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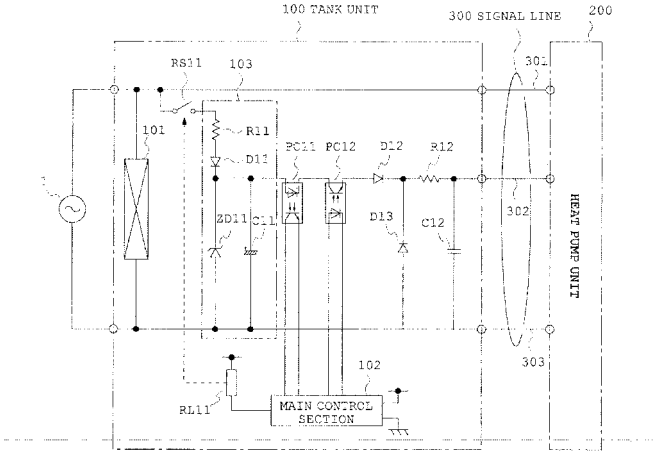
(54) HEAT-PUMP TYPE WATER HEATER

(57) In a heat pump type hot water supply apparatus including a tank unit 100 and a heat pump unit 200, the tank unit 100 includes a direct-current power circuit 103 for data communication between the units, and a relay switch RS11 for switching supply and stop of alternating-current power to the direct-current power circuit 103. A main control section 102 controls the relay switch RS11 to supply direct-current power from the direct-current power circuit 103 only when the data communication processing between the units is performed.

Fig. 1



EP 2 251 618 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a hot water supply apparatus using a heat pump as a heat source, and more particularly, to a power-saving technique.

BACKGROUND ART

[0002] A hot water supply apparatus disclosed in Patent Document 1 has been conventionally known as this type of heat pump type hot water supply apparatus. The hot water supply apparatus disclosed in Patent Document 1 includes a heat pump unit having a heat exchanger or the like, and a tank unit having a hot water storage tank, a water supply pump or the like. The hot water supply apparatus heats water and stores hot water in the tank unit using heat obtained in the heat pump unit, and supplies hot water when necessary. The heat pump unit and the tank unit are connected through a three-wire signal line. Commercial alternating-current power is supplied to the tank unit. Meanwhile, the heat pump unit receives the commercial alternating-current power from the tank unit through the signal line. The alternating-current power supply through the signal line is performed by using two wires in the signal line. Two-way data communication is also performed between a control section of the heat pump unit and a control section of the tank unit through the signal line. The data communication through the signal line is performed by using two wires in the signal line. That is, one of the wire lines in the signal line is used for transmitting both the alternating-current power and the data communication. Since the three-wire signal line is thin, thus easily wired, and also widely distributed in the market at low cost, the three-wire signal line is used instead of a four-wire signal line. For example, Patent Document 2 discloses a connection technique as this type of connection technique between the two units.

[0003] The configuration disclosed in Patent Document 2 includes a direct-current power circuit having a rectifying diode, a voltage regulating zener diode, and a smoothing capacitor. The direct-current power circuit is used exclusively for transmitting data communication. Units are connected such that direct current supplied from the direct-current power circuit flows through a closed circuit including a signal line and provided over the units. The communication between the units is enabled by turning ON and OFF the electric current flowing through the closed circuit by a photo coupler.

PATENT DOCUMENT 1: Japanese Patent Publication 2007-192499

PATENT DOCUMENT 2: Japanese Patent Publication H08-270122

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] In the conventional hot water supply apparatus, however, the direct-current power is supplied to the closed circuit including the signal line from the direct-current power circuit even while the communication between the units is not being performed. Thus, power consumption is increased. To be more specific, electric power of about 0.5 to 1.0 W is consumed even when no communication is performed.

[0005] The present invention has been made in view of the aforementioned circumstance, and it is an object of the present invention to provide a heat pump type hot water supply apparatus capable of suppressing power consumption.

MEANS FOR SOLVING THE PROBLEMS

[0006] In order to achieve the above object, the present invention provides a heat pump type hot water supply apparatus having a heat exchanger and a hot water supply device for supplying water heated by the heat exchanger, including a first control device for controlling the hot water supply device, and a second control device for controlling the heat exchanger, the first control device including a communication control section used for data communication with the second control device, a direct-current power circuit for supplying direct-current power used for the data communication using the communication control section, a main control section for performing the data communication using the communication control section and controlling operation of the hot water supply device, and switching means for switching supply and stop of the direct-current power by the direct-current power, and the main control section controlling the switching means to supply the direct-current power only when the communication using the communication control section is performed.

