

Manual No.'19 • HM-T-339

updated October 11, 2021



TECHNICAL MANUAL

AIR TO WATER HEAT PUMP

**Q-ton Natural refrigerant CO₂ water heater
Space heating edition**

ESA30EH-25

MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD.

CONTENTS

● Compatibility	2
1. GENERAL DESCRIPTION	3
1.1 Mechanism of CO ₂ heat pump for space heating	3
1.2 CO ₂ heat pump for space heating: Operation chart	4
2. SPECIFICATIONS	7
2.1 Remote control	7
2.2 Heating performance characteristics	14
2.3 Control	18
2.4 Technical information of European regulations	21
3. APPLICATION DATA	24
3.1 Installation work for air to water heat pump water heater	24
(1) Before installation	24
(2) Installation location	25
(3) Carrying in and installation of unit	25
(4) Water piping work	25
(5) Insulation work and water proofing work unit	25
(6) Electrical wiring work for the heat pump unit	25
(7) Electrical wiring work for temperature control circuit	25
(8) Control setting	27
(9) Commissioning and handover	28
(10) Inspection report	28
(11) The behavior after power recovery	29
3.2 Setting and operation models for space heating and configuration of master-slave units	30
3.3 External input and output	32
4. Additional 7-segment display for space heating	33
5. Option part: Modbus interface	34

● Compatibility

Compatibility with previous models

This model has a heating function added to the previous models, and various functions have been added or changed.

Function		Overview	Model	Previous models				
			ESA30EH-25	ESA30E-25				
			Service code	/F	/C	/B	/A	/1
Space heating	Heating weekly timer	Weekly timer for heating operation	○	×	×	×	×	×
Water heating	Weekly timer with HW temperature setting		○	×	×	×	×	×
	Weekly timer		×	○	○	○	○	○
	User setting memory		○	×	×	×	×	×
	Anti-regionella control		○	○	×	×	×	×
General	Application setting	Usage setting function to accompany the added heating operation	○	×	×	×	×	×
	Priority setting	Priority setting of space heating and water heating function to accompany the added heating operation	○	×	×	×	×	×

Connectibility of remote control

Due to differences in communication specifications, the combination of remote control and heat pump unit is limited as shown in the table below.

Connectibility of remote control and heat pump unit

		Heat pump unit	
		ESA30EH-25	ESA30E-25
Remote control	RC-Q1EH	○	×
	RC-Q1E	×	○

1. GENERAL DESCRIPTION

1.1 Mechanism of CO₂ heat pump for space heating

In addition to a conventional hot water supply system, the application to a floor heater system and the combination of floor heater and hot water supply system was enabled in NEW MODEL (ESA30-EH).

In floor heating system, the temperature control circuit controls inlet/outlet temperature of the floor heating panel.

⑨ Mixing valve TCCV1 controls the flow rate of the heat pump unit by adjusting the bypass flow rate.

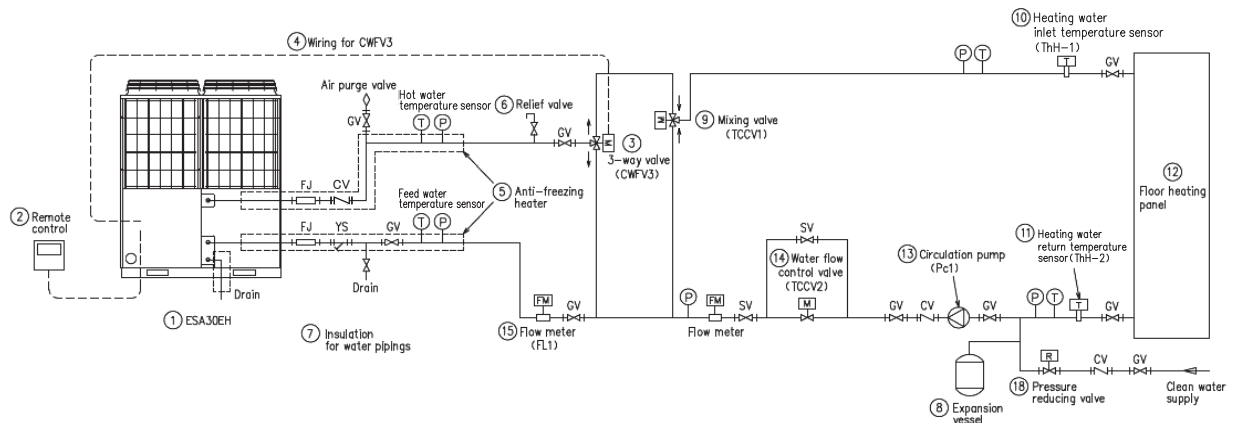
⑭ Water flow control valve TCCV2 adjusts the temperature difference between the inlet and outlet of the floor heating panel to be constant.

In combination system, heating with hot water supply at the same time is capable with ⑯ switching valve TCCV3.

