MITSUBISHI ELECTRIC

Changes for the Better

Mitsubishi Electric Air Conditioner
CITY MULTI Control System

2013

Technical Manual (First Edition)

Advanced HVAC CONTROLLER

• Safety notes are marked with ⚠**WARNING** or ⚠**CAUTION**, depending on the severity of possible consequences that may result when the instructions are not followed exactly as stated.
Proper installation is important for your safety and proper functioning of the units.
Thoroughly read the following safety precautions prior to installation.

To ensure safety and proper operation of the unit, the unit should only be installed by qualified personnel.

After reading this manual, pass the manual on to the end user to retain for future reference.
The users should keep this manual for future reference and refer to it as necessary.
This manual should be made available to those who repair or relocate the units.
Make sure that the manual is passed on to any future air condition system users.

About Advanced HVAC CONTROLLER (AHC)

Advanced HVAC CONTROLLER (hereafter referred to as AHC) comprises of MITSUBISHI ELECTRIC's AHC ADAPTER (PAC-IF01AHC-J) and α2 SIMPLE APPLICATION CONTROLLER* (hereafter referred to as ALPHA2).

* α2 SIMPLE APPLICATION CONTROLLER is one of the Programming Logic Controllers that are manufactured by MITSUBISHI ELECTRIC CORPORATION.

AHC allows for the connection of MITSUBISHI ELECTRIC's air conditioning network system (hereafter referred to as M-NET) to other systems, which was not possible with the use of ALPHA2 alone. AHC provides the following functions.

①Controls external devices using the sensor data of the air conditioning units connected to M-NET.
②Interlocks the operation of air conditioning units and external devices that are connected to ALPHA2.
③Controls air conditioning units that are connected to M-NET.
④Allows for the combined use of the items ①-③ above.
⑤Monitors the input/output status of ALPHA2 via a remote controller or a centralized controller.

Compatible controllers [As of April 2013 (North America); June 2013 (outside North America)]

  • Remote Controller: PAR-U01MEDU, PAR-U02MEDA
  • Centralized Controller: EB-50GU-A, EB-50GU-J

* Refer to the manual that came with ALPHA2 for information about ALPHA2.
* The use of AHC ADAPTER requires either a remote controller or a centralized controller.

— Advanced HVAC CONTROLLER Technical Manual —
— (First Edition) Contents —

1 Safety Precautions

- Thoroughly read the following safety precautions prior to installation.
- Observe these precautions carefully to ensure safety.

⚠**WARNING**	Indicates a risk of death or serious injury.
⚠CAUTION	Indicates a risk of injury or structural damage.

●Nomenclature

(Prohibited actions)　(Do not touch)　(No water)　(No wet hands)　(Fire hazards)　(Electric shock hazards)　(Injury hazards)　(Important actions)　(Grounding required)

- After reading this manual, pass the manual on to the end user to retain for future reference.
- The users should keep this manual for future reference and refer to it as necessary. This manual should be made available to those who repair or relocate the units. Make sure that the manual is passed on to any future air condition system users.

> **All electric work must be performed by qualified personnel.**

General precautions

⚠WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance. 🚫	To reduce the risk of injury or electric shock, stop the operation and switch off the power supply before cleaning, maintaining, or inspecting AHC. ⚡
	To reduce the risk of shorting, current leakage, electric shock, malfunctions, smoke, or fire, do not wash AHC with water or any other liquid. 🚫
Do not install AHC in a place where large amounts of oil, steam, organic solvents, or corrosive gases, such as sulfuric gas, are present or where acidic/alkaline solutions or sprays are used frequently. These substances can compromise the performance of AHC or cause certain components of AHC to corrode, which can result in electric shock, malfunctions, smoke, or fire. 🚫	To reduce the risk of electric shock, malfunctions, smoke or fire, do not operate the switches/buttons or touch other electrical parts with wet hands. 🚫
	Properly install all required covers to keep moisture and dust out of AHC. Dust accumulation and water can cause electric shock, smoke, or fire. ❗
To reduce the risk of injury or electric shock, before spraying a chemical around AHC, stop the operation and cover AHC. ⚡	To reduce the risk of injury, keep children away while installing, inspecting, or repairing AHC. ❗

⚠CAUTION

To reduce the risk of fire or explosion, do not place flammable materials or use flammable sprays around AHC. 🚫	To reduce the risk of injury and electric shock, avoid contact with sharp edges of certain parts. ⚡
To reduce the risk of damage to AHC, do not directly spray insecticide or other flammable sprays on AHC. 🚫	To reduce the risk of injury, wear protective gear when working on AHC. ❗

Precautions during installation

⚠WARNING

Do not install AHC where there is a risk of leaking flammable gas. If flammable gas accumulates around AHC, it may ignite and cause a fire or explosion.	🚫

Take appropriate safety measures against earthquakes to prevent AHC from causing injury.	❗

Properly dispose of the packing materials. Plastic bags pose suffocation hazard to children.	❗

To prevent injury, install AHC on a flat surface strong enough to support its weight.	❗

⚠CAUTION

To reduce the risk of shorting, current leakage, electric shock, malfunctions, smoke, or fire, do not install AHC in a place exposed to water or in a condensing environment.	🚫

AHC must be installed by qualified personnel according to the instructions detailed in the Installation and Instructions Manual. Improper installation may result in electric shock or fire.	❗

Precautions during wiring

⚠WARNING

To reduce the risk of damage to AHC, malfunctions, smoke, or fire, do not connect the power cable to the signal terminal block.	🚫

To reduce the risk of current leakage, overheating, smoke, or fire, use properly rated cables with adequate current carrying capacity.	❗

Properly secure the cables in place and provide adequate slack in the cables so as not to stress the terminals. Improperly connected cables may break, overheat, and cause smoke or fire.	⚠🔥

Proper grounding must be provided by a licensed electrician. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or telephone wire. Improper grounding may result in electric shock, smoke, fire, or malfunction due to electrical noise interference.	⏚

To reduce the risk of injury or electric shock, switch off the main power before performing electrical work.	⚠⚡

All electric work must be performed by a qualified electrician according to the local regulations, standards, and the instructions detailed in the Installation and Instructions Manual. Capacity shortage to the power supply circuit or improper installation may result in malfunction, electric shock, smoke, or fire.	❗

⚠CAUTION

To reduce the risk of electric shock, shorting, or malfunctions, keep wire pieces and sheath shavings out of the terminal block.	⚠⚡

To reduce the risk of electric shock, malfunctions, or fire, seal the gap between the cable access holes with putty.	❗

To reduce the risk of shorting, current leakage, electric shock, or malfunctions, keep the cables out of contact with AHC edges.	⚠⚡

Precautions for moving or repairing AHC

⚠WARNING

AHC should be repaired or moved only by qualified personnel. Do not disassemble or modify AHC. Improper installation or repair may cause injury, electric shock, or fire.

⚠CAUTION

To reduce the risk of shorting, electric shock, fire, or malfunction, do not touch the circuit board with tools or with your hands, and do not allow dust to accumulate on the circuit board.

Additional precautions

To avoid damage to AHC, use appropriate tools to install, inspect, or repair AHC.

AHC is designed for exclusive use with the Building Management System by Mitsubishi Electric. The use of AHC for with other systems or for other purposes may cause malfunctions.

Take appropriate measures against electrical noise interference when installing the air conditioners in hospitals or facilities with radio communication capabilities. Inverter, high-frequency medical, or wireless communication equipment as well as power generators may cause the air conditioning system to malfunction. Air conditioning system may also adversely affect the operation of these types of equipment by creating electrical noise.

To avoid malfunctions, do not bundle power cables and signal cables together, or place them in the same metallic conduit.

To reduce the risk of electric shock, turn off the power to AHC before installing or wiring AHC.

To avoid causing damage or fire, do not apply an AC voltage or a voltage higher than 32VDC to the M-NET or the power supply (24VDC) terminal blocks on AHC.

To avoid damage to AHC, do not overtighten the screws.

To avoid damage to AHC, do not make holes on AHC cover.

Do not use solderless terminals to connect cables to the terminal block. Solderless terminals may come in contact with the circuit board and cause malfunctions or damage AHC cover.

To avoid deformation and malfunction, do not install AHC in direct sunlight or where the ambient temperature may exceed 55°C (131°F) or drop below -10°C (14°F).

Do not install AHC on the panel door of the metal control box. Vibrations or shocks to AHC may damage AHC or cause AHC to fall.

2 Important Notice

This manual is a guide manual to ensure tasks such as programming, configuration of the initial settings, and trial operation are performed correctly in order to use the functions of the Advanced HVAC CONTROLLER (hereinafter referred to as AHC). Read this manual before installing or using Advanced HVAC CONTROLLER, and follow all the instructions.

[NOTES]
• This manual contains explanations and figures to help the user to properly install, program, and operate AHC.

• All the examples and figures contained in this manual are there for the sole purpose of clarification. It is not guaranteed that AHC will properly work in the types of applications used as examples or are shown in figures. MITSUBISHI ELECTRIC shall not be held responsible for any damage or loss that may result from the use of AHC in the manners shown in the examples and figures contained in this manual.

3 Functions

Advanced HVAC CONTROLLER comprises of an ALPHA2 and an AHC ADAPTER. The use of AHC ADAPTER requires the use of ALPHA2.

The following ALPHA2 are compatible with AHC. Other types of ALPHA2 do not support AHC.
- AL2-14MR-A
- AL2-14MR-D
- AL2-24MR-A
- AL2-24MR-D

System Configuration Diagram
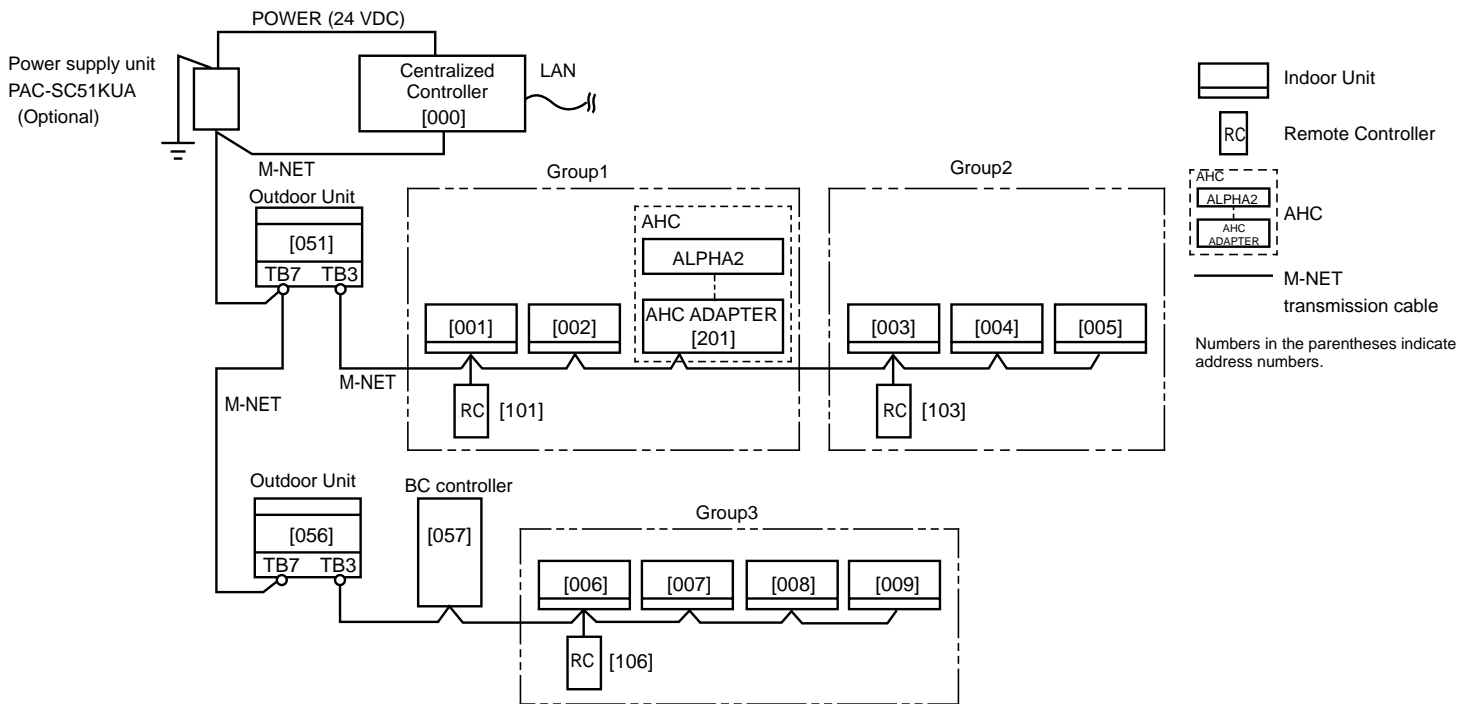
* AHC ADAPTER requires either an outdoor unit or a power supply device as a power source.

Compatible controllers [As of April 2013 (North America); June 2013 (outside North America)]

Remote Controller: PAR-U01MEDU, PAR-U02MEDA

Centralized Controller: EB-50GU-A, EB-50GU-J

AHC enables the connection of M-NET with other systems, which was not possible with the use of ALPHA2 alone. AHC supports the functions listed in Table 1.

Table 1: AHC function list

AHC Function	Example	Supplemental Inf.
① Controls external devices using the sensor data of the air conditioning units connected to M-NET.	• External heaters are controlled, using the temperature sensors on air conditioning units or on remote controllers.	By using the sensor on the air conditioning unit connected to the M-NET, no other external sensors will be required. [1]
② Interlocks the operation of air conditioning units and external devices that are connected to ALPHA2.	• The operation of external heaters is interlocked with the operation of air conditioning units in heating operation. • The operation of external humidifiers is interlocked with up to 16 air conditioning units. Humidifiers will go into operation whenever at least one air conditioning unit is in operation.	Operation status data of a maximum of 2 groups of units can be simultaneously collected. Each group can contain a maximum of 16 units. Error status of a maximum of 50 units can be simultaneously collected.
③ Controls air conditioning units that are connected to M-NET.	• The ON/OFF operation of air conditioning units is interlocked with the insertion/removal of a card into or out of a card reader.	A maximum of 2 groups of units can be simultaneously controlled. Each group can contain a maximum of 16 units.
④ Allows for the combined use of the items ①-③ above.	• Drying operation of air conditioning units is controlled, using the built-in humidity sensor on the remote controller.	
⑤ Monitors the input/output status of ALPHA2 via a remote controller or a centralized controller.		

[1] The sensor on the air conditioning unit connected to the M-NET will collect data at 70-second intervals. If a real time control at intervals shorter than 70 seconds is required, connect a sensor to the Analog Input on ALPHA2.

3.1 Use Cases

This section presents typical use cases of air conditioning control using AHC. AHC is able to use various sensor information and operational information of equipment items as input information, and control various equipment items based on the input information. Table 2 shows the typical input information and equipment items.

Table 2: Examples of Sensors and Equipment Items That Can Be Connected to AHC

Input Information			Equipment Items		
Input information from Digital Input	Input information from Analog Input	Input information from M-NET	Devices connected to Digital Output	Devices connected to Analog Output	Devices connected to M-MET
Heater ON/OFF	Temperature	Room temp (I/U)	Heater	Heater	Indoor unit
Humidifier ON/OFF	Humidity	Room temp (R/C)	Humidifier	Humidifier	Outdoor unit
Dehumidifier ON/OFF	Brightness	Indoor humidity	Dehumidifier	Dehumidifier	Lossnay
FAN ON/OFF	CO_2 concentration	Indoor occupancy sensor	FAN	FAN	PWFY
Ventilator ON/OFF	Pressure	Indoor brightness sensor	Ventilator	Ventilator	CAHV
Valve Open/Close	Water level	Outdoor temp	Damper	Damper	—
Pump ON/OFF	Wind velocity	Inlet water temp (PWFY・CAHV)	Pump	Pump	—
Damper ON/OFF	—	Outlet water temp (PWFY・CAHV)	Valve	Valve	—
Demand ON/OFF	—	Representative water temp (CAHV)	Window	Window	—
Window Open/Close	—	Set temp for heating	Lighting	Lighting	—
Water Leakage Detection	—	Set temp for cooling	Emergency bell	—	—
Abnormal Signal	—	Air conditioner ON/OFF	Abnormal output	—	—
Card Reader	—	Air conditioner mode	—	—	—
Gas Detection	—	Indoor unit capacity save	—	—	—
Door Open/Close	—	Defrost	—	—	—
Power Failure Information	—	Set humidity	—	—	—
Thermostat Signal	—	Ventilation ON/OFF	—	—	—
Brightness	—	Humidifier ON/OFF	—	—	—
Occupancy	—	Outdoor unit capacity save	—	—	—
—	—	Heat source ON/OFF	—	—	—
—	—	Set water temp (CAHV)	—	—	—
—	—	Unit error	—	—	—
—	—	M-NET communication error	—	—	—
—	—	M-NET power supply status inf	—	—	—

Meanings of the symbols for the data acquisition sources

  I/U：Indoor Unit

  R/C：Remote Controller

  PWFY：Air To Water

  CAHV：Hot Water Heat Pump

The following shows the typical combination and application examples of the input information and equipment items in Table 2.

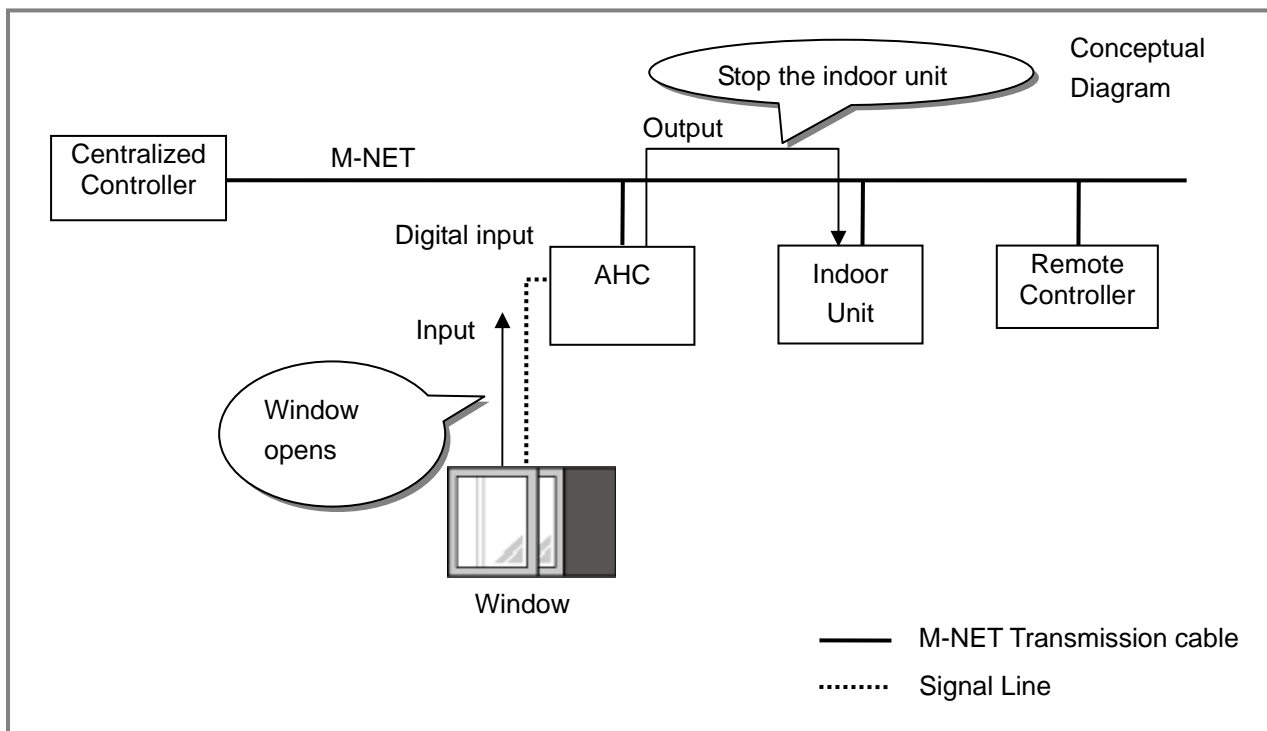Table 3 shows a summary of the combination and application examplesTable .

Table 3: Combination and Application Examples of the Input Information and Equipment Items

No.	Control	Description
1.	Interlocks the opening and closing of the window with the air conditioner	Interlocks the opening and closing of the window with the start and stop of the air conditioner.
2.	Interlocks the card reader with the air conditioner and lighting equipment	Interlocks the start and stop of the air conditioner and the on and off operation of the lighting equipment using the card reader information.
3.	Interlocks with the external heater	Interlocks the start and stop of the external heater with the start and stop of the indoor unit.
4.	Interlocks the Lossnay with the CO_2 sensor information	Changes the Lossnay operation and ventilation wind velocity level using the CO_2 sensor information.
5.	Runs the external heater using the occupancy sensor and brightness sensor information	Detects the presence or absence of humans using the occupancy sensor and brightness sensor information and interlocks it with the run of the third party heater.
6.	Interlocks with the external ventilators using the start and stop information of multiple air conditioners	Interlocks the start and stop of the third party ventilators using the start and stop information of multiple air conditioners.
7.	Interlocking of heaters, humidifiers, and fans	Interlocks the start and stop of third party heaters, humidifiers, and fans.

The following shows illustrations of the use cases summarized in Table 3.

* The following illustrations are for facilitating the understanding of the use cases. Please note that, therefore, the illustrated information (on system configurations, control items, wiring methods, etc.) are represented in an abstract form so they may differ from the actual ones.
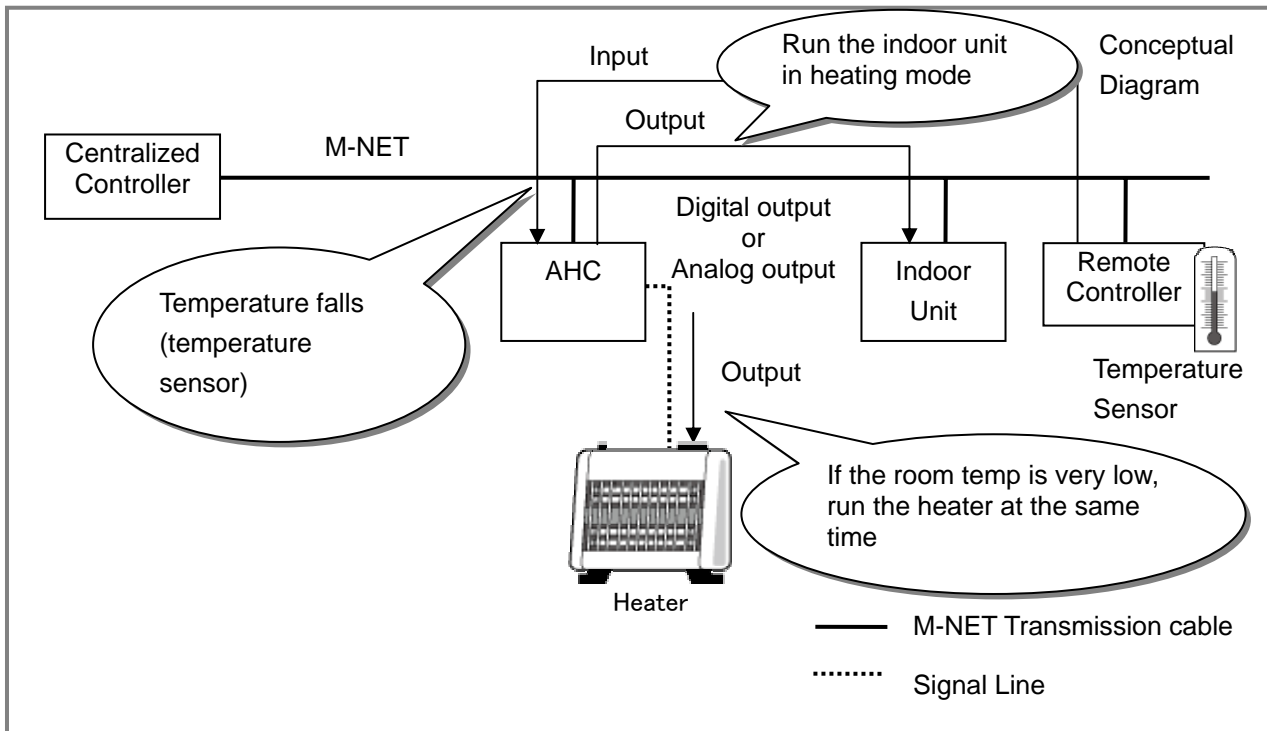
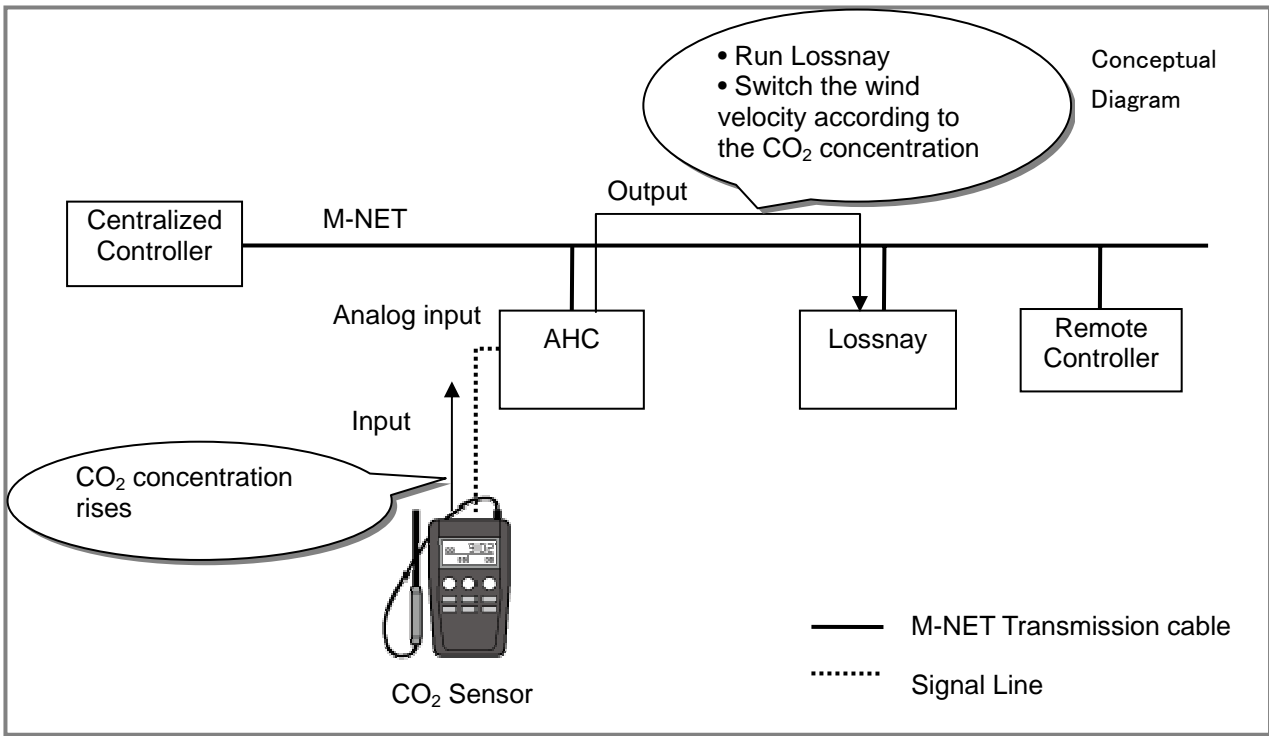## Interlocking the Opening and Closing of the Window with the Air Conditioner

