

## **SPECIFICATION**

### **AIR CONDITIONER MONITOR AND CONTROL SYSTEM**

#### **TECHNICAL FIELD**

The present invention relates to an air conditioning monitoring and control system  
5 that monitors and controls an air conditioner.

#### **BACKGROUND ART**

In recent years, an open protocol has been used for communication between an air  
conditioner and an air conditioning monitoring and control device in building monitoring  
systems (for example, see patent document 1). If this type of open protocol will be used  
10 more extensively in the future, even when air conditioners manufactured by several  
manufacturers are installed in the same building, it will be possible to operate these air  
conditioners as one system, which consequently increases user convenience.

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#### **DISCLOSURE OF THE INVENTION**

15 <PROBLEM TO BE SOLVED BY THE INVENTION>

However, at present, common data model patterns of air conditioners are limited,  
and therefore it is extremely difficult to incorporate long-accumulated  
manufacturer-private monitoring and control technologies into current building monitoring  
systems. Consequently, at present, an open protocol is only used for basic functions such  
20 as monitoring and control of start-up/shutdown of air conditioners. It is therefore an object  
of the present invention to provide an air conditioning monitoring and control system  
which is capable of performing manufacturer-private and precise monitoring and control of  
air conditioners while enabling communication between air conditioners and air  
conditioning monitoring and control devices using an open protocol.

25 <MEANS OF ACHIEVING THE OBJECT>

An air conditioning monitoring and control system according to a first aspect of  
the present invention comprises air conditioners, a first air conditioning monitoring and  
control device, and a second air conditioning monitoring and control device. The first air  
conditioning monitoring and control device communicates with the air conditioners via a  
30 first communication line. In addition, this first air conditioning monitoring and control  
device includes first monitoring and control means and second monitoring and control  
means. The first monitoring and control means and the second monitoring and control

means monitor and/or control the air conditioners. The second air conditioning monitoring and control device communicates with the air conditioners via a second communication line. In addition, this second air conditioning monitoring and control device includes the first monitoring and control means and third monitoring and control means. The first  
5 monitoring and control means and the third monitoring and control means monitor and/or control the air conditioners.

Here, the first air conditioning monitoring and control device includes the first monitoring and control means and the second monitoring and control means. In addition, the second air conditioning monitoring and control device includes the first monitoring and  
10 control means and the third monitoring and control means. Here, if the first air conditioning monitoring and control device is an air conditioning monitoring and control device compliant with a manufacturer-private protocol and if the second air conditioning monitoring and control device is an air conditioning monitoring and control device compliant with an open protocol, the first monitoring and control means will be the  
15 common monitoring and control means between the first air conditioning monitoring and control device and the second air conditioning monitoring and control device, the second monitoring and control means will be the monitoring and control means that is compliant with manufacturer-private protocol, and the third monitoring and control means will be the monitoring and control means that is compliant with an open protocol. Therefore, this air  
20 conditioning monitoring and control system is capable of performing manufacturer-private and precise monitoring and control of the air conditioners while enabling communication between the air conditioners and the monitoring control devices using an open protocol.

An air conditioning monitoring and control system according to a second aspect of the present invention is the air conditioning monitoring and control system according to  
25 the first aspect of the present invention, wherein the first air conditioning monitoring and control device and the second air conditioning monitoring and control device communicate with the air conditioners using a first communication protocol.

Here, the first air conditioning monitoring and control device and the second air conditioning monitoring and control device communicate with the air conditioners using  
30 the first communication protocol. Accordingly, this air conditioning monitoring and control system enables simplification of the communication function of the air conditioners.

An air conditioning monitoring and control system according to a third aspect of

the present invention is the air conditioning monitoring and control system according to the second aspect of the present invention, wherein the air conditioning monitoring and control system further comprises a first monitoring panel and a second monitoring panel. The first monitoring panel is configured to monitor the air conditioners, and is connected to or built into the first air conditioning monitoring and control device. The second monitoring panel is configured to monitor the air conditioners, and is connected to or built into the second air conditioning monitoring and control device. In addition, the second air conditioning monitoring and control device further includes communication protocol conversion means. The communication protocol conversion means is capable of converting between the first communication protocol and a second communication protocol. The first monitoring panel communicates with the first air conditioning monitoring and control device using the first communication protocol. In addition, the second monitoring panel communicates with the second air conditioning monitoring and control device using the second communication protocol.

