MITSUBISHI ELECTRIC

INTERFACE

AIR-HANDLING UNIT (AHU) DESIGN GUIDELINE

December 2019

[Model Name]

PAC-IF013B-E
PAC-SIF013B-E

Related document:
Refer to the following manual
- PAC-IF013B-E/PAC-SIF013B-E INSTALLATION MANUAL
- PAC-IF013B-E/PAC-SIF013B-E Modbus manual

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1 Introduction and Notice

- This manual shows guidelines regarding the AHU (Air Handling Unit) design and notices for the use of interface unit.
- This guideline details various examples of typical applications for the AHU (Air Handling Unit) controllers and their accompanying units. Please use this in conjunction with the PAC-IF013B-E/PAC-SIF013B-E installation manual, the Modbus manual, and the outdoor unit installation manual for correct use.
- This interface is to connect Mr. SLIM inverter outdoor unit of MITSUBISHI ELECTRIC to local applications. Please check the following guidelines when designing the local system.
- MITSUBISHI ELECTRIC does NOT take any responsibility on the local system design. Therefore, MITSUBISHI ELECTRIC does NOT take any responsibility on the failure (including outdoor unit) caused by local AHU and system design. Also R32 is flammable refrigerant, and the fire safety warranty for the whole system (including outdoor unit) must be done by your side when using R32 refrigerant.
- Conformity of regulations and laws must be confirmed on the system by your side.

2 Basic Specifications and Connectable Outdoor Unit Models

2.1 Basic specifications of the interface unit

Model name	PAC-IF013B-E	PAC-SIF013B-E
Power supply	~/N 230V 50Hz	
Dimension	H: 278mm, W: 336mm, D: 69mm	
Weight	2.5kg + Accessories 0.8kg	2.5kg + Accessories 0.4kg

2.2 Connectable outdoor unit models

Outdoor unit model name		Connectability	Pre-defrost signal/Delayed (balanced) defrost function *1	Refrigerant
PUHZ-ZRP	35VKA	Connectable	Available from VKA2 model	R410A
	50VKA	Connectable	Available from VKA2 model	R410A
	60VHA	Connectable	Available from VHA2 model	R410A
	71VHA	Connectable	Available from VHA2 model	R410A
	100V/YKA	Connectable	Available from V/YKA3 model	R410A
	125V/YKA	Connectable	Available from V/YKA3 model	R410A
	140V/YKA	Connectable	Available from V/YKA3 model	R410A
	200YKA	ONLY from R1 model	Available from YKA2 model	R410A
	250YKA	ONLY from R1 model	Available from YKA2 model	R410A
PUHZ-P	200YKA	ONLY from R1 model	Available from YKA2 model	R410A
	250YKA	ONLY from R1 model	Available from YKA2 model	R410A
PUHZ-SHW	80VHA	Connectable	Available ONLY from R4 model	R410A
	112V/YHA	Connectable	Available ONLY from R4 model	R410A
	140YHA	Connectable	Available ONLY from R4 model	R410A
	230YKA	ONLY from YKA2 model	Available ONLY from YKA2 model	R410A
PUZ-ZM	35VKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	50VKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	60VHA	Connectable if fire-safety is ensured *3	Available	R32 *2
	71VHA	Connectable if fire-safety is ensured *3	Available	R32 *2
	100V/YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	125V/YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	140V/YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	200YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	250YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
PUZ-M	200YKA	Connectable if fire-safety is ensured *3	Available	R32 *2
	250YKA	Connectable if fire-safety is ensured *3	Available	R32 *2

*1. Refer to "4. Function - System list".

*2. R32 is flammable refrigerant.

*3. Fire-safety for the whole system (including outdoor unit) must be ensured by your side. Refer to "7. Additional Requirements for using R32 Refrigerant".

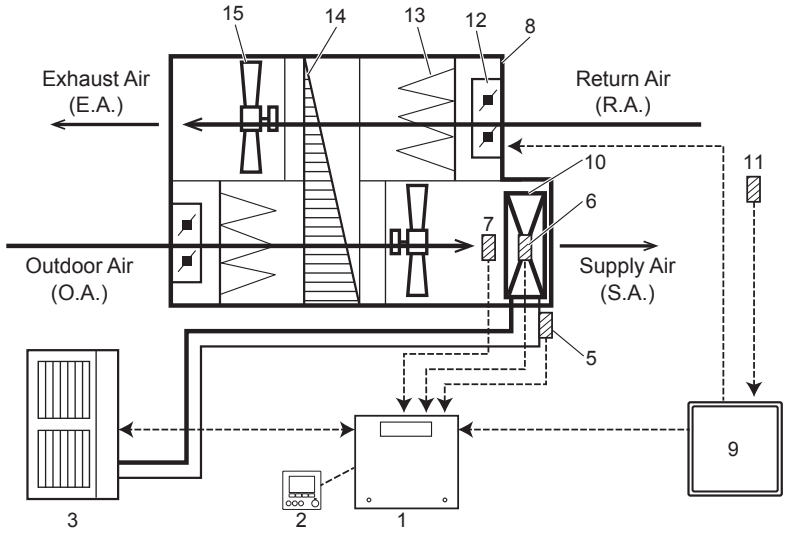
3 System

Step mode (Input)	Target temperature	Number of outdoor unit	Intelligent multiple outdoor unit control	System
Manual	—	1	Not available	See (1-1) below.
		2-6	Use	See (2-1) below.
			Not use	See (1-1) below.*1
Auto	Supply air temp. control	1-5	Not available	See (1-2) below.
	Return air temp. control	1-5	Not available	See (1-3) below.

*1. It is recommended to select Intelligent multiple outdoor unit control.
Design local AHU controller to make sure the following points.
• Minimum capacity request should be 20% or more of total capacity.
• Operate all outdoor units when outdoor temperature is below -15 °C.

3.1 System configuration (Single outdoor unit)

(1-1) Manual step mode *1



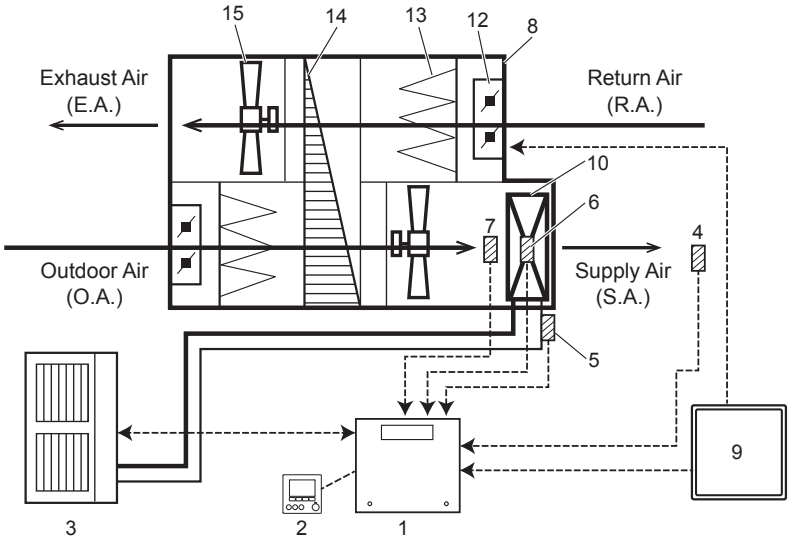
<Fig. 3.1.1>

*1. Manual step mode:
• Variable capacity request signals for heat pump need to be calculated by AHU local controller.
• AHU local controller can send “Capacity steps” by non-voltage contact signals, analog signals, or Modbus signal to the interface unit.
• Operation mode can be set by remote controller, external input, DIP switch, or Modbus signal.

