A method and system for controlling the operation of a heat pump in a load management system. The system includes a heat pump control module positioned between a thermostat and the heat pump. The heat pump module includes a pair of switching elements positioned between the control outputs of the thermostat and the compressor and heating element of the heat pump. A transfer switch control unit can selectively open and close one of the switching elements to interrupt the control signals from the thermostat to the compressor and the heating element of the heat pump. The heat pump module is a self-contained unit including both of the switching elements such that a single load control module can be positioned between the thermostat and the heat pump and control both elements of the heat pump.
METHOD AND APPARATUS FOR CONTROLLING THE COOLING AND HEATING FUNCTIONS OF A HEAT PUMP

BACKGROUND

[0001] The present disclosure generally relates to a method and apparatus for selectively enabling the cooling and heating functions of a heat pump. More specifically, the present disclosure relates to a remote load control module for use with a heat pump that has a separate switching element to separately enable the operation of the cooling and heating elements of the heat pump.

[0002] When there is a power outage, backup power may be provided by a generator. In some cases, the generator is started automatically after detection of the power outage. A generator that is started automatically usually requires an automatic transfer switch to connect electrical loads to the generator rather than the utility power supply. A combination of the generator and the automatic transfer switch is generally installed by trained personnel.

[0003] Since the power supply of a generator is limited by the size of the generator, the amperage rating of the generator can limit the types and number of appliances that are connected to the generator during power outages. As an example, large appliances such as air conditioners, heat pumps, hot water heaters, and on-demand appliances such as microwave ovens and toasters can draw a significant amount of power that in combination may exceed the rating limit for the generator. Presently, automatic transfer switches are available that include a series of priority circuits that allow the automatic transfer switch to selectively reduce the load on the generator when the load approaches the rated limit for the generator. Typically, the priority circuits are assigned a value from 1 to a maximum number, such as 6 or 8, where the circuit assigned priority value 1 has the highest priority.

[0004] When the load on the generator approaches the rating for the generator, the automatic transfer switch begins to shed loads by opening switches or relays to disconnect the load connected to the lowest priority circuit. The automatic transfer switch continues to shed the loads from the lowest priority circuits to the highest priority circuit until the combined remaining load reaches the preset limit to ensure that the generator can continue to provide power to the highest priority loads connected to the generator. When the load on the generator is reduced, load shedding censuses and loads are added back to the generator.

[0005] One common type of load driven by a generator is a heat pump. Heat pumps typically include both a compressor for supplying cooling and a heating element for use in providing heat to the residence serviced by the heat pump. Presently, when heat pumps are used in combination with a load shedding transfer switch, two separate modules are utilized for the heat pump, one for control of the compressor and one for control of the heating element. The two load control modules are each individually connected to the transfer switch. The two modules thus require separate wiring and installation during the setup of the load management system.

SUMMARY

[0006] The present disclosure generally relates to a method and apparatus for managing a load powered by a generator during the loss of utility power. More specifically, the present disclosure relates to a heat pump control module coupled to a control unit contained within a transfer switch that allows the control unit to selectively shed separate loads associated with a heat pump to manage the amount of load applied to a generator during power interruption.

[0007] The load management system of the present disclosure includes a transfer switch positioned between a generator and a main breaker panel. When power is interrupted, the transfer switch activates the generator and disconnects the supply of electricity from the utility to the main breaker panel.

[0008] The transfer switch included in the load management system of the present disclosure includes a control unit that includes a plurality of control outputs. Each of the control outputs is connected to an electric load or the heat pump.

[0009] The load management system includes a heat pump control module that is positioned between the heat pump and a thermostat that controls operation of the heat pump. The heat pump control module includes a first switching element that is coupled to a heating element of the heat pump and a second switching element that is coupled to a compressor of the heat pump. The heating elements of the heat pump are used to generate heat, while the compressor of the heat pump is used to create the cooling function of the heat pump. Since the heating element and the compressor are typically activated at different times, the heat pump control module includes separate switching elements to enable the operation of each of the components separately.

[0010] A control unit contained within the transfer switch is operable to selectively enable operation of the heating element and the compressor of the heat pump by opening and closing the first and second switching elements. The first and second switching elements are each positioned between the control outputs of the thermostat and the heat pump such that when the switching elements are in the open position, control signals from the thermostat do not reach the heat pump. When the first and second switching elements are in the closed position, control signals from the thermostat can reach the heat pump such that the thermostat activates the compressor or the heating element to maintain temperature within the home at a desired level.