Here, the first monitoring panel is connected to or built into the first air conditioning monitoring and control device. In addition, the second monitoring panel is connected to or built into the second air conditioning monitoring and control device. The second air conditioning monitoring and control device further includes the communication protocol conversion means. The communication protocol conversion means is capable of converting between the first communication protocol and a second communication protocol. The first monitoring panel communicates with the first air conditioning monitoring and control device using the first communication protocol. In addition, the second monitoring panel communicates with second air conditioning monitoring and control device using the second communication protocol. Accordingly, this air conditioning monitoring and control system allows the user to monitor not only the air conditioning monitoring and control device compliant with a manufacturer-private protocol but also the air conditioning monitoring and control device compliant with an open protocol.

An air conditioning monitoring and control system according to a fourth aspect of the present invention is the air conditioning monitoring and control system according to the third aspect of the present invention, wherein the first communication protocol is a manufacturer-private protocol. In addition, the second communication protocol is an open

protocol. Note that an "open protocol" here refers to LonWorks protocol, BACnet protocol (A Data Communication Protocol for Building Automation and Control Networks: ISO16484-5, building management system communication protocols that are currently undergoing standardization), and the like.

5           Here, the first communication protocol is a manufacturer-private protocol. In addition, the second communication protocol is an open protocol. Accordingly, air conditioners compliant with a manufacturer-private protocol can be easily connected to air conditioners compliant with an open protocol, without requiring design changes.

10           An air conditioning monitoring and control system according to a fifth aspect of the present invention is the air conditioning monitoring and control system according to any one of the first through the fourth aspects of the present invention, wherein the first communication line and the second communication line are the same communication line.

15           Here, the first communication line and the second communication line are the same communication line. Accordingly, the wiring for the air conditioning monitoring and control system can be easily installed.

20           An air conditioning monitoring and control system according to a sixth aspect of the present invention is the air conditioning monitoring and control system according to any one of the first through the fifth aspects of the present invention, wherein the first monitoring and control means is capable of performing at least one type of control with respect to the air conditioners. In addition, at least one of the first air conditioning monitoring and control device and the second air conditioning monitoring and control device further includes control selection means. The control selection means allows the user to select to enable/disable one type of control when the first monitoring and control means is capable of performing one type of control, or each of at least two types of control  
25           when the first monitoring and control means is capable of performing two or more types of control.

30           Here, with the control selection means, it is possible to select to enable/disable one type of control or each of at least two types of control, depending on the number of types of control that the first monitoring and control means is capable of performing. Accordingly, this air conditioning monitoring and control system can avoid user confusion and prevent the occurrence of problems in controlling the air conditioners.

          An air conditioning monitoring and control system according to a seventh aspect

of the present invention is the air conditioning monitoring and control system according to the sixth aspect of the present invention, wherein the control performed by the first monitoring and control means includes at least one of forcible thermo OFF control and scheduled operation control of the air conditioners.

5 Here, the control includes at least one of the forcible thermo OFF control and the scheduled operation control of the air conditioners. Accordingly, this air conditioning monitoring and control system can avoid user confusion regarding the schedule of operation and prevent the occurrence of problems in energy saving control and demand control of the air conditioners.

#### 10 <EFFECT OF THE INVENTION>

The air conditioning monitoring and control system according to the first aspect of the present invention is capable of performing manufacturer-private and precise monitoring and control of the air conditioners, while enabling communication between the air conditioners and the monitoring control devices using an open protocol.

15 The air conditioning monitoring and control system according to the second aspect of the present invention enables simplification of the communication function of the air conditioners.

The air conditioning monitoring and control system according to the third aspect of the present invention allows the user to monitor not only the air conditioning monitoring and control device compliant with a manufacturer-private protocol but also the air  
20 conditioning monitoring and control device compliant with an open protocol.

The air conditioning monitoring and control system according to the fourth aspect of the present invention enables easy connection between the air conditioners compliant with a manufacturer-private protocol and the air conditioners compliant with an open  
25 protocol, without requiring design changes.

The air conditioning monitoring and control system according to the fifth aspect of the present invention enables easy wiring installation.

The air conditioning monitoring and control system according to the sixth aspect of the present invention can avoid user confusion and prevent the occurrence of problems  
30 in controlling the air conditioners.

The air conditioning monitoring and control system according to the seventh aspect of the present invention can avoid user confusion regarding the schedule of

operation and prevent the occurrence of problems in energy saving control and demand control of the air conditioners.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is an overall configuration of an air conditioning monitoring and control system.

Figure 2 is a table (1) showing the functional comparison between a manufacturer-private protocol air conditioning controller and an open protocol air conditioning controller in a single controller system and a multiple controller system.