Interlocking the Card Reader with the Air Conditioner and Lighting Equipment

Conceptual Diagram

Stop the indoor unit

Output

Centralized Controller — M-NET

Digital input — AHC

Digital output or Analog output

Indoor Unit

Remote Controller

Input

Output

Card key is removed

Turn the lighting off

Card Reader

Lighting

—— M-NET Transmission cable

········ Signal Line

Interlocking with the external Heater

Conceptual Diagram

Input

Run the indoor unit in heating mode

Output

Centralized Controller — M-NET

AHC

Digital output or Analog output

Indoor Unit

Remote Controller

Temperature Sensor

Temperature falls (temperature sensor)

Output

If the room temp is very low, run the heater at the same time

Heater

—— M-NET Transmission cable

········ Signal Line

Interlocking the Lossnay with the CO_2 Sensor Information

Conceptual Diagram

• Run Lossnay
• Switch the wind velocity according to the CO_2 concentration

Output

Centralized Controller — M-NET

AHC

Analog input

Lossnay

Remote Controller

Input

CO_2 concentration rises

CO_2 Sensor

—— M-NET Transmission cable

········ Signal Line

Running the Third Party Heater Using the Occupancy Sensor and Brightness Sensor Information

Conceptual Diagram

Input

Centralized Controller — M-NET

AHC

Digital output or Analog output

Indoor Unit

Remote Controller

Occupancy Sensor   Brightness Sensor

• Humans are in the room (occupancy sensor)
• Room is lit up (brightness sensor)

Output

Run the heater

Heater

—— M-NET Transmission cable

········ Signal Line
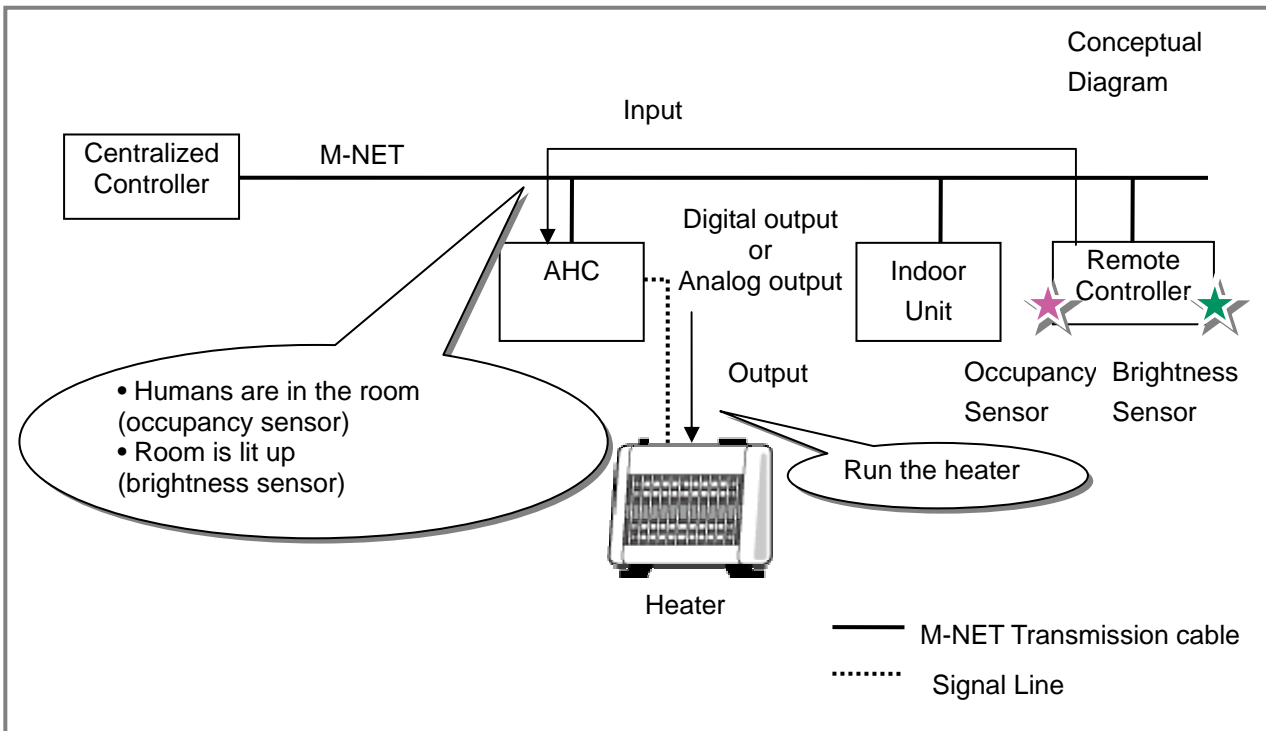
Interlocking with the external Ventilator Using the Start and Stop Information of Multiple Air Conditioners

Conceptual Diagram

One of the registered indoor units starts operation

Input

Centralized Controller

M-NET

AHC

Digital output or Analog output

Indoor Unit

Indoor Unit

Remote Controller

Output

Run the ventilator

Ventilator

—— M-NET Transmission cable

········ Signal Line
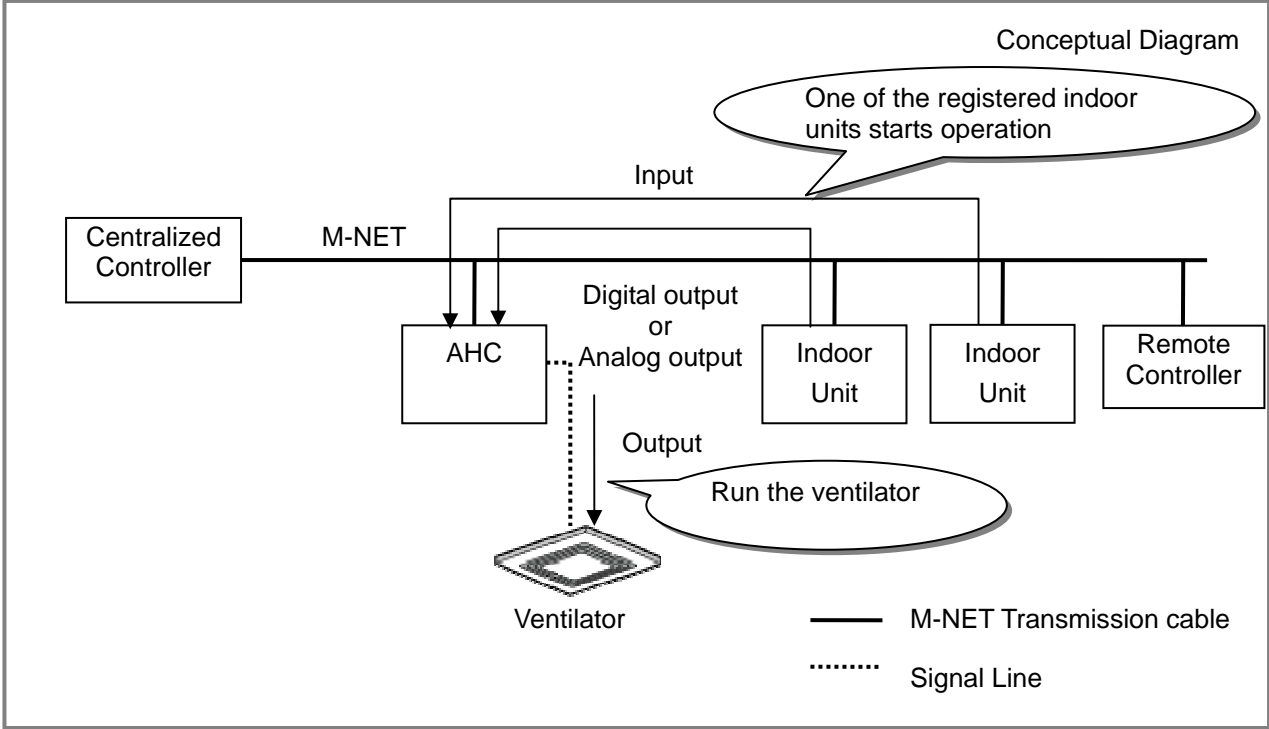
Interlocking the Heater, Humidifier, and Fan

• Temperature falls (temperature sensor)
• Humidity falls (humidity sensor)

Input

Conceptual Diagram

Centralized Controller

M-NET

AHC

Digital output or Analog output

Output

Indoor Unit

Remote Controller

Humidity Sensor

Temperature Sensor

Run the heater, humidifier, and fan

FAN   Humidifier   Heater

—— M-NET Transmission cable

········ Signal Line

13
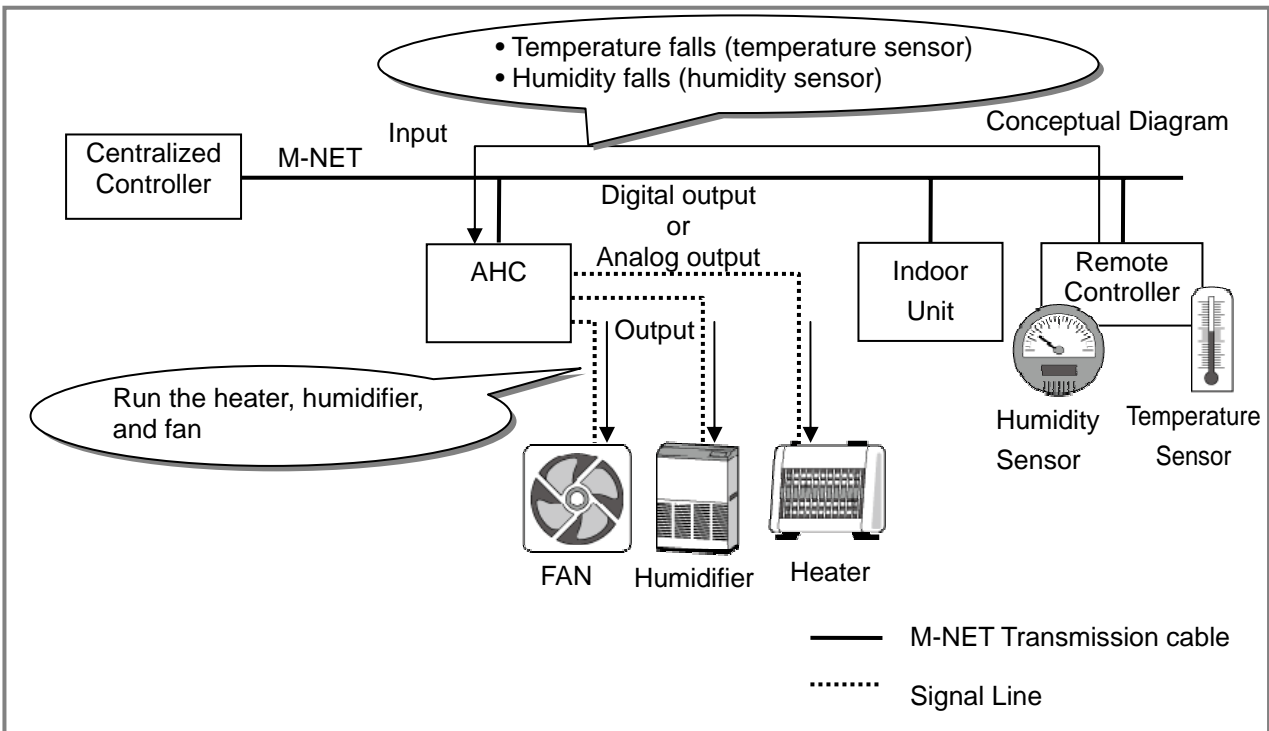
3.2 Input and Output Information

AHC is equipped with inputs and outputs of ALPHA2, inputs of data stored in Mitsubishi Electric's air conditioner, and outputs for operating Mitsubishi Electric's air conditioner, and is able to control the outputs based on the input data.

3.2.1 Inputs and Outputs of ALPHA2

Table 4 shows the input and output port information of ALPHA2 that can be used by AHC.

Table 4: List of the Number of the Input and Output Ports of ALPHA2

Power supply Types	Type Name	I/O Extension Module /Analog Expansion Module (Note 1)	Numbers of Ports			
			Digital Input (DI)	Analog Input (AI) (Note 2)	Digital Output (DO)	Analog Output (AO) (Note 2)
DC Types	AL2-14MR-D	Not available	8	(8)*	6	—
		EI available	12	(8)*	6	—
		EO available	8	(8)*	10	—
		AO available	8	(8)*	6	2
	AL2-24MR-D	Not available	15	(8)*	9	—
		EI available	19	(8)*	9	—
		EO available	15	(8)*	13	—
		AO available	15	(8)*	9	2
AC Types	AL2-14MR-A	Not available	8	—	6	—
		EI available	12	—	6	—
		EO available	8	—	10	—
	AL2-24MR-A	Not available	15	—	9	—
		EI available	19	—	9	—
		EO available	15	—	13	—

* The AI ports for the DC type are shared by DI, with a maximum number of 8 AI ports.

* AI and AO cannot be used with the AC type ALPHA2.

(Note 1) I/O Extension Module /Analog Expansion Module

    I/O Extension module

        • EI: Digital input extension module of ALPHA2. 4 digital input ports can be added.
          Type name: AL2-4EX-A2 (AC type) and AL2-4EX (DC type)

        • EO: Digital output extension module of ALPHA2. 4 digital output ports can be added.
          Type name：AL2-4EYR (AC type) and AL2-4EYT (DC type)

    Analog Expansion module

        • AO: Analog output extension module of ALPHA2. 2 analog output ports can be used.
          Type name: AL2-2DA (DC type)

    Only one of the above EI, EO, and AO can be used.

(Note 2) Analog signals that can be used for AI and AO of the DC type ALPHA2

        • Analog Input (AI)： 0-10V, PT100(*), thermocouple(*)

      (*) To use a PT100 or thermocouple, a temperature sensor module is required separately.
        Type name：AL2-2PT-ADP(Pt100 sensor), AL2-2TC-ADP(Thermocouple)
          (Converts the Pt100/thermocouple to 0-10V)

        • Analog Output (AO): 0-10V, 4-20mA

For details, refer to the ALPHA2 manuals (Installation Manual and Hardware Manual).

The input and output status of ALPHA2 and functions can be displayed on the remote controller and centralized controller connected to M-NET.

Functions can be selected by switching the functions in the initial settings in Maintenance Tool.

(For the selection method, refer to 4.4 Initial Settings of AHC ADAPTER.)

Table 5 shows a list of the functions that can be displayed on the controller.

Table 5: List of the Functions That Can Be Displayed on the Controller

Digital Input (ON/OFF Display)	Analog Input	Digital Output (ON/OFF Display)	Analog Output (% Display)
• Heater Error • Heater 1 Error • Heater 2 Error • Humidifier Error • Dehumidifier Error • Fan Error • Fan Error (Heater) • Fan Error (Humidifier) • External Unit Error • Brightness Sensor • Occupancy Sensor • Pump Interlock • Key Input • Other Input	• Room Temp (°C/°F) • Outdoor Temp (°C/°F) • SA Temp (°C/°F) • Water Temp (°C/°F) • Other Temp (°C/°F) • Room Humidity (%) • Outdoor Humidity (%) • CO_2 Sensor (ppm) • Static Pressure Sensor (%) • Brightness Sensor (%) • Water Level (%) • Other Sensor (%)	• Heater • Heater 1 • Heater 2 • Humidifier • Dehumidifier • Fan • Fan for Heater • Fan for Humidifier • Damper • Valve • Pump • Error Output • Light • Ventilation • Key Output • External Unit	• Heater(Linear) • Humidifier(Linear) • Damper(Linear) • Fan(Linear) • Valve(Linear) • Pump(Linear) • External Unit(Linear)

(Note 1) The names defined in the table above are displayed on the remote controller and centralized controller. The characters to be displayed can be changed individually on each controller.

(Note 2) If an error item is set in Digital Input and the ON signal is input in actual operation, the error is displayed on the remote controller and centralized controller.
If other digital input items are set, only the status is displayed.

(Note 3) The units for the analog inputs are pre-defined for each of the items described above. Even if the name is changed on each controller, the unit is not changed.

3.2.2 Input and Output Data Stored in Mitsubishi Electric's Air Conditioners (Via M-NET)

The input and output data stored in Mitsubishi Electric's air conditioners consists of input data captured from units connected to M-NET and output data for operating units connected to M-NET. Table 6 shows a list of the units that store input data and units that can be operated.

Table 6: Units That Have Input and Output Data and Units That Can Be Controlled

Unit Name	Input (Capture Information)	Output (Operate Unit)
Indoor Unit (I/U)	Available	Available
Outdoor Unit (O/U)	Available	Available
Remote Controller (R/C)	Available	Not available
LOSSNAY	Available	Available
Air to Water (PWFY)	Available	Available
Hot Water Heat Pump (CAHV) (*)	Available	Available
AHC	Not available	Available

Compatible Units (as of April 2013 (N.America), June 2013 (other regions))

Series	Unit	Version		Compatibility Yes	Compatibility No
CITY MULTI	Indoor Unit (I/U)	R410A or higher		✓	
		R407 or lower			✓
	Outdoor Unit (O/U)	R410A or higher	PUHY Series	✓	
			PURY Series	✓	
			PQHY Series	✓	
			PQRY Series	✓	
			PUMY Series	✓ (*2)	
		R407 or lower			✓
	LOSSNAY (LGH–RX Series)	RX4 Series or higher		✓	
		RX3 Series or lower			✓
	OA processing unit (GUF – RD(H) Series)(*1)			✓	
Air to Water (PWFY)	PWFY-AU			✓	
	PWFY-BU			✓	
Hot Water Heat Pump (CAHV) (*)	CAHV			✓	
M/P Series	M Series				✓
	P Series				✓

(*1) The OA processing unit and Hot Water Heat Pump (CAHV) are not sold in the North American region.

(*2) This only applies to PUMY Series units sold from 2007 and later.

For details, refer to 3.2.2.1 and 3.2.2.2.

3.2.2.1 Input Data

There are two types of input data stored in Mitsubishi Electric's air conditioners, sensor information and operational status information, which can be used as input data.

You need to select Use or Not Use for each item, and if you use an item, you need to set the M-NET address of the data source (if the data is captured by the reception setting from RC, no address needs to be set). Not Use is the factory default setting for all items.

(For the settings, refer to 4.4 Initial Settings of AHC ADAPTER.)

 (1) Sensor Information

AHC ADAPTER regularly monitors and acquires the sensor information stored in the units connected to M-NET, which can be used as data inside the ALPHA2. Table 7 shows a list of the data that can be captured as sensor information.

As for the sensor information, data of one unit is acquired for each piece of data.

   (Example)   Room temp (I/U) 1: Room temperature of the indoor unit with address 1

                Room temp (I/U) 2: Room temperature of the indoor unit with address 5

Table 7: Sensor Information List

Data Acquisition Source	Sensor Information	Description	Data Acquisition Timing
I/U	Room temp (I/U) 1 Room temp (I/U) 2	Room temperature sensor information of the indoor unit	Every 70 seconds
R/C	Room temp (R/C) 1 Room temp (R/C) 2	Room temperature sensor information of the remote controller	Every 70 seconds
R/C	Indoor humidity 1 Indoor humidity 2	Humidity sensor information of the remote controller	Every 70 seconds
R/C	Indoor occupancy sensor 1 Indoor occupancy sensor 2	Occupancy sensor information of the remote controller	When a change occurs
R/C	Indoor brightness sensor 1 Indoor brightness sensor 2	Brightness sensor information of the remote controller	When a change occurs
O/U	Outdoor temp 1 Outdoor temp 2	Outdoor temperature sensor information of the outdoor unit	Every 70 seconds
PWFY	Inlet water temp (PWFY) 1 Inlet water temp (PWFY) 2	Inlet water temperature sensor information of PWFY	Every 70 seconds
PWFY	Outlet water temp (PWFY) 1 Outlet water temp (PWFY) 2	Outlet water temperature sensor information of PWFY	Every 70 seconds
CAHV	Inlet water temp (CAHV) 1 Inlet water temp (CAHV) 2	Inlet water temperature sensor information of CAHV	Every 70 seconds
CAHV	Outlet water temp (CAHV) 1 Outlet water temp (CAHV) 2	Outlet water temperature sensor information of CAHV	Every 70 seconds
CAHV	Representative water temp (CAHV) 1 Representative water temp (CAHV) 2	Representative water temperature sensor information of CAHV	Every 70 seconds

Meanings of the symbols for the data acquisition sources

    I/U：Indoor Unit

    O/U：Outdoor Unit

    R/C：Remote Controller

    PWFY：Air To Water

    CAHV：Hot Water Heat Pump

(2) Operational Status Information

AHC ADAPTER can regularly monitor and acquire the operational information of the unit connected to M-NET.

The maximum number of units that can be monitored for the operational status information varies depending on the data item. As for items for which multiple units can be monitored, data of multiple units can be monitored and the aggregated results can be used as input data.
Table 8 shows a list of the data that can be captured as operational status information.

(A) Items for which the information of one unit is monitored for each piece of data
- Set temp for heating
- Set temp for cooling
- Indoor unit capacity save
- Set humidity
- Outdoor unit capacity save
- Heat source ON/OFF
- Set water temp (CAHV)
- Analog signal

(B) Items for which the information of up to 16 units can be monitored for each piece of data
- Air conditioner ON/OFF
- Air conditioner mode
- Indoor unit thermo
- Ventilation ON/OFF
- Humidifier ON/OFF

(C) Items for which the information of up to 50 units can be monitored for each piece of data
- Unit error

There are the aggregation conditions AND (when the condition for all units matches) and OR (when the condition for at least one unit matches).
When only one unit is monitored, the monitored data is used as-is as input data.
(For the setting of the aggregation condition, refer to 4.4 Initial Settings of AHC ADAPTER.)