[0011] During operation of the load management system, a priority value is assigned to the heating element and the compressor separately. Since the heating element and the compressor are each coupled to separate switching elements, the control unit of the transfer switch can activate the switching elements separately to enable operation of the heating element and the compressor separately.

[0012] When electric power is disrupted to the transfer switch, the generator is activated and begins supplying power to each of the electric loads and the heat pump. The control unit of the transfer switch monitors the load on the generator and begins disconnecting the electric loads and the compressor and heating element of the heat pump when the combined load approaches the rating for the generator. The individual loads are managed based upon the priority values assigned to each of the loads. Since the compressor and heating element can be assigned separate priority values, the control unit of the transfer switch has added flexibility when controlling the operation of loads applied to the generator.

[0013] Any time during the supply of power by the generator or at any other time, the user can selectively reassign the priority values to each of the electric loads, as well as to the heating element and compressor of the heat pump. In one embodiment, the transfer switch control unit includes a user interface that allows the user to either select one of a plurality
of predefined priority assignment programs or assign priority values to each of the loads individually. Once the priority value have been assigned by the user, the transfer switch control unit sheds loads from the generator based upon the priority sequence.

[0014] Various other features, objects and advantages of the invention will be made apparent from the following description taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The drawings illustrate the best mode presently contemplated of carrying out the disclosure. In the drawings:

[0016] FIG. 1 is an electrical system having a load management system and heat pump control module of the present disclosure;

[0017] FIG. 2 is a schematic illustration of the priority circuits controlled by the transfer switch control unit;

[0018] FIG. 3 is a schematic illustration of the location of the heat pump control module between a thermostat and the heat pump;

[0019] FIG. 4 is a schematic illustration of the first and second switching elements of the heat pump control module;

[0020] FIGS. 5a-5c are examples of a display screen on a user input device that allow the user to adjust the priority assignments for the electric loads and heating and cooling elements of the heat pump; and

[0021] FIG. 6 is a flowchart illustrating one method of controlling the operation of the transfer switch to reassign priority values.

DETAILED DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 depicts a load management system 10. The load management system 10 includes a connection to a main power supply 11 through a meter 12. The power supply from the meter 12 is fed through an optional service disconnect switch 14 to a transfer switch 16. The transfer switch 16 carries out a series of functions, as will be described below and can also be referred to as a load-management controller. Throughout the following disclosure, the term “transfer switch” will be utilized with the understanding that the transfer switch 16 could also be referred to as a load-management controller.

[0023] The transfer switch 16 feeds electrical power to a main breaker panel 18 for the residence. The main breaker panel 18 includes a series of individual branch circuits 20 to provide electrical power to normal loads included in a residence, such as the lights, power outlets, etc.

[0024] In addition to the branch circuits 20, several high power consumption loads, such as a hot water heater 22 and a heat pump 24, are connected to the main breaker panel 18. The hot water heater 22 is connected to the main breaker panel 18 through a remote contactor 26. Although only a single remote contactor 26 is shown in FIG. 1, multiple remote contactors can be controlled, as will be described below with reference to FIG. 2. The remote contactor 26 is shown in FIG. 1 as receiving a power line carrier signal along power lines 30 from the transfer switch 16. The high power consumption loads can be disconnected from the power supply through the remote contactors based upon signals from the transfer switch 16, as will be described.

[0025] Although remote contactor 26 is illustrated in FIG. 1 as controlling the supply of power to the high power consumption load, it is contemplated that different types of interconnect device could be utilized. As one example, instead of utilizing the remote contactor 26, the transfer switch 16 could include internal relays that can be selectively opened or closed to supply power to the high power consumption loads, such as the hot water heater 22. Throughout the remaining portions of the disclosure, remote contactors will be shown and described. However, it should be understood that different types of interconnect devices, such as internal relays within the transfer switch 16, could be utilized while operating within the scope of the present disclosure.

[0026] The transfer switch 16 is connected to a generator 34 through connection 36. As is well known, when the supply of power from the utility is interrupted, a control unit within the transfer switch 16 senses the interruption of power. The transfer switch 16 then sends a signal to turn on the generator 34 and controls switches in the transfer switch 16 to direct the supply of electricity generated by the generator 34 to the main breaker panel 18. When the connection is made between the generator 34 and the main breaker panel 18, the connection between the utility power supply 11 and the main breaker panel 18 is disrupted such that electricity is supplied only by the generator 34.

