AHU Controller Specifications

1. Application

This controller is used to set up a system by connecting a field-supplied Air Handling Unit (AHU) to Mitsubishi Electric City Multi outdoor unit. This controller can be used to control the system only in cooling mode.

Applicable models: PAC-AH63, 125, 140, and 250M-G

2. System restrictions and use of range

(1) System configuration

Connectable outdoor units	PUY-P250,300,350YGM-A PUHY-P250,300,350,400,450,500YGM-A
Refrigerant type	R410A
Capacity of connectable indoor units	50~100% of outdoor unit capacity
Capacity ratio between AHU and STD (standard indoor units manufactured by Mitsubishi) in a system with one outdoor units to which both indoor units and AHU controllers are connected	Capacity of connectable AHU in a system with one outdoor units to which both indoor units and AHU controllers are connected must be 50% or less of outdoor unit capacity <Example> AHU:STD = 50%:50% Acceptable = 70%:30% Not acceptable = 30%:70% Acceptable =100%: 0% Acceptable (when only AHU is connected)
Number of connectable indoor units	P250, 1~12; P300, 1~15; P350, 1~18 P400, 1~20; P450, 1~22; P500, 1~25

* When an AHU is grouped with the standard indoor units in a system with one outdoor unit, the capacity of the standard indoor unit may drop depending on the operating conditions of the AHU. A system with one AHU is recommended.

(2) Operating conditions

Operating conditions of indoor, outdoor, air handling units (cooling/heating)

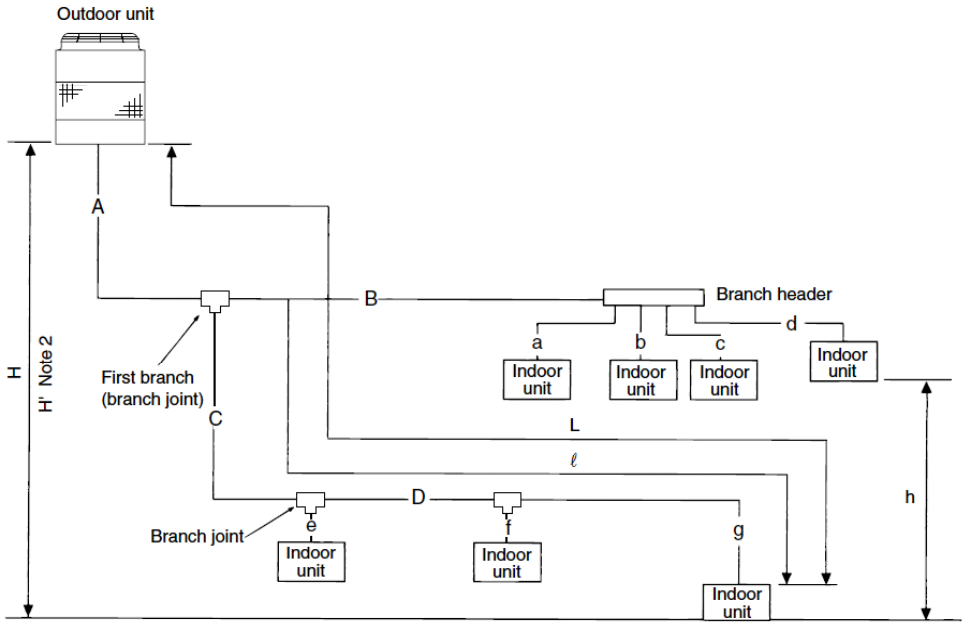
Unit Type	Cooling	Heating
AHU (evaporator inlet air temperature)	15~24°CWB	NOT available
Outdoor unit	-5~43°CDB	-20~15.5°CWB
STD in a system with one outdoor unit to which both indoor units and AHU controllers are connected	15~24°CWB	15~27°CDB

* While the AHU is running in cooling mode, the operation mode of the standard indoor units cannot be changed to heating mode, as AHU is cooling only. The operation mode of the AHU cannot be changed to cooling mode while the other units are running in heating mode. Stop all the units in the system to change the operation mode.
If the units are operated beyond the conditions shown above, the units may make an error stop, and in the worst case the compressor may not function properly. To avoid this, operate the units under the conditions shown above.

