[Document Name] Specification

[Title of the Invention] Electric circuit board and refrigeration apparatus equipped with the electric circuit board

[Technical Field]

To provide an electric circuit board connected to a control board of a refrigerating apparatus via a communication line, and a refrigerating apparatus equipped with the electric circuit board.

[Background of the Invention]

In the data transmission device of a refrigerating apparatus, if the positive electrode signal line and the negative electrode signal line are connected with the wrong polarity, communication becomes impossible. Therefore, there is a demand for a data transmission device without requiring the improvement work even if the wires are connected with the wrong polarity. For example, in the data transmission device disclosed in Patent Document 1 (Japanese Unexamined Patent Publication No. 5-347637), when the CPU determines whether the connection is correct or not, and when it is determined that the connection is incorrect, the transmission polarity switching circuit is used. The positive electrode signal is output to the positive electrode signal line, and the negative electrode signal is output to the negative electrode signal line.

[Summary of the Invention]

[Problems to be Solved by the Invention]

However, the above-mentioned data transmission device causes an increase in production cost since the CPU is used to determine the correctness of the connection. As a result, there is a demand to eliminate the need for the use of CPU to determine the correctness of the connection and without the additional improvement, even if the wiring is connected with the wrong polarity.

[Means for Solving Problems]

Aspects of the invention are defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

The electric circuit board according to the first exemplary arrangement is an electric circuit board that is connected to a control board of a refrigerating apparatus comprising a heat source unit and a utilization unit via a communication line. The electric circuit board comprises a first input line, a second input line, a first output line, a second output line, and a relay. A positive electrode signal or a negative electrode signal is input to the first input line. A signal of a pole different from that of the first input line is input to the second input line. The first output line outputs a positive electrode signal. The second output line outputs a negative electrode signal. When the first input line is a positive electrode, the relay connects the first input line and the first output line, and connects the second input line and the second output line. Further, when the first input line is a negative electrode, the relay connects the first input line and the second output line, and connects the second input

line and the first output line.

In this electric circuit board, even if the polarities of the signals input to the first input line and the second input line are reversed due to incorrect wiring, the signals with the correct polarities are output to the first output line and the second output line by the relay operation, therefore the inoperability due to incorrect wiring can be avoided.

The electric circuit board related to the second exemplary arrangement is the electric circuit board according to the first exemplary arrangement. The electric circuit board further comprises a first circuit and a second circuit. The first circuit connects the first input line with the first output line, and connects the second input line with the second output line. A second circuit connects the first input line and the second output line, and connects the second input line with the first output line. The relay includes a switching contact. The switching contact turns on the first circuit and turns off the second circuit when the first input line is a positive electrode. Further, the switching contact turns off the first circuit and turns on the second circuit when the first input line is the negative electrode.

Since this electric circuit board is a simple configuration in which either one of the first circuit and the second circuit is continuity conductive by the switching contact of the relay, so a general-purpose inexpensive relay can be used.

The electric circuit board related to the third exemplary arrangement is an electric circuit board according to the first exemplary arrangement or the second exemplary arrangement. The electric circuit board further comprises a first voltage divider circuit and a second voltage divider circuit. The first voltage divider circuit is connected between the first input line and the second input line, and when the first input line is a positive electrode that causes a voltage drop from the connection end with the first input line toward the connection end with the second input line. The second voltage divider circuit is connected between the first input line and the second input line, and when the first input line is the negative electrode causes a voltage drop from the connection end with the second input line toward the connection end with the first input line. When the first input line is a positive voltage, the second voltage, which is the potential difference between the connection point of the voltage dividing resistors of the second voltage divider circuit and the ground becomes larger than the first voltage which is the potential difference between the connection point of the voltage divider resistors of the first voltage divider circuit and the ground, and a predetermined operating voltage is output to the relay.

In this electric circuit, the relay is operated by the magnitude of the potential difference from the ground of the connection point of the voltage dividing resistance in the two voltage dividing circuits is reversed by utilizing the polarities of the first input line and the second input line. Therefore, it is not necessary to determine the polarity error by the CPU,

and the circuit design is easy.

The electric circuit board related to the fourth exemplary arrangement is the electric circuit board according to the third exemplary arrangement. In the first voltage divider circuit, the first diode, a first diode with the first resistor and the second resistor are connected in series, in which a forward current flows from the connection end with the first input line toward the connection end with the second input line in the first voltage divider circuit. In the second voltage dividing circuit, a second diode with the third resistor and the fourth resistor are connected in series in which a forward current flows from the connection end with the second input line toward the connection end with the first input line.

In this electric circuit board, the potential of the connection point of the voltage dividing resistor with respect to the ground can be made different due to the polarity error by making the forward directions of the diodes provided in each of the two voltage dividing circuits are opposite directions to each other.

The electric circuit board according to the fifth exemplary arrangement is the electric circuit board according to the fourth exemplary arrangement. The first voltage is the potential difference between the connection point between the first resistor and the second resistor and the ground. The second voltage is the potential difference between the connection point between the third resistor and the fourth resistor and the ground.

In this electric circuit board, by designing the resistance value so that the magnitude of each potential is reversed due to the polarity error, therefore, it is possible to address the polarity error without relying on the CPU.

The electric circuit board related to the sixth exemplary arrangement is an electric circuit board according to any one of the third exemplary arrangement to the fifth exemplary arrangement. The electric circuit board further comprises a comparator. The comparator compares the first voltage with the second voltage, and when the second voltage is larger than the first voltage, then outputs the operating voltage to the relay. The voltage of the inverting input of the comparator is the first voltage, and the voltage of the non-inverting input of the comparator is the second voltage.

Since this electric circuit board can supply a stable operating voltage to the relay, the reliability is improved.

The electric circuit board related to the seventh exemplary arrangement is an electric circuit board according to any one of the first exemplary arrangement to the sixth exemplary arrangement. The control board includes a first control board equipped with the heat source unit and a second control board equipped with the utilization unit. The electric circuit board includes a first electric circuit board connected to the first control board and a second electric circuit board connected to the second control board.

The refrigerating apparatus according to the eighth exemplary arrangement is the refrigerating apparatus equipped with the electric circuit board according to any one of the first exemplary arrangement to the seventh exemplary arrangement.

[Brief Description of the Drawings]

FIG. 1 is a configuration diagram of an air conditioner which is a refrigerating apparatus on which an electric circuit board according to an embodiment of the present disclosure is equipped.

FIG. 2 is a diagram of an electric circuit of an air conditioner.

FIG. 3 is a circuit diagram of a polarity correction circuit.