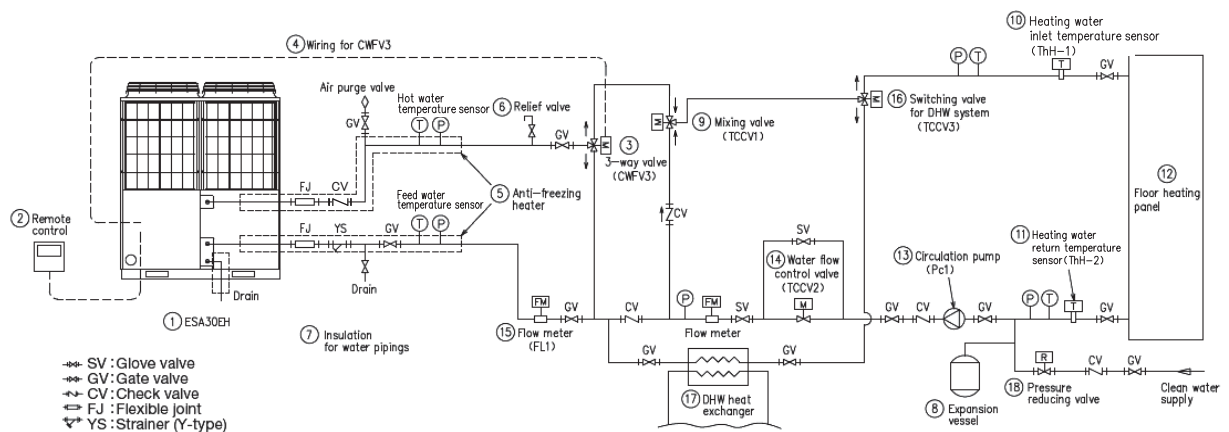
Addition, you can set the temperature setting and the priority of heating or hot water supply with simple operation of remote control.

Standard space heating system diagram

(1) For the purpose of space heating only



(2) For the purpose of combination system with space heating and DHW

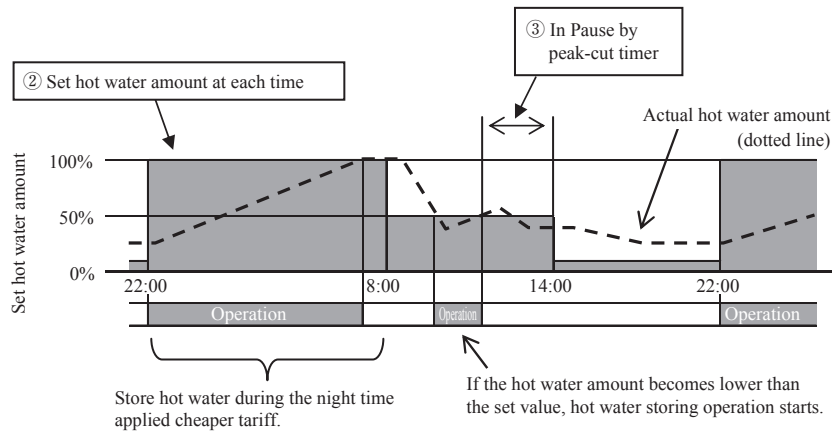


- ⇌ SV : Glove valve
- ⇌ GV : Gate valve
- ⇌ CV : Check valve
- ⇌ FJ : Flexible joint
- ⇌ YS : Strainer (Y-type)

1.2 CO₂ heat pump for space heating: Operation chart

(1) Operation pattern of CO₂ heat pump water heater (for hot water)

This heat pump water heater is operated with the target hot water amount set at each set time.
The typical operation pattern and setting items are explained with following figure.



Setting of hot water storage operation (Refer to the setting method in page 11.)

① Hot water temperature

Store hot water in the hot water storage unit at the hot water temperature set with remote control.

The heat reserving volume of the hot water storage unit can be increased or decreased by increasing or decreasing the hot water temperature.

If multiple heat pump units are connected to one remote control, it is available to set the hot water temperature individually.

② Hot water amount at each set time

Hot water amount can be set at each set time with remote control.

Set the hot water amount to meet the state of hot water usage.

③ Peak-cut timer

It is available to prohibit or save operation of the heat pump unit at the designated time.

The contract amount of power can be reduced by applying peak-cut operation of heat pump unit according to the power demand.

④ Hot water amount setting

The hot water amount at each set time can be increased or decreased uniformly on the day of a week basis.

In case that the usage amount of hot water may vary depending on the season or the day of a week, please use this function.