(3) Refrigerant pipe size, pipe length, and height difference restrictions

Pipe size (Liquid / Gas)	AH63,125,140	Φ9.52 / Φ15.88
	AH200	Φ9.52 / Φ19.05
	AH250	Φ9.52 / Φ22.2

Pipe length
Height difference



(1) No further branching in the pipes is possible after the header branch.

(2) When cooling operation is performed when the outdoor temp. is 0°C or lower : H'=4m or less

(3) Equivalent pipes length(m) : Actual pipe length + A×number of bent.

Table A

Outdoor unit model	A	Outdoor unit model	A
P250	0.42	P400	0.50
P300	0.42	P450	0.50
P350	0.47	P500	0.50

Item		Pipe section	Allowable length	Equivalent length
Total pipe length		A+B+C+D +a+b+c+d+e+f+g	300m max.	–
Furthest pipe length (L)		A+C+D+g or A+B+d	150m max	175m max.
Furthest pipe length (ℓ) after first branch		C+D+g or B+d	40m max.	40m max.
Btwn. indoor & outdoor units	Outdoor unit installed above	H	50m max.	–
	Outdoor unit installed below	H'	40m max.	–
Btwn. indoor & indoor units		h	15m max.	–

Amount of refrigerant to be added	(1) Original charge of refrigerant and the maximum total charge. At factory shipment, refrigerant are charged in the outdoor unit as shown at following Table. When extending the piping in the field, additional charge of refrigerant is needed. Yet, the maximum total charge in the air conditioner system should not be exceeded. The maximum additional charge varies on models, shown as at following Table.

Table

PU(H)Y-YGM		P250,300,350	P400	P450,500
Original charge	A(kg)	9.5	13.0	22.0
Maximum total charge	B(kg)	40.0	40.0	67.0
Maximum additional charge	C(kg)	30.5	27.0	45.0

(2) Calculate the additional charge for the air conditioner system in the field.
The additional charge (F kg) is calculated as follows. F should be round up to 0.1 digital, like 10.52→10.6kg.Yet, if F results bigger than C, the additional charge is the maximum additional charge C.

$F(kg)=(0.2\times Ld)+(0.12\times Le)+(0.06\times Lf)+(0.024\times Lg)+D$

Where Ld(m) : Length of liquid pipe sized Φ15.88
Le(m) : Length of liquid pipe sized Φ12.7
Lf(m) : Length of liquid pipe sized Φ9.52
Lg(m) : Length of liquid pipe sized Φ6.35
D(kg) : Additional charge of refrigerant required by the total capacity of indoor units in the refrigerant system.

Total capacity of indoor units connected	~161	161~330	331~480	481~500
D(kg)	1.5	2.0	2.5	3.0

3. Product configuration

(1) Series configuration

Several types of controllers to accommodate different AHU capacities are available.
Select the appropriate controller.

Model name	PAC-AH63M-G	PAC-AH125M-G				PAC-AH140M-G	PAC-AH250M-G	
Max. capacity (kW)	7.1	8.0	9.0	11.2	14.0	16.0	22.4	28.0
Min. capacity (kW)	5.6	7.1	8.0	9.0	11.2	14.0	16.0	22.4
Reference air flow rate (m^3/h)	1250	1500	1750	2000	2500	3000	4000	5000
Unit size	63	71	80	100	125	140	200	250

＊ Calculate the capacity of connectable indoor units using the “Unit size” in the table above.
The Unit size is set to the model name at factory shipment. Change the Unit size to the appropriate value for the selected controller using the switch on the controller board. Refer to the installation manual for how to change the Unit size.

