mins on _____ /off _____
7	_____	_____	mins on _____ /off _____
8	_____	_____	mins on _____ /off _____
9	_____	_____	mins on _____ /off _____
10	_____	_____	mins on _____ /off _____
11	_____	_____	mins on _____ /off _____
12	_____	_____	mins on _____ /off _____
13	_____	_____	mins on _____ /off _____
14	_____	_____	mins on _____ /off _____
15	_____	_____	mins on _____ /off _____
16	_____	_____	mins on _____ /off _____

*Control Points 2 and 3 are shipped with 8 minutes on and 5 minutes off. See Appendix B, page for instructions.

Owner:

1. Record circuit assignments above and in the space provided on the keyboard label of the Control/Display Unit.
2. Fill out Warranty Card and mail today!
3. Record items 5 through 8 from Warranty Card below for your records.

Date of installation _____ Serial number _____

Installing Electrical Contractor _____ Phone # _____

4. Fill in current system settings.

Record of Settings

System Loop Display Settings	Default	Description	Current Setting
dE	--	Temperature (non-user adjustable)	--
do	X	Set Day of Week: 1=SUN 7=Sat	
dA	X	Set Date (Month and Day)	
Yr	X	Set Current Year	
dS	1	Enable/Disable Automatic Daylight-Saving Time Adjustment	
ns	2	Number of Seasons	
A1	5:55 AM	Set the Start Time of Winter Peak Period #1	
A2	3:05 PM	Set the End Time of Winter Peak Period #1	
A3	11:55 AM	Set the Start Time of Winter Peak Period #2	
A4	9:05 PM	Set the End Time of Winter Peak Period #2	
Ad	10/1	Set the Start Date of the Winter Rates	
U1		Set the Start Time of Spring Peak Period #1	
U2		Set the End Time of Spring Peak Period #1	
U3		Set the Start Time of Spring Peak Period #2	
U4		Set the End Time of Spring Peak Period #2	
Ud		Set the Start Date of Spring Rates	
S1	8:55 AM	Set the Start Time of Summer Peak Period #1	
S2	10:05 PM	Set the End Time of Summer Peak Period #1	
S3	0:00	Set the Start Time of Summer Peak Period #2	
S4	0:00	Set the End Time of Summer Peak Period #2	
Sd	4/1	Set the Start Date of Summer Rates	
SS	on	Set Weekends to either On-Peak or Off-Peak	
F1		Set the Start Time of Fall Peak Period #1	
F2		Set the End Time of Fall Peak Period #1	
F3		Set the Start Time of Fall Peak Period #2	
F4		Set the End Time of Fall Peak Period #2	
Fd		Set the Start Date of Fall Rates	
H1	1/1	Set Holiday Date #1	
H2	7/4	Set Holiday Date #2	
H3	12/25	Set Holiday Date #3	
H4	0/0	Set Holiday Date #4	
H5	onP	Set Holiday Date #5	
H6	onP	Set Holiday Date #6	
H7	onP	Set Holiday Date #7	
H8	onP	Set Holiday Date #8	
H9	onP	Set Holiday Date #9	
oP		Reset Off-Peak Peak Demand	
oL	oFF	Set Off-Peak Demand Limit	
HL	oFF	Set High Instantaneous Limit	
nr	8	Set the Number of Relays Used	
Pr_1	1	Set Priority for Relay #1	
Pr_2	2	Set Priority for Relay #2	
Pr_3	3	Set Priority for Relay #3	
Pr_4	4	Set Priority for Relay #4	
Pr_5	5	Set Priority for Relay #5	
Pr_6	6	Set Priority for Relay #6	
Pr_7	7	Set Priority for Relay #7	
Pr_8	8	Set Priority for Relay #8	
Pr_9	9	Set Priority for Relay #9	
Pr_10	10	Set Priority for Relay #10	
Pr_11	11	Set Priority for Relay #11	
Pr_12	12	Set Priority for Relay #12	
Pr_13	13	Set Priority for Relay #13	
Pr_14	14	Set Priority for Relay #14	
Pr_15	15	Set Priority for Relay #15	
Pr_16	16	Set Priority for Relay #16	
on_1	0	Set Minimum On-Time for Load #1	
on_2	8	Set Minimum On-Time for Load #2	
on_3	8	Set Minimum On-Time for Load #3	
on_4	0	Set Minimum On-Time for Load #4	
on_5	0	Set Minimum On-Time for Load #5	
on_6	0	Set Minimum On-Time for Load #6	
on_7	0	Set Minimum On-Time for Load #7	
on_8	0	Set Minimum On-Time for Load #8	
on_9	0	Set Minimum On-Time for Load #9	
on_10	0	Set Minimum On-Time for Load #10	
on_11	0	Set Minimum On-Time for Load #11	
on_12	0	Set Minimum On-Time for Load #12	
on_13	0	Set Minimum On-Time for Load #13	
on_14	0	Set Minimum On-Time for Load #14	
on_15	0	Set Minimum On-Time for Load #15	
on_16	0	Set Minimum On-Time for Load #16	