[0027] In the configuration shown in FIG. 1, a heat pump control module 38 is positioned between a thermostat 41 and the heat pump 24. The thermostat 41 generates control signals that control the operation of various components of the heat pump 24. Typically, the heat pump 24 includes a compressor for cooling and a heating element including a series of resistive heat strips for heating functions. The heat pump control module 38 receives control signals from the transfer switch 16 through the power line 32 to control the operation of the heat pump control module 38, as will be described in greater detail below.

[0028] Referring now to FIG. 2, the main breaker panel 18 is connected to a transfer switch control unit 39. The control unit 39 can include any type of microcontroller that can be programmed to control the operation of various different functions of the transfer switch as is well known. In the embodiment shown in FIG. 2, only several of the connections to the main breaker panel 18 are illustrated. However, it should be understood that various other operating connections are included in the transfer switch and with the main breaker panel 18.

[0029] The control unit 39 controls the supply of power from the generator to a plurality of priority circuits through a series of control outputs on the main breaker panel 18, numbered 1-8 in FIG. 2. In the embodiment shown in FIGS. 1 and 2, the control unit 39 can send separate control outputs to the remote contactor 26 shown in FIG. 1. The remote contactor 26 includes a relay circuit that can be selectively opened or closed by the transfer switch control unit 39 to selectively allow power to be supplied to the hot water heater 22 shown in FIG. 1. As previously described, the remote contactor 26 could be replaced by internal relays contained within the main breaker panel 18 and operated by the transfer switch control unit 39.

[0030] During the initial set up of the embodiment shown in FIG. 2, the heat pump control module 38 is connected to the first and second control outputs 40 and 42. Water heater 22 is connected to the third control output 44 through the remote contactor 26. In the embodiment illustrated, pool pump 56 is connected to the fourth control output 46 through remote contactor 58. An electric baseboard heater 60 is connected to the fifth control output 48 through the remote contactor 62. A dryer 64 is connected to the sixth control output 50 through
remote contactor 66. Stove 68 is connected to the seventh control output 52 through remote contactor 70. Another generic electric load 72 is shown connected to the eighth control output 54 through the remote contactor 74.

As illustrated in FIG. 2, the transfer switch control unit 39 controls eight control outputs (40-54) of the main breaker panel 18 such that a total of eight individual loads can be controlled by the transfer switch control unit 39 through the control outputs (40-54). Although eight individual control outputs are shown in the embodiment of FIG. 2, it should be understood that the transfer switch control unit 39 could be designed having fewer or more control outputs while operating within the scope of the present disclosure.

FIG. 3 illustrates the interconnections between the main breaker panel 18 and the heat pump 24 through the heat pump control module 38. As illustrated in FIG. 3, a supply of electrical power leads from the main breaker panel 18 to the heat pump 24, as illustrated by lines 76.

The heat pump control module 38 receives power from the lines 76 and is coupled to thermostat 41 through a first pair of low voltage control lines 78 and a second pair of low voltage control lines 80. The low voltage control lines 78, 80 provide control signals from the thermostat 41 to the heat pump 24 to activate either the compressor or the heating element within the heat pump 24. In the embodiment shown in FIG. 3, the control lines 78 control the heating element of the heat pump 24 while the control lines 80 control the operation of the compressor within the heat pump 24. Although not shown in FIG. 3, the control lines 78, 80 extend from the heat pump control module 38 to the heat pump 24, as best shown in FIG. 1. The heat pump control module 38 is positioned between the thermostat 41 and the heat pump 24 to selectively allow and interrupt the delivery of control signals from the thermostat to the heat pump 24.

FIG. 4 illustrates a schematic representation of the position of the heat pump control module 38 between the transfer switch control unit 39 and the heat pump 24. As illustrated in FIG. 4, the control line 78 from the thermostat 41 is connected to a first contact 82. The first contact 82 is connected to a first switching element 84 contained as part of the heat pump control module 38. The first switching element 84 is selectively positionable in either an open position or a closed position, as illustrated in FIG. 4. When the first switching element 84 is in the open position, the signal from the first contactor 82 is interrupted from reaching the second contactor 86. When the first switching element 84 is in the closed position, the signal received at the first contactor 82 is able to pass through the first switching element 84 to the second contactor 86. The second contactor 86 is connected to the heating element 88 contained within the heat pump 24.