(2) Controller components

Name		Usage
Controller	Controller board	For operation control
	Transformer	For controller board

	Terminal block	For power source, for external I/O, for internal and external communication, for remote controller, and for thermistor
	Connector	For remote controller and for level input switch
	Relay	For operation display and for error display
LEV-kit		Electronic linear expan. valve
Thermistor		For detection of suction air temperature, liquid pipe temperature, and gas pipe temperature
Clip		For mounting suction temperature thermistor
Insulation		For insulating liquid pipe and gas pipe thermistor
Tie band		For fixing liquid pipe and gas pipe thermistor
Tube		For fixing wiring
Installation manual		-

(3) Major specifications

Power supply		220~240V 50Hz
External dimension (mm)		382(430)×326×117(132) The figure in ( ) indicates mounting's.
Net weight (kg)		7
External finish(Munsel No.)		5Y 8/1
IP-class		IP24
Remote controller temperature setting range		14~30°C
Operation	Operation by optional remote controller	Press ON/OFF button on the remote controller to start/stop the operation.
	Operation by external input*	Connect the field-installed external thermostat (ON/OFF) to the external input (ON/OFF) to start the operation when the external thermo is ON, and stop the operation when it is OFF.
	Interlock operation with AHU fan	Interlock setting between the error stop of AHU fan and the external input ON/OFF must be made to close the LEV of AHU heat exchanger when AHU fan makes an error stop. Refer to section 5 for details.
Temperature control	Temperature control by optional remote controller	The thermostat will be turned off (LEV will be closed) when the suction air temperature thermistor reading reaches the preset temperature on the remote controller.
	Temperature control by external thermostat	Connect the field-installed external thermostat (ON/OFF) to the external input (ON/OFF) to start the operation when the external thermo is ON, and stop the operation when it is OFF. The thermostat will be turned off when the suction air temperature thermistor reading reaches the preset temperature on the remote controller. Refer to section 5 for details.

Protection function	Freeze prevention	After 16-minute or more cooling operation, and when 1°C or less of the thermistor detection temperature for liquid pipe is detected for 3 minutes in a row, the linear expansion valve will be closed to prevent freezing. The operation will be normal when either of the following conditions is met. - When 3 minutes have passed after 10°C or more of the thermistor detection temperature for liquid pipe is detected. - When 6 minutes have passed after the expansion valve was closed to prevent freezing.
	Sensor failure	If a short or an open of the thermistor is detected during operation, the error will affect the LEV, and it will be closed.
	Communication error	If the addresses overlap or the transmission line is not connected properly, the error will affect the LEV, and it will be closed.
	Other types of error	If the outdoor unit in the system with one outdoor unit has a problem, the problem will affect the entire system, and the compressor will stop.

＊ Default setting (operation mode setting or temperature setting) with an optional remote controller must be made when an external input is used.

4. Requirements on AHU design

(1) Design method of heat exchanger

Model name	PAC-AH63M-G	PAC-AH125M-G				PAC-AH140M-G	PAC-AH250M-G	
Unit size	63	71	80	100	125	140	200	250
Max. capacity (kW)	7.1	8.0	9.0	11.2	14.0	16.0	22.4	28.0
Min. capacity (kW)	5.6	7.1	8.0	9.0	11.2	14.0	16.0	22.4
Reference air flow rate (m^3/h)	1250	1500	1750	2000	2500	3000	4000	5000
Heat exchanger tube size in evaporator	Φ9.52							
Min. volume inside heat exchanger tube	950	1100	1200	1500	1900	2150	3000	3750
Max. volume inside heat exchanger tube	1800	2000	2250	2850	3550	4050	5700	7100
Standard number of paths	3	3	3	4~5	4~5	5~6	6~10	8~10
LEV inlet temperature	25ºC							
Evaporating temperature	8.5ºC							
SH	5K							
Evaporator outlet temperature	13.5ºC							
Evaporator suction air temperature	27ºCDB/19ºCWB							

Calculate the capacity of connectable indoor units using the “Unit size” in the table above.

