MITSUBISHI ELECTRIC

CITY MULTI

AHU Controller

PAC-AH001-1

SERVICE MANUAL

Table of Contents

1. Safety Precautions

Read before installation and performing electrical work

- Thoroughly read the following safety precautions prior to installation.
- Observe these safety precautions for your safety.
- This equipment may have adverse effects on the equipment on the same power supply system.
- Contact the local power authority before connecting to the system.

Symbol explanations

WARNING
This symbol indicates that failure to follow the instructions exactly as stated poses the risk of serious injury or death.

CAUTION
This symbol indicates that failure to follow the instructions exactly as stated poses the risk of serious injury or damage to the unit.

Symbols used in the text

⃠	: Indicates an action that must be avoided.
❗	: Indicates that important instructions must be followed.
⏚	: Indicates a part which must be grounded.
⚠	: Indicates that caution should be taken with rotating parts. (This symbol is displayed on the main unit label.) <Color: yellow>
⚠	: Beware of electric shock (This symbol is displayed on the main unit label.) <Color: yellow>

WARNING
Carefully read the labels affixed to the main unit.

⚠ WARNING

- Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
  - Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, during repair, or at the time of disposal of the unit. It may also be in violation of applicable laws. MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.
- Ask your dealer or a qualified technician to install the unit.
  - Improper installation by the user may result in water leakage, electric shock, or fire.
- Properly install the unit on a surface that can withstand its weight.
  - Unit installed on an unstable surface may fall and cause injury.
- Only use specified cables. Securely connect each cable so that the terminals do not carry the weight of the cable.
  - Improperly connected cables may produce heat and start a fire.
- Take appropriate safety measures against wind gusts and earthquakes to prevent the unit from toppling over.
  - Improper installation may cause the unit to topple over and cause injury or damage to the unit.
- Only use accessories (i.e., air cleaners, humidifiers, electric heaters) recommended by Mitsubishi Electric.
- Do not touch the heat exchanger fins with bare hands.
  - The fins are sharp and pose a risk of cuts.
- In the event of a refrigerant leak, thoroughly ventilate the room.
  - If gaseous refrigerant leaks out and comes in contact with an open flame, toxic gases will be generated.
- Properly install the unit according to the instructions in the Installation Manual.
  - Improper installation may result in water leakage, electric shock, or fire.
- Have all electrical work performed by an authorized electrician according to the local regulations and the instructions in this manual. Use a dedicated circuit.
  - Insufficient power supply capacity or improper installation of the unit may result in malfunctions of the unit, electric shock, or fire.
- Keep electrical parts away from water.
  - Wet electrical parts pose a risk of electric shock, smoke, or fire.
- Securely attach the control box cover.
  - If the cover is not installed properly, dust or water may infiltrate and pose a risk of electric shock, smoke, or fire.
- Only use the type of refrigerant that is indicated on the unit when installing or relocating the unit.
  - Infiltration of any other types of refrigerant or air into the unit may adversely affect the refrigerant cycle and may cause the pipes to burst or explode.
- When installing the unit in a small space, take appropriate precautions to prevent leaked refrigerant from reaching the limiting concentration.
  - Leaked refrigerant gas will displace oxygen and may cause oxygen starvation. Consult your dealer before installing the unit.
- Consult your dealer or a qualified technician when moving or reinstalling the unit.
  - Improper installation may result in water leakage, electric shock, or fire.
- After completing the service work, check for a refrigerant leak.
  - If leaked refrigerant is exposed to a heat source, such as a fan heater, stove, or electric grill, toxic gases will be generated.
- Do not try to defeat the safety features of the unit.
  - Forced operation of the pressure switch or the temperature switch by defeating the safety features for these devices, or the use of accessories other than the ones that are recommended by Mitsubishi Electric may result in smoke, fire, or explosion.
- Consult your dealer for proper disposal method.
- Do not use a leak detection additive.

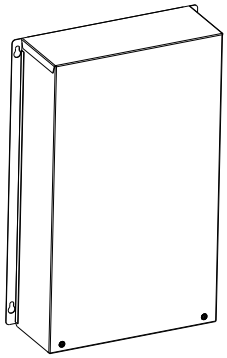
Precautions for handling units for use with R410A

⚠ CAUTION

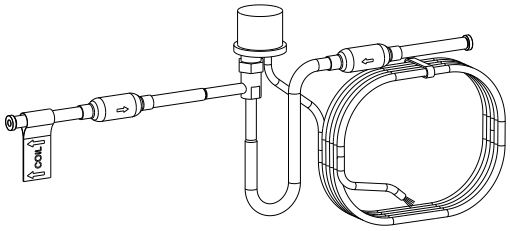
- Do not use the existing refrigerant piping.
  - A large amount of chlorine that may be contained in the residual refrigerant and refrigerator oil in the existing piping may cause the refrigerator oil in the new unit to deteriorate.
- Use refrigerant piping materials made of phosphorus deoxidized copper. Keep the inner and outer surfaces of the pipes clean and free of such contaminants as sulfur, oxides, dust, dirt, shaving particles, oil, and moisture.
  - Contaminants in the refrigerant piping may cause the refrigerator oil to deteriorate.
- Store the piping materials indoors, and keep both ends of the pipes sealed until immediately before brazing. (Keep elbows and other joints wrapped in plastic.)
  - Infiltration of dust, dirt, or water into the refrigerant system may cause the refrigerator oil to deteriorate or cause the compressor to malfunction.
- Use a small amount of ester oil, ether oil, or alkyl benzene to coat flares and flanges.
  - Infiltration of a large amount of mineral oil may cause the refrigerator oil to deteriorate.
- Charge the system with refrigerant in the liquid phase.
  - If gaseous refrigerant is drawn out of the cylinder first, the composition of the remaining refrigerant in the cylinder will change and become unsuitable for use.
- Only use R410A.
  - The use of other types of refrigerant that contain chloride may cause the refrigerator oil to deteriorate.
- Use a vacuum pump with a check valve.
  - If a vacuum pump that is not equipped with a check valve is used, the vacuum pump oil may flow into the refrigerant cycle and cause the refrigerator oil to deteriorate.
- Prepare tools for exclusive use with R 410A. Do not use the following tools if they have been used with the conventional refrigerant: gauge manifold, charging hose, gas leak detector, check valve, refrigerant charge base, vacuum gauge, and refrigerant recovery equipment.
  - If the refrigerant or the refrigerator oil that may be left on these tools are mixed in with R410A, it may cause the refrigerator oil in the new system to deteriorate.
    Infiltration of water may cause the refrigerator oil to deteriorate.
    Leak detectors for conventional refrigerants will not detect an R410A leak because R410A is free of chlorine.
- Do not use a charging cylinder.
  - If a charging cylinder is used, the composition of the refrigerant in the cylinder will change and become unsuitable for use.
- Exercise special care when handling tools for use with R410A.
  - Infiltration of dust, dirt, or water into the refrigerant system may cause the refrigerator oil to deteriorate.

2. Features

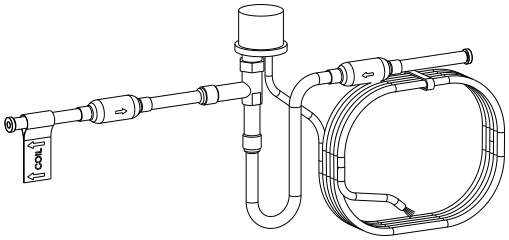
PAC-AH001-1



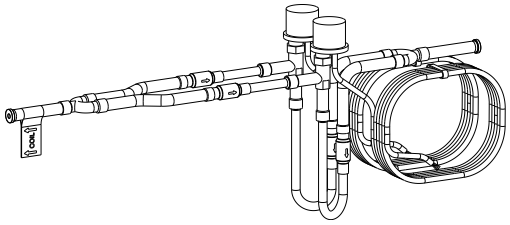
PAC-LV24AC-1



PAC-LV48AC-1, PAC-LV60AC-1



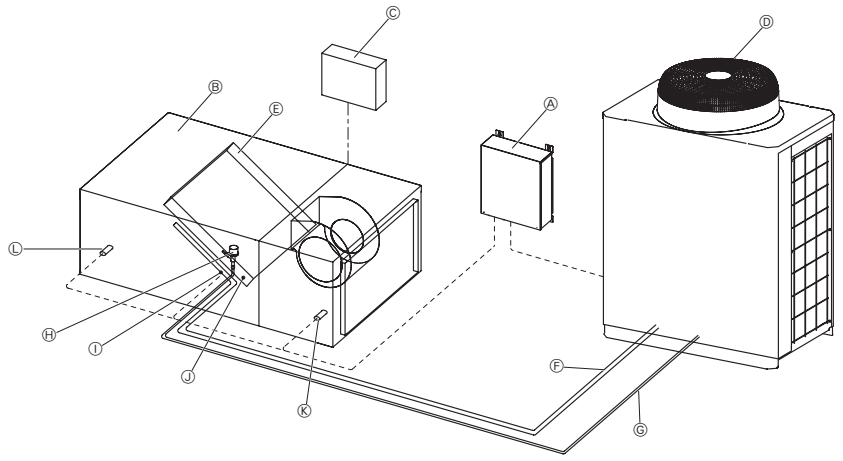
PAC-LV96AC-1, PAC-LV120AC-1



LEV Assembly			
LEV Assembly	**Design Capacity Range**		**Capacity Code**
Model	**[Btu/h]**	**[kW]**	**Setting [Ton]**
PAC-LV24AC-1	4,800 - 24,000	1.8 - 7.0	0.5, 0.7, 1, 1.25, 1.5, 2
PAC-LV48AC-1	24,000 - 48,000	7.0 - 14.1	2.25, 2.5, 3, 4
PAC-LV60AC-1	48,000 - 60,000	14.1 - 17.6	4.5, 5
PAC-LV96AC-1	60,000 - 96,000	17.6 - 28.1	6, 8
PAC-LV120AC-1	96,000 - 120,000	28.1 - 35.2	10
PAC-LV96AC-1 (x2)	120,000 - 192,000	35.2 - 56.3	12, 14, 16
PAC-LV120AC-1 (x2)	192,000 - 240,000	56.3 - 70.3	18, 20

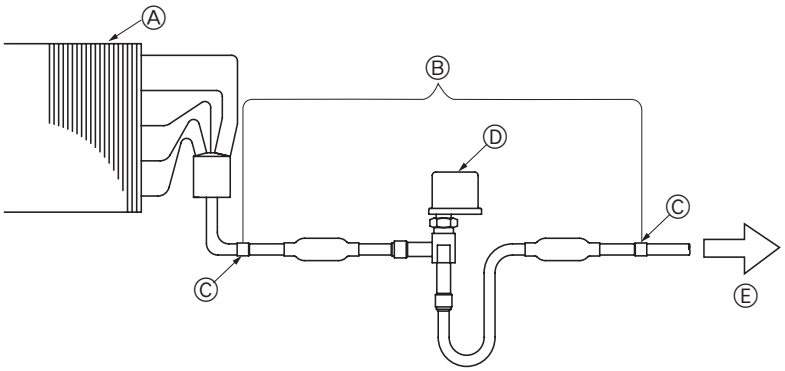
3. Part Names and Functions

3.1. System Assembly



Ⓐ Air handling unit controller PAC-AH001-1
Ⓑ Air handling unit (field supply)
Ⓒ Controller (field supply)
Ⓓ Outdoor unit
Ⓔ Heat exchanger (field supply)
Ⓕ Gas Pipe (field supply)
Ⓖ Liquid Pipe (field supply)
Ⓗ LEV Assembly
Ⓘ Thermistor (gas pipe)
Ⓙ Thermistor (liquid pipe)
Ⓚ Thermistor (suction air)
Ⓛ Thermistor (discharge air)