Figure 3 is a table (2) showing the functional comparison between the manufacturer-private protocol air conditioning controller and the open protocol air conditioning controller in the single controller system and the multiple controller system.

Figure 4(a) is a function block diagram of the manufacturer-private protocol air conditioning controller, and Figure 4(b) is a function block of the open protocol air conditioning controller.

## **DESCRIPTION OF THE REFERENCE SYMBOLS**

|          |                                                                                                                  |
|----------|------------------------------------------------------------------------------------------------------------------|
| 11       | manufacturer-private protocol monitoring PC (first monitoring panel)                                             |
| 12       | open protocol monitoring PC (second monitoring panel)                                                            |
| 21       | manufacturer-private protocol air conditioning controller (first air conditioning monitoring and control device) |
| 20 22d   | protocol conversion unit (protocol conversion means)                                                             |
| 22       | open protocol air conditioning controller (second air conditioning monitoring and control device)                |
| 30a, 30b | indoor unit (air conditioner)                                                                                    |
| 31       | outdoor unit (air conditioner)                                                                                   |
| 25 53    | first communication line                                                                                         |
| 100      | air conditioning monitoring and control system                                                                   |

## **BEST MODE FOR CARRYING OUT THE INVENTION**

### **<Configuration of the Air Conditioning Monitoring and Control System>**

Figure 1 illustrates an air conditioning monitoring and control system according to an embodiment of the present invention.

As shown in Figure 1, this air conditioning monitoring and control system 100 mainly comprises air conditioner indoor units 30a, 30b ..., an air conditioner outdoor unit

31, a manufacturer-private protocol air conditioning controller 21, an open protocol air conditioning controller 22, a manufacturer-private protocol monitoring PC 11, an open protocol monitoring PC 12, and subsystems 40a, 40b ... including open protocol devices (for example, lighting equipment, security equipment, disaster prevention equipment, etc.).

## 5 <Connection Topology of the Air Conditioning Monitoring and Control System>

The air conditioner indoor units 30a, 30b ... and the air conditioner outdoor unit 31 are communicatively connected to the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22 via a first communication line 53. The manufacturer-private protocol air conditioning controller 21 communicates with the manufacturer-private protocol monitoring PC 11 via a second communication line 51. The open protocol air conditioning controller 22 communicates with the open protocol monitoring PC 12 via a third communication line 52. In addition, the subsystems 40a, 40b ... including the open protocol devices are also communicatively connected to the open protocol monitoring PC 12 via the third communication line 52.

## 15 <Components of the Air conditioning Monitoring and Control System>

### (1) Air Conditioner Indoor Unit and Outdoor Unit

The air conditioner indoor units 30a, 30b ... and the air conditioner outdoor unit 31 are mutually connected via refrigerant piping (not shown). The indoor units 30a, 30b ... cool or heat the space around the indoor units 30a, 30b ... by taking in air and cooling or heating the air using a refrigerant that is supplied from the outdoor unit 31 through the refrigerant piping. Note that these indoor units 30a, 30b ... and the outdoor unit 31 are compliant with a manufacturer-private protocol.

### (2) Manufacture-private Protocol Air Conditioning Controller

The manufacturer-private protocol air conditioning controller 21 has a function of monitoring the conditions of the indoor units 30a, 30b ... and the outdoor unit 31 and ambient conditions (temperature, humidity, air cleanliness, etc.) and also has a function of controlling the indoor units 30a, 30b ... and the outdoor unit 31. As shown in Figure 4(a), this manufacturer-private protocol air conditioning controller 21 mainly comprises a control unit 21a, a memory unit 21c, and a communication unit 21b. The memory unit 21c stores a monitoring and control program that controls the following functions: a status monitoring function, a function of monitoring prohibition/permission setting of operation by remote controller, a function of monitoring start-up/shutdown failure, a function of