(2) Heat exchanger manufacturing

Design pressure	4.15 MPa
Evaporator burst pressure Compressive strength	The compressive strength of the evaporator and of other pipes must exceed 12.45MPa. Insufficient withstand pressure may cause the pipes to crack and result in gas

	leakage.
Contamination control	Wash the heat exchanger with detergent to make the allowable level of contamination per unit length of the heat exchanger tube the following values or less on the assumption that the heat exchanger tube size is Φ9.52. Do not use chlorinated detergent. Do not leave flux. Allowable level of contamination may cause the compressor not to function properly. Contamination amount: residual water amount 0.6 mg/m or less, residual oil amount 0.5 mg/m or less, amount of solid contaminants 1.8 mg/m or less

(3) Installation conditions of AHU controller

Installation site	- Avoid locations in direct sunlight. - Avoid locations exposed to steam or oil vapor. - Avoid locations where combustible gas may leak, settle or be generated - Avoid installation near machines emitting high-frequency waves. - Avoid places where acidic solutions are frequency waves. - Avoid places where sulfur-based or other sprays are frequently used. - Avoid places where vibration may occur.
Ambient temperature	-20~43ºC
Ambient humidity	Relative humidity of 95% or less (No dew condensation is allowed)
Installation angle	Vertical installation

(4) Cautions on installing LEV-kit

Installation environment	Avoid locations in direct sunlight.
Installation angle	Install the motor above the horizontal.
Pipe size	Φ9.52 (Brazing) Use two LEVs when installing AH250. Connect two LEVs in parallel, and connect them to the appropriate refrigerant pipe according to the unit size.
Caution on brazing	LEV can withstand only up to 120ºC. Cool the LEV while brazing.
Wire connection	- Connect the wire according to the wire color code to avoid miswiring. In case of AH250, connect two wires to the same terminal. - Do not strain the power supply wires. - Be careful with the plate edge not to damage to the wire from being damaged. - The wire can withstand only up to 105ºC. Keep the wire away from high-temperature part. - Bend the wire into "U" shape to prevent water from running down the wire and from dripping on the electrical components or the LEV.

(5) Cautions on installing thermistor

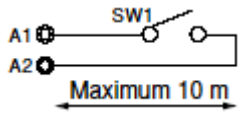
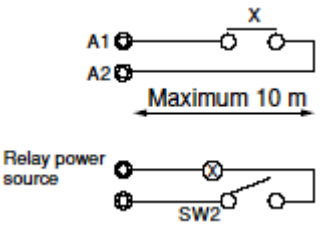
Installation site	- Install the pipe thermistor properly so that it can accurately measure the pipe temperature. Protect it with the insulation material so that it is not affected by the temperature at other places. - Install the liquid thermistor sensor at the evaporator inlet where the lowest temperature is found, as the thermistor is used for freeze prevention. - Install the gas pipe thermistor at the junction at the evaporator outlet. - Install the suction air temperature thermistor at a place where the average temperature of suction air into the evaporator can be measured.
Wire connection	- Connect the wire according to the terminal number to avoid miswiring.

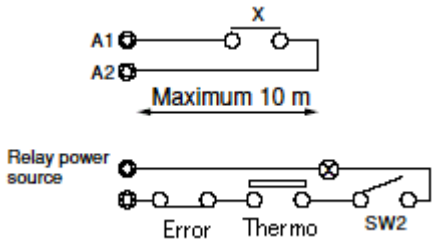
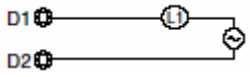
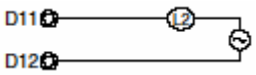
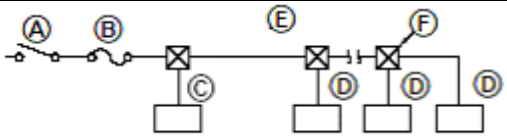
	- Do not strain the power supply wires. - Be careful with the plate edge not to damage to the wire from being damaged. - The wire can withstand only up to 105ºC. Keep the wire away from high-temperature part. - Bend the wire into "U" shape to prevent water from running down the wire and from dripping on the electrical components or the thermistor.