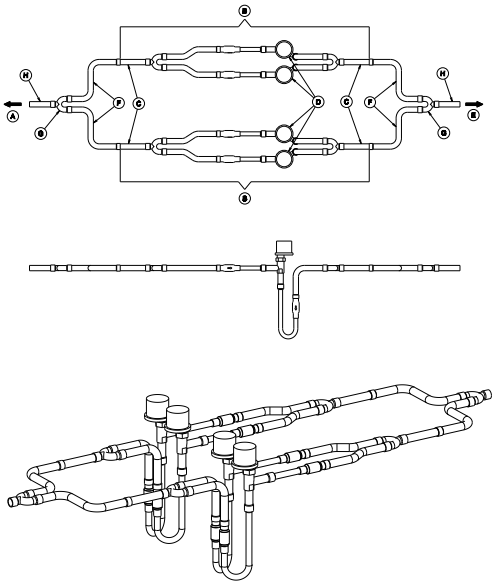
3.2. Installation Detail for Single LEV Assembly



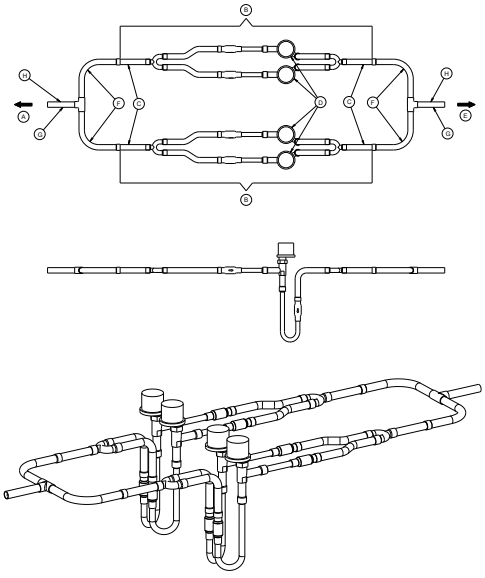
Ⓐ AHU Heat exchanger (field supplied)
Ⓑ LEV Assembly
Ⓒ Brazing
Ⓓ LEV
Ⓔ To Outdoor Unit

3.3. Installation Detail for 2 LEV Assemblies in Parallel

Piping configuration with Y-Distributors



Piping configuration with T-Joints



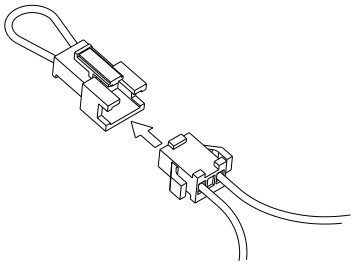
Ⓐ To AHU Heat exchanger (field supply)
Ⓑ LEV Assembly
Ⓒ Brazing
Ⓓ LEV
Ⓔ To Outdoor unit
Ⓕ Refrigerant pipe size ø1/2” (field supply)
Ⓖ Distributor (field supply)
Ⓗ Refrigerant pipe size (field supply) based on outdoor unit piping specification

3.4. Remote Controller

The AHU Controller can be installed to operate using either a Mitsubishi remote controller or a 3rd party controller. The AHU controller cannot be operated by a Mitsubishi remote controller and a 3rd party controller at the same time.

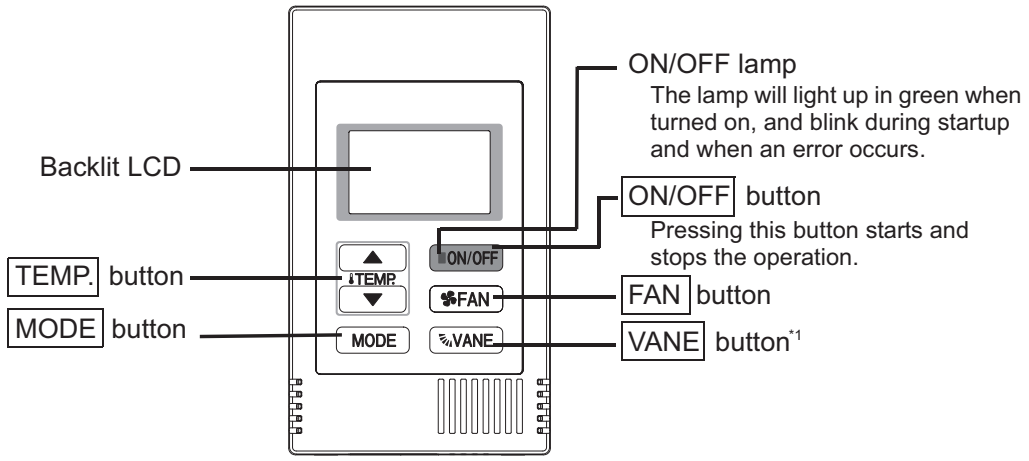
3.4.1. City Multi® Remote Controller, PAC-YT53CRAU

- To operate the system using a Mitsubishi controller, disconnect the jumper connector “CNRM” located inside the AHU controller. Disconnecting “CNRM” activates the Mitsubishi controller.



- Once the operation mode is selected, the unit will remain in the selected mode until changed.

1. City Multi Remote Controller Buttons

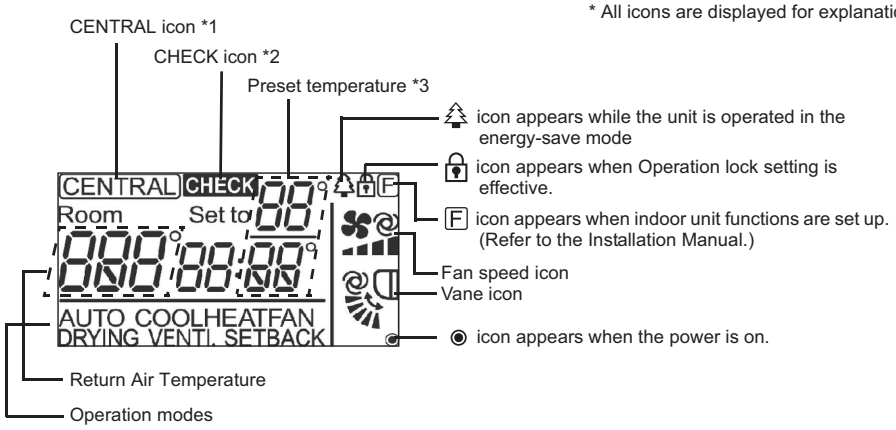


*1 Function not available for PAC-AH001-1

- Keep the remote controller out of the direct sunlight to ensure accurate measurement of room temperature.
- The thermistor at the lower right-hand section of the remote controller must be free from obstructions to ensure accurate measurement of room temperature.
- To set the functions that are not available on this controller (PAC-YT53CRAU), use MA remote controller or the centralized controller.

2. City Multi Remote Controller Display

* All icons are displayed for explanation.



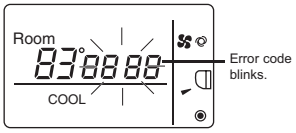
*1 CENTRAL icon

Appears when one of the following local operations is prohibited: ON/OFF; operation mode; preset temperature; fan speed; vane.

*2 **CHECK** icon

For City Multi, when an error occurs, power indicator will blink, and unit address (three digits) and error code (four digits) will blink.
Check the error status, stop the operation, and consult your dealer.

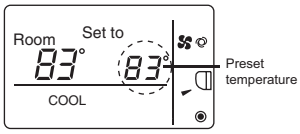
When only error code blinks, air conditioning units stay in operation, but an error may have occurred.
Check the error code, and consult your dealer.



*3 Preset temperature

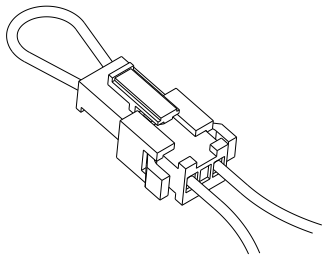
* Centigrade or Fahrenheit is selectable. Refer to the Installation Manual for details.

In COOL, DRYING, HEAT, or AUTO (single set point) modes

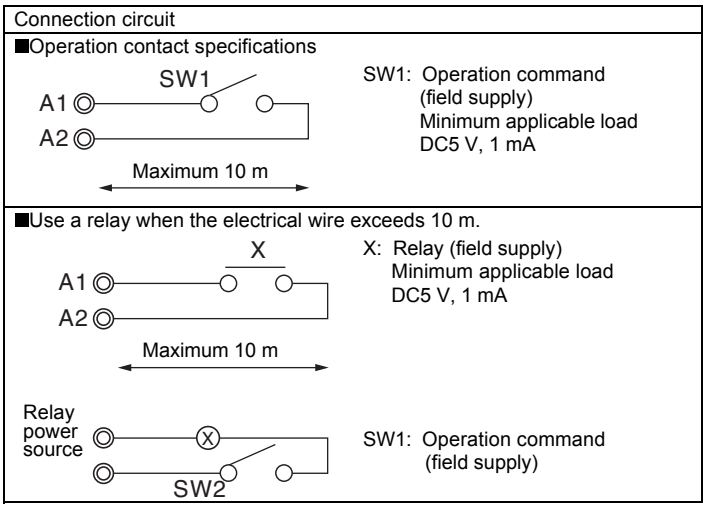


3.4.2. 3rd Party Controller

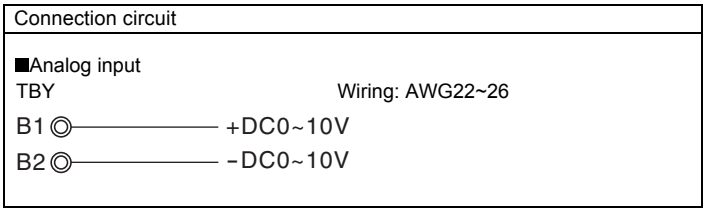
- To operate the system using a 3rd party controller, connect the jumper connector “CNRM” located inside the AHU controller as shown below. Connecting “CNRM” activates the control of the 3rd party controller.