(Example 1)   Air conditioner mode1: Set the heating in Air conditioner mode 1 when at least one of the indoor units with addresses 1 through 16 is switched to heating.
[Addresses: 1 to 16, Aggregation condition: (Heating, OR)]
Air conditioner mode2:   Set the cooling in Air conditioner mode 2 when at least one of the indoor units with addresses 17 through 32 is switched to cooling.
[Addresses: 17 to 32, Aggregation condition: (Cooling, OR)]

Send to ALPHA2 the aggregated Air conditioner mode information of indoor units 01 to 16
(Air conditioner mode1: heating)

AHC ADAPTER collects the Air conditioner mode information of indoor units 01 to 16

AHC

ALPHA2   AHC ADAPTER

Indoor Unit 01   Indoor Unit 02   …   Indoor Unit 15   Indoor Unit 16

At least one of the indoor units 01 to 16 runs in heating mode

Indoor Unit 17   Indoor Unit 18   …   Indoor Unit 31   Indoor Unit 32

At least one of the indoor units 17 to 32 runs in cooling mode

AHC ADAPTER collects the Air conditioner mode information of indoor units 17 to 32

Send to ALPHA2 the aggregated Air conditioner mode information of indoor units 17 to 32
(Air conditioner mode 2: cooling)

(Example 2)   Unit error 1: Set "Error occurs" in Unit error1 when a unit error occurs with all of the indoor units with addresses 1 to 50 [Aggregation condition (ON (Error occurs), AND)]

Send to ALPHA2 the aggregated error status of indoor units 01 to 50 (Unit eror 1: Error occurs)

AHC ADAPTER collects the error status of indoor units 01 to 50

AHC

ALPHA2   AHC ADAPTER

Indoor Unit 01   Indoor Unit 02   …   Indoor Unit 49   Indoor Unit 50

All of indoor units 01 to 50 are in error status
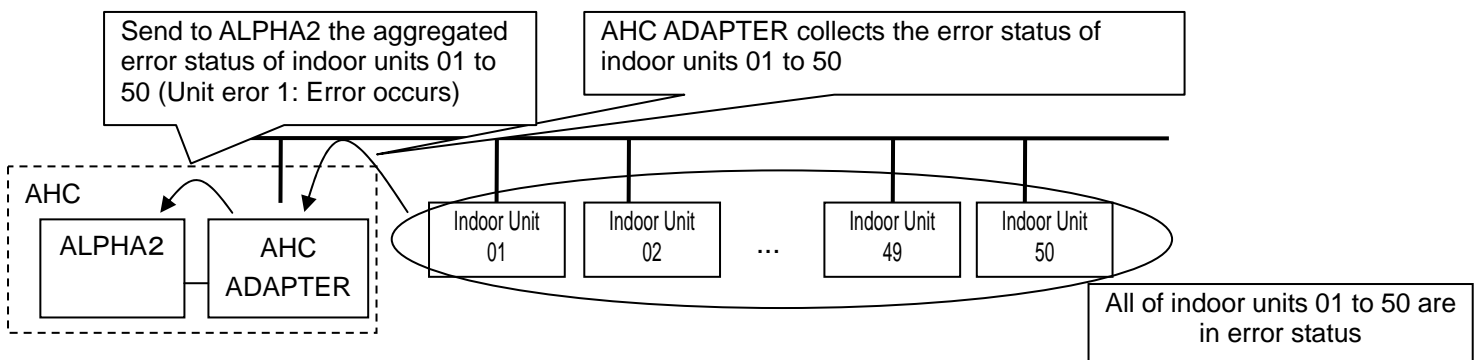
Table 8: Operational Status Information List

Data Acquisition Sources	Operational Status Information	Number of Monitors	Description	Data Acquisition Timing
I/U, PWFY	Set temp for heating 1 Set temp for heating 2	1	• Set temp for the heating, automatic heating, and set back heating of the indoor unit • Set temp for PWFY • Set temp received from RC/SC	During operation/ when unit status changes
I/U, PWFY	Set temp for cooling 1 Set temp for cooling 2	1	• Set temp for the cooling, dry, automatic cooling, and setback cooling of the indoor unit • Set temp for PWFY • Set temp received from RC/SC	During operation/ when unit status changes
I/U, PWFY	Air conditioner ON/OFF 1 Air conditioner ON/OFF 2	Up to 16	• Indoor unit and PWFY air conditioner ON/OFF status • Air conditioner operation ON/OFF received from RC/SC	During operation/ when unit status changes
I/U, PWFY, CAHV	Air conditioner mode 1 Air conditioner mode 2	Up to 16	• Indoor unit, PWFY, and CAHV operating mode status • Air conditioner operating mode received from RC/SC	During operation/ when unit status changes
I/U	Indoor unit thermo 1 Indoor unit thermo 2	Up to 16	Thermo status of the indoor unit	When unit status changes
I/U	Indoor unit capacity save 1 Indoor unit capacity save 2	1	Capacity save status of the indoor unit	When unit status changes
I/U	Defrost 1 Defrost 2	Up to 16	Defrost status of the indoor unit	When unit status changes
—	Set humidity	1	Set humidity received from RC	During operation
LOSSNAY	Ventilation ON/OFF 1 Ventilation ON/OFF 2	Up to 16	Lossnay's ventilation ON/OFF status	When unit status changes
LOSSNAY	Humidifier ON/OFF 1 Humidifier ON/OFF 2	Up to 16	Lossnay's humidifier ON/OFF status	When unit status changes
O/U	Outdoor unit capacity save 1 Outdoor unit capacity save 2	1	Capacity save status of the outdoor unit	When unit status changes
CAHV	Heat source ON/OFF 1 Heat source ON/OFF 2	1	CAHV heat source ON/OFF status	When unit status changes
CAHV	Set water temp (CAHV) 1 Set water temp (CAHV) 2	1	Set water temperature for CAHV	When unit status changes
AHC	Analog signal 1 Analog signal 2	1	Analog signal (0 to 100%) from the "Operation of signal output to other AHC"	When unit status changes
I/U,O/U, PWFY, CAHV	Unit error 1 Unit error 2	Up to 50	Unit error status of the indoor unit, PWFY, and CAHV	When unit status changes
—	M-NET communication error	—	AHC ADAPTER's communication error status in the M-NET communication	When an error occurs/ during error reset operation
—	M-NET power supply status inf	—	M-NET communication status (Energized status of the AHC ADAPTER)	Every 10 seconds (when energized)/ when 60 seconds have elapsed after a power failure

Meanings of the symbols for the data acquisition sources

I/U：Indoor Unit

O/U：Outdoor Unit

PWFY：Air To Water

LOSSNAY：LOSSNAY, OA processing unit

CAHV：Hot Water Heat Pump

AHC：Advanced HVAC CONTROLLER

RC：Remote controller
SC：Centralized controller

3.2.2.2 Output Data

The output can be used to control units connected to M-NET using the control logic of ALPHA2.

Items with the same name (with different numbers) can be used to operate two pieces of data at the same time using a single program.Up to 16 units can be operated at the same time for a single piece of data. (excluding operation of signal output to other AHC)

You need to select Use or Not Use for each item, and if you use an item, you need to set the M-NET address of the data acquisition destination. Not Use is the factory default setting for all items.

Table 9 shows a list of the data that can be operated as output information.

(Example 1)　ON/OFF operation 1: Performs ON/OFF operation for indoor units with addresses 1 to 16 at the same time.

　　　　　　　ON/OFF operation 2: Performs ON/OFF operation for indoor units with addresses 17 to 32 at the same time.

AHC ADAPTER monitors the internal data of ALPHA2
(ON/OFF operation1: ON or OFF)

When the internal data of ALPHA2 (ON/OFF operation1) changes, perform ON/OFF operation for the indoor units 01 to 16.

AHC

| ALPHA2 | AHC ADAPTER |

| Indoor Unit 01 | Indoor Unit 02 | … | Indoor Unit 15 | Indoor Unit 16 |

| Indoor Unit 17 | Indoor Unit 18 | … | Indoor Unit 31 | Indoor Unit 32 |

AHC ADAPTER monitors the internal data of ALPHA2 (ON/OFF operation2: ON or OFF)

When the internal data of ALPHA2 (ON/OFF operation2) changes, perform ON/OFF operation for the indoor units 17 to 32.

Table 9: Output Information List

Operational Targets	Output Information	Number of Units That Can Be Operated	Description	Output Timing
I/U, PWFY	ON/OFF operation1 ON/OFF operation 2	Up to 16	ON/OFF operation of the air conditioner [Air conditioner operation ON or air conditioner operation OFF]	When ALPHA2's internal data status changes
I/U, PWFY	Mode operation 1 Mode operation 2	Up to 16	Operating mode operation of the air conditioner [Operating mode: cooling, heating, fan, or others]	When ALPHA2's internal data status changes
I/U	Indoor unit capacity save operation 1 Indoor unit capacity save operation 2	Up to 16	Capacity save operation of the indoor unit [Capacity save amount 0 to 100%]	When ALPHA2's internal data status changes
I/U	Fan speed operation 1 Fan speed operation 2	Up to 16	Fixed air volume operation of the indoor unit [Fixed strong wind or release]	When ALPHA2's internal data status changes
LOSSNAY	Ventilation airflow operation 1 Ventilation airflow operation 2	Up to 16	Ventilation air volume operation of Lossnay [Ventilation OFF, ventilation ON (weak wind), or ventilation ON (strong wind)]	When ALPHA2's internal data status changes
O/U	Outdoor unit capacity save operation 1 Outdoor unit capacity save operation 2	Up to 16	Capacity save operation of the outdoor unit [Capacity save amount 0 to 100%]	When ALPHA2's internal data status changes
CAHV	Heat source ON/OFF operation 1 Heat source ON/OFF operation 2	Up to 16	CAHV heat source ON/OFF operation [Heat source operation ON or heat source operation OFF]	When ALPHA2's internal data status changes
AHC	Direct control operation 1 - Direct control operation 10	1	Operation of digital output to other AHC [Fixed ON or release (OFF)] Analog signal output to other AHC [Analog signal 0 to 100%]	When ALPHA2's internal data status changes

Meanings of the symbols for the operational targets

I/U : Indoor Unit

O/U : Outdoor Unit

PWFY : Air To Water

LOSSNAY : LOSSNAY, OA processing unit

CAHV : Hot Water Heat Pump

AHC : Advanced HVAC CONTROLLER

4 Installation Procedures

This section describes the steps up until actually using AHC. Table 10 shows the implementation process list.

Table 10: Implementation Processes Up Until Using AHC

Steps	Location	Necessary tools
(1) Programming of ALPHA2	Office	PC, programming tool (ALVLS Programming Software)
(2) Programming verification (simulation function) using the PC's programming tool	Office	PC, programming tool
(3) Downloading program to ALPHA2	Office or on site	ALPHA2 *1, ALPHA2-PC connection cable (AL-232CAB), PC, programming tool
(4) On-site installation of AHC	On site	AHC(ALPHA2 + AHC ADAPTER)
(5) Initial setting of AHC ADAPTER using Maintenance Tool	On site (office)	AHC, Maintenance Tool*2, PC, MN converter (CMS-MNG) or centralized controller *3
(6) Test run	On site	AHC, Maintenance Tool*2, PC, MN converter or centralized controller (*3), ALPHA2-PC connecting cable, and programming tool

*1 Includes the power supply to ALPHA2. (A separate power supply is required for AC and DC types.)
*2 Use Maintenance Tool Ver. 5.08, or later.
*3 Systems with a Centralized Controller do not require an MN converter (LAN connection). Systems without a Centralized Controller require an MN converter.

(1) (2) Programming and programming verification (simulation function) of ALPHA2 using PC's programming tool

Programming Mode Screen

Simulation Mode Screen

PC
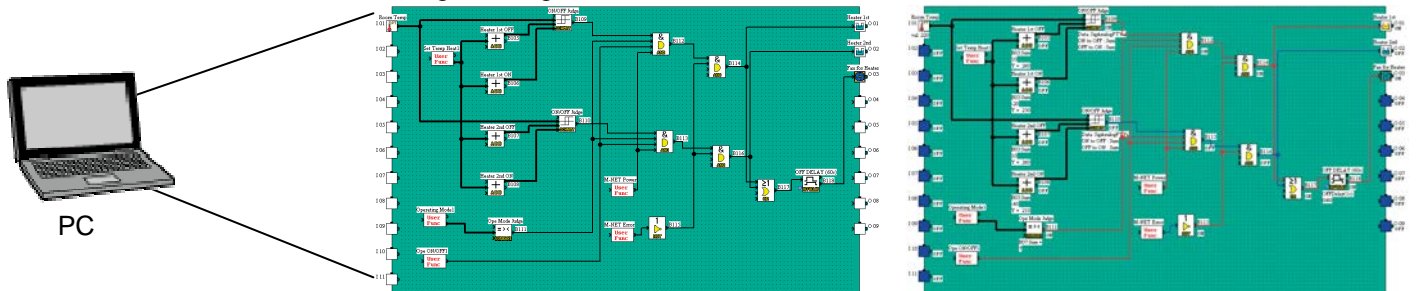
Note: Proper operation of what is shown on the programming screen above is not guaranteed.

(3) Downloading program to ALPHA2

ALPHA2-PC connecting cable (AL-232CAB)

PC

ALPHA2

Program download

(4) On-site installation of AHC

AHC

ALPHA2
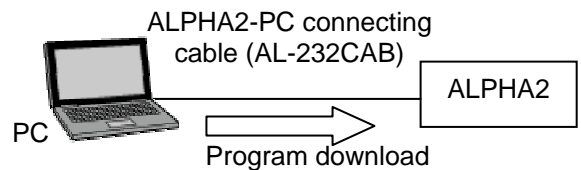
AHC ADAPTER

Install AHC
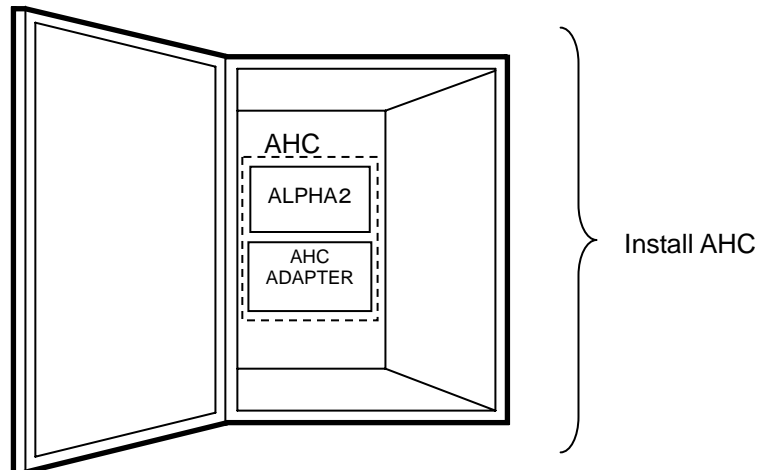
(5) Initial setting of AHC ADAPTER using Maintenance Tool

(a) System without a Centralized Controller (MN converter connection)

AHC Initializing Setting Screen

M-NET

AHC
- ALPHA2
- AHC ADAPTER
- MN Converter (CMS-MNG)

USB Cable

PC

Initial Setting Data
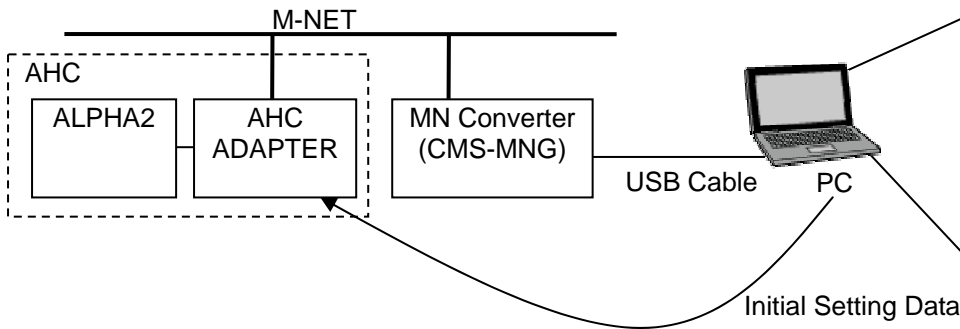
※Use Maintenance Tool Ver. 5.08, or later.

(b) System with a Centralized Controller (LAN connection)

AHC Initializing Setting Screen

M-NET

AHC
- ALPHA2
- AHC ADAPTER
- Centralized Controller

LAN Cable

PC

Initial Setting Data
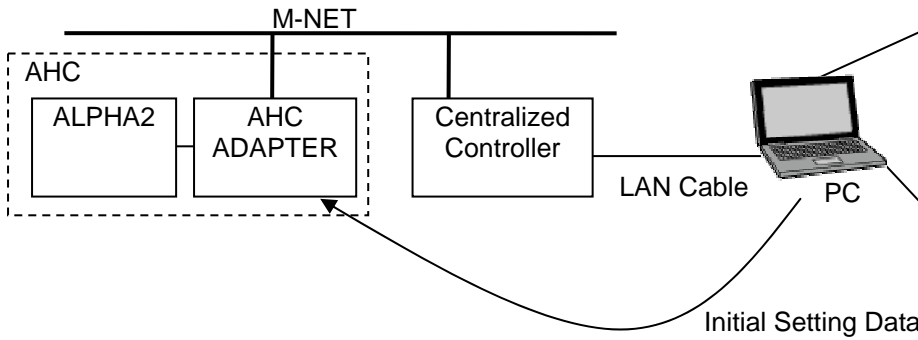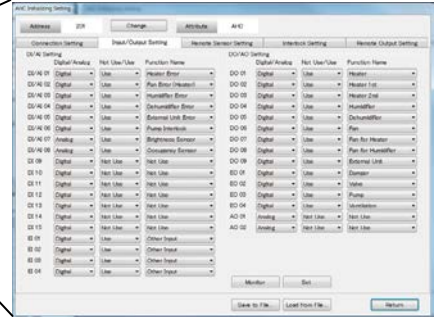
※Use Maintenance Tool Ver. 5.08, or later.

(6) Test Run

M-NET

AHC
- ALPHA2
- AHC ADAPTER

Indoor Unit   Indoor Unit   Indoor Unit

Monitoring operation status
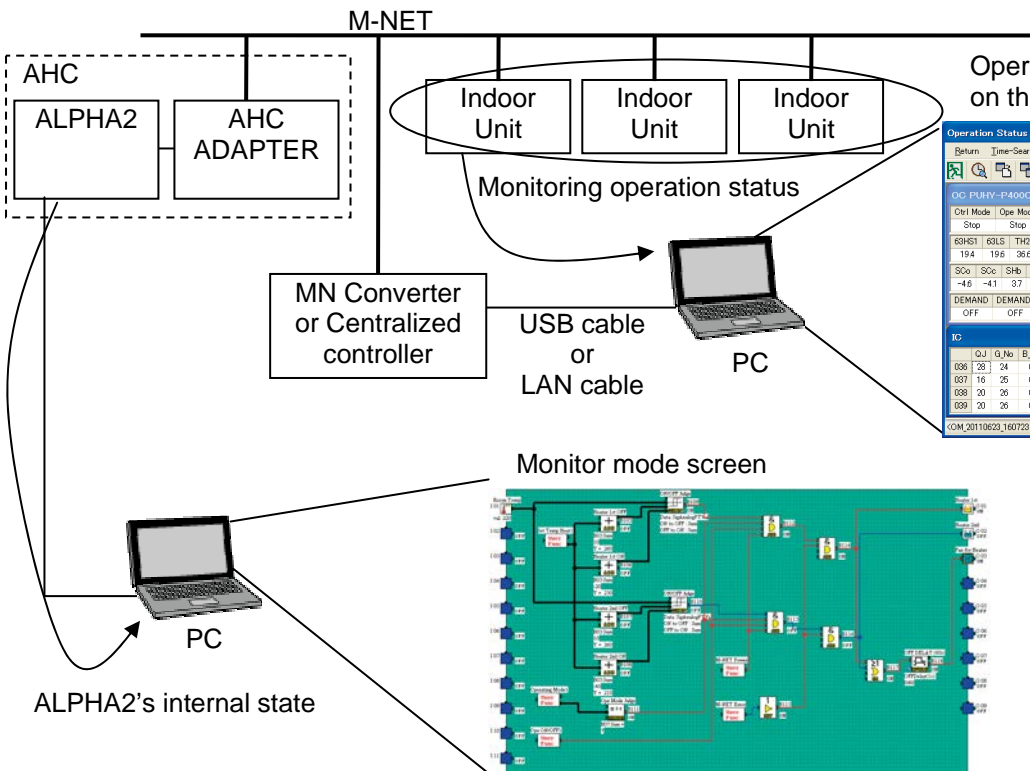
Operation Status Monitor screen on the Maintenance Tool

MN Converter or Centralized controller

USB cable or LAN cable

PC

Monitor mode screen

PC

ALPHA2's internal state
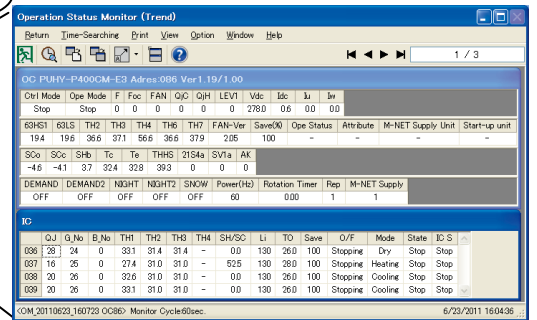
* There are no problems connecting the same PC to ALPHA2 and to the M-NET.

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4.1 Programming of ALPHA2

4.1.1 Creating Programs Using ALPHA2

Programs must be created for ALPHA2 in order to operate equipment connected to AHC.

There are the following two programming methods for ALPHA2.

- Method to create programs using ALPHA2.
- Method to create programs by connecting ALPHA2 and PC

* To connect to the PC, another dedicated cable (AL-232CAB) is required in addition to that for ALPHA2, and the ALPHA2 programming tool (ALVLS Programming Software) must be installed on the PC.

For details, refer to the ALPHA2 manuals (Software Manual and Programming Manual).

The following describes the method to create programs on the PC.

4.1.2 Method to Connect to Mitsubishi Electric's Air Conditioning Network

To use AHC by connecting it to Mitsubishi Electric's air conditioning network M-NET, programs must be created using a dedicated program (Base-program_v0100.vls) supplied with the AHC ADAPTER.

For details on creating programs, refer to the ALPHA2 manuals (Software Manual and Programming Manual).

Normal Initial Program (Untitled.vls)
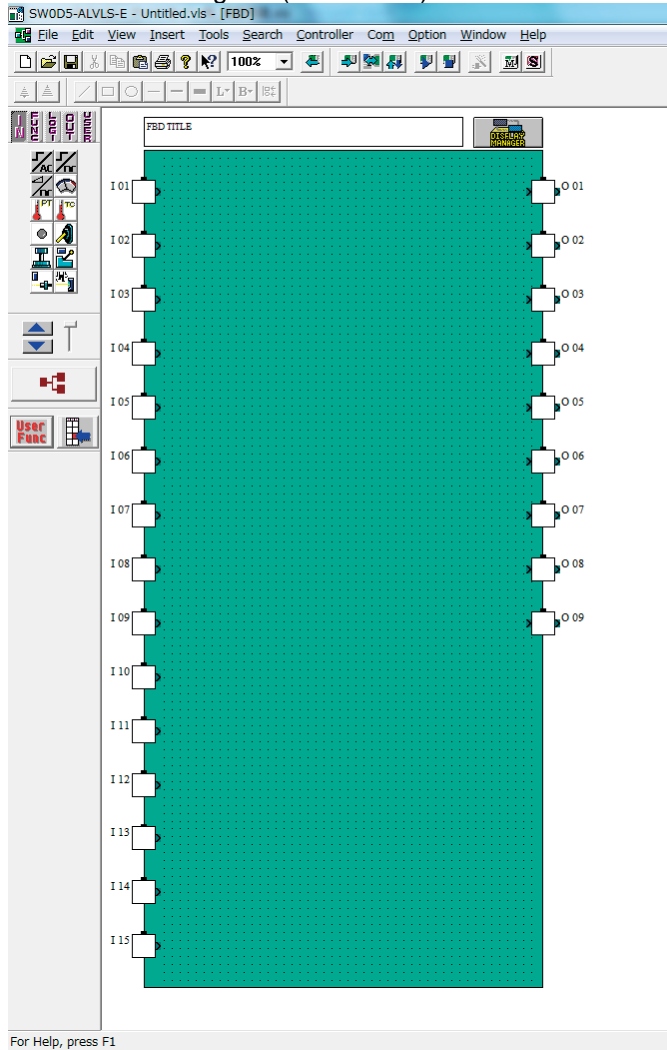
Dedicated Program (Base-program_v0100.vls)
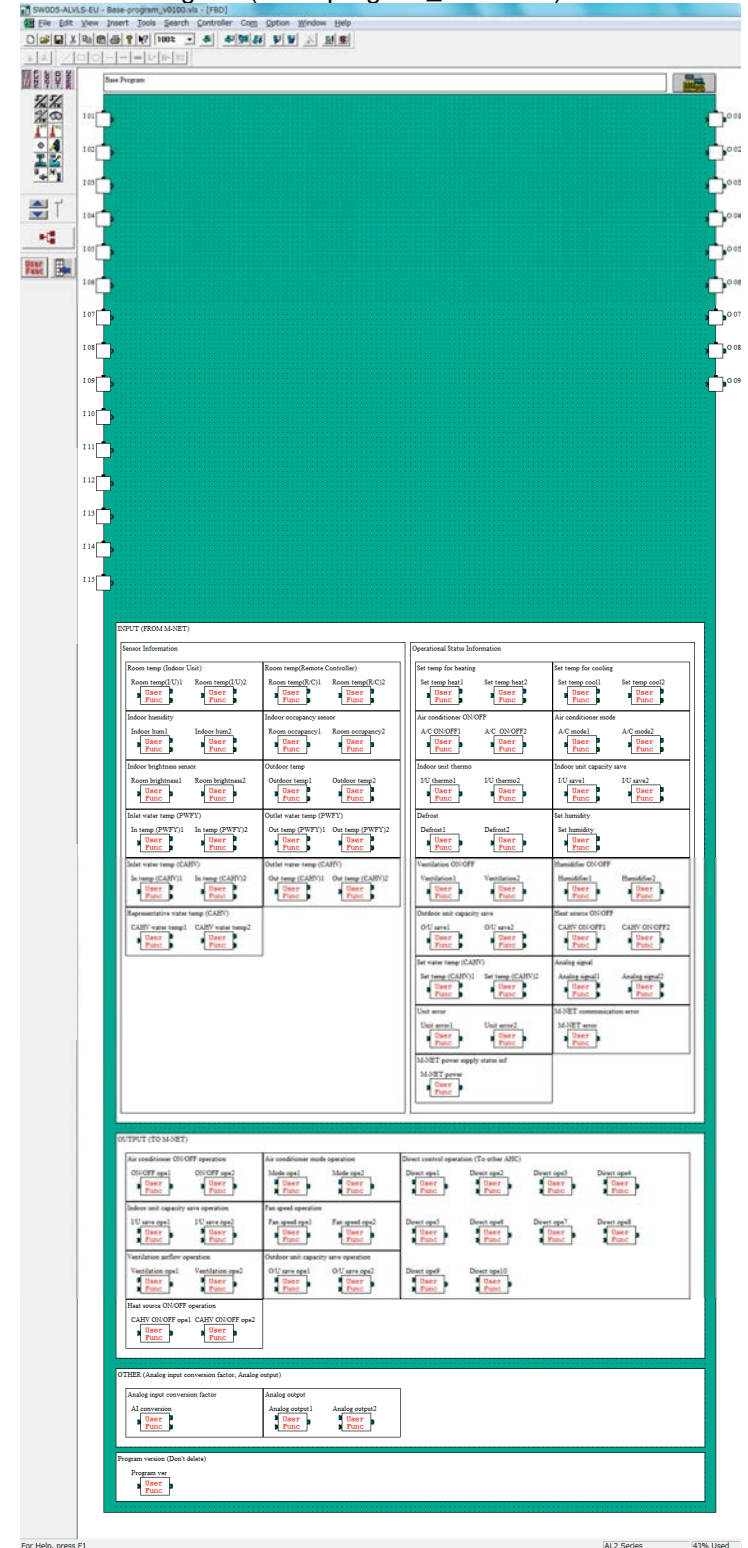
* The information required for AHC is set in the dedicated program. Be sure to use this program to create programs.

4.1.3 Programming Method Using Input and Output Data Stored in Mitsubishi Electric's Air Conditioners

The dedicated program supplied with the AHC ADAPTER includes the input and output data stored in Mitsubishi Electric's air conditioners described in 3.2.2, which can be used to create programs.