(6) Other cautions

- The refrigerant temperature inside the evaporator may become 0ºC. Note that dew condensation on AHU main body or on the refrigerant pipe may occur.
- Drain the AHU properly.
  If the LEV of AHU does not close due to malfunction in a system with one outdoor unit to which both indoor units and AHU controllers are connected and if the AHU is stopped and other STD are in operation, the
  temperature of AHU evaporator becomes low and dew may condense on the AHU main body.
  Take appropriate measures against dew condensation to avoid serious damage to the unit.
- When a heater for heating operation is built-in and when both the heater for heating operation and the evaporator are operated, the operation must be conducted within the evaporator inlet temperature range.
- Install an air filter on the evaporator.
- Interlock the unit with the fan to prevent the refrigerant system from running when the fan is stopped.
- In a system with one outdoor unit to which both in indoor units and AHU controllers are connected, the LEV of AHU will be slightly open in heating operation to prevent the refrigerant from accumulating inside the AHU heat exchanger, and the temperature of theAHU heat exchanger will slightly rise.
- In a system with one outdoor unit to which both indoor units and AHU controllers are connected, the LEV will be temporarily open in heating operation to run the outdoor unit in defrost operation. In this case, low-temperature refrigerant will run inside the AHU heat exchanger, and the heating capacity of AHU that is running heating operation using the heater for heating operation will temporarily drop.
- Capacity control is affected by the outdoor temperature. When the outdoor temperature drops, the discharge temperature also drops. Take proper measures to control the room temperature, to select the outlet position, and to prevent dew condensation.

5. Requirements on interface with controller

Item	Connection circuit
Operation	■Operation contact specifications  SW1: Operation command (field supply) Minimum applicable load DC5V, 1mA
	■Use a relay when the electrical wire exceeds 10m.  X: Relay(field supply) Minimum applicable load DC5V, 1mA SW2: Operation command (field supply)

	■Interlock operation with fan error and connection example of field-installed thermostat Interlock the unit so that the unit stops when an error occurs on the fan (field supply).  X: Relay(field supply) Minimum applicable load DC5V, 1mA SW2: Operation command (field supply) Error: Error of fan sections (field supply) Thermo: Thermistor (field supply)
Operation signal	 L1: Operation display lamp (field supply) Display power source: DC30V 1A, AC100V/200V 1A
Error signal	 L2: Error display lamp (field supply) Display power source: DC30V 1A, AC100V/200V 1A If error resets (stop operation) and restart operations are repeatedly performed, the Compressor may be damaged seriously. Install an error lamp, and contact the service firm or the dealer when an error occurs. Installation of the remote controller is recommended so that the error details can be checked.
Electrical wiring	 Ⓐ Switch 16 A Ⓑ Overcurrent protection 16 A Ⓒ AHU controller Ⓓ Indoor unit Ⓔ Total operating current be less than 16 A Ⓕ Pull box - Power supply cords of appliances shall not be lighter than design 245 IEC 57 or 227 IEC 57. - A switch with at least 3mm contact separation in each pole shall be provided by the Air conditioner installation. - The diameter of the power supply wire to the AHU controller must be 1.5mm^2 or larger. - Use an earth leakage breaker with a sensitivity of 30 mA 0.1s or less. - Use a separate wire for AHU's main circuit from that for the circuit shown above. Select the appropriate wire or the protection device on site, according to the AHU specifications.
Transmission cables	- Type of cable : Shielding wire (2-core) CVVS or CPEVS or MVVS - Cable diameter : 1.25mm^2
M-NET Remote controller cables	- Type of cable : Sheathed wire 2-core cable(unshielded) CVV - Cable diameter: 0.3~1.25mm^2 (0.75~1.25mm^2 : connected with simple remote controller) * When 10m is exceeded, use cables with the same specification as transmission cables.
MA Remote controller cables	- Type of cable : Sheathed wire 2-core cable(unshielded) CVV - Cable diameter: 0.3~1.25mm^2 (0.75~1.25mm^2 : connected with simple remote controller) - Max length : 200m

CVVS, MVVS : PVC insulated PVC jacketed shielded control cable
CPEVS : PE insulated PVC jacketed shielded communication cable
CVV : PV insulated PVC sheathed control cable

6. Related cautions

(1) Installation work

- Secure enough service space for replacement of the LEV and the thermistor.
- After an AHU controller is installed, address setting and unit size setting on the switch on the controller board are necessary. Refer to the installation manual for the setting method.
- Refer to the outdoor unit installation manual or the data book for installation of the outdoor unit.