monitoring continuous operation period, a function of monitoring conflicting status and warning, a function of monitoring upper and lower measurement limits, a function of starting up/shutting down and changing set values for each device individually, a function of prohibiting/permitting operation by remote controller, a function of registering device  
5 for maintenance, a schedule control function, a function of gang control, a function of handling power failure and restoration, a forcible shutdown function, a function of prohibiting integrated operation from low-order device, an energy saving control function, demand control function, a function of counting total operation hours, a function of counting total number of start-up/shutdown events, a function of preparing daily, monthly,  
10 annual reports, a trend report function, a function of calculating energy consumption cost based on power allocation, a NSC AIRNET function, and a function of predicting local malfunction (see Figures 2 and 3). Note that among these functions, the following functions are functions that are unique to the manufacturer-private protocol air conditioning controller 21: the function of monitoring continuous operation period, the  
15 function of monitoring conflicting status and warning, the energy saving control function, the demand control function, the function of preparing daily, monthly, annual reports, and the function of predicting local malfunction. The memory unit 21c also stores monitoring data and the like which are transmitted from the indoor units 30a, 30b ... and the outdoor unit 31. The control unit 21a executes the monitoring and control program mentioned  
20 above, and enables these various functions with respect to the indoor units 30a, 30b ... and the outdoor unit 31. The communication unit 21b is compliant with a manufacturer-private protocol.

The status monitoring function is a function that measures and monitors the conditions of the indoor units 30a, 30b ... and the outdoor unit 31 and ambient conditions  
25 of the indoor units 30a, 30b ... and the outdoor unit 31 (temperature, humidity, etc.) from various sensors. The function of monitoring prohibition/permission setting of operation by remote controller is a function that monitors whether operation via local remote control (wired remote control, wireless remote control, etc.) is permitted or prohibited in each of the indoor units 30a, 30b ... . This function is mainly used to check the relationship  
30 between the status of the indoor units 30a, 30b ... and the control related functions of the air conditioning controllers 21 and 22. The function of monitoring start-up/shutdown failure is a function that notifies the user when the manufacturer-private protocol air

conditioning controller 21 fails in the start-up/shutdown operations of the indoor units 30a, 30b ... and the outdoor unit 31. The function of monitoring continuous operation period is a function that monitors continuous operation periods of the air conditioning system, the outdoor unit 31, the indoor units 30a, 30b, and the like. The function of monitoring conflicting status and warning determines errors in devices such as the indoor units 30a, 30b ... and the outdoor unit 31, and issues a warning, when the expected status based on the control setting does not match the actual status. The function of monitoring upper and lower measurement limits is a function that monitors whether or not sensor values are within a predetermined range of acceptable values. The function of starting-up/shutting down and changing set values for each device individually is a function that can individually start-up/shutdown devices such as the indoor units 30a, 30b ... and the outdoor unit 31, and can also individually change the setting values of devices such as the indoor units 30a, 30b ... and the outdoor unit 31. The function of prohibiting/permitting operation by remote controller is a function that prohibits or permits the operation of each of the indoor units 30a, 30b ... via local remote control (wired remote control, wireless remote control, etc.). The function of registering device for maintenance is a function that detects devices such as the indoor units 30a, 30b ... and the outdoor unit 31, which are set to maintenance mode, and registers these devices on a maintenance list. The schedule control function is a function that specifies the operation time of devices such as the indoor units 30a, 30b ... and the outdoor unit 31, and operates these devices according to the schedule. The function of gang control is a function that controls such that the indoor units 30a, 30b ... are linked to other devices such as a fan for cooling with outside air and a damper for cooling with outside air, for example. The function of handling power failure and restoration is a function that determines what procedures will be used to recover the manufacturer-private protocol air conditioning controller 21 upon the restoration of power after power failure. The forcible shutdown function is a function that forcibly stops devices such as the indoor units 30a, 30b ... and the outdoor unit 31, when a predetermined condition is reached. The function of prohibiting integrated operation from low-order device is a function that, when an integrated control unit has a hierarchical structure, prohibits operation of the air conditioners from a low-order integrated device in the hierarchical structure and permits direct operation of the air conditioners from an integrated host device in the hierarchical structure. The energy saving control function is a