4.1.3.1 Input Data

The following describes the method to create programs using the input data described in 3.2.2.1.
If there are multiple items with the same name, data for multiple units can be used for a program at the same time.

Program Connections
Data can be connected and used by connecting the output of the input data (a block named as User Func) in "INPUT(FROM M-NET)" to the input of another function block, etc.
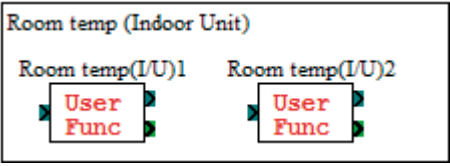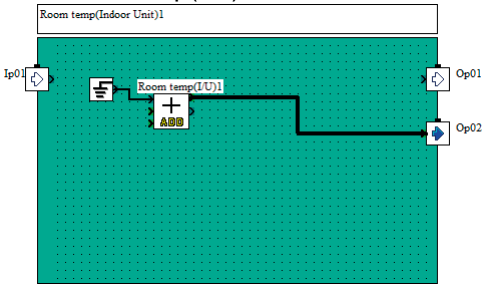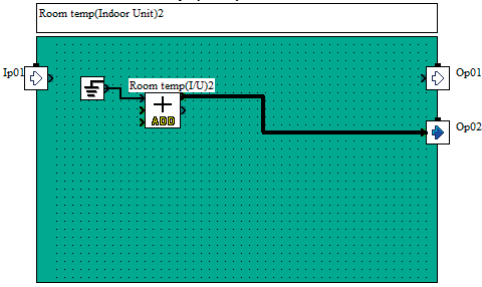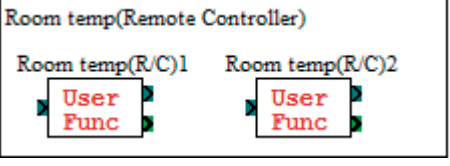
• When the data is analog input data (temperature, humidity, or other data)
   On the program screen, connection is made from a green pin on the lower right corner of each item.
      (Program example)
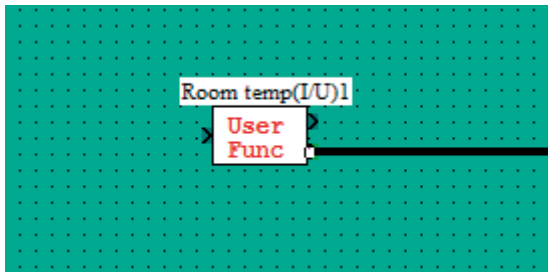
• When the data is digital input data (occupancy, brightness, or other data)
   On the program screen, connection is made from a black pin on the right of each item.
      (Program example)
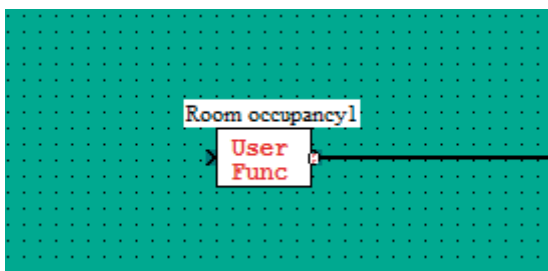
(A) Details on Each Input Data Item (Sensor Information)

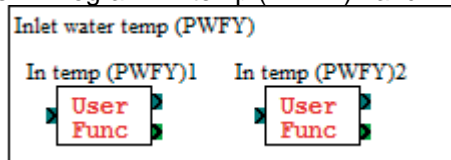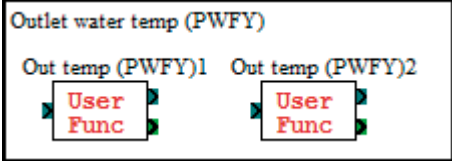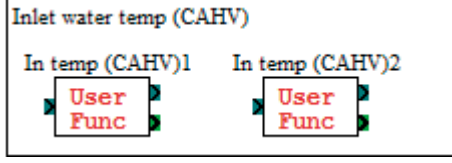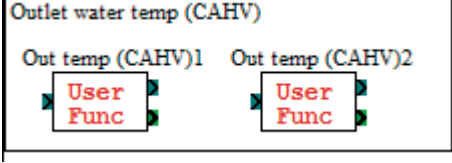| (1) Room temp (I/U)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Room temp(I/U)1 and Room temp(I/U)2

Internal Data Screen

Room temp(I/U)1   Room temp(I/U)2

The output of the ADD (Room temp(I/U)1 or Room temp (I/U)2) function block is the data of Room temp (I/U).

(2) Room temp (R/C)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Room temp(R/C)1 and Room temp(R/C)2

Internal Data Screen
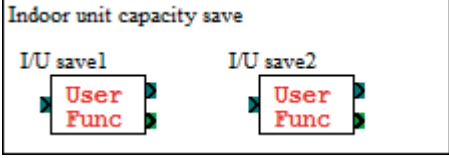The output of the ADD (Room temp(R/C)1 or Room temp(R/C)2) function block is the data of Room temp (R/C).
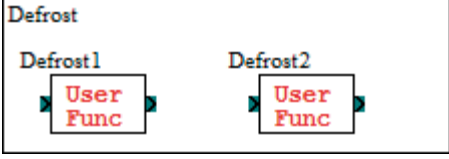(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(3) Indoor humidity	Data Description: Humidity data (0 to 100%)

Names in Program: Indoor hum1 and Indoor hum2

Internal Data Screen
The output of the ADD (Indoor hum1 or Indoor hum2) function block is the data of the indoor humidity.
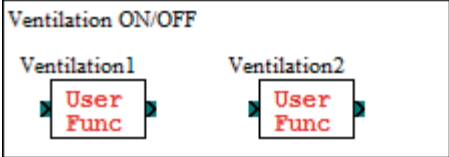(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

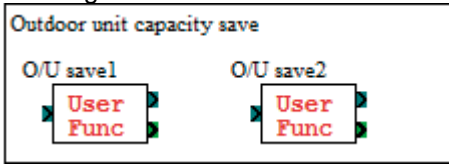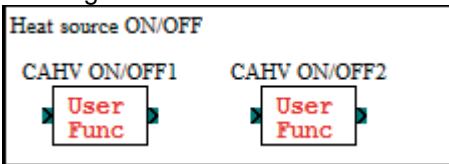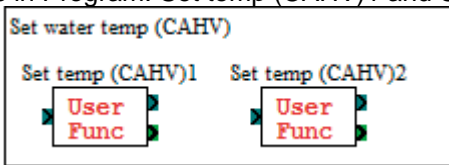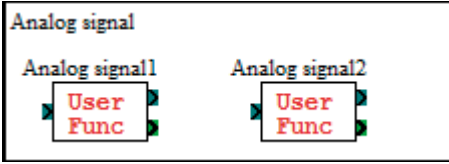| (4) Indoor occupancy sensor	Data Description: Occupancy data (Occupancy (ON) / Absence (OFF))
Names in Program: Room occupancy1 and Room occupancy2 	
Internal Data Screen Room occupancy1 Room occupancy2 The output of the SET/RESET (Room occupancy1 / Room occupancy2) function block is the data of the indoor occupancy sensor.	
(5) Indoor brightness sensor	Data Description: Brightness data (Bright(ON) / Dark(OFF))
Names in Program: Room brightness1 and Room brightness2 	
Internal Data Screen The output of the SET/RESET (Room brightness1 or Room brightness 2) function block is the data of the indoor brightness sensor. (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)	
(6) Outdoor temp	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)
Names in Program: Outdoor temp1 and Outdoor temp2 	
Internal Data Screen The output of the ADD (Outdoor temp1 or Outdoor temp2) function block is the data of the outdoor temp. (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)	
(7) Inlet water temp (PWFY)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)
Names in Program: In temp (PWFY)1 and In temp (PWFY)2 	
Internal Data Screen The output of the ADD (In temp (PWFY)1 or In temp (PWFY)2) function block is the data of the inlet water temp (PWFY). (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)	
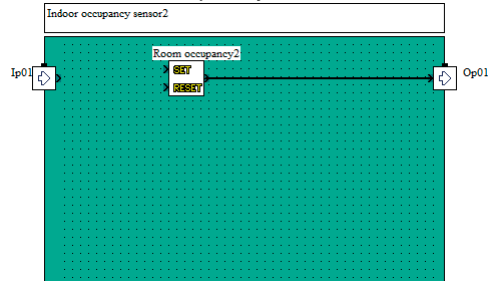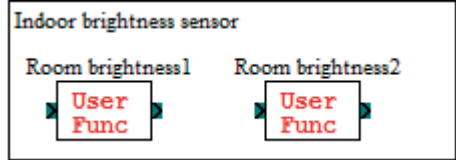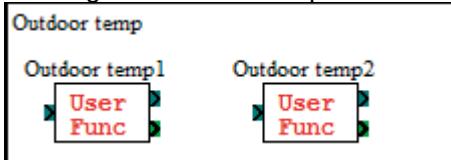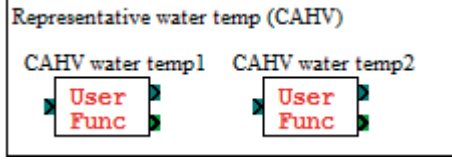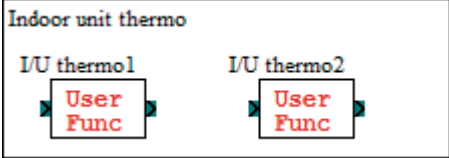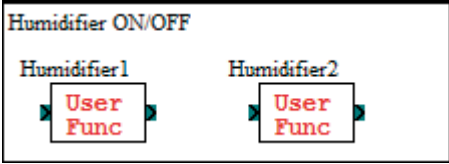
(8) Outlet water temp (PWFY)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Out temp (PWFY)1 and Out temp (PWFY)2

Outlet water temp (PWFY)

Out temp (PWFY)1   Out temp (PWFY)2

User Func   User Func

Internal Data Screen

The output of the ADD (Out temp (PWFY)1 or Out temp (PWFY)2) function block is the data of the outlet water temp (PWFY).
(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(9) Inlet water temp (CAHV)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: In temp (CAHV)1 and In temp (CAHV)2

Inlet water temp (CAHV)

In temp (CAHV)1   In temp (CAHV)2

User Func   User Func

Internal Data Screen

The output of the ADD (In temp (CAHV)1 or In temp (CAHV)2) function block is the data of the inlet water temp (CAHV).
(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(10) Outlet water temp (CAHV)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°C→770)

Names in Program: Out temp (CAHV)1 and Out temp (CAHV)2

Outlet water temp (CAHV)

Out temp (CAHV)1   Out temp (CAHV)2

User Func   User Func

Internal Data Screen

The output of the ADD (Out temp (CAHV)1 or Out temp (CAHV)2) function block is the data of the outlet water temp (CAHV).
(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(11) Representative water temp (CAHV)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: CAHV water temp1 and CAHV water temp2

Representative water temp (CAHV)

CAHV water temp1   CAHV water temp2

User Func   User Func

Internal Data Screen

The output of the ADD (CAHV water temp1 or CAHV water temp2) function block is the data of the representative water temp (CAHV).
(The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(B) Details on Each Input Data Item (Operational Status Information)

(12) Set temp for heating	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Set temp heat1 and Set temp heat2

Internal Data Screen
   The output of the ADD (Set temp heat1 or Set temp heat2) function block is the data of the set temp for heating.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(13) Set temp for cooling	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Set temp cool1 and Set temp cool2

Internal Data Screen
   The output of the ADD (Set temp cool1 or Set temp cool2) function block is the data of the set temp for cooling.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(14) Air conditioner ON/OFF	Data Description: Operation data (Run (ON) / Stop (OFF)) of the air conditioner

Names in Program: A/C ON/OFF1 and A/C ON/OFF2

Internal Data Screen
   The output of the SET/RESET (A/C ON/OFF1 or A/C ON/OFF2) function block is the data of the air conditioner ON/OFF.
   (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(15) Air conditioner mode	Data Description: Operating mode of the air conditioner (I/U, PWFY, and CAHV)

Data value	Operating mode	Unit
2(*1)	Setback (*1)	I/U
7	Heating (*2)	I/U
8	Cooling (*2)	I/U
13	Fan	I/U
14	Dry	I/U
32	Auto	I/U
144	Heating	PWFY, CAHV
145	Heating ECO	PWFY, CAHV
146	Hot Water	PWFY, CAHV
147	Anti freaze	PWFY, CAHV
148	Cooling	PWFY

(*1) Operating mode setback is only supported for the indoor units for North America.
(*2) Auto (cool) and Setback (cool) are cooling modes. Auto (heat) and Setback (heat) are heating modes.

Names in Program： A/C mode1 and A/C mode2

Internal Data Screen
   The output of the ADD (A/C mode1 or A/C mode2) function block is the data of the Air conditioner mode.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(16) Indoor unit thermo	Data Description: Thermo status data (Thermo ON (ON) / Thermo OFF (OFF)) of the indoor unit

Names in Program: I/U thermo1 and I/U thermo2

Internal Data Screen
   The output of the SET/RESET (I/U thermo1 or I/U thermo2) function block is the data of the indoor unit thermo.
   (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(17) Indoor unit capacity save	Data Description: Capacity save status data (0 to 100%) of the indoor unit

Names in Program: I/U save1 and I/U save2

Internal Data Screen
   The output of the ADD (I/U save1 or I/U save2) function block is the data of the indoor unit capacity save.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(18) Defrost	Data Description: Defrost status data (Defrost Status (ON) and Normal Status (OFF)) of the indoor unit

Names in Program: Defrost1 and Defrost2

Internal Data Screen
   The output of the SET/RESET (Defrost1 or Defrost2) function block is the data of the defrost.
   (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(19) Set humidity	Data Description: Humidity data (0 to 100%)

Name in Program: Set humidity

Internal Data Screen
   The output of the ADD (Set humidity) function block is the set humidity data.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(20) Ventilation ON/OFF	Data Description: Operational data (Run (ON) and Stop (OFF)) of the LOSSNAY

Names in Program: Ventilation1 and Ventilation2

Internal Data Screen
   The output of the SET/RESET (Ventilation1 or Ventilation2) function block is the ventilation ON/OFF data.
   (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(21) Humidifier ON/OFF	Data Description: Humidifier status data (Humidifier ON (ON) and Humidifier OFF (OFF)) of the LOSSNAY

Names in Program: Humidifier1 and Humidifier2

Internal Data Screen
   The output of the SET/RESET (Humidifier1 or Humidifier2) function block is the humidifier ON/OFF data.
   (The internal data screen is the same as that for Room Occupancy1 and Room Occupancy2)

(22) Outdoor unit capacity save	Data Description: Capacity save status data (0 to 100%) of the outdoor unit

Names in Program: O/U save1 and O/U save2

Internal Data Screen
   The output of the ADD (O/U save1 or O/U save2) function block is the outdoor unit capacity save data.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(23) Heat source ON/OFF	Data Description: Operational data (Run (ON) and Stop (OFF)) of the Hot Water Heat Pump(CAHV)

Names in Program: CAHV ON/OFF1 and CAHV ON/OFF2

Internal Data Screen
   The output of the SET/RESET (CAHV ON/OFF1 or CAHV ON/OFF2) function block is the heat source ON/OFF data.
   (The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(24) Set water temp (CAHV)	Data Description: Data of 10 times the temperature (Celsius or Fahrenheit) (25°C→250 or 77°F→770)

Names in Program: Set temp (CAHV)1 and Set temp (CAHV)2

Internal Data Screen
   The output of the ADD (Set temp (CAHV)1 or Set temp (CAHV)2) function block is the set water temp (CAHV) data.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(25) Analog Signal	Data Description: Analog value data (0 to 100%) from other AHC

Names in Program：Analog signal1 and Analog signal2

Internal Data Screen
   The output of the ADD (Analog signal1 or Analog signal2) function block is the analog signal data.
   (The internal data screen is the same as that for Room temp(I/U)1 and Room temp(I/U)2)

(26) Unit error	Data Description: Error data (Error Occurs (ON) / No Error Occurs (OFF))

**Names in Program：Unit error1 and Unit error2**
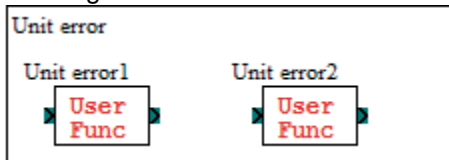
Internal Data Screen

The output of the SET/RESET (Unit error1 or Unit error2) function block is the unit error data.
(The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(27) M-NET communication error	Data Description: Error data (Error Occurs (ON) and No Error Occurs (OFF))

Name in Program：M-NET error
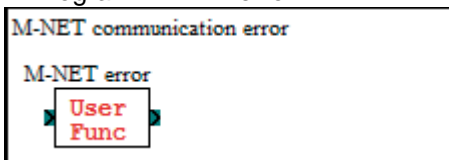
Internal Data Screen

The output of the SET/RESET (M-NET error) function block is the M-NET communication error data.
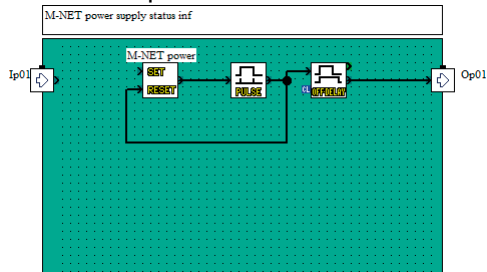(The internal data screen is the same as that for Room occupancy1 and Room occupancy2)

(28) M-NET power supply status inf	Data Description: Power ON/OFF data (Power ON (ON) / Power OFF (OFF)) of AHC ADAPTER

Name in Program: M-NET power
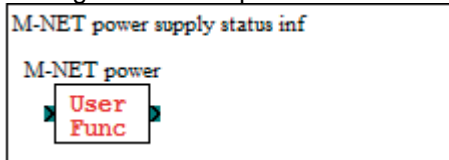
Internal Data Screen

M-NET power

The output data of the OFFDELAY function block is the M-NET power supply status inf data.
(Explanation)
When the power is ON, the output data of the SET/RESET (M-NET power) function block turns ON every 10 seconds, which then turns ON the output of the OFFDELAY function block.
The output of the OFFDELAY function block turns OFF if the ON signal is not input during a period of 60 seconds.
When the power is ON, the ON signal is input every 10 seconds, so the output of the OFFDELAY function block is always ON.

4.1.3.2 Output Data

The following describes the method to create programs using the output data described in 3.2.2.2.
If there are multiple items with the same name, data for multiple units can be used for a program at the same time.
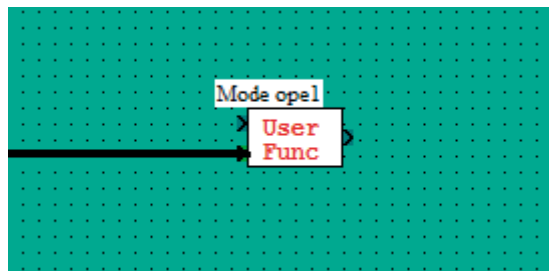
Program Connections
Units connected to M-NET can be operated based on the connected data by connecting the input of the output data (a block named as User Func) in "OUTPUT(TO M-NET)" to the output of another function block, etc.

• When the data is analog output data (mode operation, indoor capacity save operation, etc.)
  On the program screen, connection is made to a green pin on the lower left corner of each item.
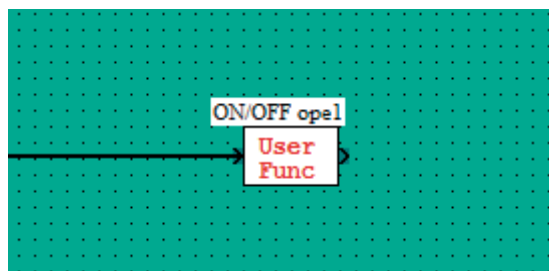   (Program example)

• When the data is digital output data (ON/OFF operation, fan speed operation, etc.)
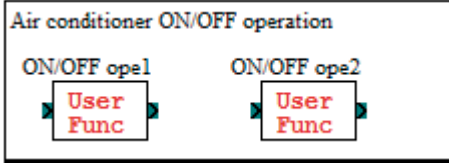 On the program screen, connection is made to a black pin on the left of each item.
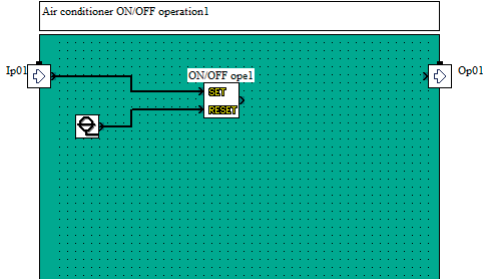   (Program example)

Details on Each Output Data Item

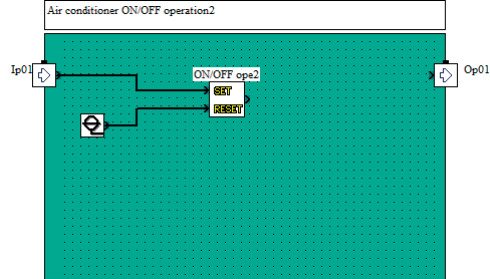| (1) ON/OFF Operation	Data Description: Operation data (Run (ON) and Stop (OFF)) of the air conditioner

Names in Program：ON/OFF ope1 and ON/OFF ope2

Internal Data Screen

ON/OFF ope1

ON/OFF ope2

The output of the SET/RESET (ON/OFF ope1 or ON/OFF ope2) function block is the ON/OFF operation data.
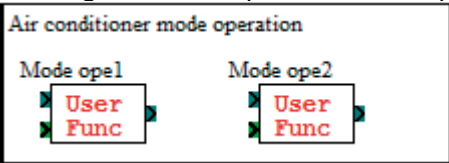If the function block output changes, the ON/OFF operation of the air conditioner unit is performed via M-NET.

| (2) Mode Operation	Data Description: Operating mode of the air conditioner (I/U, PWFY, and CAHV)

| Data value	Operating mode	Unit
2(*)	Setback (*)	I/U
7	Heating	I/U
8	Cooling	I/U
13	Fan	I/U
14	Dry	I/U
32	Auto	I/U
144	Heating	PWFY, CAHV
145	Heating ECO	PWFY, CAHV
146	Hot Water	PWFY, CAHV
147	Anti freaze	PWFY, CAHV
148	Cooling	PWFY

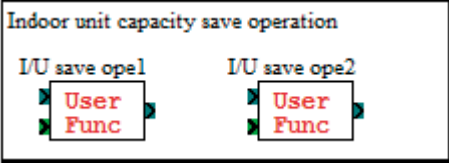(*) Operating mode setback is only supported for the indoor units for North America.
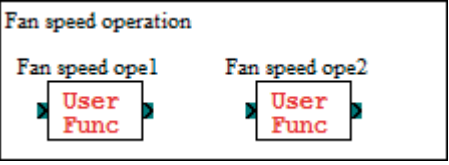
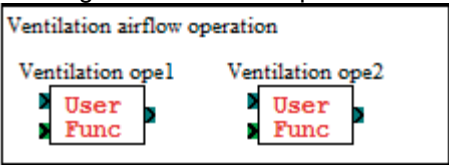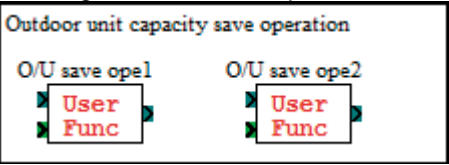Names in Program: Mode ope1 and Mode ope2

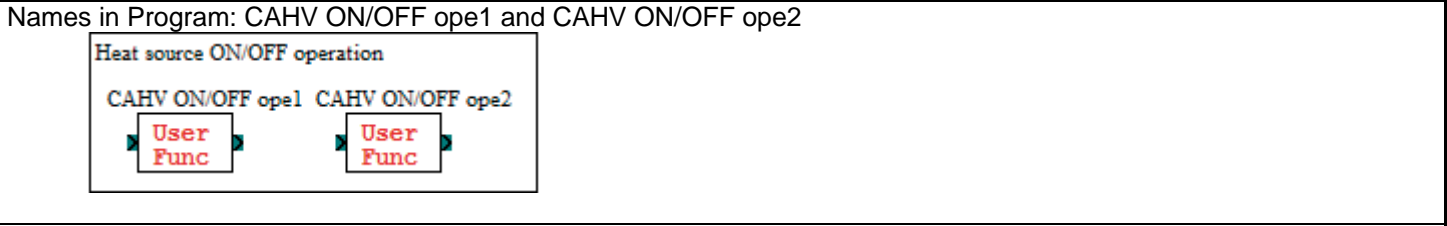
Internal Data Screen

Mode ope1
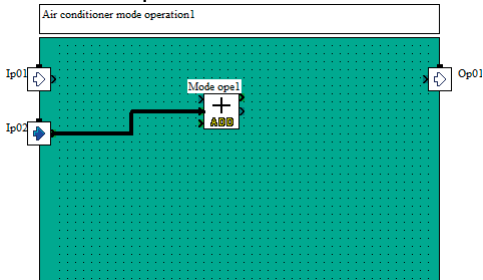
Mode ope2
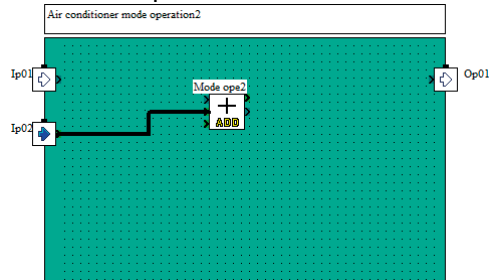
The output of the ADD (Mode ope1 or Mode ope2) function block is the mode operation data.
If the function block output changes, the mode operation of the air conditioner unit is performed via M-NET.

(3) Indoor unit capacity save operation	Data Description: Capacity save operation data (0 to 100%)

Names in Program: I/U save ope1 and I/U save ope2

Internal Data Screen

  The output of the ADD (I/U save ope1 or I/U save ope2) function block is the data of the indoor unit capacity save operation.