The second control line 80 leaving the thermostat 41 is connected to a third contactor 90. The third contactor 90 is connected to a second switching element 92 formed as part of the control module. The second switching element 92 is also movable between an open position and a closed position. When the second switching element 92 is in the closed position, control signals from the third contactor 90 reach a fourth contactor 94. In the embodiment shown in FIG. 4, the compressor 96 of the heat pump 24 is connected to the fourth contactor 94. When the second switching element 92 is in the open position, control signals from the thermostat 41 are prevented from reaching the compressor 96.

The first and second switching elements 84, 92 shown in FIG. 4 are selectively controllable by the transfer switch control unit 39. Thus, the transfer switch control unit 39 can selectively open or close the first switching element 84 separate from the second switching element 92. Since the first and second switching elements are separate, the priority level of the heating element 88 and the compressor 96 can be separately set, as will be described in greater detail below.

During the initial set up of the transfer switch, the user selects the priority level for each of the remote contactors 26, 38, 58, 62, 66, 70, and 74 based upon the type of load that is connected to each of the eight control outputs 40-54. This setting can be made at the actual remote contactors. Alternatively, in another contemplated embodiment shown in FIG. 2, a user interface device 98 is connected to the transfer switch control unit 39. The user interface device 98 preferably includes a display screen and some type of input device that allows the user to enter information into the control unit 39. As an example, when the system is set up as shown in FIG. 2, the user enters information into the control unit 39 to indicate that the compressor 96 of the heat pump 24 is connected to control output 40, the heating element 88 of the heat pump 24 is connected to control output 42, the water heater 22 is connected to control output 44, the pool pump 56 is connected to control output 46, and so on. Once this information is entered into the control unit 39 through the user interface device 98, the control unit 39 can maintain a database indicating the type of device connected to each of the eight control outputs 40-54. When the system is initially set up as shown in FIG. 2, the compressor 96 connected to the first control output 40 is initially assigned the highest priority value while the load 72 connected to the eighth control output 54 is initially assigned the lowest priority value.

When electrical power is interrupted, the generator 34 begins to operate and supplies electric power to the transfer switch. When electric power is being supplied from the generator, the transfer switch control unit 39 monitors the operation of the generator 34 to determine the amount of power being generated by the generator 34, which represents the total combined load seen by the generator, which includes not only the priority circuits but also all of the loads within the residence. When the transfer switch control unit 39 detects a combined current draw from all of the loads in the residence that approaches a first percentage amount of the rated load capacity for the generator 34, the transfer switch control unit 39 begins to shed loads in a manner to be described. As an example, when the load reaches approximately 85% of the rating for the generator 34, the transfer switch control unit 39 begins to shed loads, as will be described.

During normal operating conditions of the generator, when the combined load calculated by the transfer switch control unit 39 approaches the rated percentage amount for the generator, the transfer switch control unit initially begins to shed load by first shedding the lowest priority load 72 connected to the eighth control output 54 through the contactor 74. Once load 72 has been shed, the transfer switch control unit again monitors for the current draw. If the current draw still exceeds the allowable threshold, the next lowest priority load connected to the seventh control output 52 is shed. This process continues until enough load is shed to bring the combined load on the generator below the rated value for the generator. As can be understood in FIG. 2, during the initial set up, the highest priority load, which in the embodiment of FIG. 2 is the compressor of the heat pump 24, is connected to the first control output 40. The second highest priority load, namely the heating element of the heat pump, is connected to
the second control output 42. Thus, when the load on the generator 34 exceeds the rated value, the transfer switch control unit 39 begins to sequentially shed loads from the eighth control output 54 to the first control output 40. Therefore, during initial installation of the transfer switch, the individual loads are connected to the transfer switch control unit in the priority sequence shown in FIG. 2.

[0040] As described above, any one of the loads can be shed by simply sending a signal from the transfer switch control unit 39 to the contactor associated with the load to cause a relay to open to interrupt power supply from the generator 34 to the individual load. Once the combined load on the generator 34 falls below the rated value, the relays contained in each of the contactors can be closed in a reverse priority order such that current from the generator is again supplied to the electric loads.