[0007] Witch the present invention, when not performing the communication using the communication control section, the main control section controls the switching means to stop the supply of the direct-current power from the direct-current power circuit. Accordingly, power consumption during no communication can be suppressed.

[0008] As an example of preferred embodiments according to the present invention, in the heat pump type hot water supply apparatus, the direct-current power circuit includes a voltage regulating zener diode, and the switching means switches power supply and supply stop to the zener diode. With the present invention, the power supply to the zener diode is stopped when no communication is performed. Thus, power consumption by the element can be reduced.

ADVANTAGES OF THE INVENTION

[0009] As described above, with the present invention, when not performing the communication using the communication control section, the main control section controls the switching means to stop the supply of the direct-current power from the direct-current power circuit. Accordingly, power consumption during no communication can be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a circuit diagram of a communication control device of a heat pump type hot water supply apparatus;
Figure 2 is a circuit diagram of a communication control device of the heat pump type hot water supply apparatus; and
Figure 3 is a flowchart for explaining the operation of a main control section of a tank unit.

DESCRIPTION OF SYMBOLS

[0011] 1 ... Commercial alternating-current power, 100 ... Tank unit, 102 ... Main control section, 103 ... Direct-current power circuit, RS11 ... Relay switch, RL11 ... Relay coil, PC11 ... Receiving photo coupler, PC12 ... Transmitting photo coupler, 200 ... Heat pump unit, 202 ... Main control section, PC21 ... Receiving photo coupler, PC22 ... Transmitting photo coupler, 300 ... Signal line

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] A heat pump type hot water supply apparatus according to one embodiment of the present invention will be described by reference to the drawings. Figures 1 and 2 are circuit diagrams of an operation control device of the heat pump type hot water supply apparatus. In Figures 1 and 2, only characteristic features of the present invention are shown for the simplicity of illustration.

[0013] In the heat pump type hot water supply apparatus, a heat pump unit 200 installed outdoors or indoors such as a boiler room and having a heat exchanger, and a tank unit 100 having a hot water storage tank and a hot water supply pump, and heating water and supplying hot water using heat obtained in the heat pump unit are connected through a three-wire signal line 300 as shown in Figures 1 and 2. Single-phase two-wire system commercial alternating-current power 1 is supplied to the tank unit 100.

[0014] The tank unit 100 supplies the commercial alternating-current power 1 to a first wire line 301 and a third wire line 303 of the signal line 300 as shown in Figure 1. In the tank unit 100, the commercial alternating-current power 1 is supplied to a load device 101 with a power source of alternating current such as a hot water supply pump, and also to a direct-current power circuit (not shown). The tank unit 100 includes a main control section 102 having a microcomputer or the like. The main control section 102 is operated by direct-current power supplied from the direct-current power circuit (not shown).

[0015] In the tank unit 100, direct-current power for data communication with the heat pump unit 200 is obtained by a data communication direct-current power circuit 103 including an electric current limiting resistor R11, a rectifying diode D11, an electric voltage limiting zener diode ZD11, and a smoothing capacitor C11. A relay switch RS11 controls the supply of alternating-current power to the direct-current power circuit 103. The direct-current power supplied from the direct-current power circuit 103 flows through a closed circuit formed between the tank unit 100 and the heat pump unit 200. A communication control section of the tank unit 100 controls the flows of the direct-current power corresponding to a communication message by a photo coupler described below to thereby enable data communication with the heat pump unit 200. In the following, the connection condition of the direct-current power circuit 103 and the circuit configuration of the communication control section of the tank unit 100 will be described.

[0016] The negative side of the power circuit 103 is connected to the third wire line 303 of the signal line 300. Meanwhile, the positive side of the power circuit 103 is connected to a second wire line 302 of the signal line 300 through the light emission side of a receiving photo coupler PC11, the light receiving side of a transmitting photo coupler PC12, a backflow preventing diode D12, and a resister R12 constituting a filter circuit. A backflow preventing diode D13 is connected to the diode D12 on the downstream side thereof parallel to the power circuit 103. A capacitor C12 constituting the filter circuit is connected to the diode D13 on the downstream side thereof parallel to the diode D13. The light receiving side of the receiving photo coupler PC11 and the light emission side of the transmitting photo coupler PC12 are connected to the main control section 102. A relay coil RL11 operating in conjunction with the relay switch RS11 is connected to the main control section 102.