  If the function block output changes, the indoor unit capacity save operation is performed via M-NET.

  (The internal data screen is the same as that for Mode ope1 and Mode ope2)

(4) Fan speed operation	Data Description: Fan speed operation data (Fixed High (ON) or Release (OFF)) of the indoor unit

Names in Program: Fan speed ope1 and Fan speed ope2

Internal Data Screen

  The output of the SET/RESET (Fan speed ope1 or Fan speed ope2) function block is the data of the indoor unit fan speed operation.

  If the function block output changes, the fan speed operation is performed via M-NET.

  (The internal data screen is the same as that for ON/OFF ope1 and ON/OFF ope2)

(5) Ventilation airflow operation	Data Description: Ventilation operation data of Lossnay

Data value	Operation mode	Unit
0	Stop	LOSSNAY
1	Low	LOSSNAY
2	High	LOSSNAY

Names in Program: Ventilation ope1 and Ventilation ope2

Internal Data Screen

  The output of the ADD (Ventilation ope1 or Ventilation ope2) function block is the data of the ventilation airflow operation.

  If the function block output changes, the run operation of Lossnay is performed via M-NET.

  (The internal data screen is the same as that for Mode ope1 and Mode ope2)

(6) Outdoor unit capacity save operation	Data Description: Capacity save operation data (0 to 100%)

Names in Program: O/U save ope1 and O/U save ope2

Internal Data Screen

  The output of the ADD (O/U save ope1 or O/U save ope2) function block is the data of the outdoor unit capacity save operation.

  If the function block output changes, the capacity save operation of the outdoor unit is performed via M-NET.

  (The internal data screen is the same as that for Mode ope1 and Mode ope2)

(7) Heat source ON/OFF operation	Data Description: Operation data (Run (ON) and Stop (OFF)) of the Hot Water Heat Pump(CAHV)

Names in Program: CAHV ON/OFF ope1 and CAHV ON/OFF ope2

Internal Data Screen

The output of the ADD (CAHV ON/OFF ope1 or CAHV ON/OFF ope2) function block is the data of the CAHV heat source ON/OFF operation.

If the function block output changes, the run operation of CAHV is performed via M-NET.

(The internal data screen is the same as that for ON/OFF ope1 and ON/OFF ope2)

(8) Direct control operation	Data Description: ON/OFF data or analog value data (0 to 100%)

In case of setting digital output ports

Data value	Output data	Unit
0	OFF	AHC
1	ON	AHC

In case of setting analog output ports

Data value	Output data	Unit
0	0%(OFF)	AHC
1	1%(ON)	AHC
~	~	AHC
100	100%(ON)	AHC

Names in Program: Direct ope1 to Direct ope10
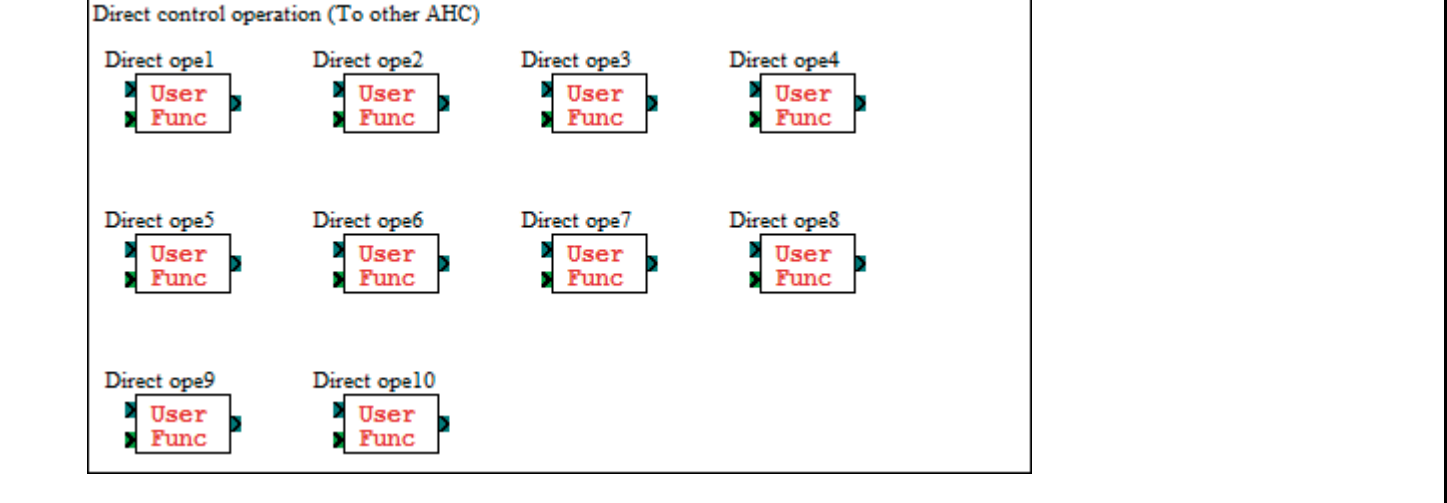
Internal Data Screen

The output of the ADD (Direct ope1 to Direct ope10) function block is the data of direct control operation to other AHC.

If the function block output changes, the operation of the direct output to other AHC is performed via M-NET.

(The internal data screen is the same as that for Mode ope1 and Mode ope2)

4.1.4 Method to Create Programs Using the Analog Input and Output Items

When using the analog input and output of ALPHA2 to create programs, the specified function blocks must be used to display the analog input and output status on the remote controller, etc.

4.1.4.1 Analog Input

Functions using analog input include the temperature input (°C/°F), CO_2 concentration input (ppm), and other (humidity) input (%).

(1) Temperature Input (°C/°F)

To use the temperature input, connect the Analog Expansion Module (AL2-2PT-ADP or AL2-2TC-ADP) to the input port of ALPHA2 so that the temperature data can be input to ALPHA2 as is. (The value is the temperature data x 10)
The temperature input can be used by setting "PT100 Analog Input" or "TC Analog Input" for the input port in the program. So use that input data in the program as is.
The Celsius and Fahrenheit temperature scales are available for the analog input of ALPHA2, and need to be switched in the setting.

- Setting the temperature scale in Analog Input of ALPHA2
  In the menu file, click Option → Analog Input to switch the temperature scale.
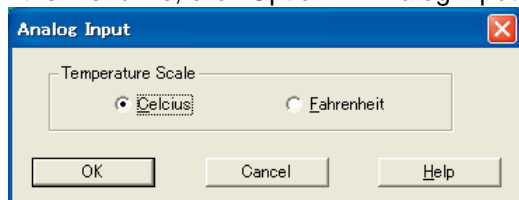
For details, refer to the ALPHA2 manuals (Hardware Manual and Software Manual).

The temperature scale needs to be set for Analog Input of ALPHA2 as well as for the input of the data stored in Mitsubishi Electric's air conditioner that is captured from M-NET.

- Setting the temperature scale of data stored in Mitsubishi Electric's air conditioner
  Switch the temperature scale using DIPSW (103-1) on the AHC ADAPTER board
  SW103-1 OFF: Celsius setting (factory default setting)
          ON: Fahrenheit setting

(*) Be sure to match the temperature scale for Analog Input of ALPHA2 with that for the data stored in Mitsubishi Electric's air conditioner.

The analog input temperature captured by ALPHA2 can be displayed on Mitsubishi Electric's air conditioner controllers such as the remote controller for AHC.

(2) CO$_2$ Concentration Input (ppm)

To use the CO$_2$ concentration input, connect a CO$_2$ sensor capable of 0 to 10 V output directly to the input port of ALPHA2.

In the program, a value of 0 to 500 corresponding to 0 to 10 V is entered by setting "Analog Input" for the input port. Furthermore, adaptation to the characteristic of the CO$_2$ sensor (for example, 0 to 2000 ppm or 0 to 5000 ppm, etc.) is required in the program, so use the Multiplication function block to multiply an input value of 0 to 500 by the analog input conversion factor available in the dedicated program and use the calculation result as control data.

- Method to use the analog input conversion factor

1. Set the conversion factor for adaptation to the characteristic of the CO$_2$ sensor in Input Values (A) of the ADD (AI Conversion) function block inside the available Analog Input conversion factor.

   Analog input conversion factor: Value obtained by dividing the upper limit (ppm) of the CO$_2$ sensor by 500
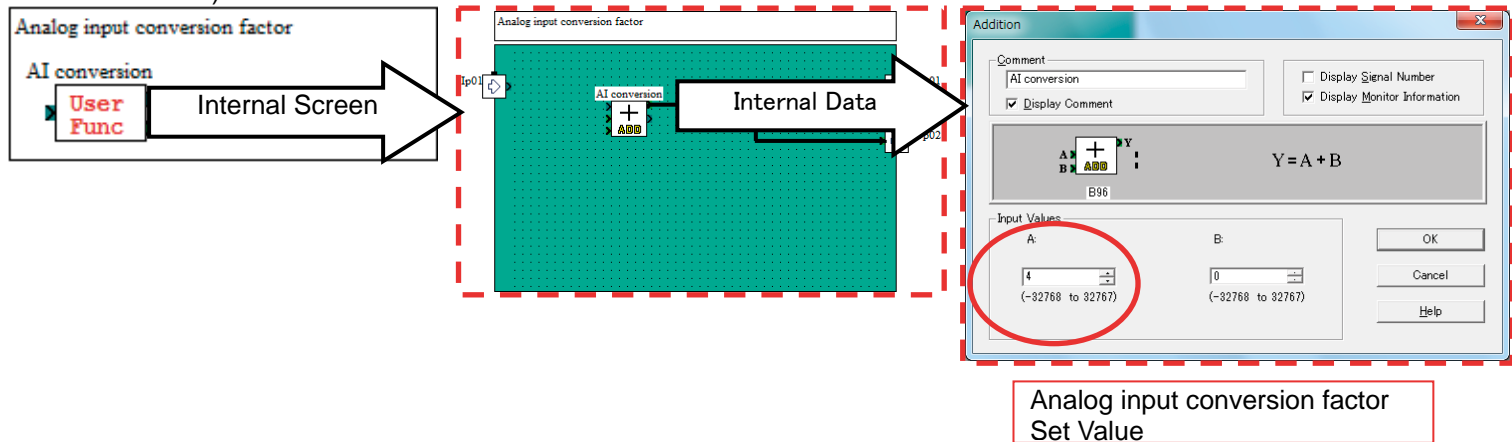   (Example) Analog input conversion factor for a 0 to 2000 ppm CO$_2$ sensor: 4
   Analog input conversion factor for a 0 to 5000 ppm CO$_2$ sensor: 10

Main Screen (Analog input conversion factor)

Analog input conversion factor Internal Screen

ADD (AI conversion) function block Internal Data Screen
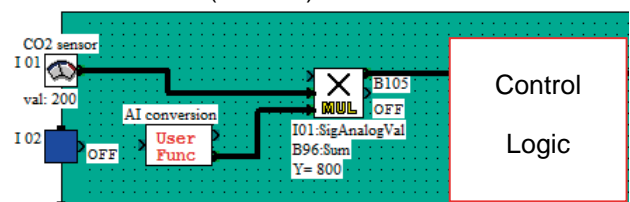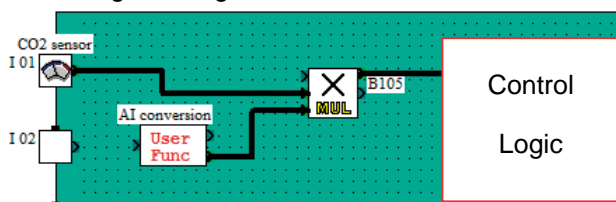

Analog input conversion factor Set Value

2. Multiply the analog input data by the set analog input conversion factor and use the calculation result as control data.

   Enter the conversion factor in Input Values (A) for adaptation to the characteristic of the CO$_2$ concentration sensor.

Programming Mode Screen

Simulation (Monitor) Mode Screen

The data obtained by multiplying the analog input data by the analog input conversion factor that is captured by the ALPHA2 can be displayed on Mitsubishi Electric's air conditioning controllers such as the remote controller for AHC.

(3) Other Inputs (%) (Including Humidity Input)

For inputs other than the above (1) Temperature Input and (2) CO$_2$ Concentration Input, connect each sensor that allows a direct 0 to 10 V output to the input port of ALPHA2.

In the program, a value of 0 to 500 corresponding to 0 to 10 V is entered by setting "Analog Input" for the input port. Furthermore, use the Multiplication and Division function blocks to perform calculations for adaptation to the characteristic data of each sensor. The analog input conversion factor used in the above (2) CO$_2$ Concentration does not need to be used.

However, the analog input data captured by ALPHA2 is all displayed as 0 to 100% data on Mitsubishi Electric's air conditioning controllers such as the remote controller for AHC.

4.1.4.2 Analog Output

There are two types of analog outputs, 0 to 10 V output and 4 to 20 mA output, so connect external equipment for the 0 to 10 V input or 4 to 20 mA input.

When setting 0 to 10 V: 0 to 4000 ⇒ 0 to 10V   Resolution: 2.5 mV (10 V/4000)

When setting 4 to 20 mA: 0 to 2000 ⇒ 4 to 20 mA   Resolution: 8 uA ((20 to 4) mA/2000)

For details, refer to the ALPHA2 manuals (Hardware Manual and Software Manual).

In the program, use the Analog output1 or Analog output2 available in the dedicated program.

The desired analog signal is output from the analog output port by inputting the analog signal into the analog input pin of Analog output1 or Analog output2.

(*) Do not add and use a new Analog Output in the function block available in the program.

Main Screen (Analog output)

Programming Screen
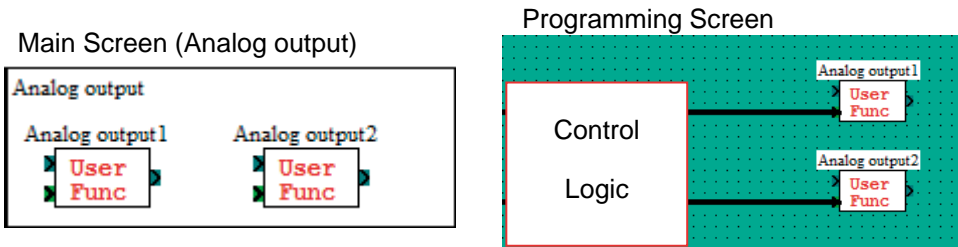
• Switching the output signal (0 to 10 V and 4 to 20 mA)

To switch the output signal for the analog output, change the signal connected to the input of the SET/RESET function block in the internal screen of Analog ouput1 or Analog output2.

When connected to RESET: 0 to 10 V output setting (factory default setting)

When connected to SET: 4 to 20 mA output setting

When Setting 0 to 10 V Output (Analog output1 Internal Screen)
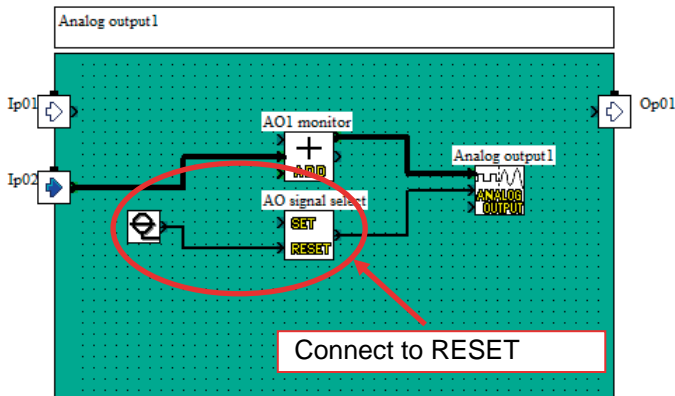
When Setting 0 to 10 V Output (Analog output2 Internal Screen)
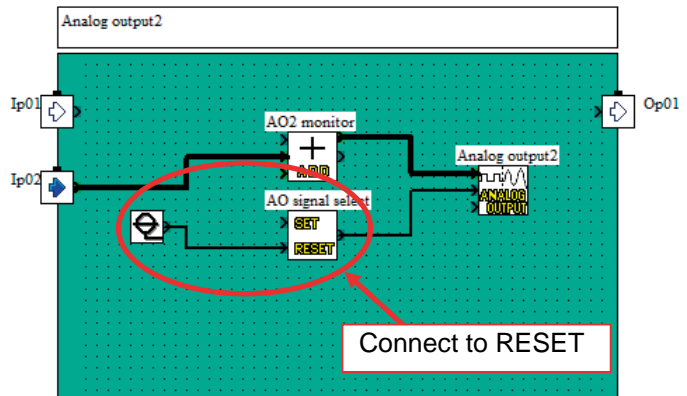
Connect to RESET

Connect to RESET

When Setting 4 to 20 mA Output (Analog output1 Internal Screen)

When Setting 4 to 20 mA Output (Analog output2 Internal Screen)

Connect to SET

Connect to SET
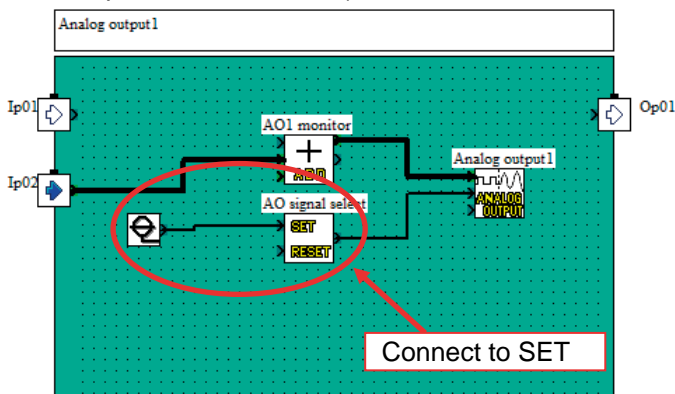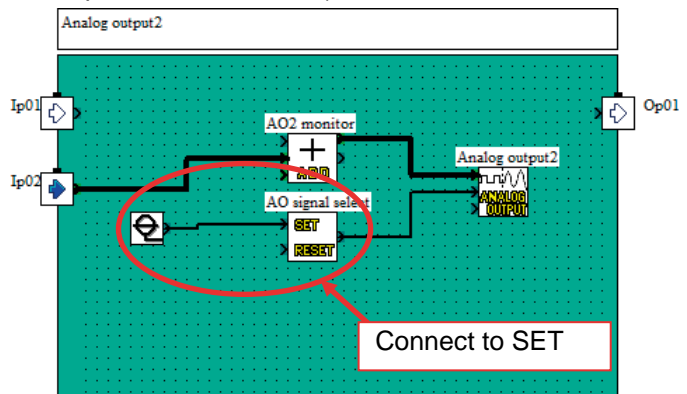
The analog output data of ALPHA2 is all displayed as 0 to 100% data on Mitsubishi Electric's air conditioning controllers such as the remote controller for AHC.

4.2 Programming Verification of ALPHA2

Programs created using the PC programming tool (ALVLS Programming Software) can be verified using the simulation function of the programming tool. Be sure to run a simulation of the created programs to verify that there is no problem with the programs.

For details, refer to the ALPHA2 manual (Software Manual).

4.3 Downloading Software to ALPHA2

Download the programs you created using the PC programming tool (ALVLS Programming Software) to ALPHA2 using the dedicated cable (AL-232CAB).

For details, refer to the ALPHA2 manuals (Hardware Manual and Software Manual).

4.4 Initial Settings of AHC ADAPTER

4.4.1 Method to Connect Maintenance Tool to AHC ADAPTER

To operate equipment to be connected to AHC, you need to configure the initial settings of AHC ADAPTER with Maintenance Tool.
There are two modes for configuring settings with Maintenance Tool, [Online Setting] and [Offline Setting].

[Online Setting]

  Connect a PC with Maintenance Tool installed to the M-NET transmission line via the MN converter, or connect a PC with Maintenance Tool installed to the centralized controller using a LAN cable to monitor or set up AHC online.

  • MN Converter Connection
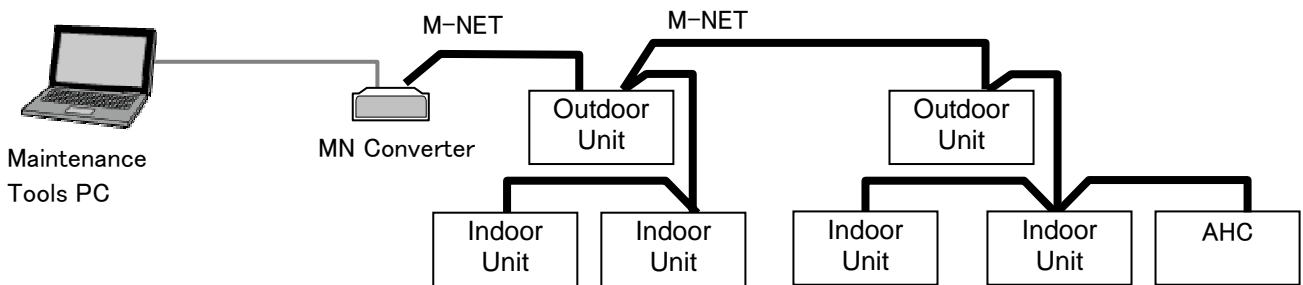
  • LAN Connection
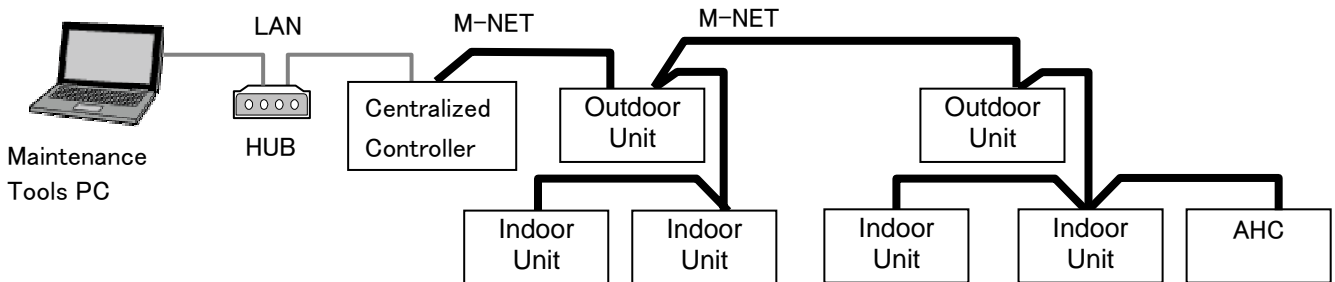
[Offline Setting]

  The initial setting items of AHC can be edited and saved.

  The saved data can be retrieved during online setting.

  The time and effort required for the work on site can be reduced by editing the initial setting items beforehand in Offline Setting.

4.4.2 Initial Settings Flow

Follow the flow chart below to configure the initial settings.