(2) Test run

- Turn on the main power to the unit at least 12 hours before test run to power the crankcase heater. Insufficient powering time may result in compressor damage.
- As the temperature setting and the operation mode setting are made at initial setting, a remote controller is necessary. Remove the remote controller after making the initial settings if it is used. In case of PAR21MAA, remove the remote controller after turning off the power of the indoor and outdoor units. In case of PAR-27MEA, remove it after deleting the address of the remote controller.
  (Refer to the installation manual for remote controller for more details.)

(3) Operation control

- Remove the connector inside the AHU controller when a local remote controller is used. When the connector is connected, the controller will be in the remote operation mode, and the operation by the local remote controller will be prohibited.
- If the error lamp lights or the error display appears on the remote controller, do not make an error reset by yourself. Contact the service firm or the dealer.
- Refer to the data book for system controller when using the system controller.

(4) Service

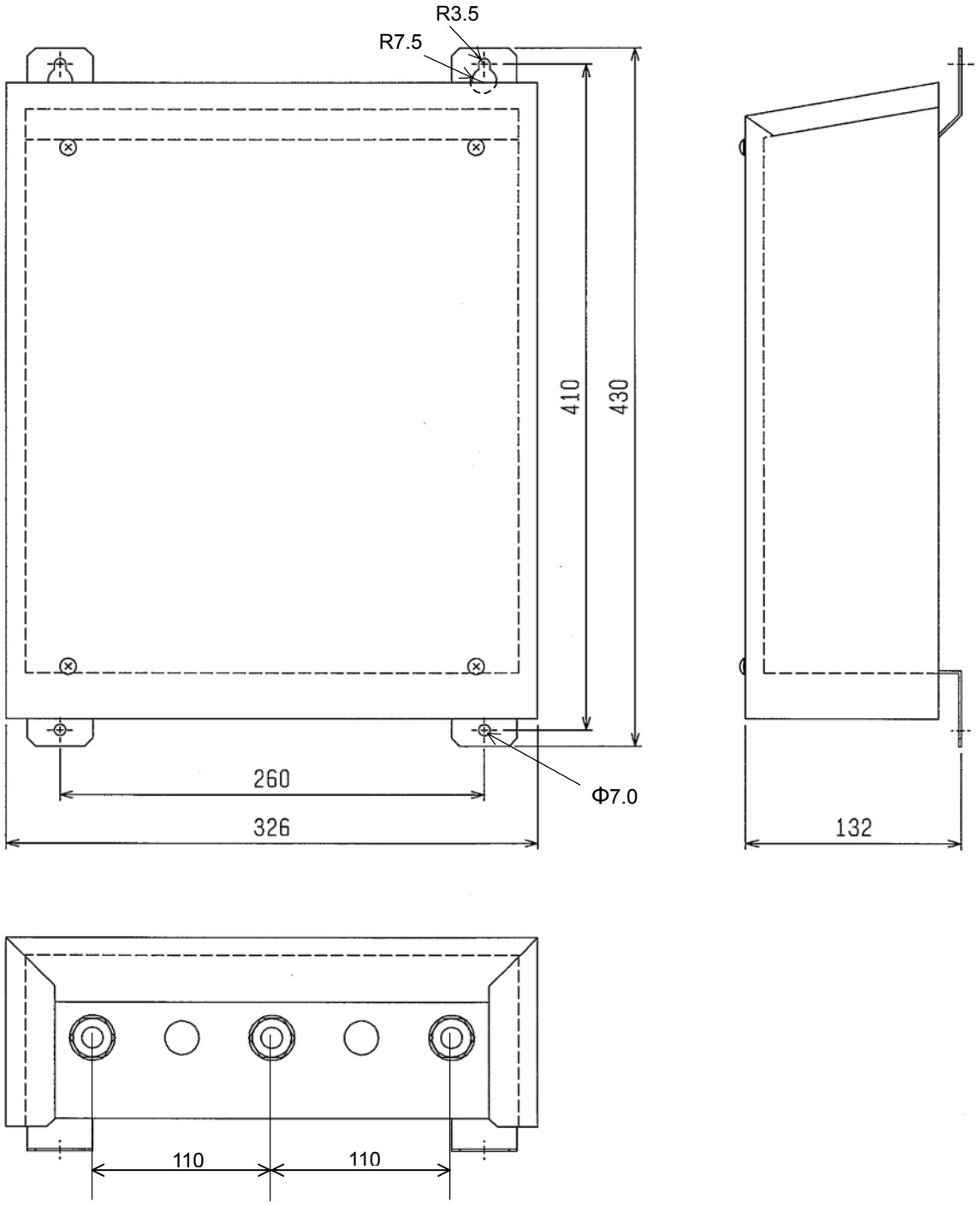
- Establish a regular maintenance routine to prolong the life of the units. It is recommended that the maintenance contract be concluded with a maintenance firm.