[0041] As an example, the preset maximum amount of load on the generator 34 is 85%, although other percentages can be used. When the total current draw drops far enough below the 85% preset maximum, additional loads can be added to the generator 34.

[0042] As discussed previously, during the initial set up of the transfer switch control unit 39 shown in FIG. 2, each of the electric loads are connected to one of the eight control outputs 40-54. During the initial set up, the electric load connected to the first control output 40 is assigned the highest priority value of 1 and the electric load connected to the control output 54 is assigned the lowest priority value of 8. However, in accordance with one contemplated embodiment of the present disclosure, the transfer switch control unit 39 is able to reassign the priority values assigned to each of the control outputs 40-54, and thus the loads connected to the outputs, utilizing internal programming contained within the control unit 39.

[0043] During normal operation of the control unit 39, the control unit sheds each of the electric loads connected to the control outputs based upon the priority value assigned to the load. Although the loads may be assigned priority values based upon a perceived importance of the loads during normal conditions, the priority for each of the loads may change during a power outage or based upon the particular situation. As an example, during a power outage during a holiday family event, the home residents may desire to place a higher priority on the stove 68 rather than the compressor of the heat pump 24. In accordance with the present disclosure, the method and system allows the user to adjust the priority values assigned to each of the loads dynamically through the user interface device 98.

[0044] Referring now to FIG. 5a, a user interface is shown in one embodiment of the disclosure. Although the graphical user interface (GUI) shown FIG. 5a is one contemplated embodiment, it should be understood that various different embodiments could be utilized while operating within the scope of the present disclosure.

[0045] The display 100 shown in FIG. 5a includes a priority label 102 above a column of priority values 104. As previously described, the main breaker panel 18 includes eight control outputs and thus includes eight priority values 104. The display further includes a device heading 108 positioned above eight individual device labels 110. The device labels 110 can be changed by the control unit as desired.

[0046] The display further includes a program heading 112. The program heading 112 is positioned above three separate programs 114 designated by labels A, B and C. In addition, the program heading 112 also includes a user defined setting 116.

[0047] In the embodiment shown in FIG. 5a, the user interface device 98 includes a touch-screen display 100 that allows the user to enter input commands into the user interface device 98. The user interface device 98 could be positioned either near the transfer switch or, alternatively, remotely from the transfer switch, such as in a room within the residence. If the user interface device 98 is positioned remotely from the transfer switch, the user interface device 98 can communicate with the transfer switch either through a wired or wireless connection. Alternatively, it is contemplated that the user interface 98 could be shown on a home computer or other similar device in communication with the transfer switch.

[0048] Referring back to FIG. 5a, during initial set up, each of the electric loads is assigned an initial priority value based upon the control output to which the electric load is connected. The initial set up is referred to as the default setting and is indicated by program label A in FIG. 5a. The initial assignment of priority values to each of the control outputs, and thus the loads connected to the control outputs, is determined based on the physical connections to the transfer switch at the time the transfer switch is initially connected to the electric loads.

[0049] If the user desires to change the priority assignments, the user can select one of the two other predefined priority assignment programs indicated by reference characters B and C in FIG. 5a. As an illustrative example, the priority assignment program B can be defined such that the stove is assigned priority value 1, the heat pump compressor assigned priority value 2, the dryer assigned priority value 3 and so on as shown in FIG. 5b.

[0050] If the user selects the predefined priority assignment program C, the priority values are reassigned as shown in FIG. 5c. As an example, when program C is selected, the dryer is assigned priority value 1, the compressor of the heat pump is assigned priority value 2, the stove is assigned priority value 3 and so on, as illustrated in FIG. 5c. As can be understood in FIGS. 5a-5c, the priority values assigned to each of the electric loads can be modified by allowing the user to select one of the three predefined priority assignment programs A-C. Although three predefined priority assignment programs are shown, it should be understood that additional predefined priority assignment programs could be incorporated into the display while operating within the scope of the present disclosure.

[0051] In addition to the predefined priority assignment programs A-C shown in FIG. 5a, the display also includes a user defined setting 116. When the user defined setting 116 is selected by the user, the user can individually assign priority values to each of the loads depending upon the currently perceived priority for each of the loads by the user. As an example, if a power outage occurs during a very cold day, the user may wish to select the baseboard heater 60 as the highest priority load and the compressor as the lowest priority load. Alternatively, during a family function in which food is being cooked, the stove may be the highest priority load for the home occupant. By selecting the user defined setting 116, the home occupant can control which of the loads are shed first and which load is assigned the highest priority directly from the display.