For details on each item, refer to 4.4.2.1 to 4.4.2.12.

```
                          ┌─────────┐
                          │  Start  │
                          └────┬────┘
                               │
                ┌──────────────┴───────────────┐
                │ 4.4.2.1 Starting Maintenance  │
                │            Tool               │
                └──────────────┬───────────────┘
                               │
          ◇ 4.4.2.2 Selecting the Connection Method ◇
     Online Setting                        Offline Setting
          │                                      │
   ┌──────┴────────────────┐                     │
   │ 4.4.2.3 Searching for │                     │
   │          AHC          │                     │
   └──────────┬────────────┘                     │
              └────────────────────┐             │
                                   │             │
                    ┌──────────────┴──────────────┐
                    │ 4.4.2.4 Initial Settings of  │
                    │            AHC               │
                    └──────────────┬───────────────┘
                                   │
              ◇      Setting file available?      ◇
         No                                      Yes
          │                                       │
┌─────────┴──────────────────────┐                │
│ 4.4.2.5 Editing the Connection │                │
│          Information           │                │
└─────────┬──────────────────────┘                │
┌─────────┴──────────────────────┐                │
│ 4.4.2.6 Editing the Input and  │                │
│       Output Information        │                │
└─────────┬──────────────────────┘                │
┌─────────┴──────────────────────┐                │
│ 4.4.2.7 Editing the Input Data │                │
│ (Operational Status Information)│               │
└─────────┬──────────────────────┘     ┌──────────┴───────────────┐
          │                             │ 4.4.2.11 Loading the     │
          │                             │      Setting File        │
┌─────────┴──────────────────────┐     └──────────┬───────────────┘
│ 4.4.2.8 Editing the Input Data │                │
│      (Sensor Information)       │                │
└─────────┬──────────────────────┘                │
┌─────────┴──────────────────────┐                │
│ 4.4.2.9 Editing the Output Data │               │
└─────────┬──────────────────────┘                │
┌─────────┴──────────────────────┐                │
│ 4.4.2.10 Saving the Setting    │                │
│            File                │                │
└─────────┬──────────────────────┘                │
          └────────────────┐         ┌────────────┘
                    ┌───────┴─────────┴────┐
                    │ 4.4.2.12 Settings    │
                    └──────────┬───────────┘
                               │
                          ┌────┴────┐
                          │   End   │
                          └─────────┘
```
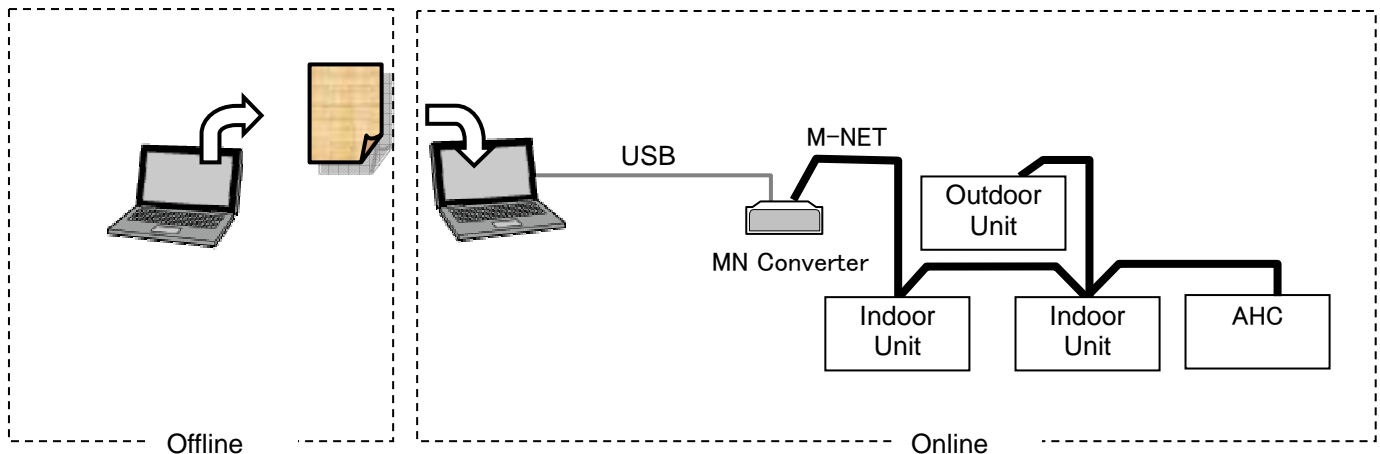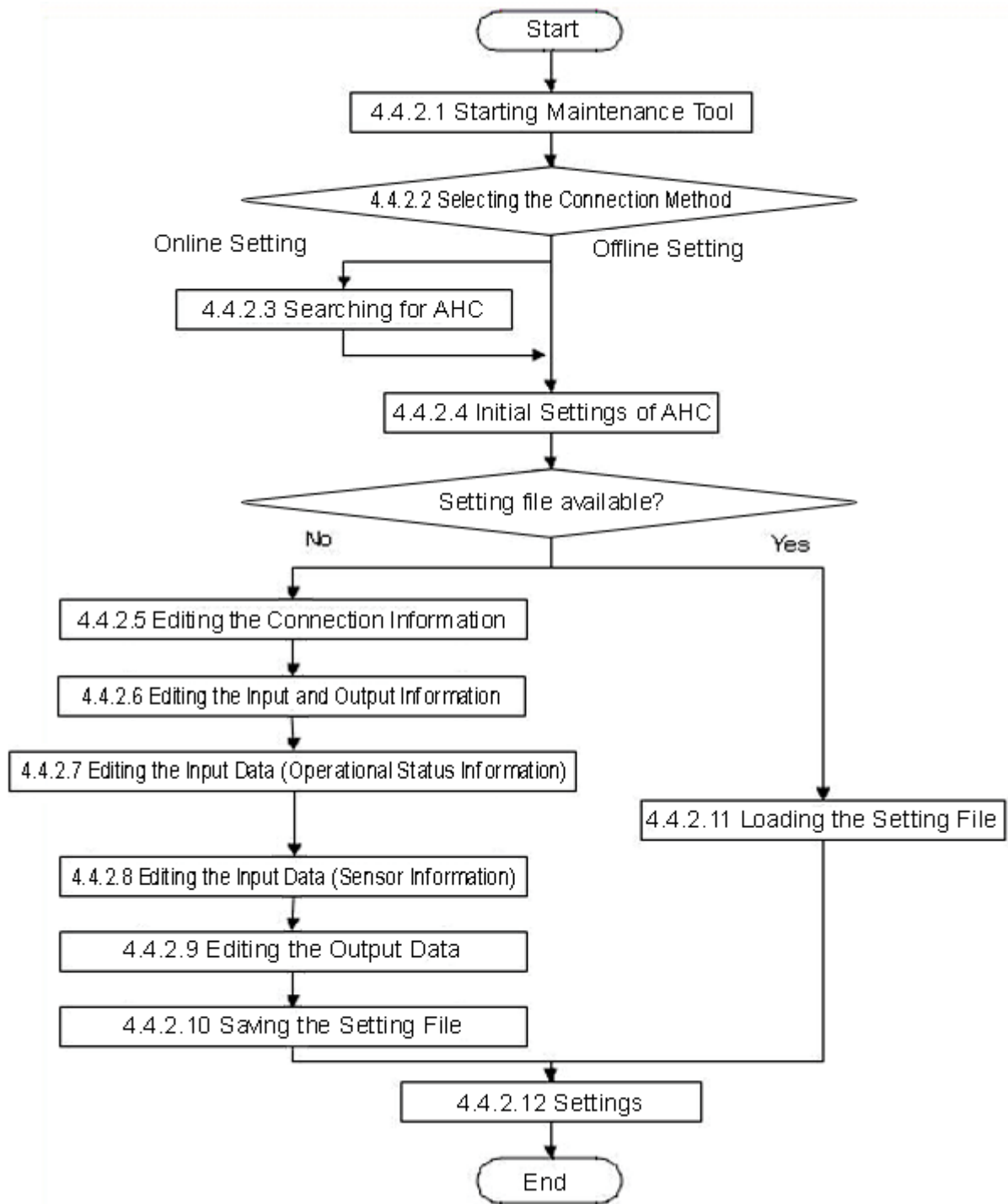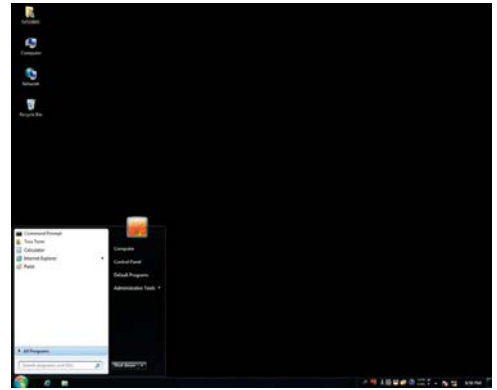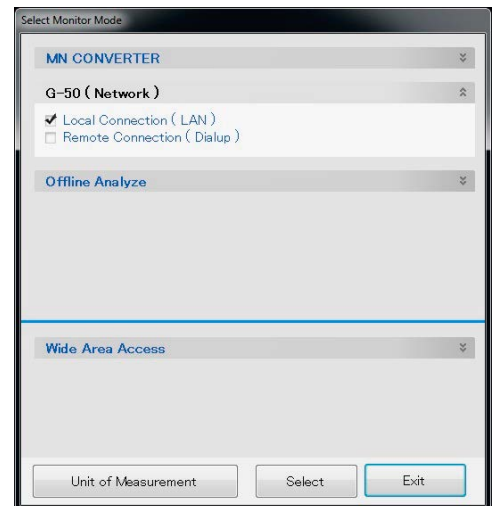
4.4.2.1 Starting Maintenance Tool

(1) Start Maintenance Tool on the PC from [Start] - [All Programs].

(2) The title screen appears after a short time.

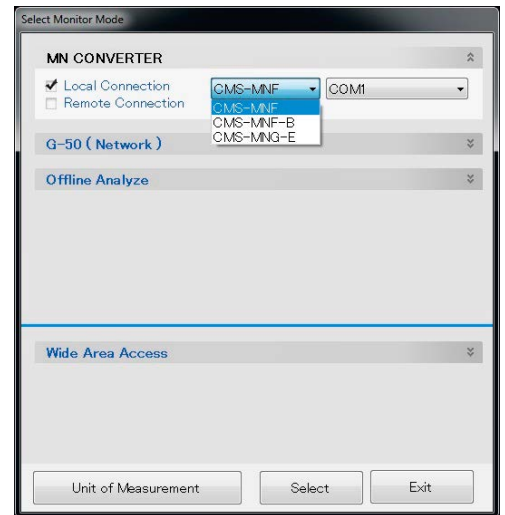(3) Then, the [Select Monitor Mode] screen appears.

### 4.4.2.2 Selecting the Connection Method

Select the connection method.

a) MN Converter Connection
   (1) Select MN CONVETER.
   (2) Select the Local Connection check box (Note 1).
   (3) Select the MN converter type to be used.
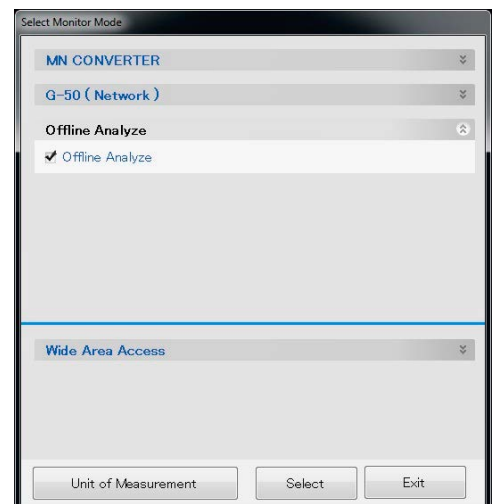   (4) Select the COM port to be used.
   (5) Click the Select button.

b) LAN Connection
   (1) Select G-50 (Network).
   (2) Select the Local Connection (LAN) check box (Note 1).
   (3) The IP address input screen appears. Enter the IP
      address for the centralized controller.
   (4) Click the Select button.
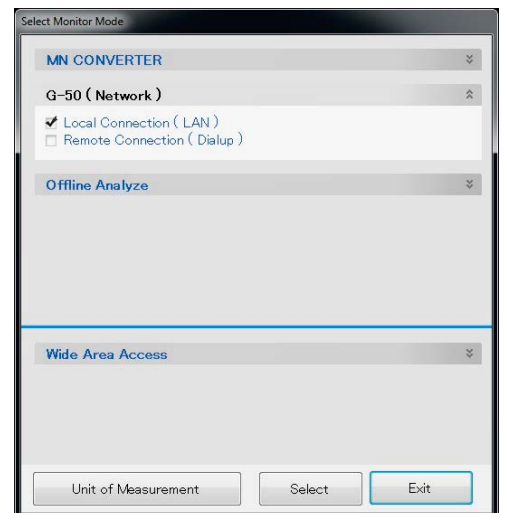
c) Offline Connection
   (1) Select Offline Analyze.
   (2) Click the Select button.

Note 1) To use Remote Connection, refer to the Maintenance Tool manual.

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4.4.2.3 Searching for AHC

(1) Search for the address of AHC connected to M-NET.
There are two types of address searches. One is a manual
search where the user searches for an arbitrary address and
the other is an automatic search where Maintenance Tool
searches for each unit.

If the address for AHC is known, select Manual
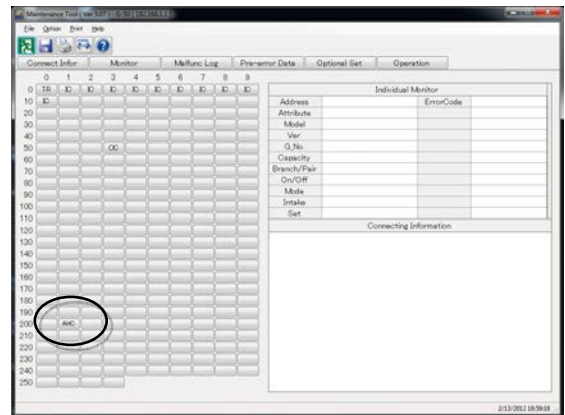and click the corresponding address.
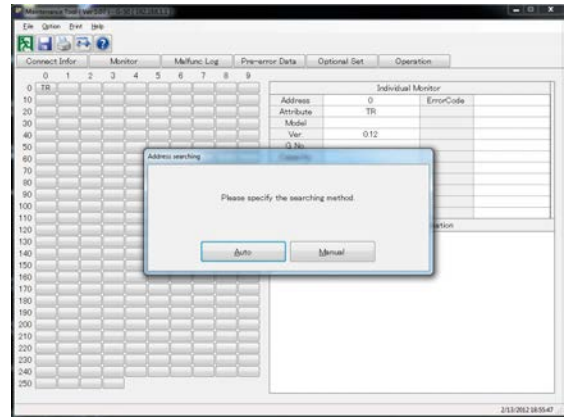
If the address for AHC is unknown, select Auto.
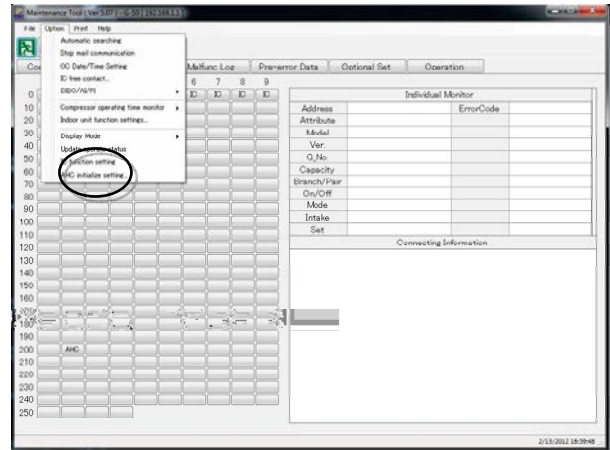Auto search starts. Auto search may take about 30 minutes
for some systems.
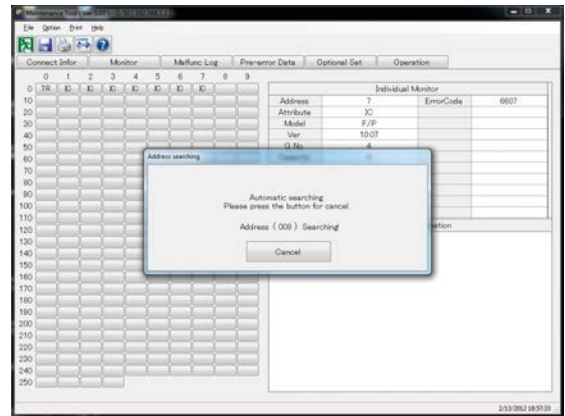
(2) When the search is complete, the attribute for the unit
appears on the button for the address. Check that AHC
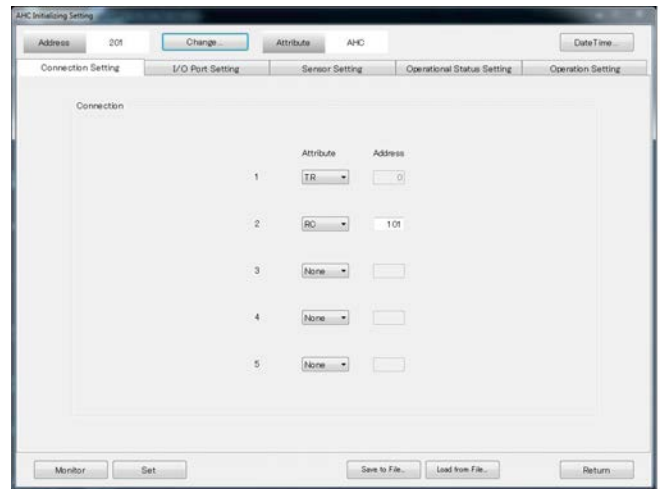exists on M-NET.

4.4.2.4 Initial Settings of AHC
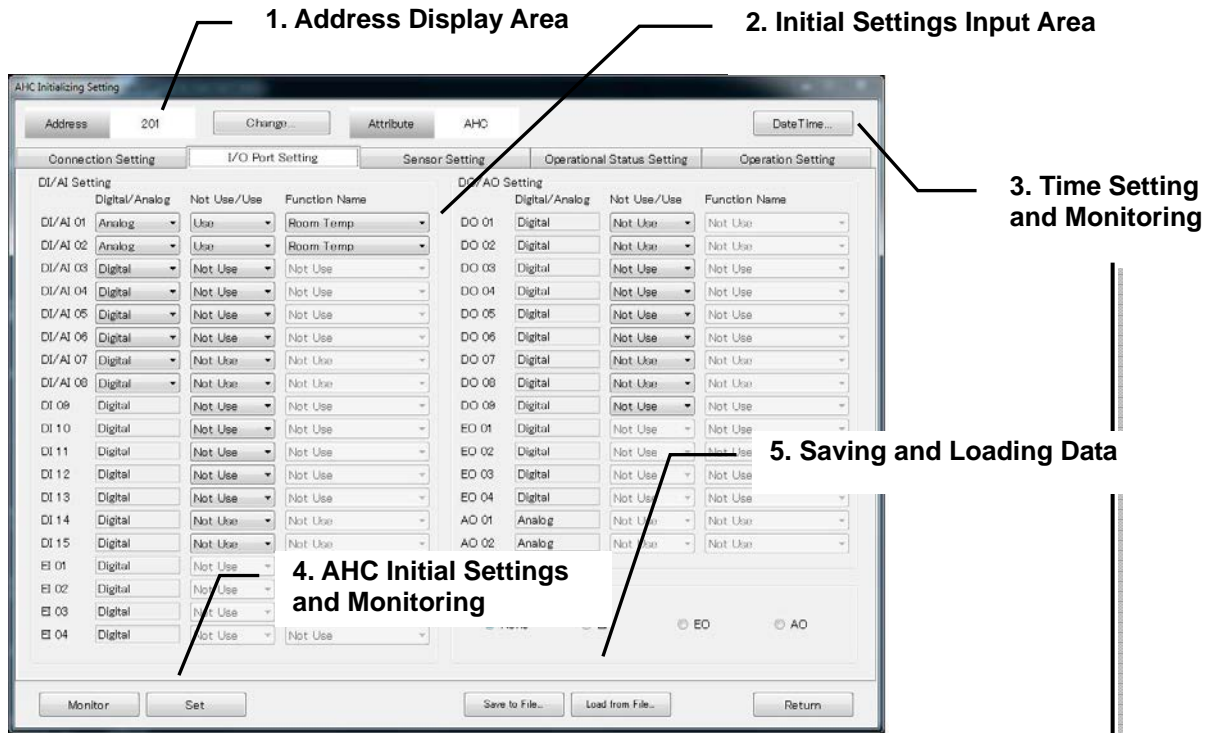
Open the AHC Initializing Setting screen

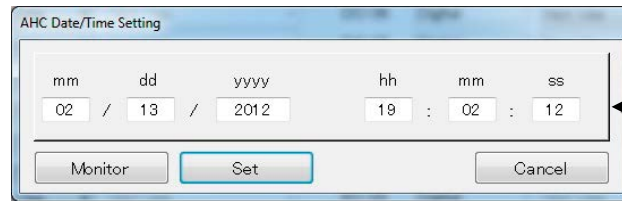(1) Select [AHC initialize setting] from the [Option] menu.

(2) The AHC Initializing Setting screen opens.

The screen configuration is as follows.

1. Address Display Area

2. Initial Settings Input Area

3. Time Setting and Monitoring

5. Saving and Loading Data

4. AHC Initial Settings and Monitoring

**Time Setting and Monitoring Screen**

1. Address Display Area [Online Setting Only]

   Displays the address for AHC.

   Press the Change button and specify the address to configure the initial settings of another AHC and monitor.

2. Initial Settings Input Area

   Allows you to edit the initial setting items of AHC.

   The items that can be set vary depending on the tab.

3. Date/Time and Monitoring [Online Setting Only]

   Displays the date/time for AHC.

   Edit the date/time and click the Set button to set the display date/time for AHC.

4. AHC Initial Settings and Monitoring [Online Setting Only]

   Press the Set button to set the item that was edited in "2. Initial Settings Input Area" for AHC.

   Press the Monitor button to monitor the setting item and update the display from AHC.

5. Saving and Loading Data

   Press the Save to File button to save the item that was edited in "2. Initial Settings Input Area."

   Press the Load from File button to apply the changes saved using Save to File to the "2. Initial Settings Input Area."

4.4.2.5 Editing the Connection Information

Assign the controllers（centralized controller and remote controller）to AHC. The status of external equipment connected to AHC can be monitored from the assigned controllers.

Furthermore, if an error occurs with AHC, the error status can be displayed on the controllers.

Connection Information
Monitoring Screen

Centralized Controller

AHC
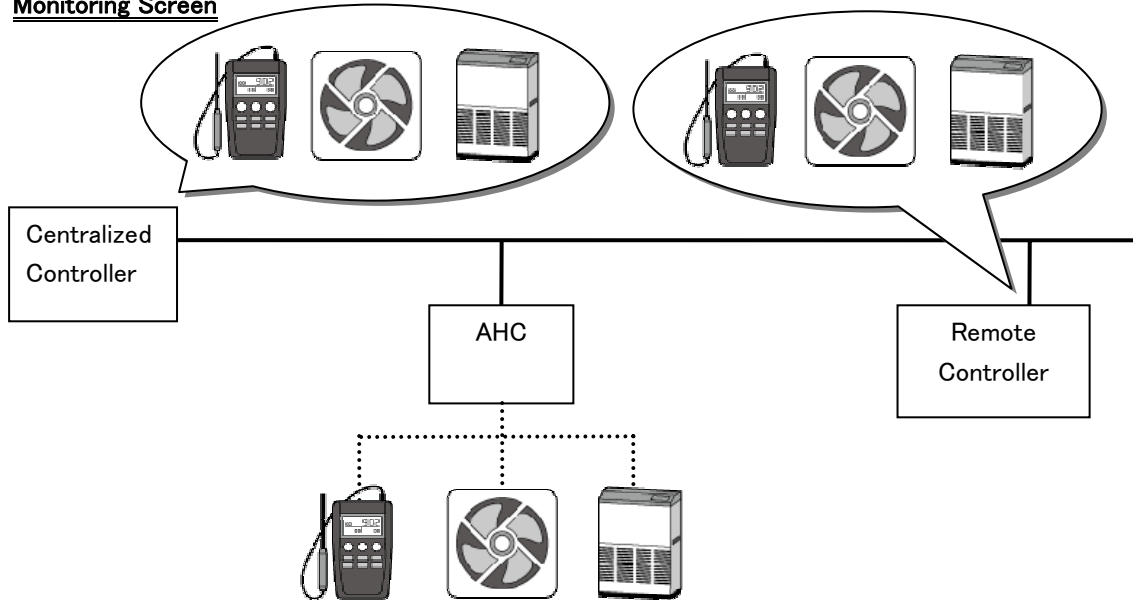
Remote Controller

(1) Select the Connection Setting tab and enter the address for the remote controller in the address input box (Note 1).
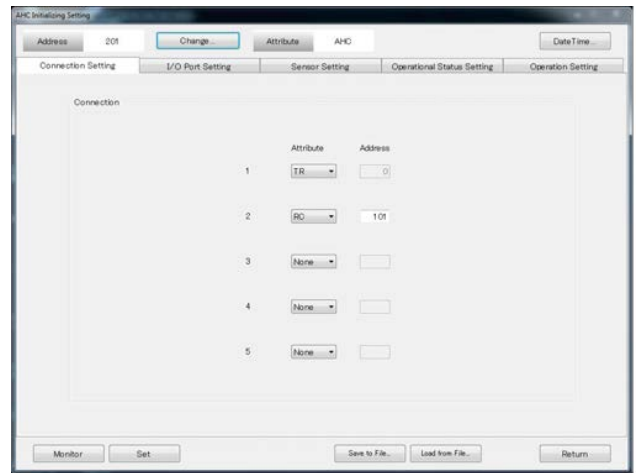
(Note 1) Only the address for the remote controller can be set in Maintenance Tool. The address for the centralized controller cannot be set.
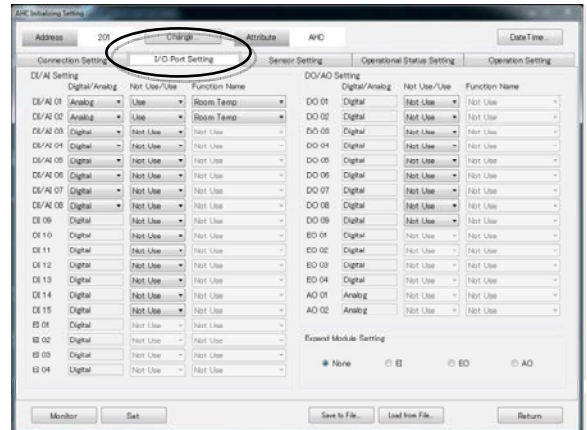Assign the centralized controller to AHC from the centralized controller.
(*) Refer to the centralized controller manual.

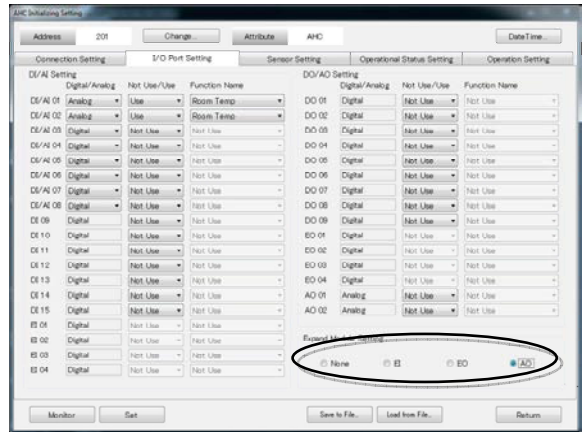### 4.4.2.6 Editing the Input and Output Information

Set the input and output function of ALPHA2. For the details of the inputs and outputs of ALPHA2, refer to "3.2.1 Inputs and Outputs of ALPHA2."

(1) Select the Input/Output Setting tab.

(2) Select the expansion module.
The ports that can be set are converted in accordance with the expansion module type.

(3) Select the input and output information
a) Digital/Analog
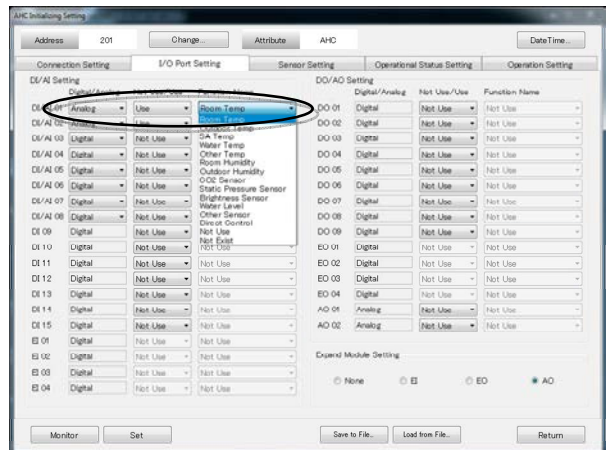 Set whether the input and output ports are used for analog or digital inputs and outputs.

  The function names that can be selected vary depending on whether Analog or Digital is selected.

b) Not Use/Use

  Set whether to use or not use the input and output ports.

c) Function name

  Set the function for which to use the input and output ports.