No.	Part name	System (1-1)
1	Interface unit	✔
2	Remote controller	✔
3	Outdoor unit	✔
4	Target air temp. thermistor (TH1)	—
5	Ref. liquid temp. thermistor (TH2)	✔
6	2-Phase temp. thermistor (TH5)	✔ *2
7	HEX inlet (Coil on) temp. thermistor (TH11)	✔
8	Air-Handling Unit (AHU) (Local supply)	✔
9	AHU local controller (Local supply)	✔
10	Direct expansion (DX) coil (Local supply)	✔
11	Target air temp. thermistor (Local supply)	✔
12	Louver (Local supply)	✔
13	Air filter (Local supply)	✔
14	Heat recovery (Local supply)	✔
15	Fan (Local supply)	✔

*2. If outdoor unit is PUHZ-SHW model, it’s not needed to install this thermistor.

(1-2) Auto step mode *3 & Supply air temp. control



<Fig. 3.1.2>

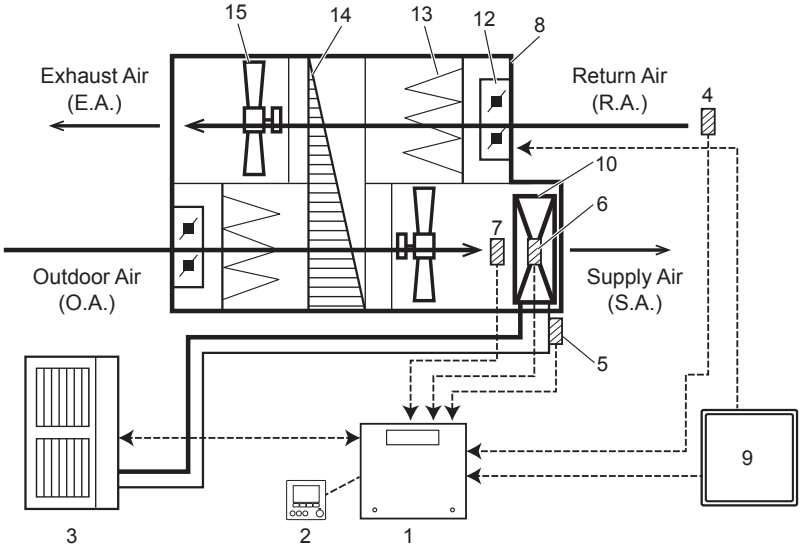
*3. Auto step mode:
- In this mode, the capacity step of the outdoor unit is controlled automatically to let the target temperature reach the set temperature.
- Set temperature can be set by remote controller, DIP switch, or Modbus signal.
- Operation mode can be set by remote controller, external input, DIP switch, or Modbus signal.

Note
- Auto change over function between cooling and heating mode is NOT available in this system.

No.	Part name	System (1-2)
1	Interface unit	✔
2	Remote controller	✔
3	Outdoor unit	✔
4	Target air temp. thermistor (TH1)	✔
5	Ref. liquid temp. thermistor (TH2)	✔
6	2-Phase temp. thermistor (TH5)	✔ *4
7	HEX inlet (Coil on) temp. thermistor (TH11)	✔
8	Air-Handling Unit (AHU) (Local supply)	✔
9	AHU local controller (Local supply)	✔
10	Direct expansion (DX) coil (Local supply)	✔
11	Target air temp. thermistor (Local supply)	–
12	Louver (Local supply)	✔
13	Air filter (Local supply)	✔
14	Heat recovery (Local supply)	✔
15	Fan (Local supply)	✔

*4. If outdoor unit is PUHZ-SHW model, it's not needed to install this thermistor.

(1-3) Auto step mode *5 & Return/ Room air temp. control



<Fig. 3.1.3>

*5. Auto step mode:
- In this mode, the capacity step of the outdoor unit is controlled automatically to let the target temperature reach the set temperature.
- Set temperature can be set by remote controller, DIP switch, or Modbus signal.
- Operation mode can be set by remote controller, external input, DIP switch, or Modbus signal.

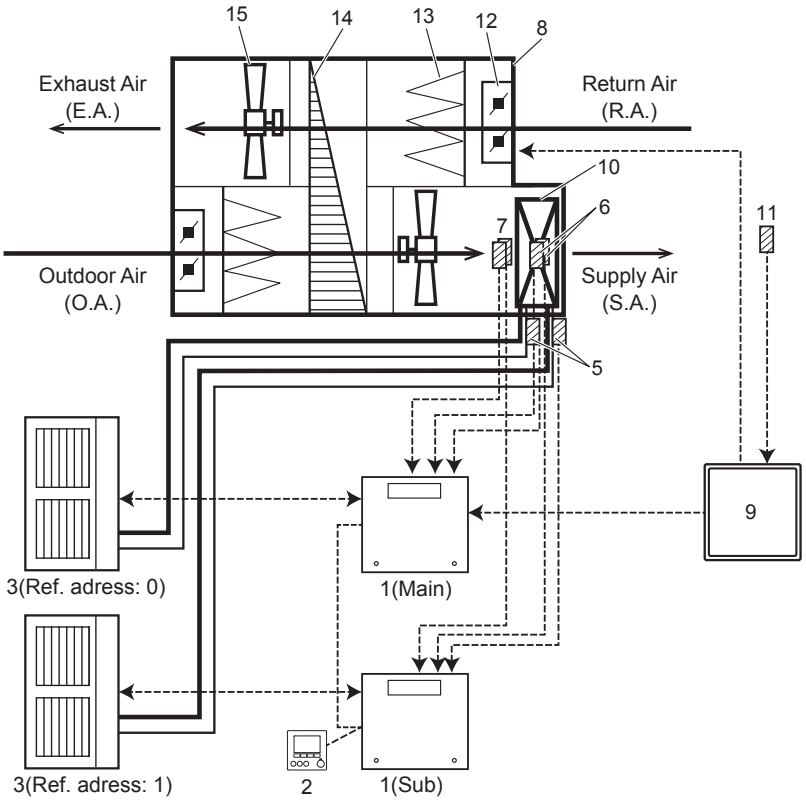
Note
- Auto change over function between cooling and heating mode is available ONLY when this system is selected and the input selection of capacity setting (DIP SW1 and SW6) is "No input (Auto step mode)".