function that operates devices such as the indoor units 30a, 30b ... and the outdoor unit 31 in energy saving mode, based on the air conditioning load in the building and meteorological conditions. The demand control function is a function that estimates the amount of energy that may be used in a 30 minutes basis and controls operation of devices such as the indoor units 30a, 30b ... and the outdoor unit 31, so that the amount of energy used will not exceed an upper limit. The function of counting total operation hours is a function that counts the total number of hours of operation of devices such as the air conditioning system, the outdoor unit 31, and the indoor units 30a, 30b. The function of counting total number of start-up/shutdown events is a function that counts the total number of times in which devices such as the outdoor unit 31 and the indoor units 30a, 30b are started up and shut down. The function of preparing daily, monthly, annual reports is a function that compiles various data, in report format, including the operation hours, the number of start-up/shutdown events, the amount of power consumption, the achievement ratio of energy saving performance, and the number of error occurrences of the air conditioning system, the outdoor unit 31, and the indoor units 30a, 30b ... on the daily, monthly, and annual basis. The trend report function is a function that notifies the user of relatively recent trends of the conditions of devices such as the indoor units 30a, 30b ... and the outdoor unit 31. The function of calculating energy consumption cost based on power allocation is a function that allocates power consumption for each tenant in the building and determines the cost to collect from each tenant based on the allocated amount of power. The NSC AIRNET function is a function that transmits monitoring data from the air conditioning system, the outdoor unit 31, the indoor units 30a, 30b, and the like to a remote central control center. Accordingly, it will be possible to remotely monitor and control devices such as the indoor units 30a, 30b ... and the outdoor unit 31. The function of predicting local malfunction is a function that notifies the user when the conditions of specific parts of devices such as the indoor units 30a, 30b ... and the outdoor unit 31 reach a predetermined condition, and informs the user that these devices such as the indoor units 30a, 30b and outdoor unit 31 will malfunction or the specific parts will be worn out in the near future.

### (3) Open Protocol Air Conditioning Controller

Same as the manufacturer-private protocol air conditioning controller 21, the open protocol air conditioning controller 22 has a function of monitoring the conditions of the

indoor units 30a, 30b ... and the outdoor unit 31 and ambient conditions (temperature, humidity, air cleanliness, etc.) and also has a function of controlling the indoor units 30a, 30b ... and the outdoor unit 31. As shown in Figure 4(b), this open protocol air conditioning controller 22 mainly comprises a control unit 22a, a memory unit 22c, a communication unit 22b. The memory unit 22c stores a monitoring and control program that controls the following functions: the status monitoring function, the function of monitoring prohibition/permission setting of operation by remote controller, a function of monitoring forced thermostat OFF state, a function of forcibly setting thermostat OFF, the function of monitoring start-up/shutdown failure, function of monitoring upper and lower measurement limits, the function of starting up/shutting down and changing set values for each device individually, the function of prohibiting/permitting operation by remote controller, the function of registering device for maintenance, the schedule control function, the function of gang control, the function of handling power failure and restoration, the forcible shutdown function, the function of prohibiting integrated operation from low-order device, the function of counting total operation hours, the function of counting total number of start-up/shutdown events, the trend report function, the function of calculating energy consumption cost based on power allocation, and the NSC AIRNET function (see Figures 2 and 3). Among these functions, the function of monitoring forced thermostat OFF state and the function of forcibly setting thermostat OFF are functions that are unique to the open protocol air conditioning controller 22. This memory unit 22c also stores monitoring data and other data that are transmitted from the indoor units 30a, 30b ... and the outdoor unit 31. The control unit 22a executes the monitoring and control program mentioned above, and enables these various functions with respect to the indoor units 30a, 30b ... and the outdoor unit 31. The communication unit 22c has a protocol conversion unit 22d that converts between a manufacturer-private protocol and an open protocol (BAC net protocol), and that is compliant with both communication protocols.

As for the functions of this open protocol air conditioning controller 22, the following functions are the same as the functions of the manufacturer-private protocol air conditioning controller 21: the status monitoring function, the function of monitoring prohibition/permission setting of operation by remote controller, the function of monitoring start-up/shutdown failure, the function of monitoring upper and lower measurement limits, the function of starting up/shutting down and changing set values for

each device individually, the function of prohibiting/permitting operation by remote controller, the function of registering device for maintenance, the schedule control function, the function of gang control, the function of handling power failure and restoration, the forcible shutdown function, the function of prohibiting integrated operation  
5 from low-order device, the function of counting total number of start-up/shutdown events, the trend report function, the function of calculating energy consumption cost based on power allocation, and the NSC AIRNET function. However, the targets of monitoring include not only devices such as the outdoor unit 31 and the indoor units 30a, 30b ... but also the subsystems 40a, 40b ... including devices compliant with an open protocol.

10       The function of monitoring forced thermostat OFF state is a function that monitors the operational state of a forced thermostat OFF setting in which the operation of the outdoor unit 31 and the indoor units 30a, 30b ... is forcibly stopped when a predetermined condition is reached.

#### (4) Manufacture-private Protocol Monitoring PC

15       The manufacturer-private protocol monitoring PC 11 stores various monitoring data transmitted from the manufacturer-private protocol air conditioning controller 21 in memory media such as a hard disk and the like (not shown). In addition, this manufacturer-private protocol monitoring PC 11 shows these monitoring data on a display. Further, this manufacturer-private protocol monitoring PC 11 is capable of changing status  
20 values and control values that are set in the manufacturer-private protocol air conditioning controller 21. Note that this manufacturer-private protocol monitoring PC 11 is compliant with a manufacturer-private protocol.