[0052] As can be understood in FIG. 2, during the initial set up of the transfer switch control unit 39, the installer defines,
in the main breaker panel 18, which load is connected to which of the control outputs 40-54. As set forth previously, the control unit can shed load by simply opening or closing the interconnect devices positioned between the electric loads and the transfer switch control unit. In the embodiment shown, each load is connected to the control unit through a contactor, such as contactors 26 and 38. Alternatively, the connection between the loads could be carried out by a relay contained within the main breaker panel 18. In either case, the control unit 39 can selectively shed loads in any order defined by the user once the transfer switch control unit 39 has been programmed to define which of the loads is connected to which of the control outputs.

[0053] As can be understood in the drawings and description, the heat pump control module 38 positioned between the thermostat 41 and the heat pump 24 allows the transfer switch control unit 39 to selectively enable the operation of the compressor and heating element separately within the single heat pump 24. The single heat pump control module 38 having the two switching elements 84 and 92 provides greater flexibility in the control of the operation of the heat pump 24 while reducing the number of components and complexity of the system. As previously described, the first and second switching elements are independently controllable by the transfer switch control unit 39 through separate signals sent to each of the switching elements.

[0054] Referring now to FIG. 6, the operation of the control unit will now be described. Initially, when the control unit determines that electric power has been lost from the utility, the control unit sends a start signal to the generator, as illustrated in step 120. In addition to starting the generator, the control unit closes the priority circuits starting with priority level 1 to 8 until the preset generator shed load is reached, as illustrated in step 122.

[0055] Upon power interruption and activation of the generator, the control unit determines in step 124 whether the total load for a combination of all the priority output circuits as well as the load distributed through the branch circuits 20 connected to the main breaker panel 18 in FIG. 1 is less than the generator rating. As indicated previously, the generator is typically operated at a percent of its maximum output, such as 85%.

[0056] If the current load on the generator is less than the rating, the transfer switch control unit continues to maintain all of the priority output circuits in a closed position such that power from the generator is supplied to each of the priority loads. However, if the system determines in step 124 that the combined load is no longer below the generator rating, the system begins to shed load by opening the relay associated with the lowest priority circuit still closed, as indicated in step 126. In the embodiment of FIG. 2, the system first opens the contactor 74 on the eighth control output 54, as indicated in step 126 of FIG. 4.

[0057] After the first load is shed in step 126, the system determines in step 128 whether the total load on the generator is now below the generator rating. If the total load is not below the generator rating, the system will return to step 126 and shed the next lowest priority load on the seventh control output 52. This sequence continues until the transfer switch control unit has opened the required number of priority circuits to decrease the load on the generator below the generator rating. As an example, the transfer switch control unit may need to open the relays associated with priority outputs 5-6 to bring the total load on the generator below the generator rating.

[0058] Once enough of the load has been shed, the system determine in step 130 whether the user has entered an input into the user interface device indicating that the user wishes to reassign the priority values for the loads. If the user has indicated such a desire to change the priority values, the system reassigns the priority values in the control unit, as shown in step 132. The reassignment of the priority values can be based upon either the selection of one of the predefined priority assignment programs A-C or based upon user controlled assignments of priority values to each of the loads individually.

[0059] Once the priority values have been reassigned in step 132, the system adjusts which of the priority circuits are opened and closed, as indicated in step 134. As an example, if the stove moved from priority value number 6 to priority value number 1, the system will cause the contactor 70 positioned between the stove 68 and the main breaker panel 18 to close, thus applying electric power to the stove 68. At the same time, the control unit 39 will close other contactors based upon the reassigned priority values. Once the priority circuits have been adjusted, the control system monitors the load on the generator in step 136 and again determines whether the load is below the generator rating in step 138. If the load is not below the generator rating, the system returns to step 126 and opens the lowest priority circuit still closed.