[0017] The heat pump unit 200 is operated by the commercial alternating-current power supplied through the first wire line 301 and the third wire line 303 of the signal line 300 as shown in Figure 2. The commercial alternating-current power is supplied to a load device 201 with a power source of alternating current such as a compressor or an air blower, and also to a direct-current power circuit (not shown). The heat pump unit 200 includes a main control section 202 having a microcomputer or the like. The main control section 202 is operated by direct-current power supplied from the direct-current power circuit.

[0018] Communication data transmitted through the second wire line and the third wire line of the signal line

300 is supplied to the light emission side of a receiving photo coupler PC21 and the transmitting side of a transmitting photo coupler PC22 through a filter circuit having a resistor R21 and a capacitor C21, a backflow preventing diode D21 and an electric voltage limiting zener diode ZD21. The light receiving side of the receiving photo coupler PC21 and the light emission side of the transmitting photo coupler PC22 are connected to the main control section 202.

[0019] Next, the operation of the main control section 102 of the tank unit 100 will be described by reference to Figure 3. Figure 3 is a flowchart for explaining the operation of the main control section 102 at the time of performing data communication. The main control section 102 stops the supply of alternating-current power to the data communication direct-current power circuit 103 by controlling power supply to the relay coil RL11 and thereby bringing the relay switch RS11 into an open state when no communication is performed. The main control section 102 starts the supply of alternating-current power to the data communication direct-current power circuit 103 by controlling power supply to the relay coil RL11 and thereby bringing the relay switch RS11 into a closed state when communication with the heat pump unit 200 is performed (step S1). Data communication between the units is thereby enabled, and the main control section 102 performs data communication processing by using the receiving photo coupler PC11 and the transmitting photo coupler PC12 (step S2). When required data communication processing is completed, the main control section 102 stops the supply of alternating-current power to the data communication direct-current power circuit 103 by controlling power supply to the relay coil RL11 and thereby bringing the relay switch RS11 into an open state (step S3).

[0020] As described above, in the heat pump type hot water supply apparatus according to the present embodiment, the alternating-current power is supplied to the data communication direct-current power circuit 103 of the tank unit 100 only when the data communication is performed. In other words, the alternating-current power is not supplied to the direct-current power circuit 103 when no communication is performed. Accordingly, power consumption during no communication can be suppressed.

[0021] Although one embodiment of the present invention is described above in detail, the present invention is not limited thereto. For example, the circuit shown in Figure 1 is employed as the data communication direct-current power circuit 103 in the above embodiment. However, many power circuit may carry out the present invention. Although the relay switch is used as switching means for switching the supply and stop of the alternating-current power to the direct-current power circuit 103 in the above embodiment, another switching element such as a transistor may be also used.

[0022] Also, in the present embodiment, both the tank unit 100 and the heat pump unit 200 are provided as separate casings, and can be thus installed at separate locations from each other. However, the two units may be installed at the same location. In this case, the tank unit 100 and the heat pump unit 200 may be provided as the separate casings as in the above embodiment and vertically stacked, or installed side by side. Alternatively, the tank unit 100 and the heat pump unit 200 may be provided in a common casing.

Claims

1. A heat pump type hot water supply apparatus having a heat exchanger and a hot water supply device for supplying water heated by the heat exchanger, comprising
   a first control device for controlling the hot water supply device, and a second control device for controlling the heat exchanger,
   the first control device comprising a communication control section used for data communication with the second control device, a direct-current power circuit for supplying direct-current power used for the data communication using the communication control section, a main control section for performing the data communication using the communication control section and controlling operation of the hot water supply device, and switching means for switching supply and stop of the direct-current power by the direct-current power, and
   the main control section controlling the switching means to supply the direct-current power only when the communication using the communication control section is performed.

2. The heat pump type hot water supply apparatus according to claim 1, wherein the direct-current power circuit comprises a voltage regulating zener diode, and the switching means switches power supply and supply stop to the zener diode.