#### (5) Open Protocol Monitoring PC

25       The open protocol monitoring PC 12 stores various monitoring data transmitted from the open protocol air conditioning controller 22 in memory media such as a hard disk and the like (not shown). In addition, this open protocol monitoring PC 12 shows these monitoring data on a display. In addition, this open protocol monitoring PC 12 is capable of changing status values and control values that are set in the open protocol air conditioning controller 22. Note that this open protocol monitoring PC 12 is compliant  
30 with an open protocol.

#### (6) Subsystem Comprising Open Protocol Devices

The subsystems 40a, 40b ... including the open protocol devices are subsystems

that comprise devices such as lighting equipment, security equipment, disaster prevention equipment. Note that the subsystems 40a, 40b ... including the open protocol devices are compliant with an open protocol.

#### <Function of Selecting Monitoring and Control in the Air Conditioning Monitoring and Control System>

The manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22 are provided with a function of selecting monitoring and control, which is a function that allows the user to select to enable or disable each function. By using this function of selecting monitoring and control, the user can adjust the relationship between the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22 in terms of monitoring and control with respect to the indoor units 30a, 30b ... and the outdoor unit 31. Examples of which functions are preferably selected will now be described.

##### (1) Monitoring Related Functions

With this air conditioning monitoring and control system 100, as shown in the right column of the table in Figure 2, among the monitoring related functions of the open protocol air conditioning controller 22, the function of monitoring prohibition/permission setting of operation by remote controller is set to be disabled. This is because the manufacturer-private protocol air conditioning controller 21 is given a higher priority that is determined by the central address than the open protocol air conditioning controller 22. Although the status monitoring function, the function of monitoring startup/shutdown failure and the function of monitoring upper and lower measurement limits are set to be enabled in both the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22, it is possible to set these functions to be enabled in only one of the air conditioning controllers 21 and 22.

##### (2) Operation Related Functions

With this air conditioning monitoring and control system 100, as shown in the right column of the table in Figure 2, among the operation related functions of the open protocol air conditioning controller 22, the function of prohibiting/permitting operation by remote controller and the function of forcibly setting thermostat OFF are set to be disabled. This is because when the forced thermo OFF state is released in the open protocol air conditioning controller 22, it will disturb the energy saving control function and the

demand control function of the manufacturer-private protocol air conditioning controller 21. Although the function of starting up/shutting down and changing set values for each device individually and the function of registering device for maintenance can be enabled in both the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22, it is possible to set these functions to be enabled in only one of the air conditioning controllers 21 and 22.

### (3) Control Related Functions

With this air conditioning monitoring and control system 100, as shown in the right column of the table in Figure 3, among the control related functions, the schedule control function, the function of gang control, the function of handling power failure and restoration, and the forcible shutdown function of the open protocol air conditioning controller 22 are set to be disabled. Alternatively, it may be the case that the schedule control function, the function of gang control, the function of handling power failure and restoration, and the forcible shutdown function of the manufacturer-private protocol air conditioning controller 21 are set to be disabled. Note that the user can optionally choose either case. It is technically possible to enable the schedule control function in both the air conditioning controllers 21 and 22. However, in order to avoid user confusion, the schedule control function in one of the air conditioning controllers 21 and 22 is set to be disabled. In addition, when the function of gang control is enabled in both the air conditioning controllers 21 and 22, it may cause a loop in which a linking program is endlessly iterated between the air conditioning controllers 21 and 22, so that the function of gang control in one of the air conditioning controllers 21 and 22 is set to be disabled. In addition, the function of handling power failure and restoration is selected to be enabled in one of the air conditioning controllers 21 and 22, depending on how the electric power is installed. In addition, the forcible shutdown function is selected to be enabled in one of the air conditioning controllers 21 and 22, depending on the source of a fire signal. In addition, the function of prohibiting integrated operation from low-order device is disabled in both the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22.

### (4) Data Management Related Function

With this air conditioning monitoring and control system 100, as shown in the right column of the table in Figure 3, among all functions, the function of calculating

energy consumption cost based on power allocation and the NSC AIRNET function of the open protocol air conditioning controller 22 are set to be disabled. Alternatively, it may be the case that the function of calculating energy consumption cost based on power allocation of the manufacturer-private protocol air conditioning controller 21 is set to be disabled. Note that the user can optionally choose either case. In addition, although the function of counting total operation hours, the function of counting total number of start-up/shutdown events, and the trend report function are set to be enabled in both the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22, it is possible to set these functions to be enabled in only one of the air conditioning controllers 21 and 22.