[0060] However, if the system determines in step 138 that the load is below the generator rating, the system determines whether the highest priority circuit that is open can be closed without exceeding the rating of the generator, as illustrated in step 140. This step ensures that the system provides power to the highest priority loads if and when the total load on the generator falls, such as when a device is turned off, such as the microwave oven. The system ensures that when the total overall load decreases, the system activates the highest priority loads that are disconnected first and only activates lower priority loads when the lower priority loads do not exceed the rating of the generator. In the manner described above, although various loads are initially connected to priority control outputs based upon their importance during the initial installation, the transfer switch control unit is capable of reassigning priority values to each of the loads without actually requiring the loads to be rewired to the transfer switch. In this manner, the system allows the user to selectively reassign priority values, either before or during a power outage.

We claim:
1. A load management system for managing the operation of a heat pump powered by a generator, the system comprising:
   a) a transfer switch coupled to the generator;
   b) a heat pump control module positioned between the heat pump and a thermostat, the heat pump control module including a first switching element coupled to a heating element of the heat pump and a second switching element coupled to a compressor of the heat pump;
   c) a control unit contained within the transfer switch and operable to selectively enable operation of the heating element and the compressor of the heat pump, the control unit being configured to:
      i. assign a first priority value to the heating element;
      ii. assign a second priority value to the compressor, wherein the first priority value is different than the second priority value;
      iii. monitor the combined load on the generator; and
      iv. selectively enable and disable operation of the heating element and the compressor based upon the first and second priority values assigned to each.
2. The load management system of claim 1 further comprising a plurality of electric loads powered by the generator, wherein the control unit is configured to:

assign a priority value to each of the electric loads, wherein the priority value assigned to each of the electric loads and the first and second priority values range between a highest priority value and a lowest priority value; selectively disconnect the electric loads, the heating element and the compressor from the generator in a sequential order based upon the priority value assigned to each load, the heating element and the compressor, wherein the lowest priority values are sequentially disconnected until the combined load on the generator falls below a rated value for the generator.

3. The load management system of claim 1 wherein the heat pump control module is a self-contained unit.

4. The load management system of claim 3 wherein the first and second switching elements are independently movable between an open position and a closed position.

5. The load management system of claim 1 wherein the first priority value and the second priority value are adjustable within the control unit.

6. A heat pump control module positioned between a thermostat and a heat pump, the control module comprising:

a first switching element movable between an open position to prevent control signals from the thermostat from reaching the heat pump and a closed position to allow control signals from the thermostat to reach the heat pump; and

a second switching element movable between an open position to prevent control signals from the thermostat from reaching the heat pump and a closed position to allow control signals from the thermostat to reach the heat pump,

wherein the first and second switching elements are independently movable between the open and closed positions.

7. The heat pump control module of claim 6 wherein the first and second switching elements are contained within a single housing.

8. The heat pump control module of claim 6 wherein the first switching element is connected to a heating element of the heat pump and the second switching element is connected to a cooling element of the heat pump.

9. The heat pump control module of claim 8 further comprising a first contact pair connected to the heating element of the heat pump, wherein the first switching element is connected between the first contact pair.

10. The heat pump control module of claim 9 further comprising a second contact pair connected to the compressor, wherein the second switching element is connected across the second contact pair.

11. A load management system for managing the operation of a heat pump and an electric load powered by a generator, the system comprising:

a transfer switch coupled to the generator;

a heat pump control module positioned between the heat pump and a thermostat, the heat pump control module including a first switching element coupled to a heating element of the heat pump and a second switching element coupled to a compressor of the heat pump;

a remote contactor coupled to the electric load; and

a control unit contained within the transfer switch and operable to selectively enable operation of the heating element, the compressor of the heat pump and the electric load.

12. The load management system of claim 11 wherein the control unit is configured to:

assign an initial priority value to the electric load, the heating element and the compressor;

monitor the combined load on the generator; and

selectively enable and disable operation of the heating element, the compressor and the electric load based upon the priority values assigned to each.

13. The load management system of claim 12 wherein the control unit is further configured to:

selectively reassign priority values to the electric load, the compressor and the heating element based upon user input; and

enable operation of the compressor, the heating element and the electric load based upon the reassigned priority values.

14. The load management system of claim 13 further comprising a user interface device coupled to the control unit of the transfer switch, wherein the user reassigns priority values for the electric load, the heating element and the compressor through the user interface device.

15. The load management system of claim 11 wherein the heat pump control module is a self-contained unit.

16. The load management system of claim 15 wherein the first and second switching elements are independently movable between an open position and a closed position.