No.	Part name	System (1-3)
1	Interface unit	✔
2	Remote controller	✔
3	Outdoor unit	✔
4	Target air temp. thermistor (TH1)	✔
5	Ref. liquid temp. thermistor (TH2)	✔
6	2-Phase temp. thermistor (TH5)	✔ *6
7	HEX inlet (Coil on) temp. thermistor (TH11)	✔
8	Air-Handling Unit (AHU) (Local supply)	✔
9	AHU local controller (Local supply)	✔
10	Direct expansion (DX) coil (Local supply)	✔
11	Target air temp. thermistor (Local supply)	–
12	Louver (Local supply)	✔
13	Air filter (Local supply)	✔
14	Heat recovery (Local supply)	✔
15	Fan (Local supply)	✔

*6. If outdoor unit is PUHZ-SHW model, it's not needed to install this thermistor.

3.2 System configuration (Intelligent multiple outdoor unit control *1)

(2-1) Manual step mode (example)



<Fig. 3.2.1>

*1. Interface system receives step request signal correspond to total capacity of outdoor units, and calculates necessary capacity for each outdoor unit automatically.

Note
- This intelligent multiple outdoor unit control function is available only when Manual step mode is selected.
- Up to 6 outdoor units can be connected.
- 2 different type of outdoor units (capacity and/or series) can be mixed,but connecting the same capacity outdoor units is highly recommended.
- Ref. address setting on each outdoor unit is needed.
- Interface unit which connects to the Ref. address 0 outdoor unit, becomes main interface unit.
- Connect AHU local controller (Part No. 9) to the main interface unit.
- Connect ONE remote controller (Part No. 2) to the interface unit.
- Connect between the interface units with a remote controller (daisy chain). MAX. : 500m

No.	Part name	System (2-1)
1	Interface unit	✔
2	Remote controller	✔
3	Outdoor unit	✔
4	Target air temp. thermistor (TH1)	—
5	Ref. liquid temp. thermistor (TH2)	✔
6	2-Phase temp. thermistor (TH5)	✔ *2
7	HEX inlet (Coil on) temp. thermistor (TH11)	✔
8	Air-Handling Unit (AHU) (Local supply)	✔
9	AHU local controller (Local supply)	✔
10	Direct expansion (DX) coil (Local supply)	✔
11	Target air temp. thermistor (Local supply)	✔
12	Louver (Local supply)	✔
13	Air filter (Local supply)	✔
14	Heat recovery (Local supply)	✔
15	Fan (Local supply)	✔

*2. If outdoor unit is PUHZ-SHW model, it's not needed to install this thermistor.

3.3 Operation range

(1) Operation range

Make sure to keep operation range shown at the table below.

Operation range	Outdoor temperature	Cooling		Depend on outdoor unit
		Heating		Depend on outdoor unit
	Coil on temperature	Cooling		15 - 32°C
		Heating	Number of outdoor unit: 1	0 - 28°C
			Number of outdoor unit: 2 or more	5 - 28°C

(2) Set temperature range in Auto step mode

Set temperature range in Auto step mode *1	Supply air control	Cooling	12 - 30°C
		Heating	17 - 28°C
	Return/Room air temperature control	Cooling	19 - 30°C
		Heating	17 - 28°C
	Auto cooling/heating *2		19 - 28°C

Note

*1. When potential of the DX coil does not match the capacity of outdoor unit, the air temperature may not reach the set temperature or there may be ON-OFF cycle. Design the DX coil to match the capacity of outdoor unit. (As for capacity of outdoor unit, refer to "6.2 Standard conditions".)

*2. This function is available ONLY when capacity setting (DIP SW1 and SW6) is "No input (Auto step mode)" and return/room air temp. control is selected (DIP SW 1-7 is ON).

			Step mode	Manual															
			Input type	Analog (0-10V/1-5V/4-20mA/0-10kΩ)					Remote switch (A/B)					Modbus					
			Target temp.	–					–					–					
			No. of outdoor unit	1		2-6			1		2-6			1		2-6			
			Intelligent multiple outdoor unit control (IMOUC)	–		Use	Not use		–		Use	Not use		–		Use	Not use		
			Group (Auto step mode)	–		–	–		–		–	–		–		–	–		
			Remote controller	With	Without	With	With	Without	With	Without	With	With	Without	With	Without	With	With	Without	
			System configuration *1	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
No.	Item	Function name	Description																
1	IMOUC	Intelligent multiple outdoor unit control (IMOUC)	Interface system receives step request signal correspond to total capacity of outdoor units, and calculates necessary capacity for each outdoor unit automatically. (See "3. System".)	–	–	✔	–	–	–	–	✔	–	–	–	–	✔	–	–	
2		Back up operation	In case of one outdoor unit failure, next outdoor unit starts to operate automatically.	–	–	✔	–	–	–	–	✔	–	–	–	–	✔	–	–	
3		Rotation control	To make cumulative operation time of each outdoor unit even. (This function is only among same capacity outdoor units.)	–	–	✔	–	–	–	–	✔	–	–	–	–	✔	–	–	
4		Delayed (balanced) defrost	To avoid simultaneous defrosting among multiple outdoor units as much as possible. *2	–	–	✔ *2	–	–	–	–	✔ *2	–	–	–	–	✔ *2	–	–	
5	Output	Pre-defrost signal	This output becomes ON before defrost starts (to switch ON back up heater on your side). *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2
6	Step input	11-step control	Refined capacity request in 11 steps becomes possible.	✔ (Only 0-10V)	✔ (Only 0-10V)	✔ (Only 0-10V)	✔ (Only 0-10V)	✔ (Only 0-10V)	–	–	–	–	–	✔	✔	✔	✔	✔
7	Connection	Modbus connection	Modbus communication is available. (Refer to the Modbus manual.)	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔	✔	✔	✔	✔
8		SD card slot	Operation data logging is available.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
9			Time stamp function by remote controller for SD card log data is available.	✔	–	✔	✔	–	✔	–	✔	✔	–	✔	–	✔	✔	–	
10	Other	Auto heating/cooling	Auto change over function between heating and cooling is available.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

*1. As for system configuration, see the following page.
*2. These functions are available ONLY with adaptable outdoor unit. Refer to "2.2 Connectable outdoor unit models".
*3. Only reading is available.