7. Warranty

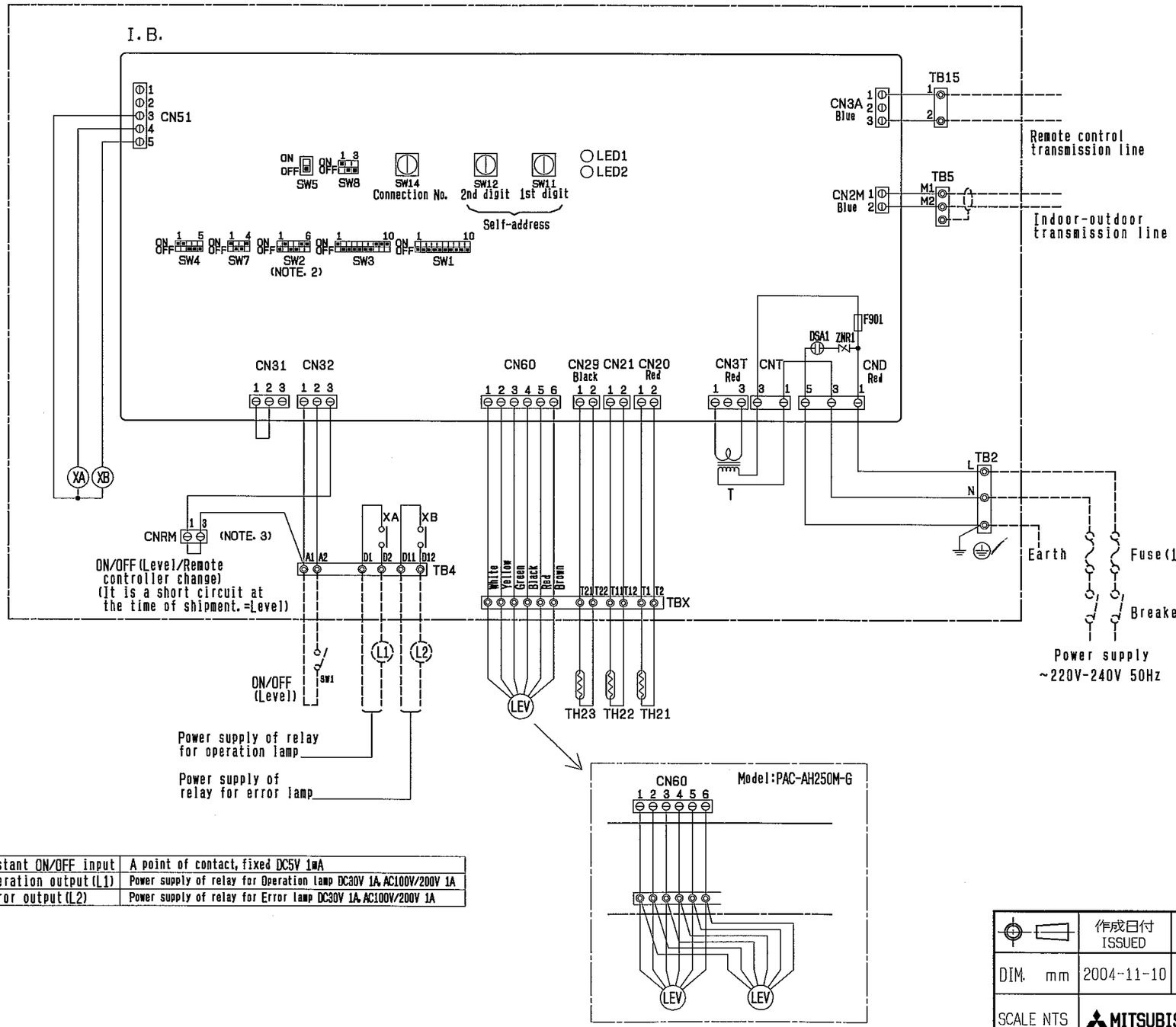
- Specifications of AHU and compatibility with regulations must be confirmed by your company.
- Selection of an appropriate AHU (with appropriate specifications to match those of units connected to the AHU such as configuration, dimension, lifetime, vibration, noise, or characteristic) must be made by your company.
- Mitsubishi Electric shall not be liable for any damage to the entire system or the AHU main body caused by connected AHU with wrong specification or wrong usage of AHU.
- Mitsubishi Electric shall not be liable for any damage to the outdoor units or the indoor units connected caused by AHU damage.