Fig. 1

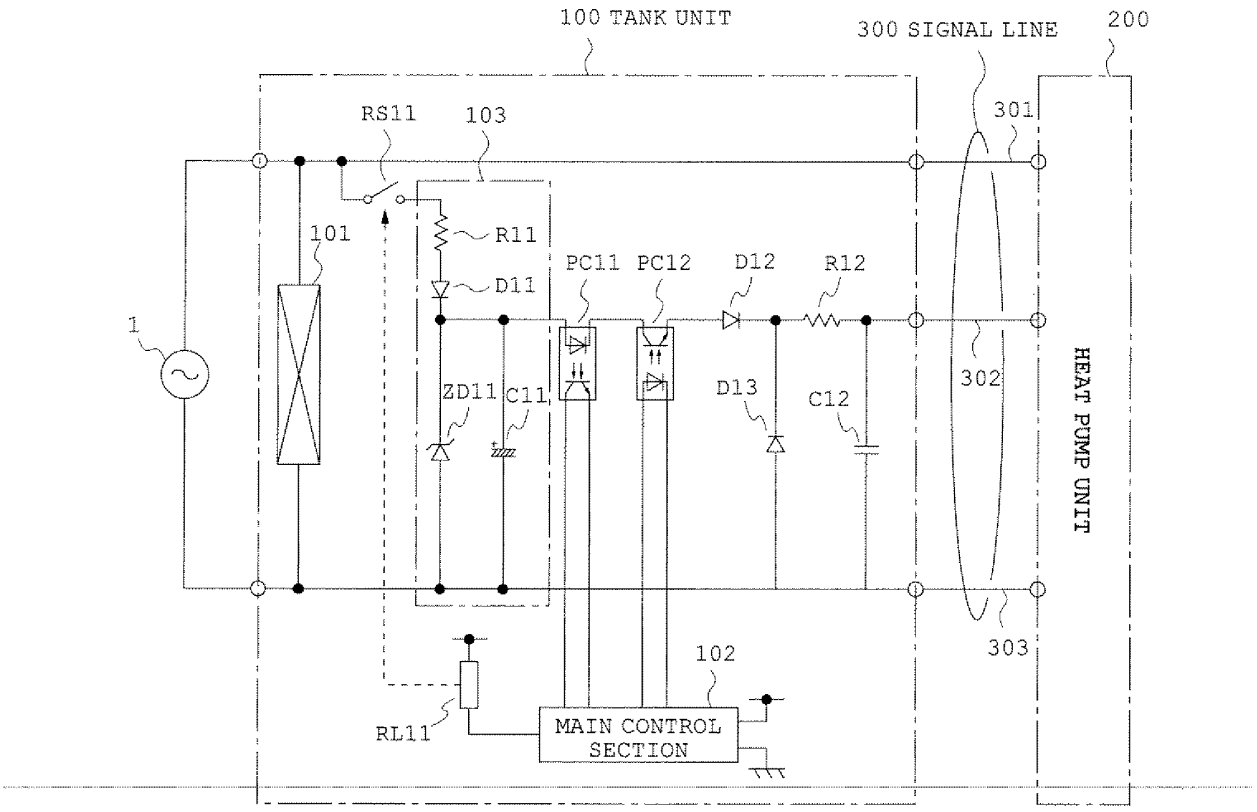

100 TANK UNIT
300 SIGNAL LINE
200
RS11
103
301
101
R11
D11
PC11
PC12
D12
R12
1
ZD11
C11
D13
C12
302
HEAT PUMP UNIT
303
102
RL11
MAIN CONTROL SECTION