#### <Characteristics of the Air Conditioning Monitoring and Control System>

##### (1)

With the air conditioning monitoring and control system 100 according to the present embodiment, both the manufacturer-private protocol air conditioning controller 21 and the open protocol air conditioning controller 22 have the following functions: the status monitoring function, the function of monitoring startup/shutdown failure, the function of monitoring upper and lower measurement limits, the function of starting up/shutting down and changing set values for each device individually, the function of registering device for maintenance, the function of counting total operation hours, the function of counting total number of start-up/shutdown events, and the trend report function. Further, only the manufacturer-private protocol air conditioning controller 21 has the following functions: the function of monitoring continuous operation period, the function of monitoring conflicting status and warning, the function of prohibiting/permitting operation by remote controller, the schedule control function, the function of gang control, the function of handling power failure and restoration, the forcible shutdown function, the energy saving control function, the demand control function, the function of preparing daily, monthly, annual reports, the function of calculating energy consumption cost based on power allocation, the NSC AIRNET function, and the function of predicting local malfunction. On the other hand, only the open protocol air conditioning controller 22 has the following functions: the function of monitoring forced thermostat OFF state and the function of forcibly setting thermostat OFF. In addition, the manufacturer-private protocol air conditioning controller 21 is

compliant with a manufacturer-private protocol, whereas the open protocol air conditioning controller 22 is compliant with an open protocol. Therefore, the air conditioning monitoring and control system 100 enables functions compliant with a manufacturer-private protocol, i.e., the function of monitoring continuous operation period, the function of monitoring conflicting status and warning, the energy saving control function, the demand control function, the function of preparing daily, monthly, annual reports, and the function of predicting local malfunction, while enabling communication between the indoor units 30a, 30b ... and the air conditioning controllers 21 and 22 using an open protocol.

10 (2)

With the air conditioning monitoring and control system 100 according to the present embodiment, a communication protocol between the indoor units 30a, 30b ... and the manufacturer-private protocol air conditioning controller 21 is the same communication protocol between the indoor units 30a, 30b ... and the open protocol air conditioning controller 22. Therefore, the communication function of the indoor units 30a, 30b ... can be simplified.

(3)

With the air conditioning monitoring and control system 100 according to the present embodiment, each of the indoor units 30a, 30b ... communicates with the first communication line 53. Accordingly, the wiring for the air conditioning monitoring and control system 100 can be easily installed.

(4)

With the air conditioning monitoring and control system 100 according to the present embodiment, the manufacturer-private protocol air conditioning controller 21 is compliant with a manufacturer-private protocol. In addition, the open protocol air conditioning controller 22 is compliant with an open protocol. Accordingly, the manufacturer-private protocol air conditioning controller 21 can be connected to air conditioners compliant with a different manufacturer-private protocol. Similarly, the open protocol air conditioning controller 22 can be connected to the subsystems 40a, 40b ... including the open protocol devices. Accordingly, it is possible to easily connect the air conditioners compliant with a manufacturer-private protocol to the air conditioners compliant with an open protocol, without requiring design changes.

(5)

With the air conditioning monitoring and control system 100 according to the present embodiment, the manufacturer-private protocol monitoring PC 11 is connected to the manufacturer-private protocol air conditioning controller 21. In addition, the open  
5 protocol monitoring PC 12 is connected to the open protocol air conditioning controller 22. Accordingly, it is possible to obtain, through the manufacturer-private protocol monitoring PC 11, the information that can be obtained only through specific functions of the manufacturer-private protocol air conditioning controller 21, i.e., the function of monitoring continuous operation period, the function of monitoring conflicting status and  
10 warning, the energy saving control function, the demand control function, the function of preparing daily, monthly, annual reports, and the function of predicting local malfunction. In addition, the information that can be obtained only through the function of monitoring forced thermostat OFF state of the open protocol air conditioning controller 22 can be monitored through the open protocol monitoring PC 12. Therefore, monitoring information  
15 of the air conditioners compliant with manufacturer-private protocol can be browsed, while monitoring information of the air conditioners compliant with an open protocol can be browsed collectively.