External Dimension

PAC-AH63/125/140/250M-G



Electrical Wiring Diagram



NOTE

1. Address switch and branch part switch setting
   For the address setting method, refer to the address setting item of the installation manual.
2. Initial setting of SW2
   Always operate in the power-off state.
   For the SW2 setting method, refer to the unit size setting item of the installation manual.

SW2 at delivery

MODELS	SW2	MODELS	SW2
PAC-AH63M-G	ON OFF 1 6	PAC-AH140M-G	ON OFF 1 6
PAC-AH125M-G	ON OFF 1 6	PAC-AH250M-G	ON OFF 1 6

3. Initial setting of operation mode
   A remote controller is required to perform initial setting, when the controller board is exchanged.
   Remove the connector "CNRM" and set the operation mode to cooling mode.
   Connect the connector as it was, when the remote controller is NOT used.
4. Sign explanation
   ---- (thick dashedline) : Local wiring
   --- (thin dashedline) : option parts
   ⏀ : Connector / ◎ : Terminal bed

SYMBOL EXPLANATION

Symbol		Name
I.B.		Indoor controller board
	F901	Fuse(6.3A)
	ZNR1	Varistor
	LED1	LED(Power supply)
	LED2	LED(Remote controller supply)
	SW1	Switch(for mode selection)
	SW2	Switch(for capacity code)
	SW3	Switch(for mode selection)
	SW4	Switch(for model selection)
	SW5	Switch(for voltage selection)
	SW7	Switch(for mode selection)
	SW8	Switch(for mode selection)
	SW11	Switch(1st digit address set)
	SW12	Switch(2nd digit address set)
	SW14	Switch(connection No. set)
T		Transformer
TB2		Power source terminal bed
TB4		Terminal bed(Distant ON/OFF input Level, Operation output, Error output)
TB5		Transmission terminal bed
TB15		Transmission terminal bed
TH21		Thermistor(AHU inlet air temp. detection)
TH22		Thermistor(AHU pipe temp. detection/liquid)
TH23		Thermistor(AHU pipe temp. detection/gas)
TBX		Terminal bed(Thermistor, LEV)
LEV		Electronic linear expan. valve
CNRM		Connector(Level/Remote controller change)
L1		Lamp (Operation output)
L2		Lamp (Error output)

Distant ON/OFF input	A point of contact, fixed DC5V 1mA
Operation output(L1)	Power supply of relay for Operation lamp DC30V 1A AC100V/200V 1A
Error output(L2)	Power supply of relay for Error lamp DC30V 1A AC100V/200V 1A

	作成日付 ISSUED	改定日付 REVISED	TITLE
DIM. mm	2004-11-10	2005-07-12	PAC-AH63/125/140/250M-G AHU Controller(M-NET)
SCALE NTS	MITSUBISHI ELECTRIC CORPORATION	DRW. NO. W661003	REV. A / PAGE 1/1