Fig. 2

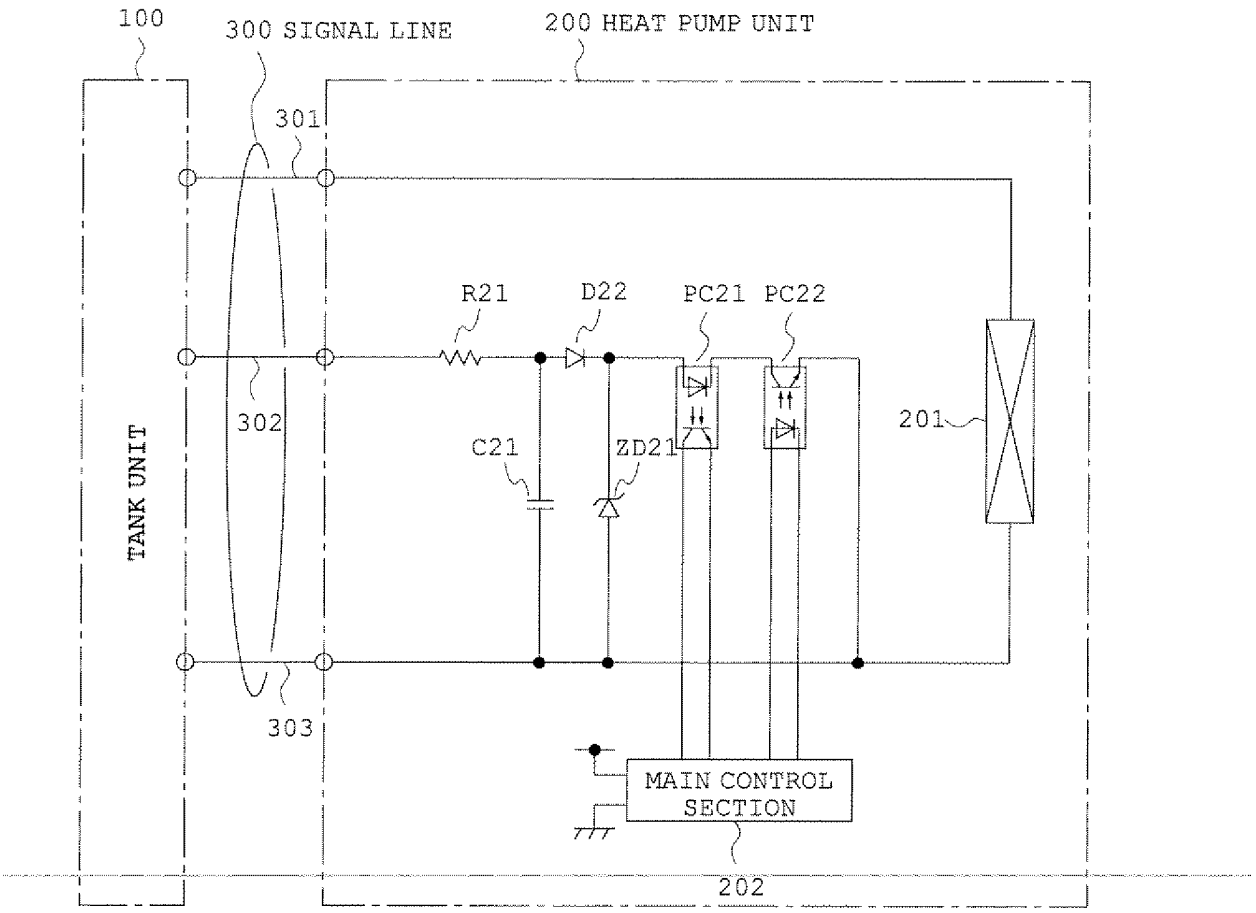
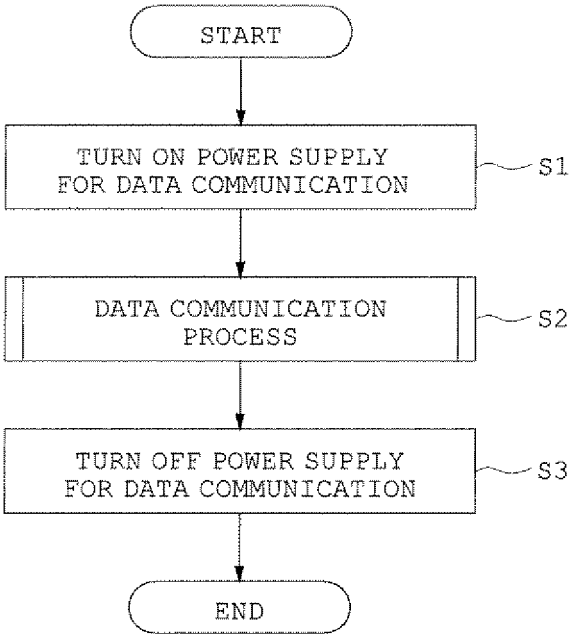

100
300 SIGNAL LINE
200 HEAT PUMP UNIT
301
R21
D22
PC21
PC22
201
302
C21
ZD21
TANK UNIT
303
MAIN CONTROL SECTION
202

Fig. 3


START
TURN ON POWER SUPPLY FOR DATA COMMUNICATION
S1
DATA COMMUNICATION PROCESS
S2
TURN OFF POWER SUPPLY FOR DATA COMMUNICATION
S3
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/063964

A. CLASSIFICATION OF SUBJECT MATTER
F24H1/18(2006.01)i, *F24H1/00*(2006.01)i, *F25B49/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24H1/18, F24H1/00, F25B49/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-298237 A (Denso Corp.), 15 November, 2007 (15.11.07), Par. Nos. [0014] to [0063]; Figs. 1, 2 (Family: none)	1,2
Y	JP 2006-349273 A (Denso Corp.), 28 December, 2006 (28.12.06), Par. Nos. [0049], [0053]; Fig. 4 (Family: none)	1,2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 October, 2008 (20.10.08)	28 October, 2008 (28.10.08)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007192499 A **[0003]**
- JP H08270122 B **[0003]**