			Step mode	Auto																
			Input type	"No input (Auto step mode)" (Input with remote controller)						"No input (Auto step mode)" (Input with Modbus)										
			Target temp.	Supply air (SA)			Return air (RA)			Supply air (SA)						Return air (RA)				
			No. of outdoor unit	1	2-5		1	2-5		1		2-5				1		2-5		
			Intelligent multiple outdoor unit control (IMOUC)	–	–		–	–		–		–				–		–		
			Group (Auto step mode)	–	Use	Not use	–	Use	Not use	–		Use	Not use			–		Use	Not use	
			Remote controller	With	With	With	With	With	With	With	Without	With	With	Without		With	Without	With	With	Without
			System configuration *1	A	F	D	A	F	D	A	B	F	D	E		A	B	F	D	E
No.	Item	Function name	Description																	
1	IMOUC	Intelligent multiple outdoor unit control (IMOUC)	Interface system receives step request signal correspond to total capacity of outdoor units, and calculates necessary capacity for each outdoor unit automatically. (See "3. System".)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2		Back up operation	In case of one outdoor unit failure, next outdoor unit starts to operate automatically.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3		Rotation control	To make cumulative operation time of each outdoor unit even. (This function is only among same capacity outdoor units.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4		Delayed (balanced) defrost	To avoid simultaneous defrosting among multiple outdoor units as much as possible. *2	–	✔ *2	–	–	✔ *2	–	–	–	✔ *2	–	–	–	–	–	✔ *2	–	–
5	Output	Pre-defrost signal	This output becomes ON before defrost starts (to switch ON back up heater on your side). *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2	✔ *2
6	Step input	11-step control	Refined capacity request in 11 steps becomes possible.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7	Connection	Modbus connection	Modbus communication is available. (Refer to the Modbus manual.)	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔ *3	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
8		SD card slot	Operation data logging is available.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
9			Time stamp function by remote controller for SD card log data is available.	✔	✔	✔	✔	✔	✔	✔	–	✔	✔	–	✔	–	✔	✔	✔	–
10	Other	Auto heating/cooling	Auto change over function between heating and cooling is available.	–	–	–	✔	✔	✔	–	–	–	–	–	✔	✔	✔	✔	✔	✔

*1. As for system configuration, see the following page.
*2. These functions are available ONLY with adaptable outdoor unit. Refer to "2.2 Connectable outdoor unit models".
*3. Only reading is available.

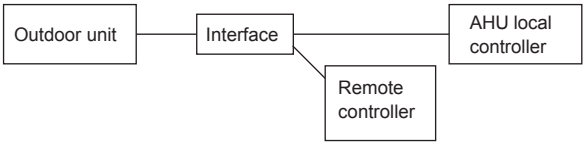
			Step mode	Auto									
			Input type	Analog / Remote switch									
			Target temp.	Supply air (SA)					Return air (RA)				
			No. of outdoor unit	1		2-5			1		2-5		
			Intelligent multiple outdoor unit control (IMOUC)	–		–			–		–		
			Group (Auto step mode)	–		Use	Not use		–		Use	Not use	
			Remote controller	With	Without	With	With	Without	With	Without	With	With	Without
			System configuration *1	A	B	F	D	E	A	B	F	D	E
No.	Item	Function name	Description										
1	IMOUC	Intelligent multiple outdoor unit control (IMOUC)	Interface system receives step request signal correspond to total capacity of outdoor units, and calculates necessary capacity for each outdoor unit automatically. (See "3. System".)	–	–	–	–	–	–	–	–	–	–
2		Back up operation	In case of one outdoor unit failure, next outdoor unit starts to operate automatically.	–	–	–	–	–	–	–	–	–	–
3		Rotation control	To make cumulative operation time of each outdoor unit even. (This function is only among same capacity outdoor units.)	–	–	–	–	–	–	–	–	–	–
4		Delayed (balanced) defrost	To avoid simultaneous defrosting among multiple outdoor units as much as possible. *2	–	–	✓ *2	–	–	–	–	✓ *2	–	–
5	Output	Pre-defrost signal	This output becomes ON before defrost starts (to switch ON back up heater on your side). *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2	✓ *2
6	Step input	11-step control	Refined capacity request in 11 steps becomes possible.	–	–	–	–	–	–	–	–	–	–
7	Connection	Modbus connection	Modbus communication is available. (Refer to the Modbus manual.)	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3	✓ *3
8		SD card slot	Operation data logging is available.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9			Time stamp function by remote controller for SD card log data is available.	✓	–	✓	✓	–	✓	–	✓	✓	–
10	Other	Auto heating/cooling	Auto change over function between heating and cooling is available.	–	–	–	–	–	–	–	–	–	–

*1. As for system configuration, see the following page.
*2. These functions are available ONLY with adaptable outdoor unit. Refer to "2.2 Connectable outdoor unit models".
*3. Only reading is available.

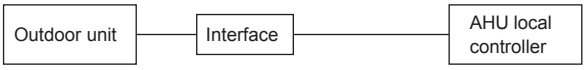
4 Function - System list

*1. Example of system configuration

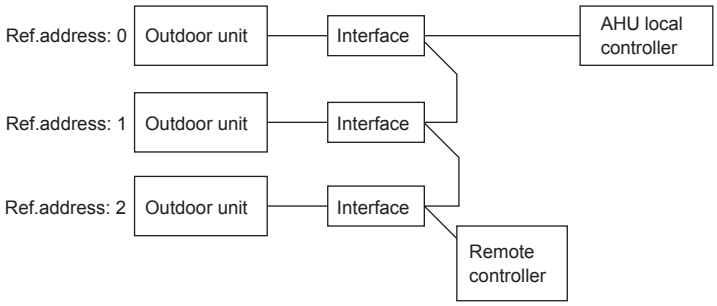
System A



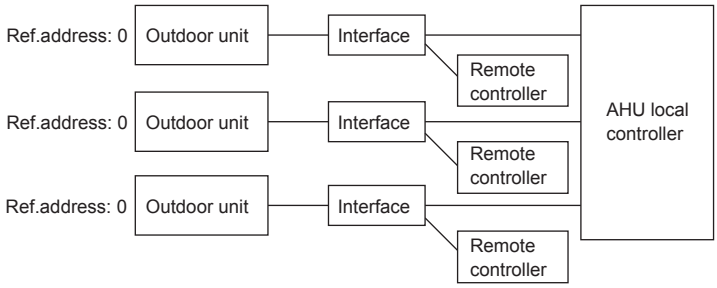
System B



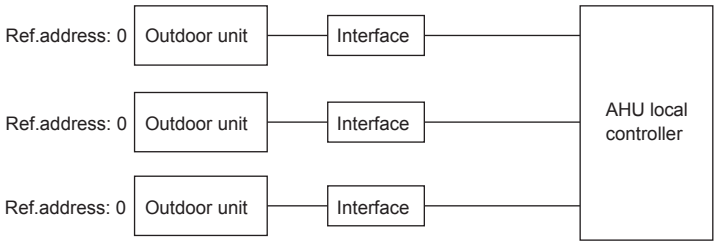
System C (Manual step mode) (IMOUC)