<Modification>

(A)

20 With the air conditioning monitoring and control system 100 according to the previous embodiment, the manufacturer-private protocol monitoring PC 11 communicates with the manufacturer-private protocol air conditioning controller 21 via the second communication line 51, however, the manufacturer-private protocol monitoring PC 11 may be installed in the manufacturer-private protocol air conditioning controller 21. In addition,  
25 similarly, the open protocol monitoring PC 12 may be installed in the open protocol air conditioning controller 22.

(B)

30 With the air conditioning monitoring and control system 100 according to the previous embodiment, the indoor units 30a, 30b ..., the outdoor unit 31, the manufacturer-private protocol air conditioning controller 21, and the open protocol air conditioning controller 22 are communicatively connected each other via the same communication line, however, the manufacturer-private protocol air conditioning

controller 21 and the open protocol air conditioning controller 22 may be communicatively connected to the indoor units 30a, 30b ... and the outdoor unit 31 via a different communication line. In addition, in this case, a communication protocol between the manufacturer-private protocol air conditioning controller 21 and devices such as the indoor units 30a, 30b ... and the outdoor unit 31 may be different from a communication protocol between the open protocol air conditioning controller 22 and devices such as the indoor units 30a, 30b ... and the outdoor unit 31.

(C)

The air conditioning monitoring and control system 100 according to the previous embodiment is provided with the function of selecting monitoring and control. This function of selecting monitoring and control may be provided with a scheduling function. Specifically, if this function of selecting monitoring and control is provided with a scheduling function, a certain function may be performed, for example, from 8:00 to 12:00 by the manufacturer-private protocol air conditioning controller 21, and the same function will be performed, for example, from 12:00 to 18:00 by the open protocol air conditioning controller.

#### **INDUSTRIAL APPLICABILITY**

The present invention provides the air conditioning monitoring and control system which is capable of performing manufacturer-private and precise monitoring and control of air conditioners while enabling communication between air conditioners and air conditioning monitoring and control devices using an open protocol, and which consequently can be applied to monitoring systems such as building monitoring systems.

## CLAIMS

1. An air conditioning monitoring and control system (100), comprising:

an air conditioner (30a, 30b ..., 31),

a first air conditioning monitoring and control device (21) communicating with the  
5 air conditioner (30a, 30b ..., 31) via a first communication line (53) and including  
first monitoring and control means and second monitoring and control means that  
are configured to monitor and/or control the air conditioner (30a, 30b ..., 31), and

a second air conditioning monitoring and control device (22) communicating with  
the air conditioner (30a, 30b ..., 31) via a second communication line (53) and  
10 including the first monitoring and control means and third monitoring and control  
means that are configured to monitor and/or control the air conditioner (30a, 30b ...,  
31).

2. The air conditioning monitoring and control system according to claim 1, wherein

the first air conditioning monitoring and control device and the second air  
15 conditioning monitoring and control device communicate with the air conditioner  
using a first communication protocol.

3. The air conditioning monitoring and control system (100) according to claim 2, further  
comprising:

a first monitoring panel (11) being connected to or built into the first air  
20 conditioning monitoring and control device so as to monitor the air conditioner, and  
a second monitoring panel (12) being connected to or built into the second air  
conditioning monitoring and control device so as to monitor the air conditioner,

wherein

the second air conditioning monitoring and control device further includes a  
25 communication protocol conversion means (22d) capable of converting between a  
first communication protocol and a second communication protocol,

the first monitoring panel is configured to communicate with the first air  
conditioning monitoring and control device using the first communication protocol,  
and

30 the second monitoring panel is configured to communicate with the second air  
conditioning monitoring and control device using the second communication  
protocol.

4. The air conditioning monitoring and control system (100) according to claim 3, wherein

the first communication protocol is a manufacturer-private protocol, and

the second communication protocol is an open protocol.

5 5. The air conditioning monitoring and control system (100) according to any one of claims 1 through 4, wherein

the first communication line (53) and the second communication line (53) are the same communication line.

10 6. The air conditioning monitoring and control system according to any one of claims 1 through 5, wherein

the first monitoring and control means is capable of controlling at least one type of control with respect to the air conditioner, and

15 at least one of the first air conditioning monitoring and control device and the second air conditioning monitoring and control device has control selection means that allows the selection to enable or disable the one type of control, or each of at least two types of control in the case where the first monitoring and control means is capable of performing two or more types of control.

7. The air conditioning monitoring and control system according to claim 6, wherein

20 the control performed by the first monitoring and control means includes at least one of forcible thermo OFF control and scheduled operation control of the air conditioner.