- When using a 3rd party controller, a Mitsubishi remote controller is still required to set the operation mode, fan speed, and function settings. A Mitsubishi remote controller is not required after the initial setting of the unit. Initial setting can be performed using the M-NET remote controllers connected to other indoor units.
- Once the operation mode is selected, the unit will remain in the selected mode until changed.
- A 3rd party controller can be installed to control the following functions of the AHU controller:
  – ON/OFF (Operation) function
  – Temperature set point (Analog Input) function
- The AHU controller can either be controlled by a Mitsubishi controller or a 3rd party controller; it cannot be installed to be controlled by both.
- Wiring for ON/OFF (Operation) function



- Wiring for temperature set point (Analog Input)



4. Specifications

4.1. AHU Controller Specifications

Model			PAC-AH001-1
Power Supply			208/230 VAC, 60 Hz, 1-Phase
External Finish			Galvanized Steel Plate
Power Input		kW	0.012
Current		A	0.055
Dimension	Height	in (mm)	19.5 (496)
	Width		12.8 (326)
	Depth		4.7 (119)
Control Box Net Weight (without packaging)		lbs (kg)	11.5 (5.2)
IP class			00
Operational Temperature Range		°F (°C)	-4 to 115 (-20 to 46)
Gas Pipe Thermistor			Resistance (B0/80 = 3460K) 0°C/15k, 10°C/9.6k 20°C/6.3k, 25°C/5.2k 30°C/4.3k, 40°C/3.0k
Liquid Pipe Thermistor			
Return Air Thermistor			
Discharge Air Thermistor			
Fuse			SOC, MQ4
Outdoor Units			W/Y-Series & W/R2-Series CITY MULTI outdoor units. S-series (PUMY) CITY MULTI outdoor units not compatible
Refrigerant Type			R410A
Installation manual			PA79D271H01

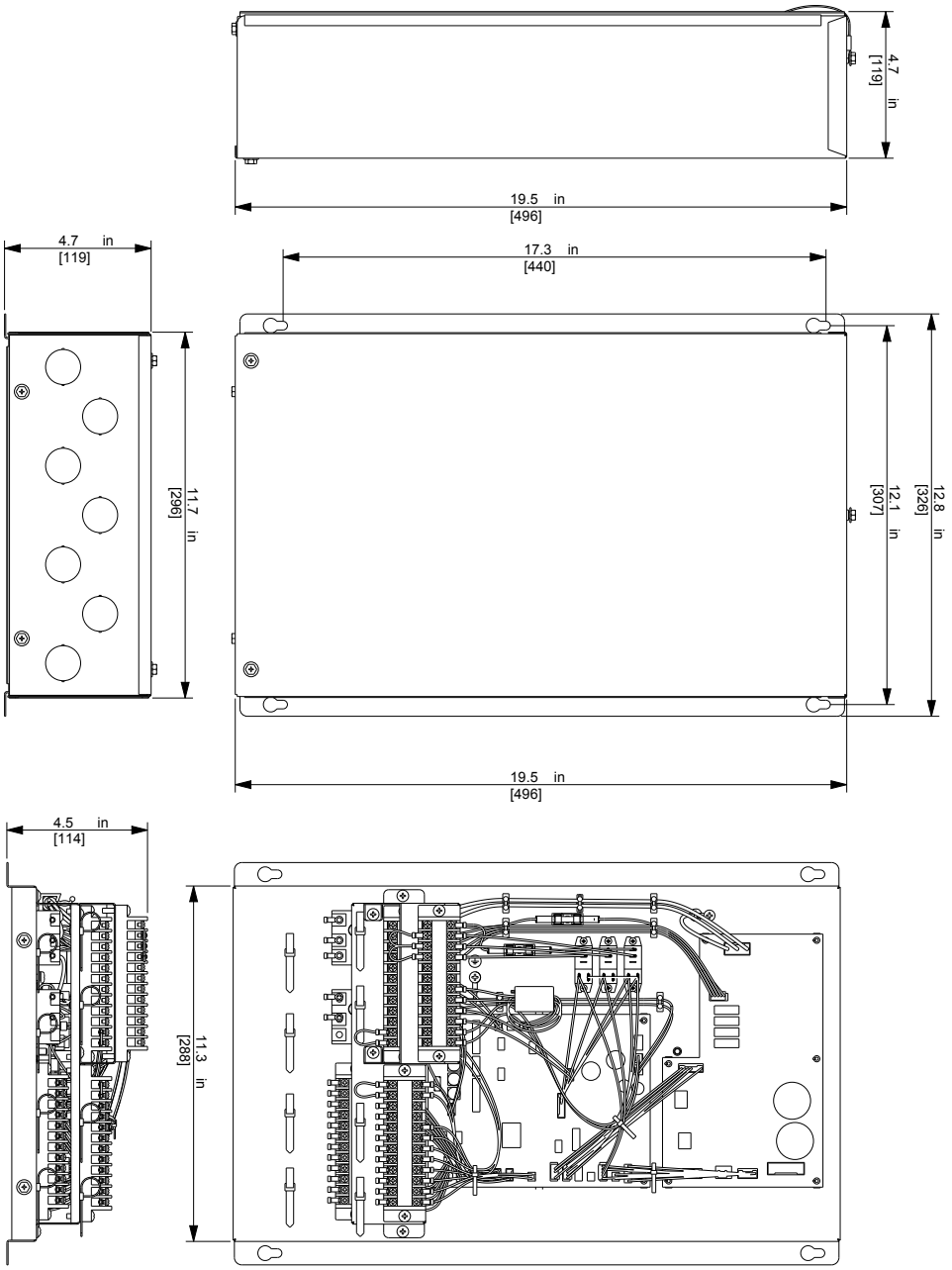
4.2. LEV Assembly Specifications

Model		PAC-LV24AC-1	PAC-LV48AC-1	PAC-LV60AC-1	PAC-LV96AC-1	PAC-LV120AC-1
LEV Model		EFM-40	EFM-80	EFM-A0	EFM-80 (x2)	EFM-A0 (x2)
LEV Motor		12VDC Stepping motor drive (0~1400 pulse) Lock nut fastening torque: 14 N·m				
Cable Length	ft [m]	16 [5]				
Connection Pipe Diameter	in (mm)	3/8 (9.52)			1/2 (12.7)	