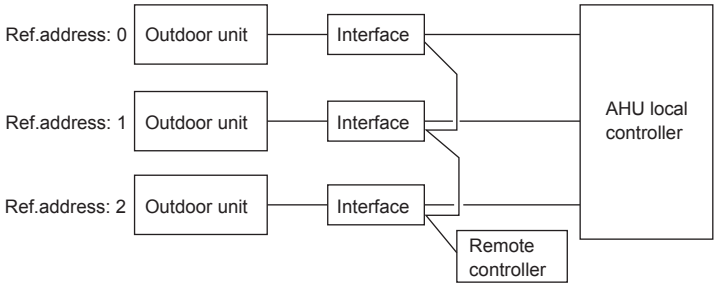
System D



System E



System F (Auto step mode) (Gruop)



5 Input and Output

5.1. Input and output

Inputs		Availability
Thermistor (Refrigerant)	Ref. liquid temperature (TH2)	✓
	2-phase temperature (TH5)	✓ *1
Thermistor (Air)	Coil on temperature (TH11)	✓
	Target air temperature (TH1) (Supply air or Return/Room air)	✓
Input (Contact signal)	Forced Comp. OFF*2	✓
	Fixed operation mode (Cooling/Heating)	✓
	Capacity request	7steps
Input for capacity request (Analog signal)	0-10V	11steps
	1-5V	7steps
	4-20mA	7steps
	0-10kΩ	7steps
Modbus connection		✓
Remote controller		✓

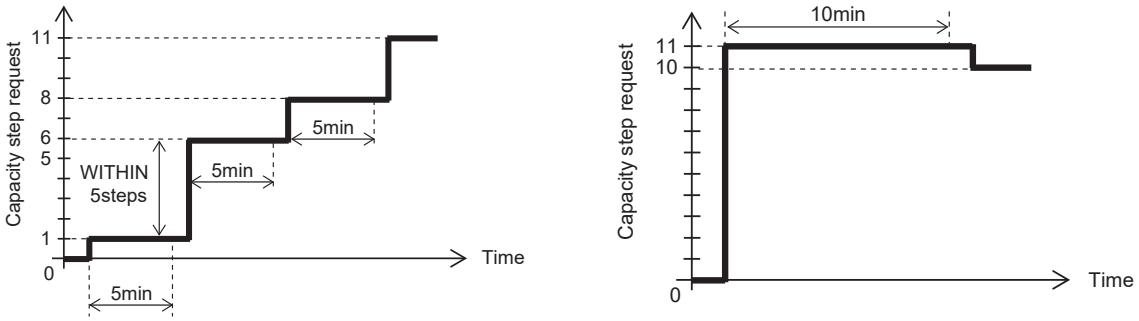
Outputs		Availability
Output (Contact signal)	Operation ON/OFF	✓
	Error	✓
	Compressor ON/OFF	✓
	Defrost	✓
	Cooling mode	✓
	Heating mode	✓
	Self protection*3	✓
	Pre-defrost*4	✓ *5

*1. If connected outdoor unit is PUHZ-SHW model, it is not needed. (PUHZ-SHW models include high-pressure sensor instead.)
*2. The operation continues during defrosting operation.
The “Forced Comp. OFF” signal should not be turned ON frequently. It should only be used if an abnormality occurs.
*3. This output is ON when compressor becomes OFF to protect outdoor unit because condition is out of operation range.
(As for operation range, refer to "3.3 Operation range".)
*4. This output is ON more than one minute before defrost starts.
*5. This function is available ONLY with adaptable outdoor unit. Refer to "2.2 Connected outdoor unit models".

5.2. Requirements and guides regarding input, output, and settings

5.2.1 Requirements on capacity step input to the interface unit (Only manual step mode)

(1) Do NOT input STEP 0 for 3 minutes after compressor is ON. (Keep compressor ON for 3 minutes at least.)
(2) Regarding timing of capacity step changes, follow the note below.
Note: Input next capacity step input after supply air temperature becomes stable.
If this note is difficult to follow by local controller,
• The change must be within 5 steps in a single request with at least 5 minutes interval between every change.
• For 6 step changing or more (such as on start-up of operation), the interval between every change needs to be at least 10 minutes.
(See figure 5-1.)

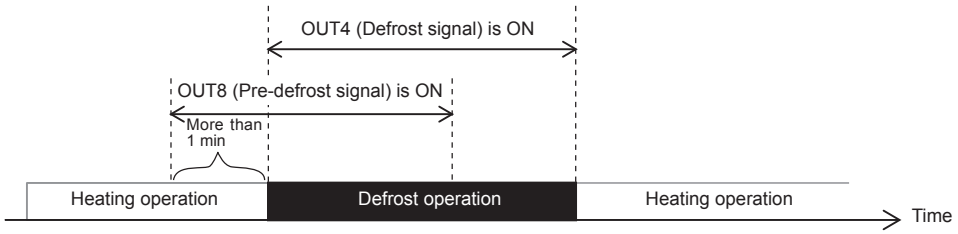


<Fig. 5-1: Examples of step changes>

(3) If you input capacity step request by analog signal, use the center value of each step.
(Regarding center values, refer to the section 4 "Electrical work" in the installation manual.)

5.2.2 Requirements and guides regarding defrost and pre-defrost signal

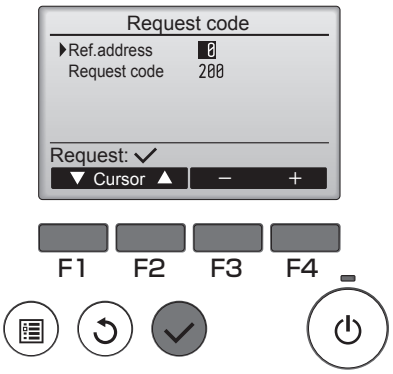
(1) Do NOT input STEP 0 during defrost operation and while pre-defrost signal is ON.
(2) After pre-defrost signal becomes ON, do NOT change capacity step request until defrost operation finishes.
If you change capacity step after pre-defrost signal is ON, outdoor unit may stop starting defrosting and frost may become big.
(3) Pre-defrost signal becomes OFF before defrost operation finishes. Using both OUT4 (Defrost signal) and OUT8 (Pre-defrost signal) is recommended if you use pre-defrost signal. (See figure 5-2.)



<Fig. 5-2>

(4) Regarding the delayed (balaced) defrost function and the pre-defrost signal, if you change outdoor unit from non-adaptable to adaptable model, initialization of the function setting on the remote controller is necessary.
- First, select "Menu" → "Service" → "Check" → "Request code" on the remote controller.
- Second, set the refrigerant address of the outdoor unit which is changed from non-adaptable to adaptable.
- Third, select "Request code" item with the F1 or F2 button and set "200" with F3 or F4 button.
- Then, press the ⊘ button. The function settings are initialized.