System Loop Display Settings	Default	Description	Current Setting
oF_1	0	Set Minimum Off-Time for Load #1	
oF_2	5	Set Minimum Off-Time for Load #2	
oF_3	5	Set Minimum Off-Time for Load #3	
oF_4	0	Set Minimum Off-Time for Load #4	
oF_5	0	Set Minimum Off-Time for Load #5	
oF_6	0	Set Minimum Off-Time for Load #6	
oF_7	0	Set Minimum Off-Time for Load #7	
oF_8	0	Set Minimum Off-Time for Load #8	
oF_9	0	Set Minimum Off-Time for Load #9	
oF_10	0	Set Minimum Off-Time for Load #10	
oF_11	0	Set Minimum Off-Time for Load #11	
oF_12	0	Set Minimum Off-Time for Load #12	
oF_13	0	Set Minimum Off-Time for Load #13	
oF_14	0	Set Minimum Off-Time for Load #14	
oF_15	0	Set Minimum Off-Time for Load #15	
oF_16	0	Set Minimum Off-Time for Load #16	
dC	1	Set Demand Control Algorithm	
AP	15	Set Demand Averaging Period	
dr	40	Set Demand Range	
Auto Limit Loop Display Settings	Default	Description	Current Setting
d1	0/0	Set Start Date - Period 1	
L1	6	Set On-Peak Demand Limit Period 1	
o1	oFF	Set Off-Peak Demand Limit Period 1	
d2	0/0	Set Start Date - Period 2	
L2	6	Set On-Peak Demand Limit Period 2	
o2	oFF	Set Off-Peak Demand Limit Period 2	
d3	0/0	Set Start Date - Period 3	
L3	6	Set On-Peak Demand Limit Period 3	
o3	oFF	Set Off-Peak Demand Limit Period 3	
d4	0/0	Set Start Date - Period 4	
L4	6	Set On-Peak Demand Limit Period 4	
o4	oFF	Set Off-Peak Demand Limit Period 4	
d5	0/0	Set Start Date - Period 5	
L5	6	Set On-Peak Demand Limit Period 5	
o5	oFF	Set Off-Peak Demand Limit Period 5	
d6	0/0	Set Start Date - Period 6	
L6	6	Set On-Peak Demand Limit Period 6	
o6	oFF	Set Off-Peak Demand Limit Period 6	
d7	0/0	Set Start Date - Period 7	
L7	6	Set On-Peak Demand Limit Period 7	
o7	oFF	Set Off-Peak Demand Limit Period 7	
d8	0/0	Set Start Date - Period 8	
L8	6	Set On-Peak Demand Limit Period 8	
o8	oFF	Set Off-Peak Demand Limit Period 8	
d9	0/0	Set Start Date - Period 9	
L9	6	Set On-Peak Demand Limit Period 9	
o9	oFF	Set Off-Peak Demand Limit Period 9	
dA	0/0	Set Start Date - Period A (10)	
LA	6	Set On-Peak Demand Limit Period A	
oA	oFF	Set Off-Peak Demand Limit Period A	
dB	0/0	Set Start Date - Period B (11)	
Lb	6	Set On-Peak Demand Limit Period B	
ob	oFF	Set Off-Peak Demand Limit Period B	
dC	0/0	Set Start Date - Period C (12)	
LC	6	Set On-Peak Demand Limit Period C	
oC	oFF	Set Off-Peak Demand Limit Period C	
nd	5	Set Number of Days of Offset	

Warranty Information

LIMITED THREE-YEAR WARRANTY

Energy Sentry Demand Management Systems and their components are warranted by Brayden Automation Corporation against defects in materials and workmanship for three (3) years from the date of original installation, provided that the original date of installation is within one year from date of manufacture. This warranty is further conditioned upon the Energy Sentry Demand Management Systems being properly installed and used for their ordinary and intended purposes. During the term of this warranty, Brayden Automation Corporation, through its authorized representative, will repair, or at its option, replace at no charge an Energy Sentry Demand Management System or its components are proven to be defective, provided that you comply with the requirements set forth in this warranty.

WARRANTY REQUIREMENTS AND CONDITIONS

1) The limited warranties contained herein extend exclusively to the original purchaser of the Energy Sentry Demand Management System and members of purchaser's immediate household. If you sell your house after installation of the Energy Sentry 9312, this warranty is non-transferable to the new owner(s).

2) The 9312 must be installed by a duly qualified electrical contractor who is appropriately licensed in the jurisdiction or an authorized dealer representative. Any removal and /or reinstallation must be done by a duly qualified and licensed electrical contractor (within the appropriate jurisdiction) or authorized dealer representative.

3) Repairs or replacement shall be undertaken by duly authorized service dealers or Brayden Automation Corporation. If you or any member of your family or any other unauthorized person manipulates, moves, alters, damages or attempts to repair or replace the Energy Sentry Demand Management Systems, the warranty shall be void and of no effect.

4) Notification to Brayden Automation Corporation or its authorized dealer under this warranty must be received within one week after discovering any defect in materials or workmanship.

5) If the Energy Sentry Demand Management System is removed and returned to the authorized service dealer or Brayden Automation Corporation, 6230 Aviation Circle, Loveland, CO 80538 for repair or replacement under this warranty, all shipping and handling charges must be prepaid by you. Transit damage is not covered by the warranty and Brayden Automation Corporation suggests you insure shipments to the service dealer or to the factory. Remember to send proof of date of installation as well as the serial number of the unit which is located on the inside of the Relay Unit.

6) The warranty does not apply if the Energy Sentry Demand Management System has been damaged by accident, alterations, abuse, misuse, improper installation, or act of nature, or as a result of service or modifications by

someone other than an authorized service representative.

7) In no event will Brayden Automation Corporation be liable for any lost profits, lost savings, incidental damages or other economic consequential damages, even if Brayden Automation Corporation has been advised of the possibility of such damages due to the proper or improper workings of the Energy Sentry Demand Management System.

8) This warranty is for factory service only. Brayden Automation Corporation will not be responsible for any field service expense for a licensed electrician or authorized service representative to service the Energy Sentry Demand Management System during or after the warranty period is in effect.

This warranty is expressly made in lieu of any other warranties expressed or implied specifically including any warranty of merchantability or fitness for a particular purpose.

This warranty is further conditioned on the return and receipt of the Warranty Registration Card.

This warranty gives you specific legal rights, and you may have other rights which vary from state to state.



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