5. Outlines and Dimensions

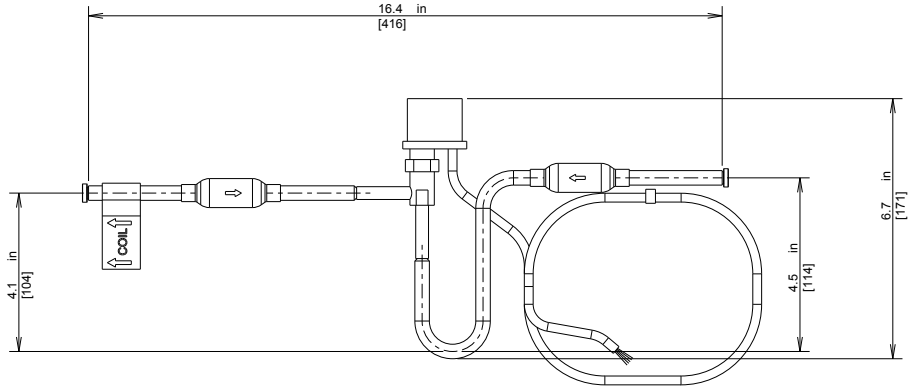
5.1. AHU Controller

PAC-AH001-1

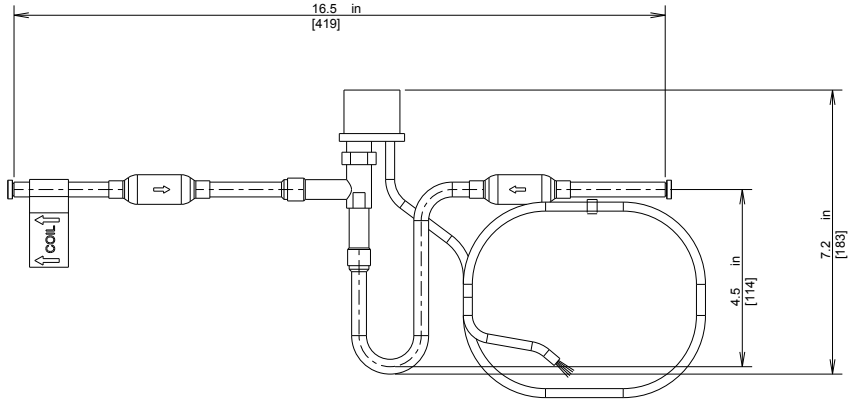


5.2. Single Valve LEV Assembly

PAC-LEV24AC-1

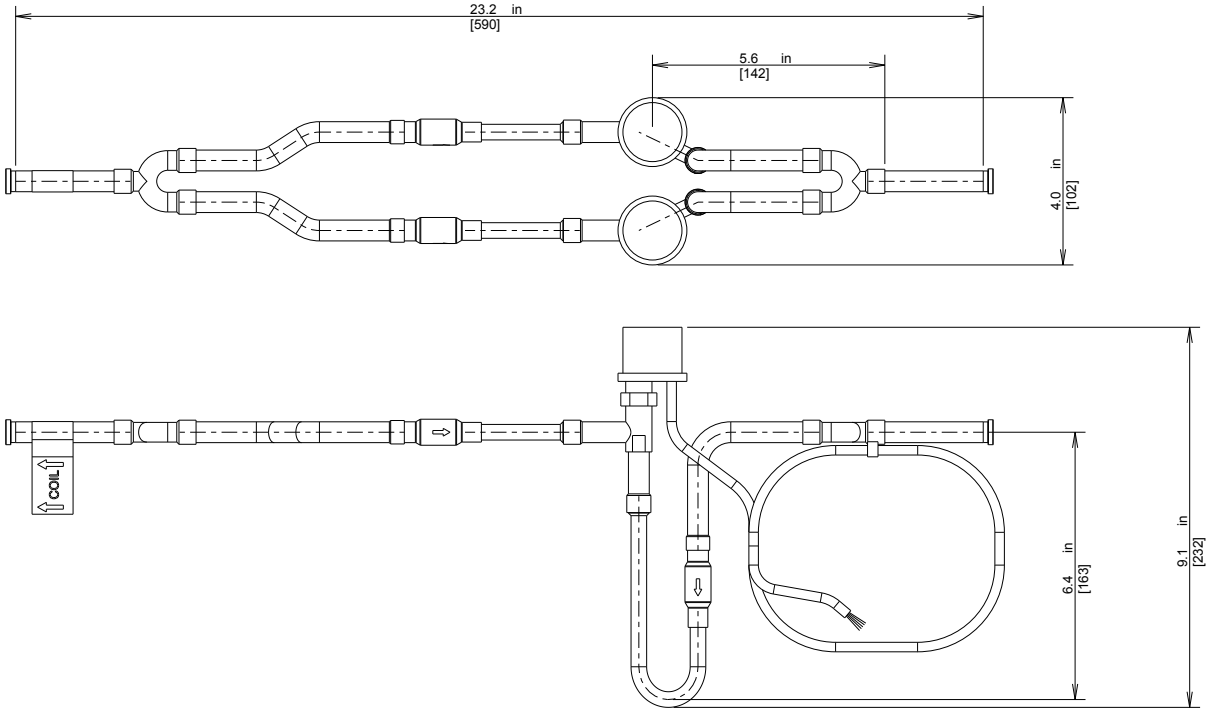


PAC-LEV48AC-1, PAC-LEV60AC-1

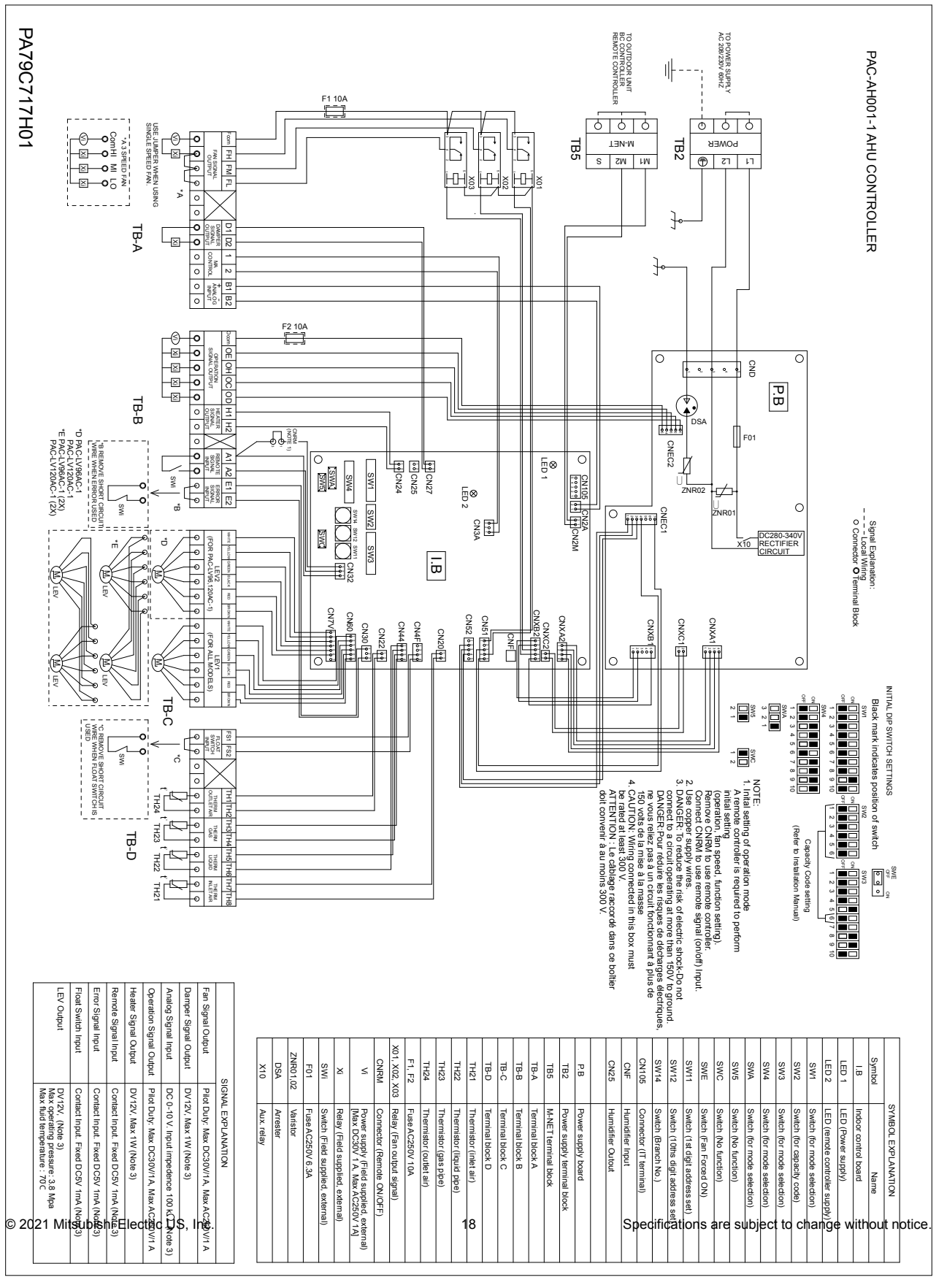


5.3. Double Valve LEV Assembly

PAC-LEV96AC-1, PAC-LEV120AC-1



6. Wiring Diagram



SYMBOL EXPLANATION	
Symbol	Name
I.B	Indoor control board
LED 1	LED (Power supply)
LED 2	LED (remote controller supply)
SW1	Switch (for mode selection)
SW2	Switch (for capacity code)
SW3	Switch (for mode selection)
SW4	Switch (for mode selection)
SWA	Switch (for mode selection)
SW5	Switch (No function)
SWC	Switch (No function)
SWE	Switch (Fan Forced ON)
SW11	Switch (1st digit address set)
SW12	Switch (10ths digit address set)
SW14	Switch (Branch No.)
CN105	Connector (IT terminal)
CNF	Humidifier Input
CN25	Humidifier Output
P.B	Power supply board
TB2	Power supply terminal block
TB5	M-NET terminal block
TB-A	Terminal block A
TB-B	Terminal block B
TB-C	Terminal block C
TB-D	Terminal block D
TH21	Thermistor (inlet air)
TH22	Thermistor (liquid pipe)
TH23	Thermistor (gas pipe)
TH24	Thermistor (outlet air)
F1, F2	Fuse AC250V 10A
X01, X02, X03	Relay (Fan output signal)
CNRM	Connector (Remote ON/OFF)
Vi	Power supply (Field supplied, external) [Max DC30V 1 A, Max AC250V 1A]
Xi	Relay (Field supplied, external)
SWi	Switch (Field supplied, external)
F01	Fuse AC250V 6.3A
ZNR01,02	Varistor
DSA	Arrester
X10	Aux. relay

SIGNAL EXPLANATION	
Fan Signal Output	Pilot Duty, Max DC30V/1A, Max AC250V/1 A
Damper Signal Output	DV12V, Max 1W (Note 3)
Analog Signal Input	DC 0-10 V, Input impedence 100 kΩ (Note 3)
Operation Signal Output	Pilot Duty, Max DC30V/1A, Max AC250V/1 A
Heater Signal Output	DV12V, Max 1W (Note 3)
Remote Signal Input	Contact Input. Fixed DC5V 1mA (Note 3)
Error Signal Input	Contact Input. Fixed DC5V 1mA (Note 3)
Float Switch Input	Contact Input. Fixed DC5V 1mA (Note 3)
LEV Output	DV12V, (Note 3) Max operating pressure : 3.8 Mpa Max fluid temperature : 70 C

7. Microprocessor Control

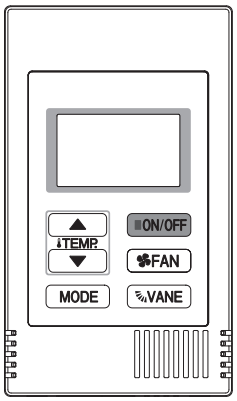
7.1. Cool Operation

Cool Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	●
	3rd Party Controls	Type 1	*1	●
		Type 2	*1	●

*1 Return Air Control not available when operating with 3rd Party Controls

7.1.1. How to operate

(1) Using CITY MULTI Controller



1. Press POWER **ON/OFF** button.
2. Press the operation **MODE** button to display COOL.
3. Press the **TEMP.** button to set the desired temperature.

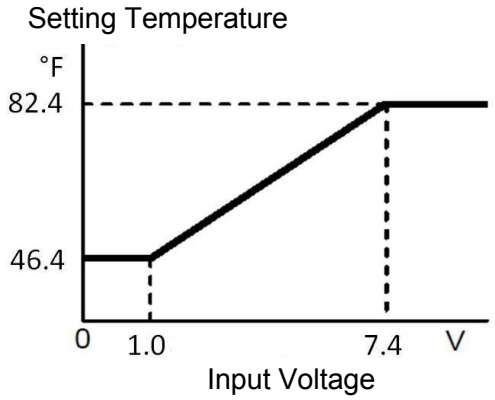
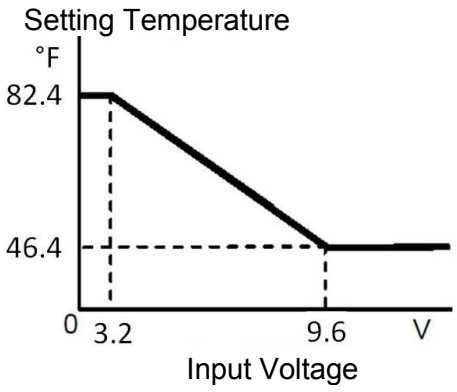
NOTE
The set temperature changes 2 °F when the **TEMP.** button is pressed one time.

Cooling Set-point Range with City Multi Controller

- Return Air Control: 67~86 °F [19~30 °C]
- Discharge Air Control: 46~86 °F [8~30 °C]

(2) Using 3rd Party Controller

1. Close the contact for “Remote Signal Input” on TB-B to turn unit ON.
2. Input 0-10 VDC signal to “Analog Input” on TB-A to set the temperature set point

	Control Type	
	Type 1 (For Temperature Control) (SWA-2)	**Type 2 (For Capacity Control) (SWA-3)**
Control Relationship (COOL)	Set point temperature = 5.625 X Ain + 40.775 [°F] [Ain = Input Temperature]	Set point temperature = -5.625 X Ain + 100.4 [°F] [Ain = Input Temperature]
		

NOTE
COOL operation mode must be set using City Multi controller

Cooling Set-point Range with 3rd Party Controller

- Discharge Air Control: 46.4~82.4 °F [8~28 °C]

7.1.2. Thermo-regulating function

(1) Thermo-regulating function (Function to prevent restarting for 3 minutes)

When indoor units are connected to the PUHY/PURY/PQHY/PQRY series of outdoor units.

- Thermo-ON/OFF conditions
  TH24: Discharge air temperature
  TH21: Return air temperature (Thermistor or remote controller)
  To: The set point temperature on the remote controller

	Return Air Control	Discharge Air Control
Thermo OFF	TH21 < To - 0.9 °F [0.5 °C]	[a) or b) or c)] a) TH21 < To b) TH21 < 57.2 °F [14 °C] c) TH24 < To – 3.6 °F [2 °C] continues over 10 minutes
Thermo ON	TH21 > To +0.9 °F [0.5 °C]	[a) & b) & c) & d)] a) TH24 > To +1.8 °F [1 °C] b) TH21 > 59 °F] [15 °C] c) TH21 > To +1.8 °F [1 °C] d) Thermo-OFF continues over 3 minutes

(2) Anti-freezing control

- Detected condition:
  When the liquid pipe temp. (TH22) is 33.8° F or less 16 minutes after compressors start up, anti-freezing control starts and unit goes to thermo OFF.
- Released condition:
  The timer which prevents reactivating is set for 3 minutes, and anti-freezing control is cancelled when any one of the following conditions is satisfied.
  1) Liquid pipe temp. (TH22) reaches 50° F or above.
  2) The condition of the thermo OFF has become complete by thermo-regulating, etc.
  3) The operation mode is changed to mode other than COOL.
  4) The operation is stopped.

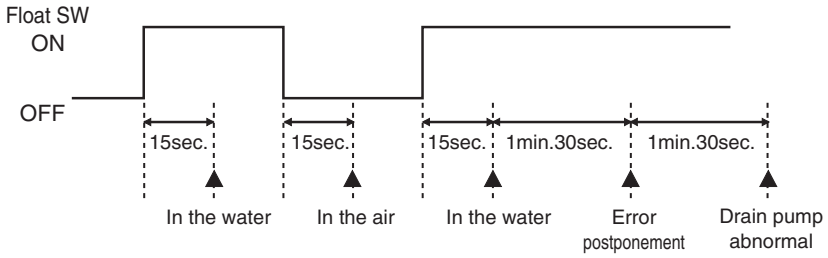
7.1.3. Fan

(1) Set the fan speed using the remote controller

Type	Fan speed notch
3 speeds	[Low], [Med], [High]

- [Auto] fan speed control is not available.

7.1.4. Float switch control



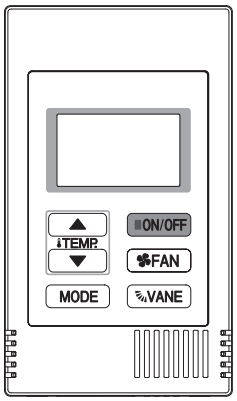
7.2. Dry Operation

Dry Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	*1
	3rd Party Controls	Type 1	*1	*1
		Type 2	*1	*1

*1 Dry mode only available when using City Multi Controller set to Return Air Control

7.2.1. How to operate

(1) Using CITY MULTI Controller



1. Press POWER **ON/OFF** button.
2. Press the operation **MODE** button to display DRY.
3. Press the **TEMP.** button to set the desired temperature.

NOTE
The set temperature changes 2 °F when the **TEMP.** button is pressed one time.

Dry Set-point Range

- Return Air Control: 67~87 °F [19~31 °C]

7.2.2. Thermo-regulating function

(1) Thermo-regulating function (Function to prevent restarting for 3 minutes)

Control of Dry Thermo ON and Dry Thermo OFF by the thermo regulating signal and the room temperature (TH21).