4.4.2.7 Editing the Input Data (Operational Status Information)

Configure the input settings for the operational status information. Setting the operational status information enables the AHC ADAPTER to regularly monitor and acquire the operational status information of units connected to M-NET.
When monitoring multiple AHC ADAPTERs, the acquired data is sent to ALPHA2 when it meets the aggregation condition.
When monitoring one AHC ADAPTER, the monitored result data is sent as is to ALPHA2.
For the input data (operating status information), refer to Table 8 "Operating Status Information List" in "3.2.2.1 Input Data."

(1) Select the Operational Status Setting tab.
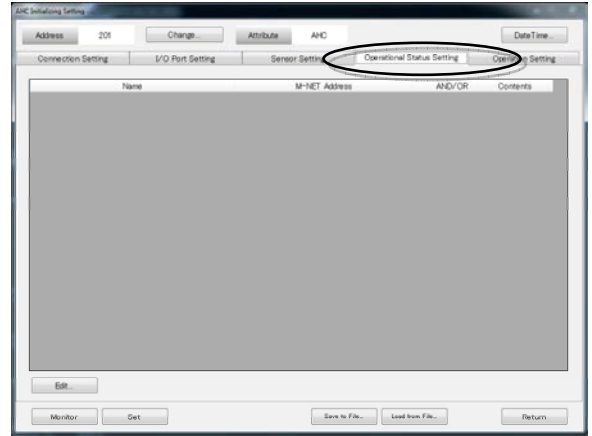
(2) Edit the input data (operational status information).
   Press the Edit button to display a list of the input data (operational status information).
   Select the check boxes for the input data (operational status information) to be acquired, and then press the Set button.
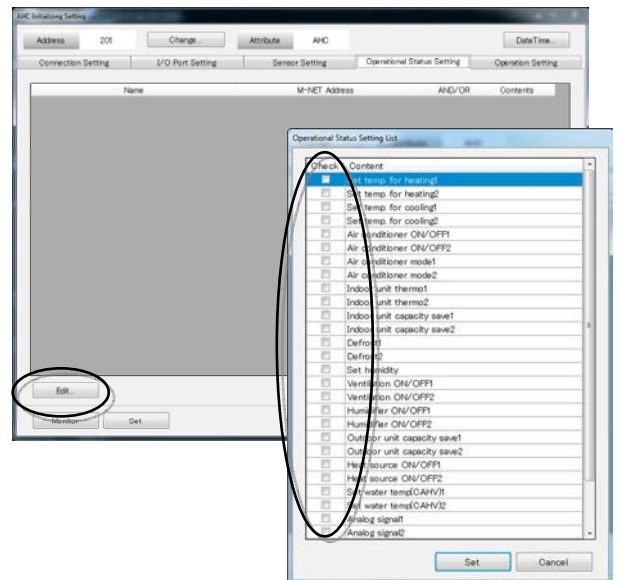
(3) Edit the M-NET address.
   Press the ☐ button to display the M-NET address input screen.
   Click the address for the input data (operational status information) to be acquired, and then press the OK button.
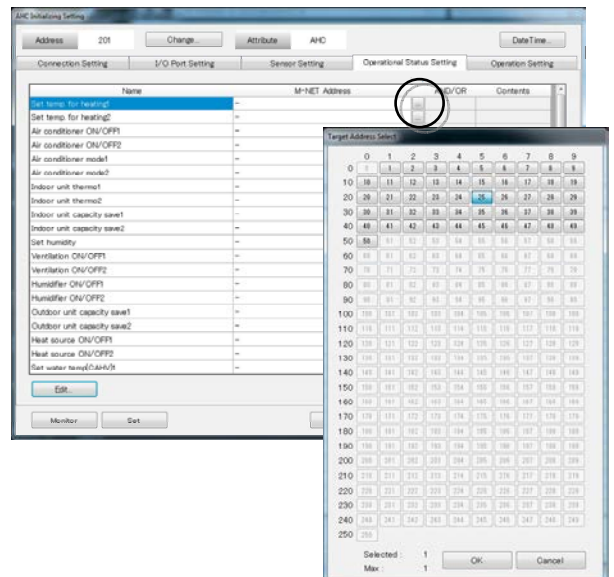
The number of selectable addresses and the range of
addresses differ according to the selected input data
(operational status information).
The maximum number of selectable addresses is displayed
at the bottom of the Target Address Select screen.

For some selected input data (operational status information),
the message "Do you want to receive directly from the
operation of the RC?" may be displayed when switching to
the Target Address Screen.
If Yes is selected, the input data (operational status
information) is acquired from the remote controller assigned
in 4.4.2.5 Editing the Connection Information.
If No is selected, the Address screen appears. Click the
addresses to acquire the input data (operational status
information) for and click the OK button.
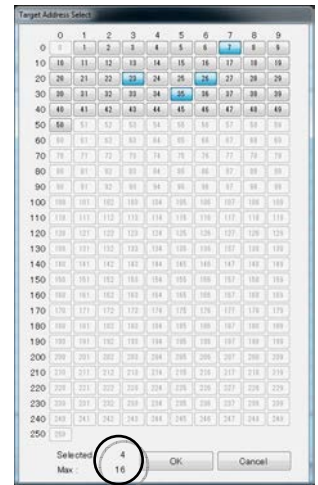
(4) Set the aggregation condition.
Set the aggregation condition only when selecting multiple
M-NET addresses.
a) AND/OR
Select the aggregation condition (AND: match for all units or
OR: match for at least one unit) to output the acquired data to
ALPHA2 when AHC ADAPTER acquires data from multiple
units.

b) Contents
Select the condition for AHC ADAPTER to output the
acquired data to ALPHA2.
Use the contents in combination with the AND and OR
conditions.
Select the acquired value for AHC ADAPTER to send to
ALPHA2.

4.4.2.8 Editing the Input Data (Sensor Information)

Configure the input data settings for the sensor information setting. The AHC ADAPTER regularly monitors and acquires the sensor information stored in units connected to M-NET.
The AHC ADAPTER sends the acquired data to ALPHA2.
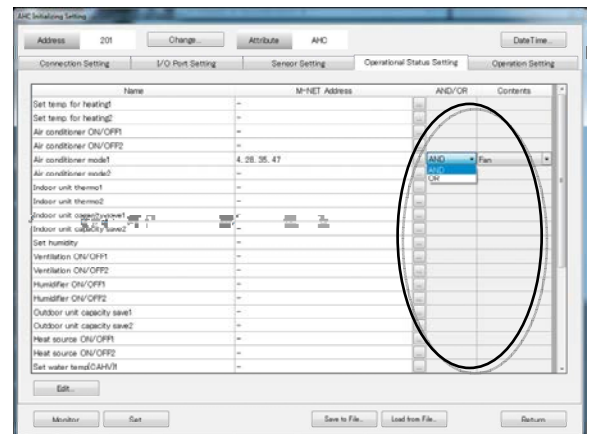For the input data (sensor information), refer to Table 7 "Sensor Information List" in "3.2.2.1 Input Data."

(1) Select the Sensor Setting tab.
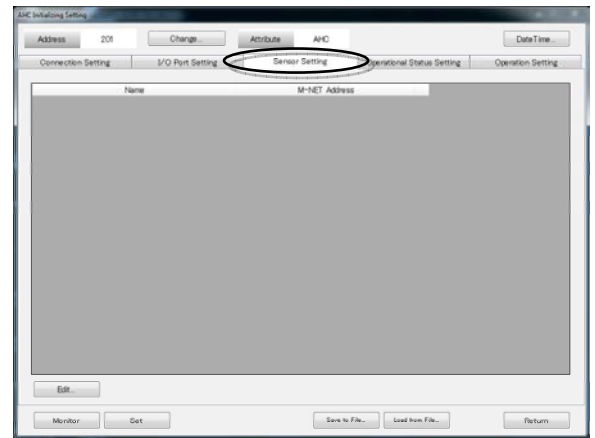
(2) Edit the input data (sensor information).
   Press the Edit button to display a list of the input data (sensor information).
   Select the check boxes for the input data (sensor information) to be acquired, and then press the Set button.
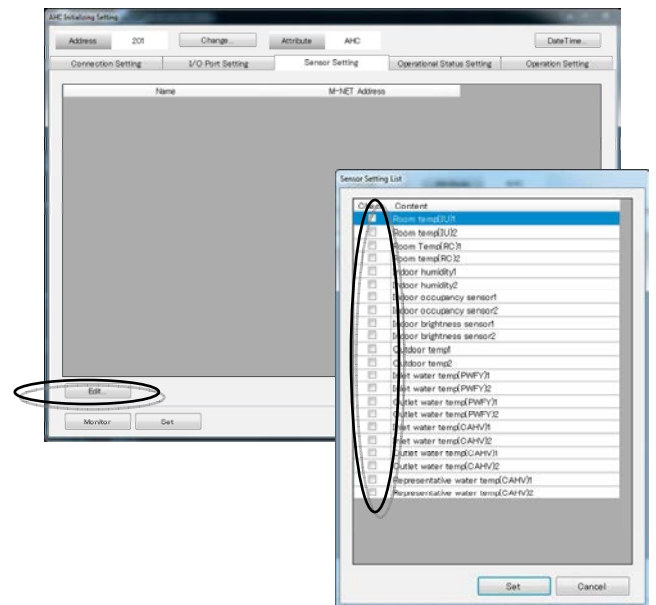
(3) Edit the M-NET address.
   Press the ☐ button to display the M-NET address input screen.
   Click the address for the input data (sensor information) to be acquired, and then press the OK button.
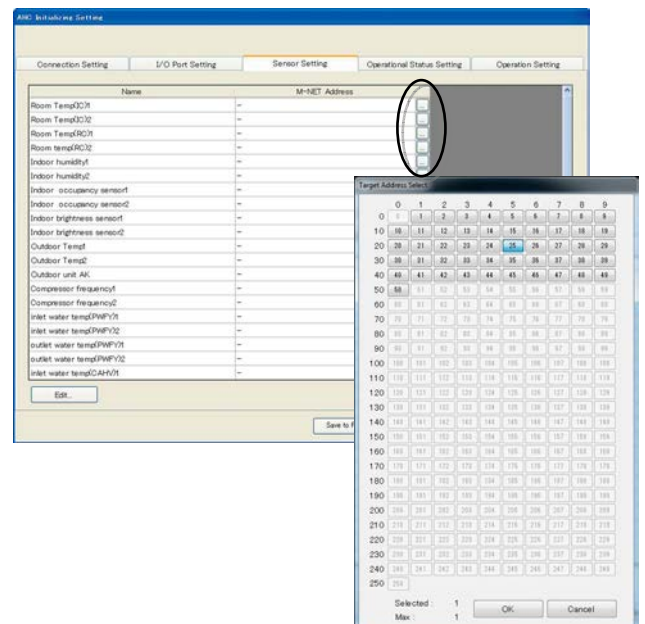
4.4.2.9 Editing the Output Data

Configure the output data settings. Units connected to M-NET are operated by the control logic of ALPHA2.

(1) Select the Operation Setting tab.
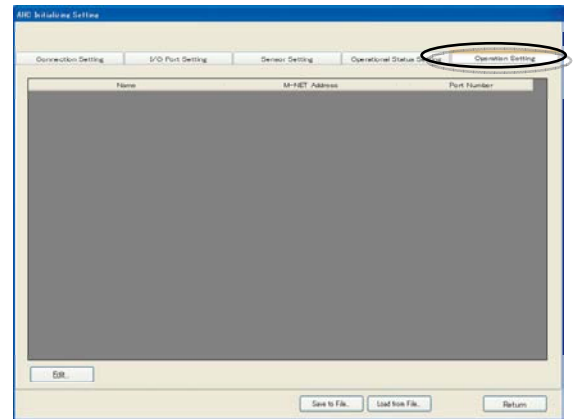
(2) Edit the output data.
Press the Edit button to display a list of the output data.
Select the check boxes for the input and output data to be acquired, and then press the Set button.
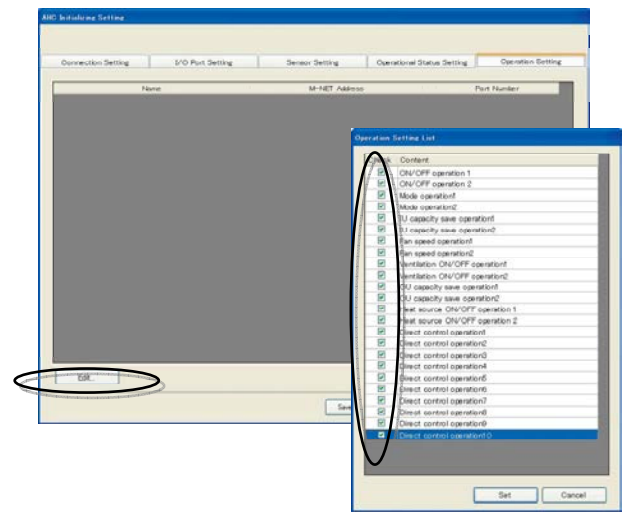
(3) Edit the M-NET address.
Press the ☐ button to display the M-NET address input screen.
Click the address for the output data to be acquired, and then press the OK button.
(*) To receive and acquire the operation command directly from the remote controller, do not select the check box for the address.
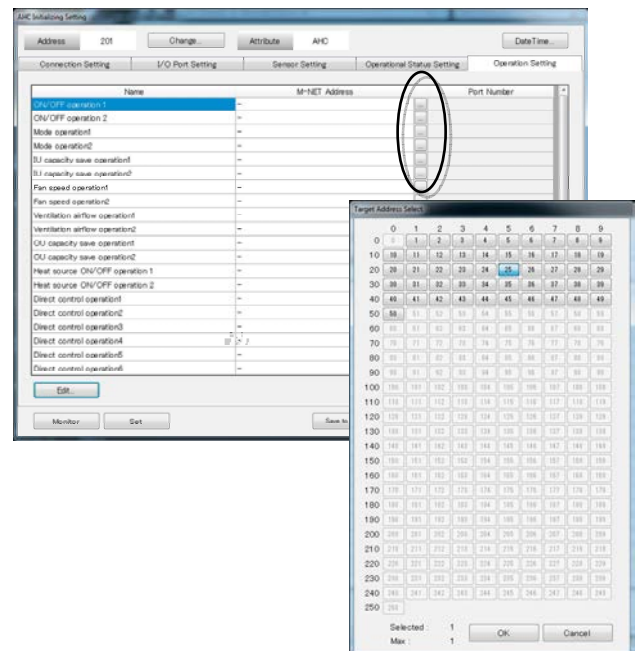
(4) Select the port.

Set this only when AHC operation is selected in Name.
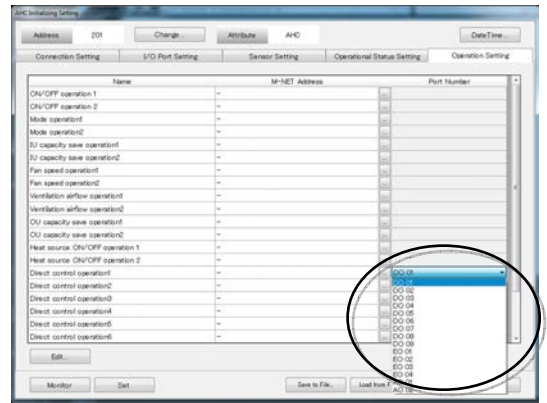
4.4.2.10 Saving the Setting File

Save the edited AHC initial setting data.

(1) Click the Save to File button.
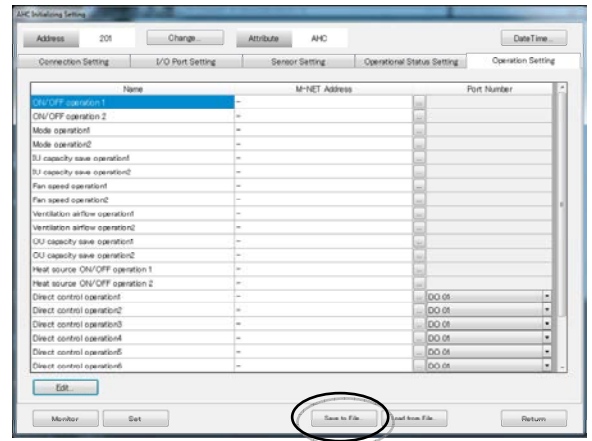
(2) The save screen appears. Save the file to any folder.
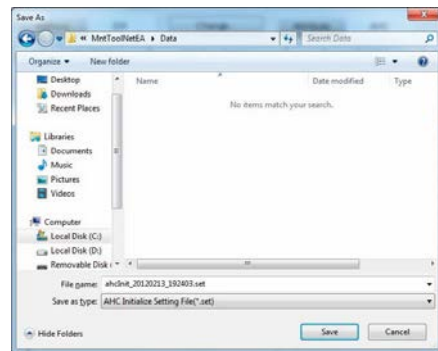
4.4.2.11 Loading the Setting File

Load the edited AHC initial setting data.

(1) Click the Load from File button.
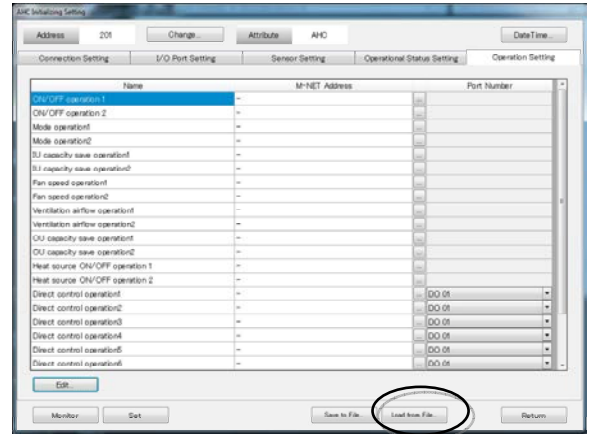
(2) The file selection screen appears. Select the setting file.
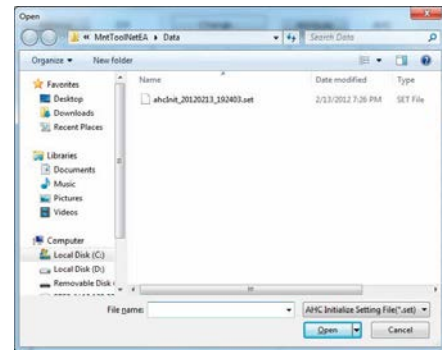
(3) A table shows the setting items that will be changed when
the setting file is loaded during online setting.
If the setting items are acceptable, click the Yes button.
The settings in the loaded setting file are applied.
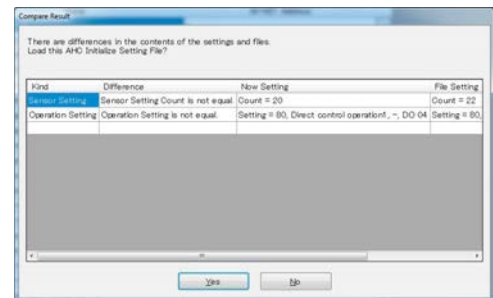
4.4.2.12 Settings

Apply the edited initial setting data to AHC.

(1) Click the Set button.
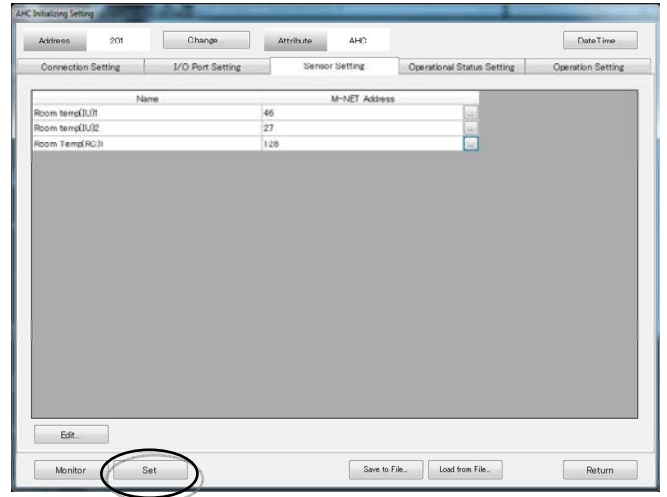
(2) The seek bar appears. The process may take a couple of
minutes depending on the number of setting items.
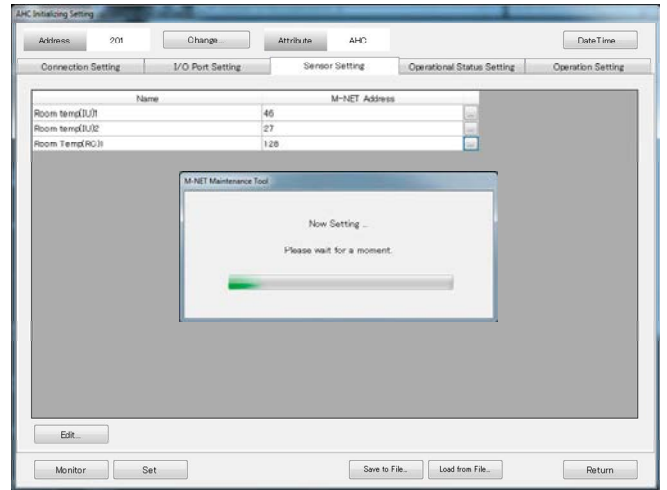
(3) Configuration of the initial settings is complete.
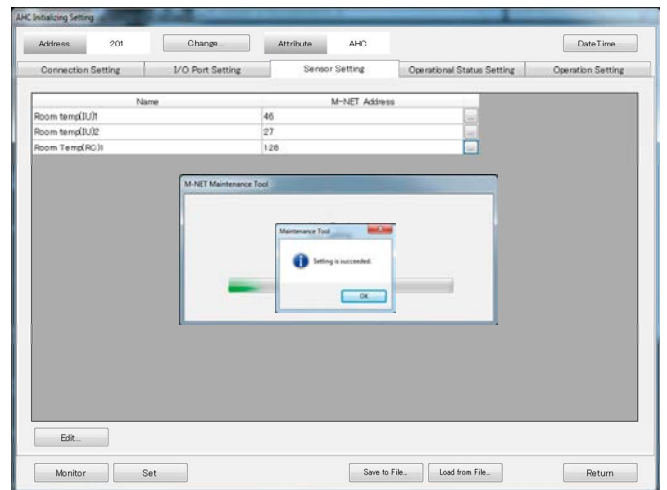
4.4.3 Example of Configuring the Initial Settings

The following describes the method for configuring the initial settings of AHC using the example of the system below.

Conceptual Diagram
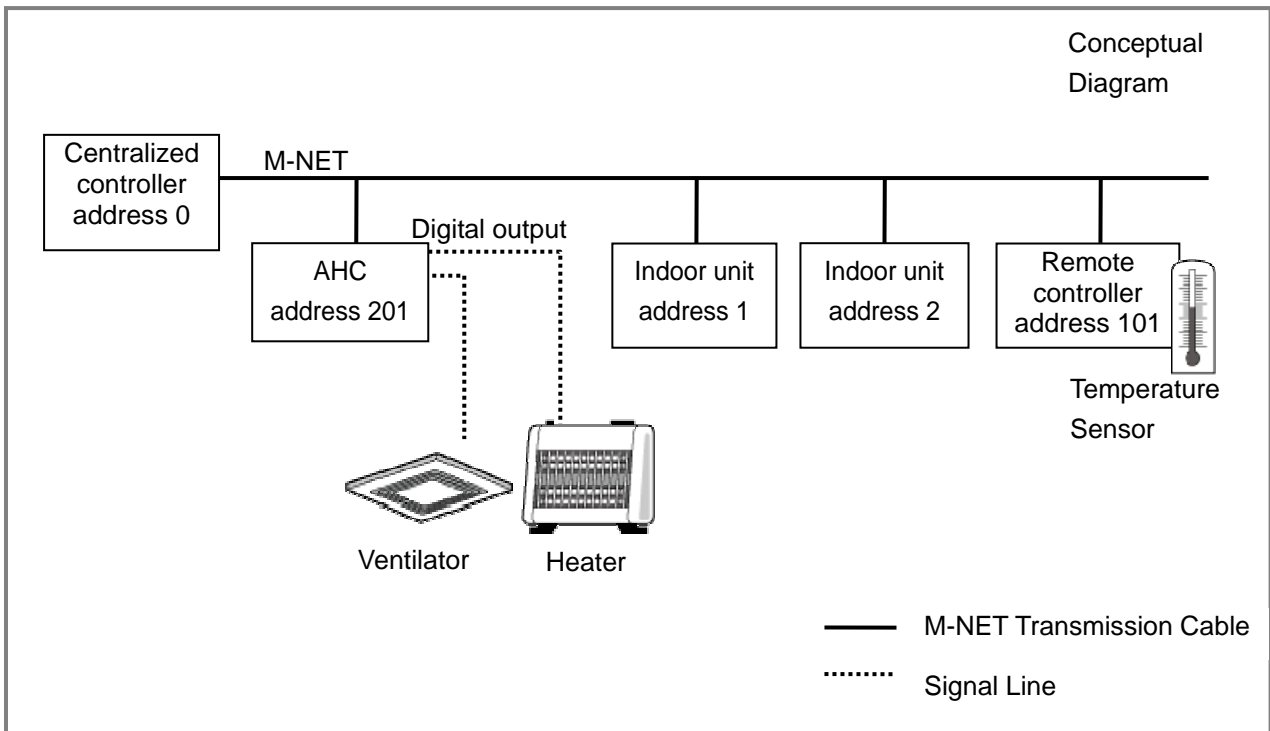
(1) System Configuration
  • Mitsubishi Electric's Equipment
    Centralized Controller (Address 0)
    Indoor Unit 1 (Address 1)
    Indoor Unit 2 (Address 2)
    Remote Controller (Address 101)
    AHC (Address 201)
  • External Equipment
    Heater (Connection Port DO 01)
    Ventilator (Connection Port DO 02)

(2) Control to be Implemented
  • When Indoor Unit 1 or Indoor Unit 2 starts operation, turn the ventilator on.
  • When the temperature sensor falls below the specified temperature, turn the heater on.
  • When the temperature sensor falls below the specified temperature, turn Indoor Unit 1 on.