Note: You have to set the function settings after this initialization, if necessary.



5.2.3 Requirement regarding operation mode setting

(1) Do NOT change operation mode frequently.

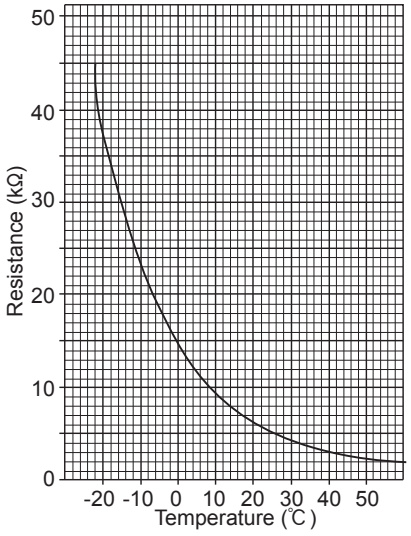
5.2.4 Thermistor characteristics

- Target air temp. thermistor (TH1)
- Ref. liquid temp. thermistor (TH2)
- 2-Phase temp. thermistor (TH5)
- HEX inlet (Coil on) temp. thermistor (TH11)

Thermistor R0 = 15kΩ ± 3%
B constant = 3480 ± 2%

$$Rt = 15\exp\left\{3480\left(\frac{1}{273+t} - \frac{1}{273}\right)\right\}$$

0°C	15 kΩ
10°C	9.6 kΩ
20°C	6.3 kΩ
25°C	5.2 kΩ
30°C	4.3 kΩ
40°C	3.0 kΩ



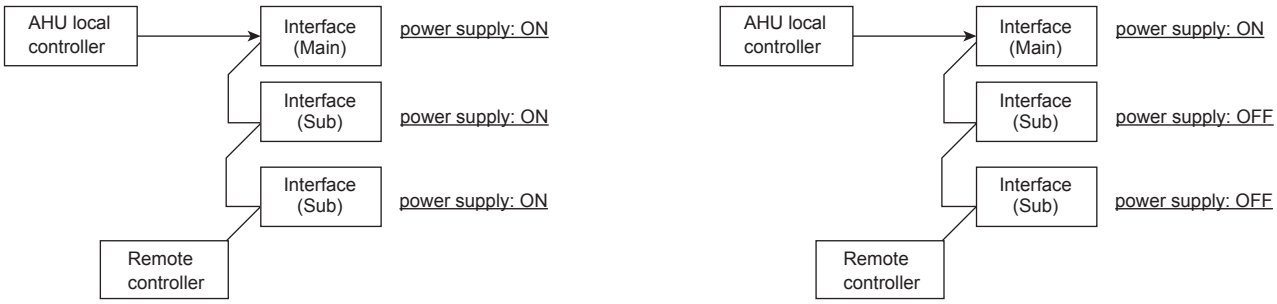
5.2.5 Central control (M-NET connection)

The central control (M-NET converter and A-control sub Interface connection between outdoor unit(s) and MELANS/BMS) is available ONLY when capacity setting (DIP SW1 and SW6) is "No input (Auto step mode)" and return/room air temp. control is selected (DIP SW 1-7 is ON).

5.3. Requirements and guides when intelligent multiple outdoor unit control (IMOUC) is used

5.3.1 Power input timing when intelligent multiple outdoor unit control (IMOUC) is used

When IMOUC is used, supply power to the first interface unit, then the second interface unit within 1 minute. Otherwise system error will occur. (See figure 5-3.)



<Fig. 5-3>

5.3.2 Connection and setting when intelligent multiple outdoor unit control (IMOUC) is used

(1) When IMOUC is used, the following input connections to sub interface unit(s) are necessary.

Input		Input to sub interface(s)
Thermistor	Target air temp. (TH1)	Input is **not necessary** because IMOUC is only in manual step mode.
	Coil on air temp. (TH11)	Input to sub interface(s) is **necessary**.
	Liquid ref. temp. (TH2)	Input to sub interface(s) is **necessary**.
	2-phase ref. temp. (TH5)	Input to sub interface(s) is **necessary**.*1
Input for capacity request	Analog input (0-10V/1-5V/4-20mA/0-10kΩ)	Input to sub interface(s) is **not necessary**.
	Modbus	Input to sub interface(s) is necessary **only for monitoring sub interface(s).**
	Remote switch	Input to sub interface(s) is **not necessary**.
Other inputs	Forced compressor OFF (IN1)	Input to sub interface(s) is **necessary**, if you use this function to sub interface(s).
	Fixed operation mode (Cooling/Heating) (IN2)	Input to sub interface(s) is **not necessary**.
Remote controller		Daisy chain wiring among interfaces is **necessary**.

*1. It is not necessary if connected outdoor units are PUHZ-SHW models (which include high-pressure sensor).

(2) When IMOUC is used, the following output connections to sub interface unit(s) are necessary.

Output		Output from sub interface(s)
1	Operation	It can be monitored via main interface.
2	Error	Output connection is **necessary**, if you monitor error information of sub interface(s).
3	Compressor ON	Output connection is **necessary**, if you monitor this information of sub interface(s).
4	Defrost	Output connection is **necessary**, if you monitor this information of sub interface(s).
5	Cooling mode	It can be monitored via main interface.
6	Heating mode	It can be monitored via main interface.
7	Self protection	Output connection is **necessary**, if you monitor this information of sub interface(s).
8	Pre-defrost *1	Output connection is **necessary**, if you monitor this information of sub interface(s).

*1. This function is available ONLY with adaptable outdoor unit. See "2.2 Connectable outdoor unit models".

(3) When IMOUC is used, the following DIP switch settings of sub interface unit(s) are necessary.

DIP switch		DIP switch setting of sub interface(s)
1-1 to 1-3	Input selection	Setting of main interface is only necessary.
1-4 to 1-5	Thermistor (TH11, TH5)	Setting of each sub interface(s) is **necessary**.
1-6	Time stamp for SD card	Setting of each sub interface(s) is **necessary**, if you use this function.
1-7	Position of TH1	Setting is not necessary because IMOUC is manual step mode.
1-8	IMOUC	Setting of each sub interface(s) is **necessary**.
2-1 to 2-2	Fixed operation mode	Setting of main interface is only necessary, if you use this function.
2-3 to 2-5	Fixed set temp.	Setting is not necessary because IMOUC is manual step mode.
2-7 to 2-8	Thermistor (TH2, TH1)	Setting of each sub interface(s) is **necessary**.
3-1 to 3-3	LED display setting	Setting of each sub interface(s) is **necessary**, if you use this function.
3-4 to 3-5	Thermo differential (Auto step mode)	Setting is not necessary because IMOUC is manual step mode.
3-6 to 3-8	Baud rate of Modbus	Setting of each sub interface(s) is **necessary**, if you use Modbus connection to sub interface(s).
4-1 to 4-8	Settings for Modbus	Setting of each sub interface(s) is **necessary**, if you use Modbus connection to sub interface(s).
6-1 to 6-2	Input selection	Setting of main interface is only necessary.