- Room temperature ≥ desired temperature + 2° F ···Dry Thermo ON
- Room temperature < desired temperature ···Dry Thermo OFF

Room temperature	3 min. passed since starting operation		Dry thermo ON time (min)	Dry thermo OFF time (min)
	Thermo regulating signal	Room temperature (TH21)		
Over 64 °F	ON	TH21 ≥ 83°F	9	3
		83°F > TH21 ≥ 79°F	7	3
		79°F > TH21 ≥ 75°F	5	3
		75°F > TH21	3	3
	OFF	Unconditional	3	10
Less than 64°F	DRY thermo OFF			

(2) Frozen prevention control

- No control function

7.2.3. Fan

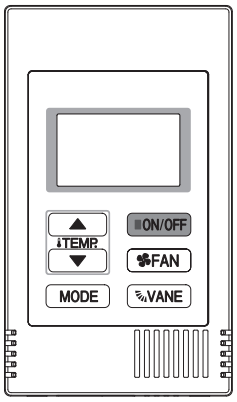
(1) Indoor fan operation control depends on the compressor conditions.

Dry thermo	Fan speed notch	
ON	[Low]	
OFF	Room temp. ≥ 64°F	Stop
	Room temp. < 64°F	[Low]

7.3. Fan Operation

Fan Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	●
	3rd Party Controls	Type 1	●	●
		Type 2	●	●

7.3.1. How to operate



1. Press POWER **ON/OFF** button.
2. Press the operation **MODE** button to display FAN.

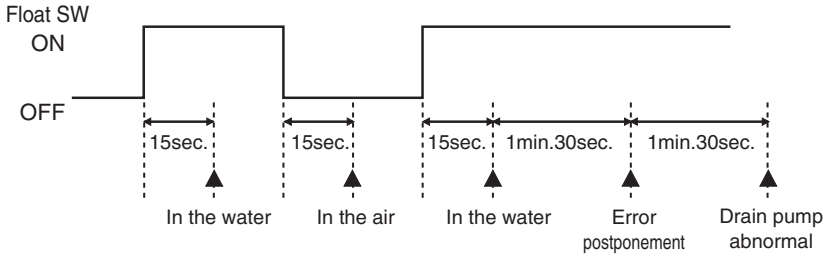
7.3.2. Fan

(1) Set by remote controller

Type	Fan speed notch
3 speeds	[Low], [Med], [High]

- [Auto] fan speed control is not available.

7.3.3. Float switch control



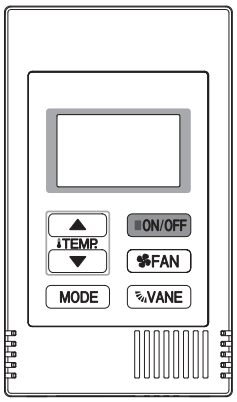
7.4. Heat Operation

Heat Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	●
	3rd Party Controls	Type 1	*1	●
		Type 2	*1	●

*1 Return Air Control not available when operating with 3rd Party Controls

7.4.1. How to operate

(1) Using CITY MULTI Controller



1. Press POWER **ON/OFF** button.
2. Press the operation **MODE** button to display HEAT.
3. Press the **TEMP.** button to set the desired temperature.

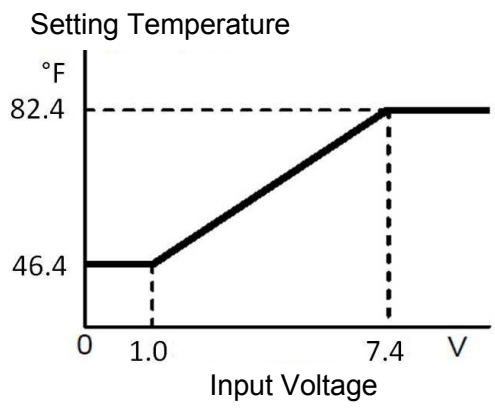
NOTE
The set temperature changes 2 °F when the **TEMP.** button is pressed one time.

Heating Set-point Range with City Multi Controller

- Return Air Control: 63~83 °F [17~28 °C]
- Discharge Air Control: 63~83 °F [17~28 °C]

(2) Using 3rd Party Controller

1. Close the contact for “Remote Signal Input” on TB-B to turn unit ON
2. Input 0-10 VDC signal to “Analog Input” on TB-A to set the temperature set point

	Control Type	
	Type 1 (For Temperature Control) (SWA-2)	Type 2 (For Capacity Control) (SWA-3)
Control Relationship (HEAT)	Set point temperature = 5.625 X Ain + 40.775 [°F] [Ain = Input Temperature]	
		

NOTE
HEAT operation mode must be set using City Multi controller

Heating Set-point Range with 3rd Party Controller

- Discharge Air Control: 46.4~82.4 °F [8~28 °C]

7.4.2. Thermo-regulating function

(1) Thermo-regulating function (Function to prevent restarting for 3 minutes)

When indoor units are connected to the PUHY/PURY/PQHY/PQRY series of outdoor units.

- Thermo-ON/OFF conditions
  TH24: Discharge air temperature
  TH21: Return air temperature (Thermistor or remote controller)
  To: The set point temperature on the remote controller

	Return Air Control	Discharge Air Control
Thermo OFF	TH21 > To + 0.9 °F [0.5 °C]	[a) or b) or c)] a) TH21 > To b) TH21 > **59 °F [15 °C]**[*1] c) TH24 > To + 5 °F [9 °C] continues over 10 minutes
Thermo ON	TH21 < To - 0.9 °F [0.5 °C]	[a) & b) & c) & d)] a) TH24 < To - 1.8 °F [1 °C] b) TH21 < **57.2 °F] [14 °C]**[*1] c) TH21 < To - 1.8 °F [1 °C] d) Thermo-OFF continues over 3 minutes

[*1] The value indicated in bold can be changed by dip-switch SW3-8 and SW3-9.

7.4.3. Fan

(1) Set the fan speed using the remote controller

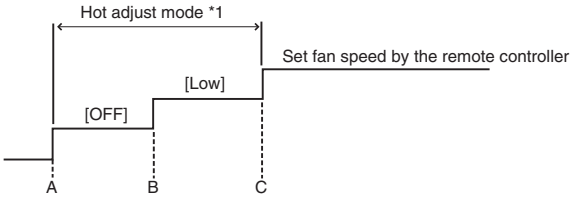
Type	Fan speed notch
3 speeds	[Low], [Med], [High]

- [Auto] fan speed control is not available.

(2) Hot adjust mode

The fan controller enters the hot adjust mode when any of the following conditions are met.

1. When starting the HEAT operation
2. When the thermo regulating function changes from OFF to ON.
3. After defrosting operation



*1 "STAND BY" will be displayed during the hot adjust mode.
A: Hot adjust mode starts.
B: 5 minutes have passed since the condition A or the indoor liquid pipe temperature turned 95°F or more.
C: 2 minutes have passed since the condition A. (Terminating the hot adjust mode)

(3) Preheating exclusion mode

When the condition changes the auxiliary heater from ON to OFF (thermo regulating or operation stop, etc.), the indoor fan operates in [Low] mode for 1 minute.

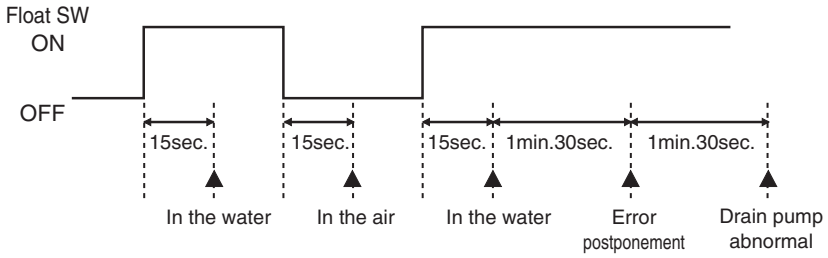
(4) Thermo OFF mode

1. Return Air Control
   When the thermo regulating function changes to OFF, the indoor fan operates according to SW1-8 and SW1-7.
2. Discharge Air Control
   When the thermo regulating function changes to OFF, the indoor fan speed does not change.

(5) Heat defrosting mode

The indoor fan stops.

7.4.4. Float switch control



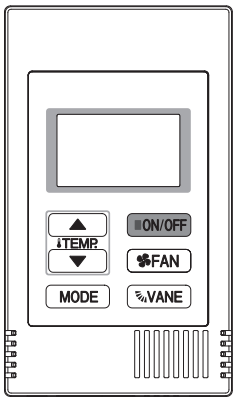
7.5. Auto Operation [Automatic cool / heat change over operation]

Auto Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	●
	3rd Party Controls	Type 1	*1	●
		Type 2	*1	*2

*1 Return Air Control not available when operating with 3rd Party Controls
*2 Auto mode not available in Discharge Air Control with Type 2 operation using 3rd Party Controls

7.5.1. How to operate

(1) Using CITY MULTI Controller



1. Press POWER **ON/OFF** button.
2. Press the operation **MODE** button to display AUTO.
3. Press the **TEMP.** button to set the desired temperature.

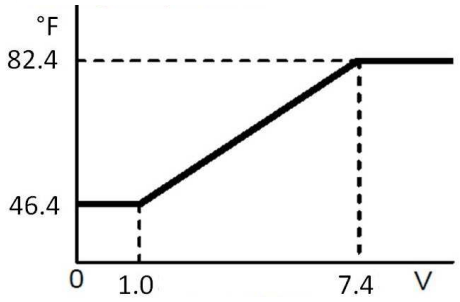
NOTE
The set temperature changes 2 °F when the **TEMP.** button is pressed one time.

Auto Set-point Range with City Multi Controller

- Return Air Control: 67~83 °F [19~28 °C]
- Discharge Air Control: 63~83 °F [17~28 °C]

(2) Using 3rd Party Controller

1. Close the contact for “Remote Signal Input” on TB-B to turn unit ON
2. Input 0-10 VDC signal to “Analog Input” on TB-A to set the temperature set point

<table>
<tr><td rowspan="2"></td><td colspan="2">Control Type</td></tr>
<tr><td>Type 1 (For Temperature Control)
(SWA-2)</td><td>Type 2 (For Capacity Control)
(SWA-3)</td></tr>
<tr><td rowspan="2">Control Relationship
(COOL & HEAT)</td><td>Set point temperature = 5.625 X Ain + 40.96 [°F]
[Ain = Input Temperature]</td><td>Auto mode N/A for Type 2 Control</td></tr>
<tr><td>Setting Temperature
 

Input Voltage</td><td>Auto mode N/A for Type 2 Control</td></tr>
</table>

NOTE
AUTO operation mode must be set using City Multi controller

Auto Set-point Range with 3rd Party Controller

- Discharge Air Control: 46.4~82.4 °F [8~28 °C]

7.5.2. Initial operation mode

(1) HEAT Mode: Room temperature < Desired temperature

(2) COOL Mode: Room temperature ≥ Desired temperature

7.5.3. Mode change

(1) HEAT Mode -> COOL Mode: Room temperature > Desired temperature + 3°F (continued over 3 min)

(2) COOL Mode -> HEAT Mode: Room temperature < Desired temperature - 3°F (continued over 3 min)

7.5.4. COOL mode

(1) Same control as cool operation

7.5.5. HEAT mode

(1) Same control as heat operation

The value "3°F" is modifiable from 1.8°F to 9°F by maintenance tool.

7.6. Heater Control

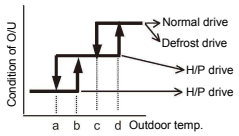
Heater Operation (Available Control Modes)			Control Mode	
			Return Air Control	Discharge Air Control
Controller Type	City Multi Controller		●	*1
	3rd Party Controls	Type 1	*1	*1
		Type 2	*1	*1

*1 Heater operation only available when operating in Return Air Control using a City Multi Controller

7.6.1. Control specifications and DIP S/W setting

- Table 1 shows the function settings for the field-installed heater. Select the desired pattern in the table below, and set the DIP SW on the outdoor and indoor units as shown in Table 1.