(3) Initial Settings

Configure the settings as follows.

• Connection Setting

Enter 101 which is the address of the remote controller.

The address for the centralized controller cannot be entered from Maintenance Tool, so set the address from the centralized controller.

If the address is set correctly from the centralized controller, the address for the centralized controller appears on the connection information screen.
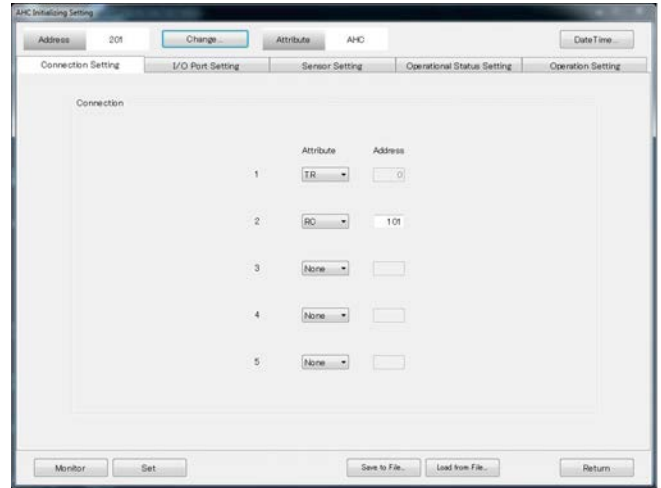
• I/O Port Setting

Set the third party equipment connected to AHC ports.

Select Heater in DO 01 and Ventilator in DO 02. For the other ports, select Not Use because they are not used.
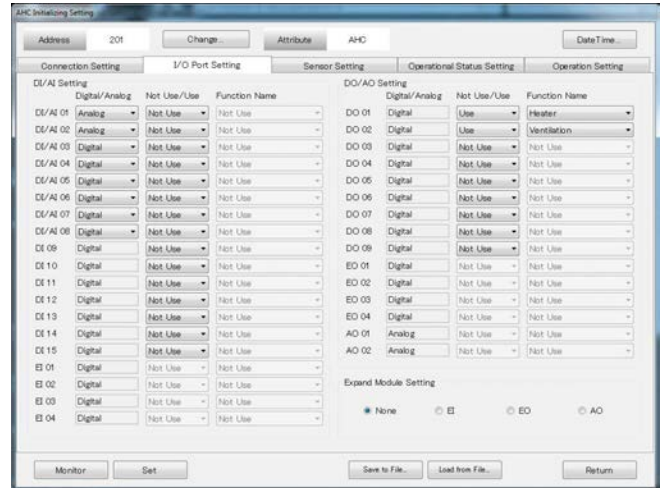
• Sensor Setting

Set the temperature sensor information of the remote controller which is the input condition to turn on the heater and indoor unit 1.

Set Room temp(RC)1(2) in Name and 101 in Address.
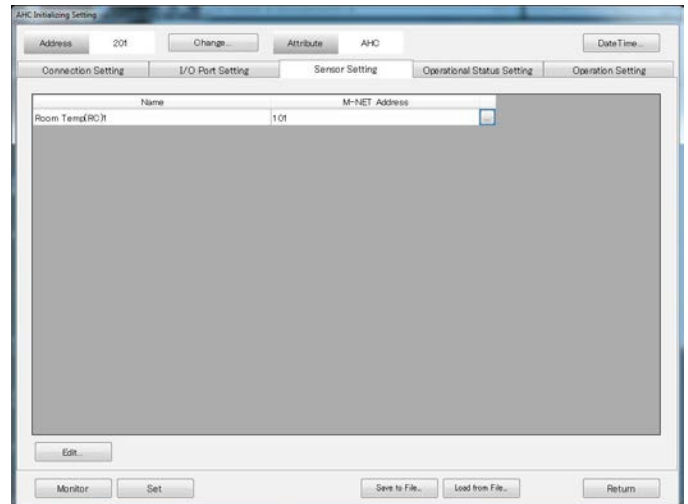
• Operatinal Sensor Setting
  Set the operational status information of indoor
  unit 1 and indoor unit 2 which is the input
  condition to turn on the ventilator.
  Set Air conditioner ON/OFF1(2) in Name.
  The input condition is that indoor unit 1 or indoor
  unit 2 turns on, so select OR in AND/OR.
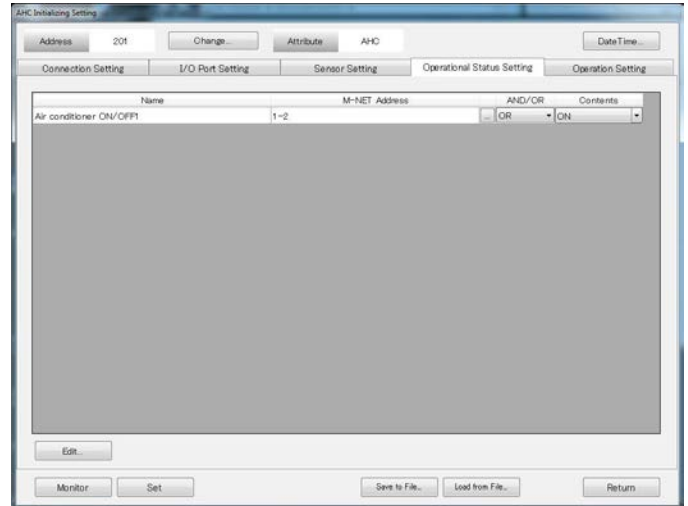
• Operation Setting
  Configure the settings for the operation. Set
  ON/OFF operation 1(2) in Name and 1 in
  Address to start operation of indoor unit 1 when
  the temperature sensor falls below the specified
  temperature.
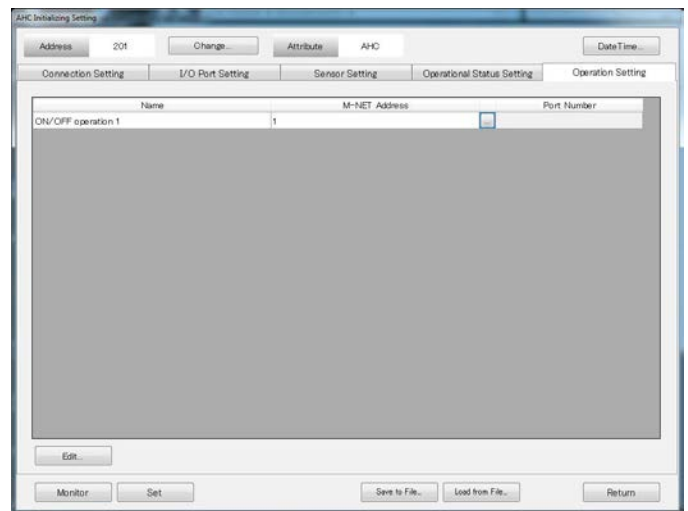
• Setting
  Click the Set button to send the setting
  information to AHC. Configuration of the initial
  settings with Maintenance Tool is complete.

4.5 Test Run

A test run is performed by connecting the actual equipment, and checking the connections, operation, and initial settings. Be sure to perform a test run to ensure that there are no setting and control errors, and operational problems.

4.5.1 Performing a Test Run with the Actual Equipment Connected

There are three points to check for AHC in the test run with the actual equipment connected.
- (A) Check the connection of the equipment connected to ALPHA2
- (B) Check the operation of the equipment connected to ALPHA2
- (C) Check the initial settings configured with Maintenance Tool

• Check procedure
  (A) Check the connection of the equipment connected to ALPHA2
  (B) Check the operation of the equipment connected to ALPHA2

  Connect a PC with the programming tool installed to ALPHA2 and use the monitoring function of the programming tool to check the connection and operation of the equipment connected to ALPHA2.
  For details, refer to the ALPHA2 manual (Software Manual).

  (C) Check the initial settings configured with Maintenance Tool

  Connect a PC with the programming tool installed to ALPHA2 and use the monitoring function of the programming tool to check the initial settings configured from Maintenance Tool.
  If programs were created using the input and output data stored in Mitsubishi Electric's air conditioner, check that the input and output data that is used behaves in the desired way. For the points to be checked, check the values of the internal data described in section 4.1.3.

  Furthermore, check that the AHC input and output monitor screen on the remote controller and centralized controller matches the initial settings.

5 Restrictions on AHC

The following describes the prohibitions and notes to be observed when building an AHC system, programming ALPHA2, and performing a test run.
Be sure to understand the details and observe them.

5.1 Restrictions on Building Systems

[Prohibitions]
➢ Do not build a fire prevention control or security control. If such a control must be built, the system must consider actions in response to a power failure and a failure of AHC.

➢ Do not build a life-critical system.

➢ Provide a safety circuit outside AHC to ensure that the entire system works safely even in the event of an external power supply error or a failure of AHC.
   Failure to do so may cause an accident due to output error or malfunction.

➢ Turn on the power of AHC first and then turn on the power of the external equipment. Turning on the power of the external equipment first may cause an accident due to output error or malfunction.

➢ If a load current greater than the rated current or an overcurrent due to a load short circuit continues to flow over a long period of time in the output circuit, smoke or fire may occur, so provide an external safety circuit such as a fuse.

➢ When using the AHC, connect at least one remote controller or centralized controller that is compatible with the AHC. As the AHC status cannot be displayed if no controller is connected, it may not be possible to observe the error status. The AHC must be set to a group containing at least one indoor unit. A maximum of one AHC can be connected to a group.

➢ The maximum number of AHC that can be connected to the M-NET transmission line (including centralized system) is given by IC+AHC≦70. However, the maximum number is given by IC+AHC≦60 when the centralized contoller, RMI maintenance data acquisition function is used.
   The maximum number of units defined above applies to the case when the AHC monitors up to six data items, such as indoor units.
   (The number of connectable units reduces when seven or more data items are monitored.)

[Cautions]
➢ When an error signal is captured in Digital Input of ALPHA2, error detection is indicated on the controller connected to M-NET when ON is detected in Digital Input. So do not connect equipment where ON is output during normal operation and OFF is output in the event of an error. If such equipment must be connected, provide a circuit to reverse ON and OFF.

➢ If a temperature input is captured in Analog Input of ALPHA2, match the temperature scale setting (switch Celsius and Fahrenheit) in the program of ALPHA2 to the DIPSW setting on the board of AHC ADAPTER. If it is not matched, the intended operation will not be performed.

➢ Do not connect the control line and communication cable to the main circuit and power line or place them near each other. Place them at a distance of at least 100 mm from each other. Failure to do so will cause a malfunction due to noise.

➢ When the heater and pump are controlled by AHC, a large current (about 10 times greater than normal current) may flow when the output is changed from OFF to ON. So select an output unit with a large enough current rating.

➢ A remote controller or centralized controller that is not AHC-compatible is not registered for management by AHC. In this case, remove the AHC-non-compatible remote controller or centralized controller from the group containing the AHC.

5.2 Restrictions on Programming

[Prohibitions]
➢ To create ALPHA2 programs, be sure to use the dedicated program on the CD supplied with AHC ADAPTER.
Do not delete or change the "Program ver" function block in the available function blocks.
If this function block is deleted or changed, an error will occur when the power is turned on and AHC will not be able to be used.

➢ Do not change the settings in GSM ＆ Serial Communication and in Dedicated Communication accessible from Option in the menu file in the ALPHA2 program. If these settings are changed, communication between ALPHA2 and the AHC ADAPTER will not be possible and AHC will not work.
To restore communication, match the settings to those in the original program.

➢ If the power of ALPHA2 is disconnected or the internal control of ALPHA2 is stopped, all digital outputs of ALPHA2 turn off (open). So do not connect external equipment that operates even though the power of ALPHA2 is disconnected or stopped.

➢ Do not set conditions that repeat processing such as the following.
Turning on and off of conditions 1 and 2 is repeated indefinitely so the air conditioner may break down.
Condition 1: When Group 1 turns ON, turn Group 1 OFF.
Condition 2: When Group 1 turns OFF, turn Group 1 ON.

➢ If the communication cable is disconnected, the line may become unstable and a communication error may occur with multiple units. Create an interlock circuit in the program to ensure that the system works safely even if a network communication error occurs with multiple units.
Failure to do so may cause an accident due to an output error or malfunction.

[Cautions]

➢ Hysteresis control is recommended to utilize the analog input information for control. Use the Schmitt trigger function block diagram (FBD) to incorporate the hysteresis control. For details of the Schmitt trigger FBD, refer to the Help item in the programming tool for ALPHA2.

➢ It is recommended to use the scheduling function of Remote controller or Centralized contoller to perform a scheduled operation of AHC. It is possible to modify the AHC program so that a scheduled operation is performed, but if Centralized contoller or Remote controller executes the scheduling function and control consistency is not ensured, an unexpected operation may occur. Furthermore, if the scheduled operation is incorporated in the AHC program and the schedule is to be changed during operation, the program must be rewritten. Therefore, operation is more difficult than with the scheduled operation of Centralized contoller and Remote controller so this is not recommended.

➢ If the sensor information of units connected to M-NET is used as input information, there is a delay of up to 70 seconds. Consider this when designing the control.
⇒ When control within 70 seconds is required, create a program using the analog input of ALPHA2.

➢ When using Analog Input of ALPHA2, the sensor, etc. may output an invalid value (error value) due to a failure or other problem of the connected sensor, etc., so it is recommended to create a control that does not capture an invalid value using "Error flag of Analog Input (*)," etc. (For example, if an invalid value is detected, stop the operation or perform an emergency operation, etc.)
(*) Error flag of Analog Input: System bit to detect an invalid value, etc. of Analog Input.
For details, refer to the Software Manual for ALPHA2.

➢ AHC ADAPTER is powered from M-NET, so if the power of the outdoor unit or power supplyunit is disconnected, AHC cannot communicate with the units connected to M-NET. Furthermore, if connected to the discrete system of M-NET and another power supply unit is used, communication is impossible if the power supply unit is turned off. Information acquired from M-NET such as sensor information remains in the same status as before the power is disconnected or the power supply unit is turned off.
If this may cause unforeseen circumstances, use the input of "M-NET Power Supply" in the operating status information to incorporate the power supply status of AHC ADAPTER in the control.

➢ When programming ALPHA2, do not delete the function blocks available in the dedicated program. If you want to delete some of them because, for example, there is a lack of memory space, delete the function blocks that are not used (doing so will not impact operation). However, note that a function block cannot be restored once deleted.
If you want to use a function block that was deleted, create the program again using the original program supplied with AHC ADAPTER.

➢ If a communication error is detected due to the disconnection of the serial communication line connecting AHC ADAPTER and ALPHA2 or external noise, etc., ALPHA2 will not be able to acquire the necessary information from the units connected to M-NET. The information acquired from M-NET such as the sensor information remains in the same status as before an error occurs.
If this may cause unforeseen circumstances, use the input of "M-NET power supply status inf" in the operating

status information to incorporate normal operation of the serial communication in the control.

(The status of the serial communication error and that of the power disconnection of AHC ADAPTER are the same event, so use the same input.)

➢ If a communication error is detected due to the disconnection of the communication line connecting AHC and units or external noise, etc., AHC will not be able to acquire the necessary information from the units connected to M-NET. The information acquired from M-NET such as the sensor information remains in the same status as before an error occurs.
If this may cause unforeseen circumstances, use the input of "M-NET Communication Error" in the operating status information to incorporate the communication error status of the M-NET communication in the control.

➢ If you want to perform special control for external equipment using AHC when the unit connected to M-NET detects an error, incorporate the error status of the unit in the control by setting the address of the unit that has the information you want to acquire using the input of "Unit error1" or "Unit error2" in the operating status information.

➢ When setting the error signal of external equipment in Digital Input of ALPHA2, control for the error signal must be created in the program of ALPHA2 to enable the control, so perform control for the error signal in the program.
(If the error signal is just connected to ALPHA2, no control will be performed even if an error is detected.)

➢ When using the analog output of ALPHA2 use the Analog output1 or Analog output2 available in the dedicated. program. If a new Analog output is added in the function block of ALPHA2, the analog output status cannot be monitored on the remote controller, etc.

➢ The time until the RUN status is established when switching the power supply of AHC from OFF to ON or switching AHC from STOP to RUN varies depending on the system configuration, parameter settings, program capacity, and so on. Design so that the entire system works safely even if the time until the RUN status is established varies.

5.3 Restrictions on Test Run

[Prohibitions]
➢ Before making any changes to the control for AHC during operation (changing the program, parameters, forced output, and operating status), read the manual thoroughly and carry out sufficient safety checks.

➢ Do not turn off the power or reset AHC while the settings are being registered. If the power of AHC is turned off or AHC is reset during registration, the settings data in the flash ROM will become inconsistent so the setting and registration must be performed again. Furthermore, this may cause a unit failure or malfunction.

[Cautions]
➢ When configuration of the initial settings is complete, be sure to perform a test run to ensure that there are no setting and control errors, and operational problems.

➢ The sensitivity of the occupancy and brightness sensors varies depending on the installation conditions, so when incorporating them in the control be sure to perform a test run to ensure that there is no problem with operation.

➢ When performing control using the input and output data stored in Mitsubishi Electric's air conditioner, AHC cannot communicate with the units connected to M-NET for 7 minutes after the power of AHC ADAPTER is turned on, so AHC cannot capture the status of the units and operate the units. The data input for the period of 7 minutes is the initial data that was held at the first power on and is the same data as before the power is disconnected when the power is turned on for the second and subsequent times.
If you want the output for 7 minutes after turning on the power of AHC ADAPTER to be ON or OFF, you can create logic to forcibly output ON or OFF by combining the input of "M-NET Power Supply" with the "Delay" FBD.
For an analog control that requires precise control for 7 minutes after turning on the power, create a program using the analog input of ALPHA2.

➢ When making the initial settings using Maintenance Tool, the ALPHA2 operation stops temporarily. Therefore, the units connected to the ALPHA2 outputs temporarily turn off. Take due care when making the initial settings while the system is operating. (The ALPHA2 operation recovers automatically after the settings are complete.)

5.4 Restrictions on the Operation of Units Connected to M-NET

[Prohibitions]
➢ To operate the units connected to M-NET from AHC, be sure to create a program that provides an interval of at least 3 minutes from the end of the previous operation before the starting of the next operation.

[Cautions]
➢ When operating a unit connected to M-NET from AHC, the operation command is output when the status changes, so if the unit is operated from other equipment such as an RC afterward, the unit changes to the status resulting from the subsequent operation. In that case, the internal data of ALPHA2 and the actual unit status do not match.
To match the output data of ALPHA2 to the unit status, create a control that captures the information of the operated unit as input data and provide feedback.

6 Troubleshooting

When an error occurs within AHC, the error code will appear on the remote controller and the centralized controller, and the LED indicator on the circuit board will blink.

6.1 Error code list

The table below summarizes the types of errors that AHC detects.

Error code	Definitions
0101	Equipment abnormality in system (DI01)
0102	Equipment abnormality in system (DI02)
~	
0115	Equipment abnormality in system (DI15)
0116	Equipment abnormality in system (EI01)
~	
0119	Equipment abnormality in system (EI04)
0403	Serial transmission trouble
6600	M-NET communication error - Address duplicate
6601	M-NET communication error - Polarity unsettled
6602	M-NET communication error - Transmission processor hardware error
6603	M-NET communication error - Transmission line busy
6604	M-NET communication error - No ACK return
6605	M-NET communication error - No return of response frame
6606	M-NET communication error - Transmission processor communication error
7130	System abnormality - Different unit model error (Program compatibility error)

6.2 Troubleshooting from the Controller Error Display

Error code		Description and Method of Detection	Cause	Check Procedure and Remedy
0101 to 0119	Equipment abnormality in system (DI01 to DI15, EI01 to EI04)	DI01～DI15 / EI01～EI04 on ALPHA2 is set to detect a certain type of error, and an error signal has been input.	1) Error signal detected for external device	Check for abnormal output of the error signal from the external device connected to ALPHA2. If the external device output is abnormal, follow the measures described in the external device manual to reset the error.
			2) Incorrect initial settings	Check for discrepancy between the signals connected to the ALPHA2 DI/EI and the DI/EI names in the initial settings or the set port numbers.
0403	Serial transmission trouble	Communication error between ALPHA2 and AHC ADAPTER	1) Incorrect wiring	Check the wiring between the M-MET_IF board CN601 connector and the AL2-CAB board CN1 connector and check the contact between wires and connectors.
			2) Incorrect initial settings (1)	Check for discrepancies between the initial settings and the I/O Extension Module (EI/EO) and Analog Expansion Module(AO) that are actually connected.
			3) Incorrect initial settings (2)	Check that the data deleted by the ALPHA2 program was not enabled in Input data/Output data in the initial settings.
			4) ALPHA2 power cut	Check that the normal power supply is connected to ALPHA2.
6600	M-NET communication error – Address duplicate	Duplicate address error Error that occurs when signal communication is detected from a unit with the same address.	1) A unit or controller with the same address exists in the same system.	Check for a unit or controller with the same address. If the same address is found, change the address, turn the power off for at least five minutes and then back on.
			2) Transmitted data changed due to noise on the M-NET transmission line.	
6601	M-NET communication error – Polarity unsettled	Polarity not set error	1) Defective AHC ADAPTER	Replace the product.
6602	M-NET communication error – Transmission processor hardware error	Transmission processor hardware error The transmission processor sent "0" but the value from the transmission line was "1".	1) Transmission line work was performed while power is supplied to M-NET.	Refer to the CITY MULTI (Outdoor Unit) Service Handbook.
			2) M-NET transmission line earth fault	
			3) Transmitted data changed due to noise on the M-NET transmission line.	
			4) Defective AHC ADAPTER	

Error code		Description and Method of Detection	Cause	Check Procedure and Remedy
6603	M-NET communication error – Transmission line busy	Transmission line (BUS) busy error 　Error that occurs when command output is disabled continuously for 4 to 10 minutes due to BUS BUSY.	1) The transmission processor is unable to transmit due to continuous noise ingress in the M-NET transmission line, such as short-period voltages. 2) Defective AHC ADAPTER	Refer to the CITY MULTI (Outdoor Unit) Service Handbook.
6604	M-NET communication error – No ACK return	No ACK return error 　Error detected by AHC ADAPTER when the other party fails to return the ACK signal after a command transmission on M-NET.	1) Incorrect initial settings 2) The address of the other party on the M-NET transmission line changed during transmission. 3) Defective M-NET transmission line 4) Transmission line or connector disconnected at the address of the other party in M-NET communications. 5) Other party in M-NET communications is defective 6) For communications about multiple refrigerants, the transmission line or connector is disconnected from the terminal block for centralized control (TB7). 7) For communications about multiple refrigerants, power is cut to an outdoor unit. 8) For communications about multiple refrigerants, the power connector (CN40) was not inserted in an outdoor unit. 9) For communications about multiple refrigerants, two or more power connectors (CN40) were inserted for centralized control. 10) For communications about multiple refrigerants, an outdoor unit power supply system is defective. 11) Transmitted data changed due to noise on the M-NET transmission line.	An AHC ADAPTER No ACK return error was displayed on the remote controller or centralized controller. 　Follow the procedure below to determine the address of the unit that caused the AHC ADAPTER error. (1) Use the centralized controller or Maintenance Tool to check for abnormalities in the I/O data held in Mitsubishi airconditioners set by the initial settings. (No value is displayed when data is abnormal.) → If an abnormality exists, check for problems in the unit at the address where the corresponding data is held and for problems in the M-NET transmission line connected to the unit or in the unit itself. (For communications about multiple refrigerants, also investigate intermediate outdoor units.) (2) Check for incorrect remote controller or centralized controller settings that do not correspond to (1) above. → If incorrect settings are discovered at steps (1) or (2), use Maintenance Tool to repeat the initial settings. (3) If the cause does not correspond to steps (1) or (2), check for noise in the M-NET transmission line.

Error code		Description and Method of Detection	Cause	Check Procedure and Remedy
6605	M-NET communication error – No return of response frame	No response error Error indicating that the ACK signal was returned to acknowledge receipt but no response was returned when a communication command was sent over M-NET.	1) Transmission line work was performed while power is supplied to M-NET.	Cut the power supply from the unit (outdoor unit or power supply unit) that supplies power to AHC ADAPTER, or reset the error from the remote controller or centralized controller. → If the same error recurs, see causes 3) and 4). → If causes 3) and 4) do not apply, check the transmission waveform and noise in the transmission line. For details about the check procedures, refer to the CITY MULTI (Outdoor Unit) Service Handbook.
			2) Transmitted data changed due to noise on the M-NET transmission line.	
			3) Transmission line voltage/signal attenuation as M-Net transmission line exceeded its permitted length range. Remote end: 200 m max.	
			4) Transmission line voltage/signal attenuation due to mismatch in M-Net transmission line types. Cable cross-sectional area: 1.25 mm^2 min.	
6606	M-NET communication error – Transmission processor communication error	Transmission processor communication error Defective communications between the on-board instrument processor and transmission processor.	1) Error due to abnormal data transmission due to a chance malfunction of the AHC ADAPTER.	Cut the power supply from the unit (outdoor unit or power supply unit) that supplies power to AHC ADAPTER, or reset the error from the remote controller or centralized controller. → If the same error recurs, AHC ADAPTER is defective.
			2) Defective AHC ADAPTER	
7130	System abnormality – Different unit model error	ALPHA2 program version mismatch error	1) The ALPHA2 program was created and run without using the base program supplied with AHC ADAPTER.	Confirm that the ALPHA2 internal program uses the base program supplied with AHC ADAPTER. Check that the program version number matches the base program version number. ⇒ If not, recreate the ALPHA2 program from scratch using the base program supplied with AHC ADAPTER.
			2) Version data has been overwritten in the base program supplied with AHC ADAPTER.	
			3) The ALPHA2 base program used did not correspond to the AHC ADAPTER version.	(N/A as of April 2013)

Technical Manual (First Edition)

Advanced HVAC CONTROLLER

MITSUBISHI ELECTRIC CORPORATION

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