5.4 SD card data logging

5.4.1 Time stamp function

Time stamp function enables to log the time of operation. Please use this function.
To use this function, setting DIP SW (SW 1-6) of interface unit to ON, connecting remote controller, and clock setting of remote controller ("Menu" → "Initial setting" → "Clock") are necessary.

6 Requirement on local AHU design

6.1 Air flow volume

Standard air flow volume

Model capacity of outdoor unit	ZRP	35	50	60	71	100	125	140	200	250
	P	–	–	–	–	–	–	–	200	250
	SHW	–	–	–	80	112	140	–	230	–
	ZM	35	50	60	71	100	125	140	200	250
	M	–	–	–	–	–	–	–	200	250
Maximum air volume	[m³/min]	12.3	18	21	24	33.6	42	48	67.2	81
	[m³/h]	738	1080	1260	1440	2016	2520	2880	4032	4860
Minimum air volume	[m³/min]	6.2	8.6	10.5	12.2	16.3	21.5	23.0	32.6	37.8
	[m³/h]	372	516	630	732	978	1290	1380	1956	2268

Make sure to keep the air flow volume within the limits of maximum and minimum below.

(1) Maximum air volume

Step mode	Number of outdoor unit	Capacities of the connected outdoor units	Maximum air volume
Manual	2-6	The same	[For PUHZ-ZRP, P, SHW models] 500% of selected outdoor unit's maximum standard air volume *1
			[For PUZ-ZM models] 440% of selected outdoor unit's maximum standard air volume *2
		Different	[For PUHZ-ZRP, P, SHW models] If smaller capacity outdoor unit's rated heating capacity is under 20% of total heating capacity, 500% of bigger capacity outdoor unit's maximum standard air volume is allowable. If smaller capacity outdoor unit's rated heating capacity is 20% or more of total heating capacity, 500% of smaller capacity outdoor unit's maximum standard air volume is allowable.
			[For PUZ-ZM models] If smaller capacity outdoor unit's rated heating capacity is under 20% of total heating capacity, 440% of bigger capacity outdoor unit's maximum standard air volume is allowable. If smaller capacity outdoor unit's rated heating capacity is 20% or more of total heating capacity, 440% of smaller capacity outdoor unit's maximum standard air volume is allowable.
	1	–	200% of selected outdoor unit's maximum standard air volume
Auto	2-5	–	[For PUHZ-ZRP, P, SHW models] 500% of the smallest capacity outdoor unit's maximum standard air volume
			[For PUZ-ZM models] 440% of the smallest capacity outdoor unit's maximum standard air volume
	1	–	200% of selected outdoor unit's maximum standard air volume

*1. 600% of selected outdoor unit's maximum standard air volume is available ONLY when 6 same capacity outdoor units are connected.
*2. 528% of selected outdoor unit's maximum standard air volume is available ONLY when 6 same capacity outdoor units are connected.

(2) Minimum air volume

Total amount of selected outdoor unit's minimum standard air volume is allowable.

6.2 Standard conditions

When calculating capacity for designing AHU DX (Direct expansion) coil, refer to standard conditions below.
It is recommended to keep nominal capacity within 90%-110% under the standard condition.

<Standard conditions>

[1] COOLING

Evaporation temp.	10℃
Superheat at evaporator outlet	5℃
Expansion valve inlet temp.	40℃
Coil on air temp. (dry-bulb/wet-bulb)	27℃/19℃
Outdoor temp. (dry-bulb/wet-bulb)	35℃/27℃

[2] HEATING

Condensing temp.	45℃
Superheat at condenser inlet	20℃
Subcool at condenser outlet	5℃
Coil on air temp. (dry-bulb/wet-bulb)	20℃/15℃
Outdoor temp. (dry-bulb/wet-bulb)	7℃/6℃

<Nominal capacity>

Model capacity of outdoor unit	ZRP	35	50	60	71	100	125	140	200	250
	P	–	–	–	–	–	–	–	200	250
	SHW	–	–	–	80	112	140	–	230	–
	ZM	35	50	60	71	100	125	140	200	250
	M	–	–	–	–	–	–	–	200	250
COOLING (kW)		3.5	5.0	6.0	7.1	10.0	12.5	14.0	20.0	25.0
HEATING (kW)		4.1	6.0	7.0	8.0	11.2	14.0	16.0	22.4	27.0

6.3 Requirement on DX (Direct expansion) coil

(1) Heat exchanger volume of DX coil

Make sure to keep the DX coil capacity within the following range.

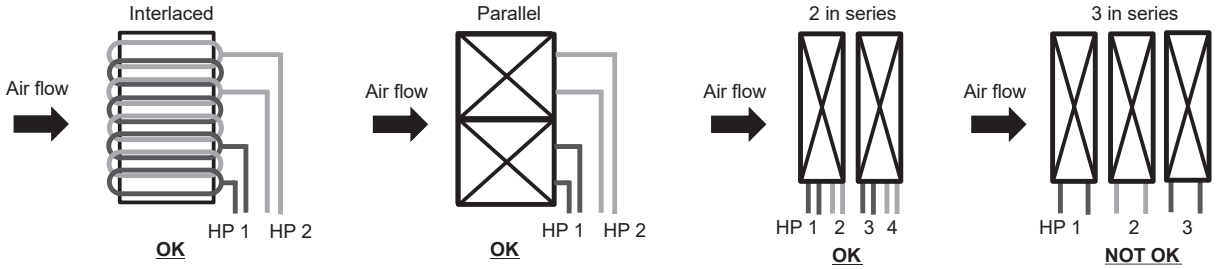
If the piping length is 30m or shorter, DX coil capacity can be increased as follows.

Model capacity of outdoor unit		ZRP	35	50	60	71	100	125	140	200	250
		P	–	–	–	–	–	–	–	200	250
		SHW	–	–	–	80	112	140	–	230	–
		ZM	35	50	60	71	100	125	140	200	250
		M	–	–	–	–	–	–	–	200	250
Max. volume [cm^3]											
	Pipe length	30m -	1050	1500	1800	2130	3000	3750	4200	6000	7500
		20m	1350	1800	2700	3030	3900	4650	5100	7800	9300
		10m	1650	2100	3600	3930	4800	5550	6000	9600	11100
Min. volume [cm^3]			350	500	600	710	1000	1250	1400	2000	2500

Note: Calculate them by linear interpolation in case of other piping lengths not shown on this table.

(2) Structure of DX coil

When multiple outdoor units are connected, basically select one interlaced DX coil which has multiple refrigerant circuit, or multiple coil placed in parallel to the air flow. If multiple coils are placed in series with the air flow, maximum 2 coils in series are acceptable. (See figure 6-1.)