Table 1. [DIP S/W]

Outdoor unit setting	Condition of outdoor unit		PAC-AH001-1				
			DIP SW (AHU controller)[a]		Heater Control		
			SW3-2	SW3-4	Mode	Defrost	Error
DIP S/W OFF In the case of: TKMU/YKMU: SW4: 932 OFF TLMU/YLMU: SW4: 932 OFF	N / A		OFF	-	Heater not Available		
			ON	OFF	Heater Available	OFF	OFF
			ON	ON	Heater Available	ON	ON[b]
DIP S/W ON In the case of: TKMU/YKMU: SW4: 932 ON TLMU/YLMU: SW4: 932 ON	 Parameters a/b/c/d are set by maintenance tool.	Normal Drive	OFF	-	Heater not Available		
			ON	OFF	Heater Available	OFF	OFF
			ON	ON	Heater Available	ON	ON[b]
		Defrost drive H/P drive H/P stop	OFF	-	Heater not Available		
			ON	OFF	Heater Available	OFF	OFF
			ON	ON	Heater Available	ON	ON[b]

[a]Default settings: SW3-2 OFF, SW3-4 OF

[b]Heater will not operate during all error modes. Heater will only operate during a communication error between indoor unit and outdoor unit.

- Table 2 shows how the field-installed heater is controlled.

Table 2. [Heater Control Table]

Mode Change	Condition								
	(T_O -T_{RA}) > 2.7 °F[1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in X min	EH1 ON for > 5 min	AND	(T_O -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in 5 min	(T_O -T_{RA}) < 0.9 °F [0.5°C]
EH1 ON	•	AND	•						
EH2 ON				•	AND	•	AND	•	
EH1 OFF									•
EH2 OFF									•

KEY

- EH1: Electric Heater 1 (CN24)
- EH2: Electric Heater 2 (CN27)
- T_O: Set point temperature
- T_{RA}: Return Air temperature
- X: Time delay (Selectable. Default is 20 min. Selectable to 10, 15, or 25 min)

NOTE

When electric heat signal is ON, Fan speed signal output will automatically go to HIGH.

- Table 3 shows how the time delay is selected

Table 3. [Time Delay Selection Table]

Function Setting[1]	Action[2]
108-1	Set Time Delay to 10 minutes
108-2	Set Time Delay to 15 minutes
108-3	Set Time Delay to 20 minutes[3]
108-4	Set Time Delay to 25 minutes

[1] Time delay can only be selected with MA controller. If use of a non-MA controller is desired, the time delay must first be selected with the MA controller. Then the non-MA controller can be attached and used.

[2] Time delays are approximate.

[3] The default time delay setting is 20 minutes.

- Chart 1 and Table 4 show an example of heater operation.

Chart 1 [Heater Operation Example]

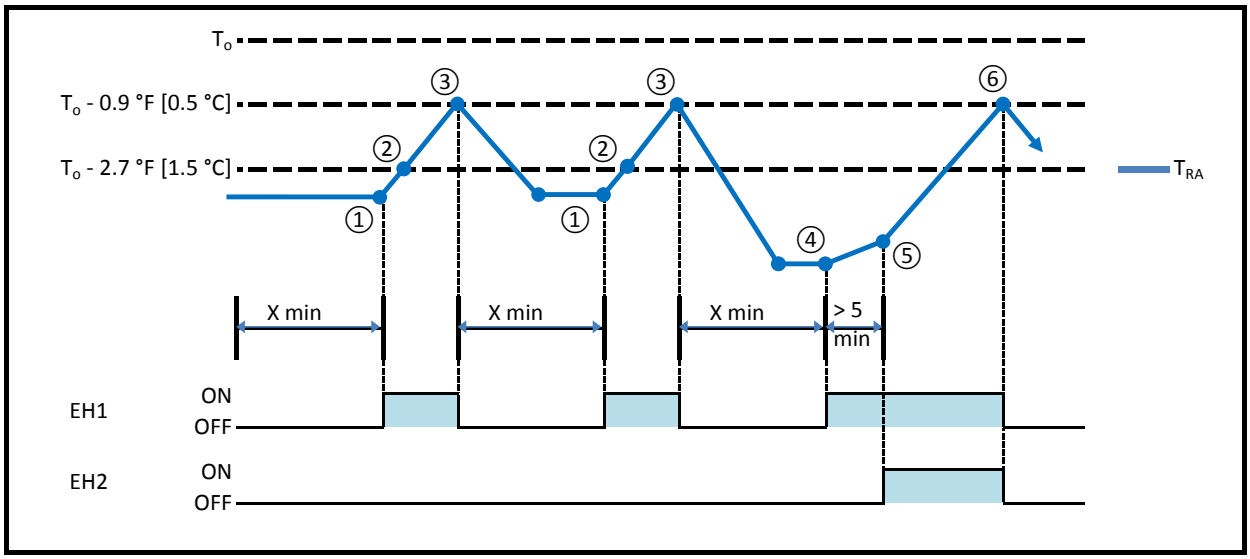
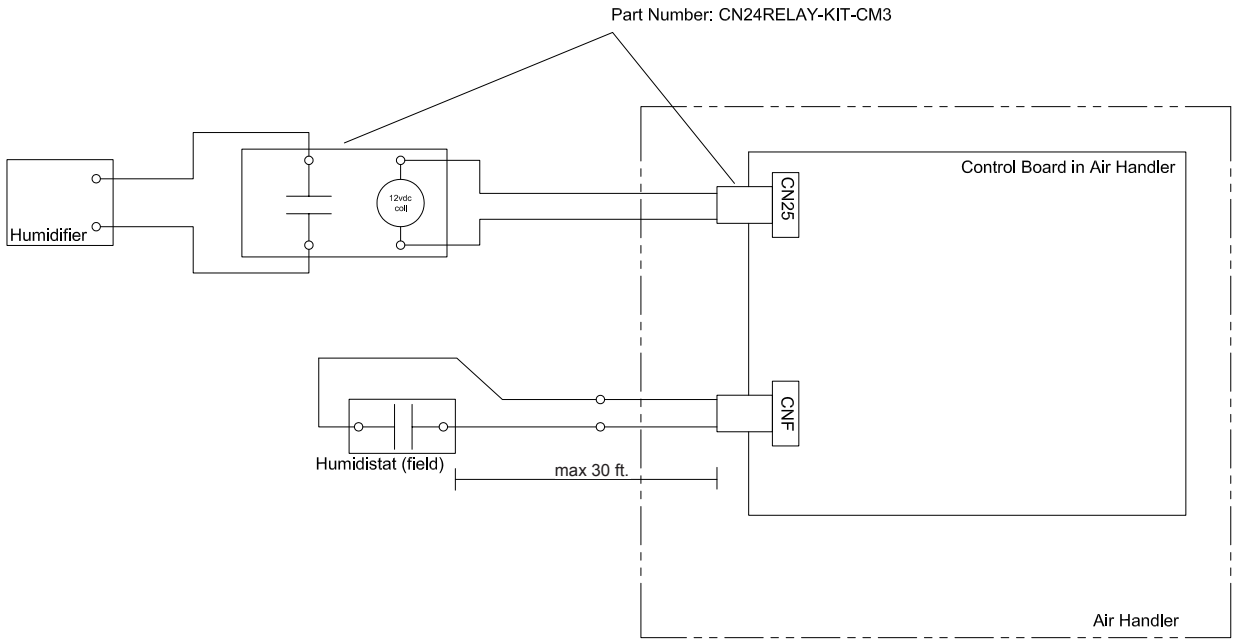


Table. 4 [Heater Operation Example]

Step	Condition			Result
①	(To -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in X min	EH1 ON
②	(To -T_{RA}) < 2.7 °F [1.5 °C]	AND	T_{RA} increasing faster than 0.9 °F [0.5°C] in 5 min	EH2 not ON
③	(To -T_{RA}) < 0.9 °F [0.5°C]			EH1 OFF
④	(To -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} has not increased by 0.9 °F [0.5°C] in X min	EH1 ON
⑤	(To -T_{RA}) > 2.7 °F [1.5 °C]	AND	T_{RA} not increasing faster than 0.9 °F [0.5°C] in 5 min	EH2 ON
⑥	(To -T_{RA}) < 0.9 °F [0.5°C]			EH1 OFF EH2 OFF

7.7. Humidifier Control



Sequence of operation:

1. The humidistat closes CNF
2. The fan starts on high
3. CN25 provides 12VDC to turn on the Humidifier (do not exceed 1 Watt draw per relay)
4. When the Humidistat opens, the fan continues to run for 30 seconds to clear the ductwork of moist air
5. If defrost starts during humidifier operation CN25 de-energizes

Humidistat:

Non-Voltage a-contact input

Contact rating voltage >=15VDC

Contact Rating Current > = 0.1 A

Minimum Applicable Load =< 1mA at DC

Dip Switch Setting	Humidistat Output	Condition (No Defrost/No Error)	CN25 Output	Fan Speed
SW1-6	CNF Input			
OFF[1]	OFF	Heat operation & Thermo OFF	OFF	RC Setting
		Heat operation & Thermo ON		
	ON	Heat operation & Thermo OFF	OFF	RC Setting
		Heat operation & Thermo ON	ON	High
ON	OFF	Heat operation & Thermo OFF	OFF	RC Setting
		Heat operation & Thermo ON		
	ON	Heat operation & Thermo OFF	ON	High
		Heat operation & Thermo ON		
—	—	Except for heat operation	OFF	RC Setting

[1] Factory Setting

RC: Remote controller

The fan continues to run for 30 seconds after the humidifier stops.

8. Troubleshooting

8.1. Check Methods

1. Component and check points

(1) Thermistor

- Return air thermistor (TH21)
- Liquid pipe thermistor (TH22)
- Gas pipe thermistor (TH23)
- Discharge air thermistor (TH24)

$$Rt = 15exp\left\{3460\left(\frac{1}{273+t}-\frac{1}{273}\right)\right\}$$

Rt: Thermistor Resistance [kΩ]

t: Thermistor Measurement Temperature [°C]

Disconnect the connector and measure the resistance between terminals with a tester.

(Ambient temperature 10°C - 30°C [50°F-86°F])

Normal	Abnormal
4.3kΩ - 9.6kΩ	Open or Short

(Refer to the thermistor characteristic graph below.)

1) Thermistor characteristic graph

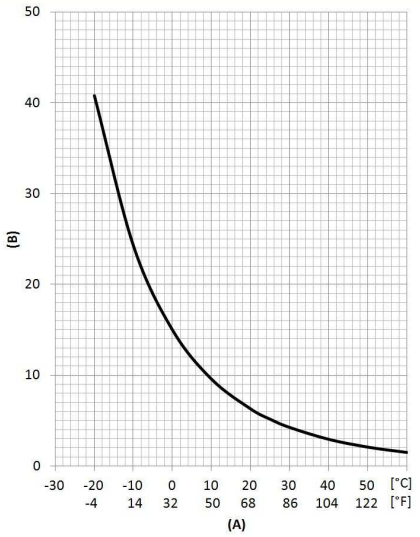
(A) Temperature [°C][°F]

(B) Resistance [kΩ]

Low-temperature thermistor

- Room temperature thermistor (TH21)
- Liquid pipe thermistor (TH22)
- Gas pipe thermistor (TH23)
- Discharge air thermistor (TH24)

- Thermistor R0 = 15 kΩ±2.9%
- Multiplier of B = 3460 kΩ±1%

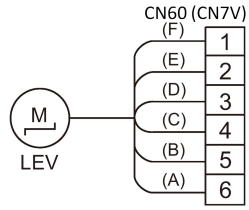


0°C	32°F	15kΩ
10°C	50°F	9.6kΩ
20°C	68°F	6.3kΩ
25°C	77°F	5.2kΩ
30°C	86°F	4.3kΩ
40°C	104°F	3.0kΩ

(2) Linear expansion valve

Disconnect the connector, and measure the resistance between terminals with a tester.

Refer to the next page for details.



Normal				Abnormal
1-5 White-Red	2-6 Yellow-Brown	3-5 Green-Red	4-6 Black-Brown	Open or short
200 kΩ ± 10%				

(A) Brown

(B) Red

(C) Black

(D) Green

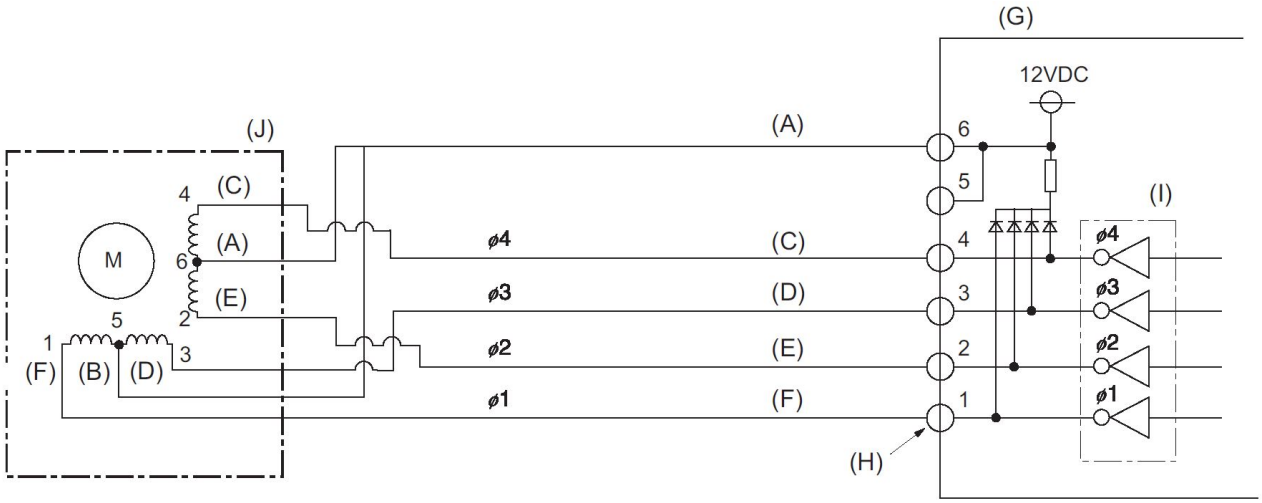
(E) Yellow

(F) White

1) Summary of linear expansion valve (LEV) operation

- The LEV is operated by a stepping motor, which operates by receiving a pulse signal from the indoor control board.
- The LEV position changes in response to the pulse signal.

Indoor control board and LEV connection



(A) Brown

(B) Red

(C) Black

(D) Green

(E) Yellow

(F) White

(G) Control board

(H) Connection (CN60, CN7V)

(I) Drive circuit

(J) Linear expansion valve

Pulse signal output and valve operation

Phase number	Output pulse			
	1	2	3	4
Φ1	ON	OFF	OFF	ON
Φ2	ON	ON	OFF	OFF
Φ3	OFF	ON	ON	OFF
Φ4	OFF	OFF	ON	ON

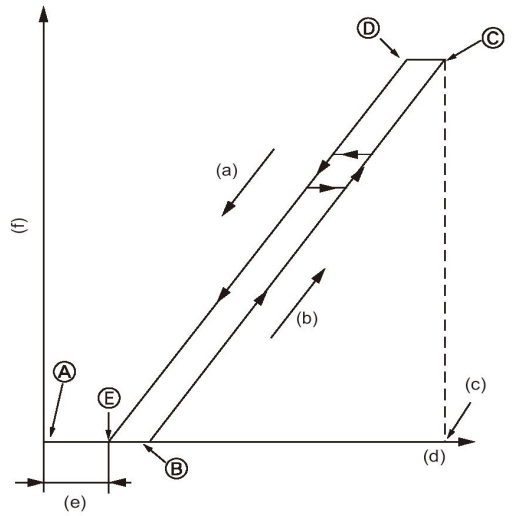
The output pulse changes in the following order:

When the valve closes 1 -> 2 -> 3 -> 4 -> 1

When the valve opens 4 -> 3 -> 2 -> 1 -> 4

- When the valve position remains the same, all output signals will be OFF.
- If any output signal is missing or if the signal remains ON, the motor vibrates and makes clicking noise.

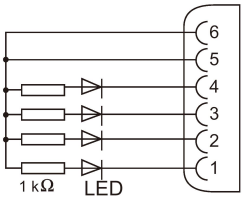
2) LEV operation

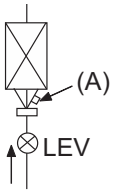


(a) Close
(b) Open
(c) Fully open valve (1400 pulses)
(d) No. of pulses
(e) Extra tightening (80 - 100 pulse)
(f) Valve opening degree

- When the power is turned on, a pulse signal of 2200 pulses is output (valve closure signal), to bring the valve to position A.
- When the valve is operating normally, it is free of vibration noise. If the valve locks or when it goes from point E to A in the figure, it makes a louder noise than would be heard when there is an open phase.
- Check for abnormal sound/vibration by placing the metal tip of a screwdriver against the valve and the handle side against your ear.

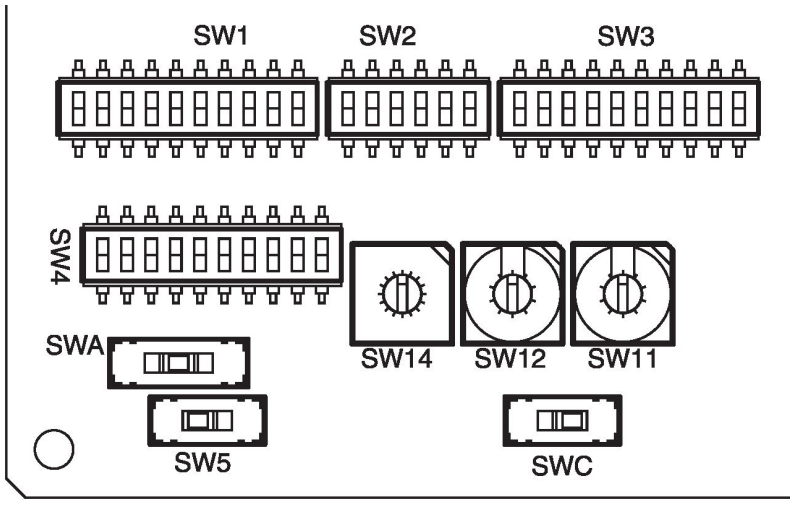
3) Troubleshooting

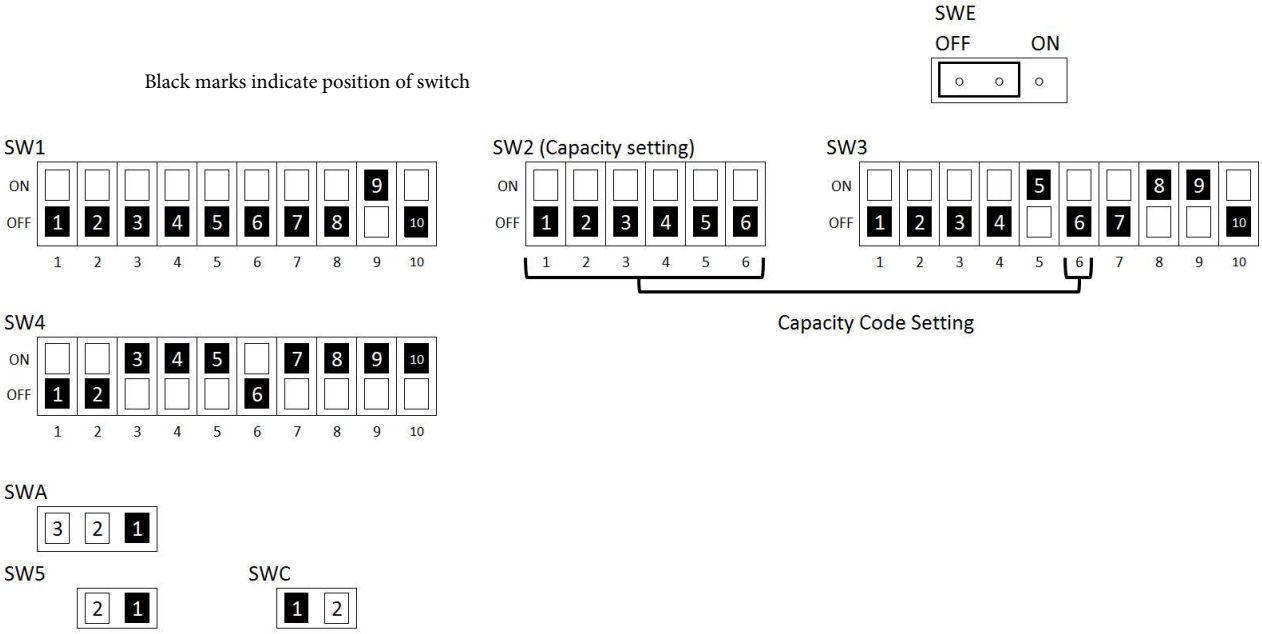
Symptom	Checking Criteria	Remedy
Circuit failure on the microcomputer	Disconnect the connectors on the control board, and connect LEDs to test the circuit as shown below.  resistance : 0.25W, 1kΩ LED : DC15V, 20mA or more Pulse signals are output for 10 seconds when the main power is turned on. If there are LEDs that do not light up at all or remain lit after the pulses are turned off, there is a problem with the driving circuit.	Replace the indoor control board if driving circuit failure is detected.
Locked LEV	The motor will idle and make small clicking noise if it is run while the LEV is locked. If this clicking noise is heard both when the valve is fully closed and while it is being opened, it indicates a problem.	Replace the LEV.

Symptom	Checking Criteria	Remedy
Disconnected or shorted LEV motor coils	Check the resistance between the coils with a tester (white-red, yellow-brown, green-red, black-brown). If LEV is disconnected or a short exists between LEV coils, LEV resistance will read abnormal.The normal range of resistance is 200 Ω±10%.	Replace the LEV.
Valve closure failure (leaky valve)	To check the LEV on the indoor unit, check the indoor unit liquid pipe temperature that appears on the operation monitor on the outdoor unit's multi control board while operating the indoor unit in question in the FAN mode and the other indoor units in the cooling mode. (A) Thermistor (TH22)  	Replace the LEV if the amount of leakage is great.
	Normally, the LEV is fully closed while the unit is in the FAN mode. If the valve is leaky, liquid pipe thermistor reading will be lower than normal. If it is significantly lower than the inlet temperature on the remote controller, valve closure failure is suspected. If the amount of leakage is insignificant, replacement of LEV is unnecessary unless it is causing a problem.	
Misconnections of connectors or contact failure	Perform a visual check for disconnected connectors. Perform a visual check of lead wire color.	Disconnect the connectors on the control board and perform a continuity test.

8.2. Address switch setting

Make sure that power to the unit is turned off.