<Fig. 6-1: Example of DX coil structure>

(3) Diameter of header

With a bigger size header, the refrigerant flow velocity decreases and this disturbs the sufficient circulation of refrigerant oil. As a result, the refrigerant oil does not flow properly and could cause a serious damage of compressor.

Use the pipe whose outside diameter is less than the value shown in the table below.

Model capacity of outdoor unit	ZRP	35	50	60	71	100	125	140	200	250
	P	–	–	–	–	–	–	–	200	250
	SHW	–	–	–	80	112	140	–	230	–
Max. diameter of header O.D.		ϕ19.05 mm (3/4 inch)				ϕ28.58 mm (9/8 inch)				

Model capacity of outdoor unit	ZM	35	50	60	71	100	125	140	200	250
	M	–	–	–	–	–	–	–	200	250
Max. diameter of header O.D.		ϕ15.88 mm (5/8 inch)				ϕ22.2 mm (7/8 inch)				

(4) Withstanding pressure

Design pressure of outdoor unit is 4.15 MPa. Following must be satisfied for burst pressure of connecting application.

Burst pressure : More than 12.45 MPa (3 times more than design pressure)

(5) Contamination maintenance

1. Wash the inside of heat exchanger to keep it clean. Be sure to rinse not to leave flux. Do not use chlorine detergent when washing.
2. Be sure that the amount of contamination per unit cubic content of heat transfer pipe is less than the following amount.
   Example) In case of ø9.52mm
   Residual water : 0.6 mg/m, Residual oil : 0.5 mg/m, Solid foreign object : 1.8 mg/m

6 Requirement on local AHU design

6.4 Additional refrigerant charging amount

Regarding additional refrigerant charging amount of PUZ-ZM100, 125, 140, 200, 250 models, follow the table below.
For other models, see the installation manual of each outdoor unit.

Model	Permitted pipe length	Permitted vertical difference	Additional refrigerant charging amount					◎ Maximum amount of refrigerant
			31 - 40 m	41 - 50 m	51 - 60 m	61 - 70 m	71 - 85 m	
ZM100 - 140	−85 m	−30 m	0.5 kg	1.0 kg	1.5 kg	2.0 kg	2.8 kg	6.8 kg
ZM200	−85 m	−30 m	0.4 kg	0.8 kg	1.2 kg	1.6 kg	Calculate the amount of additional refrigerant charge using formula provided the following formula.	9.2 kg
ZM250	−85 m	−30 m	0.6 kg	1.2 kg	1.8 kg	2.4 kg		9.2 kg

When length exceeds 70 m

When the total length of the piping exceeds 70 m, calculate the amount of additional charge based on the following requirements.
Note: If the calculation produces a negative number (i.e. a “minus” charge), of if calculation results in an amount that is less than the “Additional charge amount for 70 m”, perform the additional charge using the amount shown in “Additional charge amount for 70 m”.

Amount of additional charge	=	Main piping: Liquid line size ø12.7 overall length × 0.06	+	Main piping: Liquid line size ø9.52 overall length × 0.04 (Gas line: ø25.4)	+	Branch piping: Liquid line size ø9.52 overall length × 0.03 (Gas line: ø15.88)	+	Branch piping: Liquid line size ø6.35 overall length × 0.01	−	ZM200	1.2 (kg)
(kg)		(m) × 0.06 (kg/m)		(m) × 0.04 (kg/m)		(m) × 0.03 (kg/m)		(m) × 0.01 (kg/m)		ZM250	1.8 (kg)

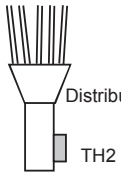
Maximum additional charge	ZM200	2.9 kg
	ZM250	2.4 kg

Additional charge amount for 70 meters	ZM200	1.6 kg
	ZM250	2.4 kg

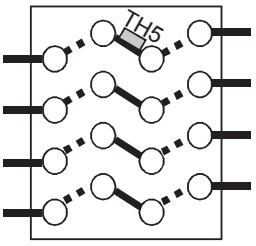
6.5 Thermistor position

< Target temp. thermistor (Locally supplied) >
Put thermistor where average supply or return air temperature can be detected.
Put thermistor where it does NOT pick up the temperature of DX coil.

< Liquid refrigerant pipe thermistor (TH2) >
Put thermistor where liquid refrigerant pipe temperature can be detected.
Protect the thermistor with heat insulating materials not to be affected by the ambient temperature, etc.
In case that the refrigerant is distributed by distributor, put thermistor before the distributor.



< 2-Phase temp. thermistor (TH5) >
Put thermistor where 2-Phase temperature can be detected on the DX coil pipe.
It should be located in the middle of inlet and outlet ports.
If there are some paths, locate it on the top of them.
Protect the thermistor with heat insulating materials not to be affected by the ambient temperature, etc.



< Target temp. thermistor (TH1) >
Put thermistor where average supply or return air temperature can be detected.
Put thermistor where it does NOT pick up the temperature of DX coil.

< Coil on temp. thermistor (TH11) >
Put thermistor where average air temperature of DX coil inlet can be detected.
Put thermistor where it does NOT pick up the temperature of DX coil.

7 Additional Requirements for using R32 Refrigerant

7.1 Important Notice (Fire safety)

R32 is flammable refrigerant, and the fire safety warranty for the whole system (including outdoor unit) must be done by your side. Conformity of regulations and laws must be confirmed on the system by your side.

As a reference, the following section 7.3 and 7.4 describe outlines of IEC 60335 2-40 (Edition 6.0). However, if you follow this standard, make sure to read the original IEC 60335. Also satisfying the following descriptions does NOT mean the guarantee of safety or the conformity with IEC 60335 2-40 (Edition 6.0).

7.2 Method to disable the compressor operation when using R32 refrigerant

If you need to disable the compressor operation as a measure to satisfy the fire safety (e.g. in the case of refrigerant leakage), take the following method.

- Input STEP 0 when the manual step mode is selected.
- Turn ON IN1 (Forced Comp. OFF) after changing the operation mode to cooling, when the auto step mode is selected.

7.3 Outline of Annex GG Requirements (regarding Charge limits and Ventilation) for AHU connection

Requirements depend on the installation space of AHU and the size of each room.

- All spaces where R32 refrigerant reaches when the refrigerant leaks, shall be considered.
- Regarding room size restriction, see the Annex GG.2.1.
- When the system does not satisfy GG.2.1, measures according to Clause GG.8 or GG.9 shall be provided.

7.4 Other requirements

- Requirements for marking (e.g. flame symbol) and information in the manual shall be satisfied.
- Requirements for constructions (e.g. location of the refrigerant detection sensor) shall be satisfied.

This product is designed and intended for use in the residential, commercial and light-industrial environment.

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BUILDING, 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

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