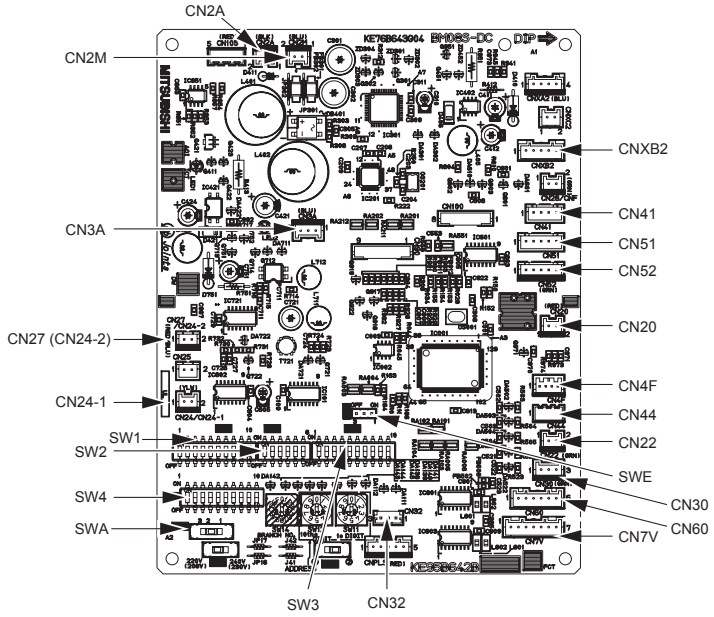


(A) Indoor unit control board

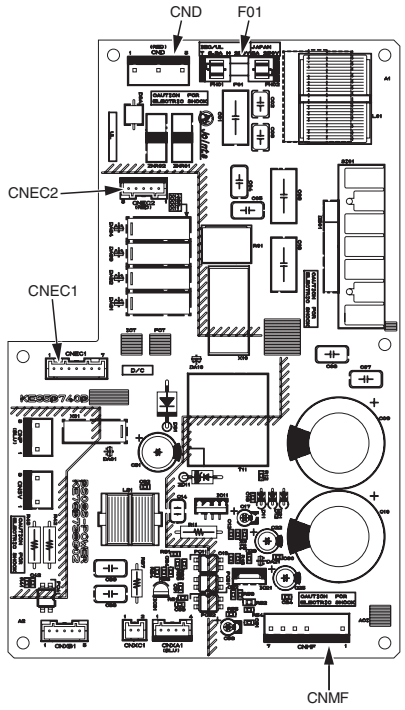
(B) Factory setting (all models)

1. Address settings vary in different systems. Refer to the section on address setting in the outdoor unit installation manual.
2. Address is set with a combination of SW12 (10's digit) and SW11 (1's digit). To set the address to "3," set SW12 to "0" and SW11 to "3." To set the address to "25," set SW 12 to "2" and SW 11 to "5."

8.3. Voltage test points



Indoor controller board

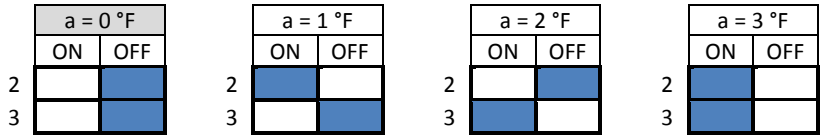


F01	Fuse (AC 250V 6.3A)
CND	Power supply voltage (220 - 240VAC)
CN2M	For M-NET transmission cable connection (24 - 30VDC)
SWE	Fan Forced ON
SW1	Mode selection
SW2	Capacity setting
SW3	Mode selection
SW4	Mode selection
SWA	Mode selection
CN2A	Analog input
CN32	Remote signal input
CN3A	For MA remote controller cable connection (10 - 13 VDC (Between 1 and 3))
CN30	Error signal input
CN52	Connect to indoor power board
CN51	To fan signal relay
CNXB2	To fan signal relay
CN41	No function
CN44	Thermistor (liquid/gas temperature)
CN20	Thermistor (Inlet air temperature)
CN22	Thermistor (Outlet air temperature)
CN4F	Float switch input
CN24-1	1st heater control
CN27 (CN24-2)	Damper control (2nd heater control)
CNMF	No function
CN60	LEV Control
CN7V	LEV Control
CNEC1	Connect to the indoor controller board
CNEC2	Operation Signal output

8.4. Dipswitch setting

8.4.1. Discharge Air Control (Factory Setting)

(1) SW1 - Function Setting

Switch Position	Function	Switch Setting	
		ON	OFF
1	Return Air Sensing Location	Remote Controller	TH21
2 3	TH24 Temperature Offset		
4	Not Available	N/A	N/A
5	Remote display	Thermostat ON signal	Fan Output
6	Not Available	N/A	N/A
7	Not Available	N/A	N/A
8	Not Available	N/A	N/A
9	Auto restart after power failure	Enabled	Disabled
10	Power start/stop	Enabled	Disabled
		Factory Setting in Gray	

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

(2) SW3 - Function Setting

Switch Position	Function	Switch Setting	
		ON	OFF
1	Heat Pump or Cooling Only	Cooling Only	Heat Pump
2	Not Available	N/A	N/A
3	Not Available	N/A	N/A
4	Fan Operation During Defrost	ON During Defrost	OFF During Defrost
5	Not Available	N/A	N/A
6	Capacity Code Up	Capacity Code Up	Capacity Code not Up
7	Not Available	N/A	N/A
8 9	TH21 value for Thermo ON/OFF in Heating mode		
10	Not Available	N/A	N/A
		Factory Setting in Gray	

TH21 Value for Thermo ON/OFF in Heating Mode			
SW3-8	SW3-9	Thermo ON	Thermo OFF
OFF	OFF	68 °F [20 °C]	70 °F [21 °C]
ON	OFF	N/A	N/A
OFF	ON	48 °F [9 °C]	50 °F [10 °C]
ON	ON	57 °F [14 °C]	59 °F [15 °C]

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

(3) SW4 - Function Setting

Switch Position	Function	Switch Setting	
		ON	OFF
1	Model Code (Not Available)	N/A	N/A
2		N/A	N/A
3		N/A	N/A
4		N/A	N/A
5		N/A	N/A
6	Not Available	N/A	N/A
7	Control Method Selection	Discharge Air Control	Return Air Control
8			
9	Not Available	N/A	N/A
10	Not Available	N/A	N/A
Factory Setting in Gray			

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

8.4.2. Return Air Control (Field Configurable Setting)

(1) SW1 - Function Setting

Switch Position	Function	Switch Setting	
		ON	OFF
1	Return Air Sensing Location	Remote Controller	TH21
2	Filter clogging detection	Available	Unavailable
3	Filter Life	2500 hours	100 hours
4	Outdoor air intake	Enabled	Disabled
5	Remote display	Thermostat ON signal	Fan output
6	Humidifier Operation	During heating mode	During heating operation
7	Fan Speed	Low	Stop
8	Fan speed at heating Thermo-OFF	Preset fan speed	Follows the setting of SW1-7
9	Auto restart after power failure	Enabled	Disabled
10	Power start/stop	Enabled	Disabled
Field configurable settings in Gray			

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

(2) SW3 - Function Setting

Switch Position	Function	Switch Setting	
		ON	OFF
1	Heat Pump or Cooling Only	Cooling Only	Heat Pump
2	Heater output	Enable	Disable
3	Monitor discharge air temperature with TH24	Enable	Disable
4	Heater control in defrost or error	Heater ON	Heater OFF
5	Not Available	N/A	N/A
6	Capacity Code Up	Capacity Code Up	Capacity Code not Up
7	Not Available	N/A	N/A
8	Heating 4-deg up	Disabled	Enabled
9	Not Available	N/A	N/A
10	Not Available	N/A	N/A
Field configurable settings in Gray			

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

(3) SW4 - Function Setting

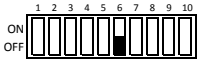
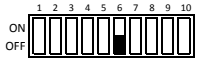
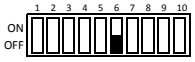
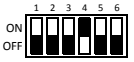
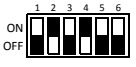
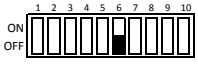
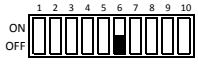
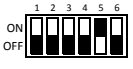
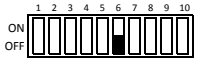
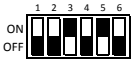
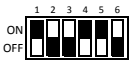
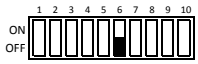
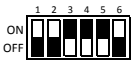
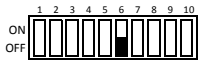
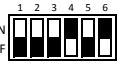
Switch Position	Function	Switch Setting	
		ON	OFF
1	Model Code (Not Available)	N/A	N/A
2		N/A	N/A
3		N/A	N/A
4		N/A	N/A
5		N/A	N/A
6	Not Available	N/A	N/A
7	Control Method Selection	Discharge Air Control	Return Air Control
8			
9	Not Available	N/A	N/A
10	Not Available	N/A	N/A
Field configurable settings in Gray			

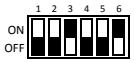
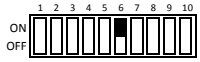
Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

8.4.3. SW2 – Capacity Code Setting

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

Black marks indicates position of switch.

LEV Assembly Model	Capacity Code Setting	Design Capacity Range Cooling	Setting switches	
	[Ton]	[Btu/h]	SW2	SW3-6
PAC-LV24AC-1	0.5	4,800-6,000		
	0.7	6,000-8,000		
	1.0	9,600-12,000		
	1.25	12,000-15,000		
	1.5	15,000-18,000		
	2.0	18,000-24,000		
PAC-LV48AC-1	2.25	24,000-27,000		
	2.5	27,000-30,000		
	3.0	30,000-36,000		
	4.0	36,000-48,000		
PAC-LV60AC-1	4.5	48,000-54,000		
	5.0	54,000-60,000		
PAC-LV96AC-1	6.0	60,000-72,000		
	8.0	72,000-96,000		
PAC-LV120AC-1	10.0	96,000-120,000		
PAC-LV96AC-1 (x2)	12.0	120,000-144,000		

LEV Assembly Model	Capacity Code Setting	Design Capacity Range Cooling	Setting switches	
	[Ton]	[Btu/h]	SW2	SW3-6
PAC-LV120AC-1 (x2)	14.0	144,000-168,000		
	16.0	168,000-192,000		
	18.0	192,000-216,000		
	20.0	216,000-240,000		

8.4.4. SW5 – Power voltage Setting (Factory Setting)

Switch Position	Function	Switch Setting	
		ON	OFF
	Power voltage selection	240V(230V)	220V(208V)
		Factory Setting in Gray	

Dipswitch settings must be operated with the main power turned OFF.

When the power supply is 230 volts, set SW5 to 240V side.

When the power supply is 208 volts, set SW5 to 220V side.

8.4.5. SWA – Controller Type Setting (Factory Setting)

Switch Position	Function	Switch Setting
		ON
1	City Multi Controller	1
2	3rd Party Controller (Type1)	2
3	3rd Party Controller (Type2)	3
	Factory Setting in Gray	

Dip switch settings must be made while the unit is stopped. There is no need to power cycle the unit.

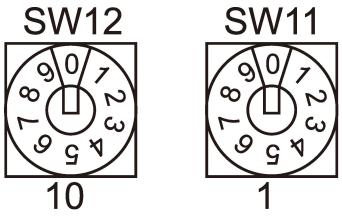
8.4.6. SWC - Function Setting (Factory Setting)

SWC has no use.

8.4.7. SW11, SW12, SW14 - Address Setting (Factory Setting)

(1) SW11, SW12 (Rotary switch)

Factory Setting

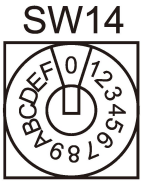


Address switch settings must be made while the unit is stopped and the remote controller is stopped.

(2) SW14 (Rotary switch)

This switch is used when the unit connected to an R2 series of outdoor unit.

Factory Setting



Address switch settings must be made while the unit is stopped and the remote controller is stopped.

Please be sure to put the contact address/telephone number on this manual before handing it to the customer.

MITSUBISHI ELECTRIC US, INC.

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Toll Free: 800-433-4822

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Specifications are subject to change without notice.