Ex. 1 In summer: More In winter: Less

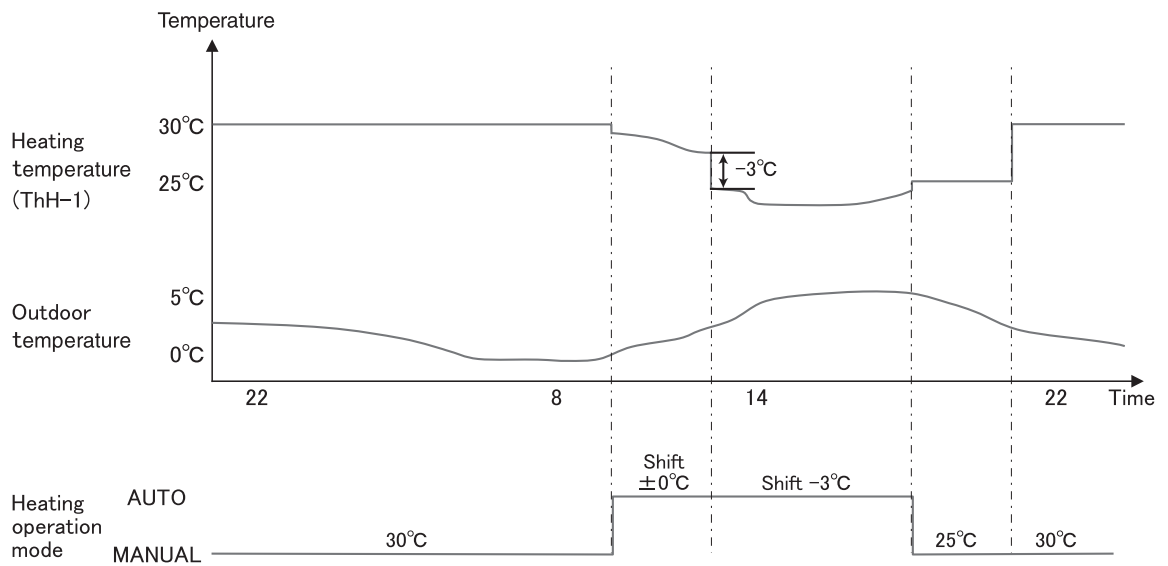
Ex. 2 From Monday to Thursday: Less Friday, Saturday: More Sunday: Normal

⑤ Setting [Pause]

If it is a day off and no hot water is required to store, it can make hot water storage operation prohibited.

(2) Operation pattern of CO₂ heat pump water heater (for heating)

This heat pump can be used as space heating system also. The typical operation pattern and setting items are explained with following figure.



Different heating mode is available.

① Mode AUTO

The heating set temperature changes automatically according to the outdoor temperature.

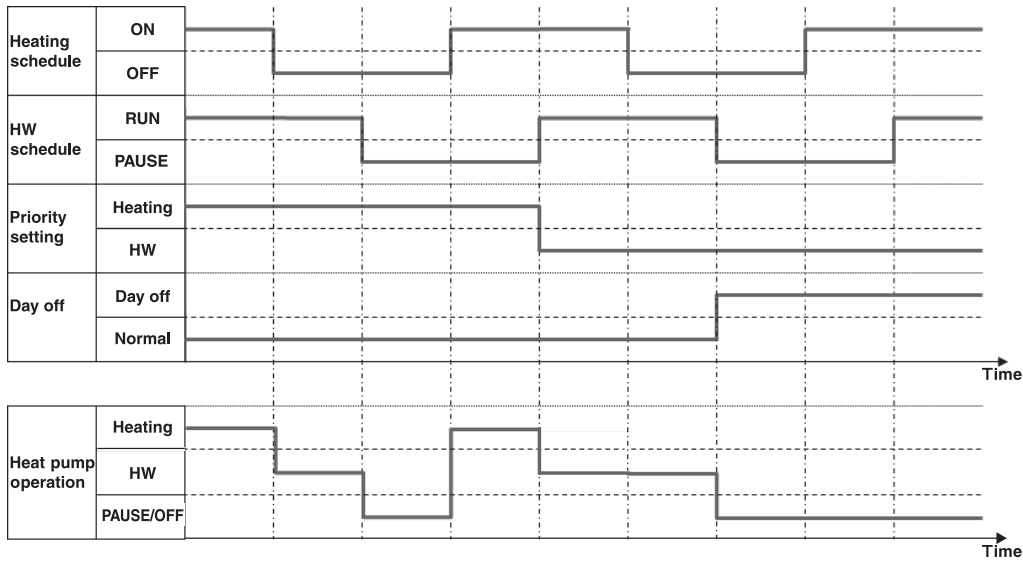
When the mode AUTO is selected, the shift temperature can be set.

② Mode MANUAL

The heating set temperature is directly set by user. It does not change with outdoor temperature.

(3) Operation pattern of CO₂ heat pump water heater (for combination use)

This heat pump can be connected to the space heating system and hot water storage tank at the same time. The typical operation pattern and setting are explained with following figure.



Setting in case of HW & heating application (Combination use)

① Priority setting (Please see user's manual for details.)

There are 2 schedules, 1 for Hot Water mode and 1 for Heating mode. When both Hot Water and Heating are required, the heat pump decides which operation mode is prioritized.

· HW priority

Every time, "HW operation" is prioritized over "Heating operation".

· Heating priority

Always the "Heating operation" is prioritized.

Notice:

Even if the Heating priority is set, there is a risk of water shortage, the heat pump unit could decide to move on the HW operation.

② Day off, Peak cut timer (Please see user's manual for details.)

For these setting, they are common for both HW operation and Heating operation.

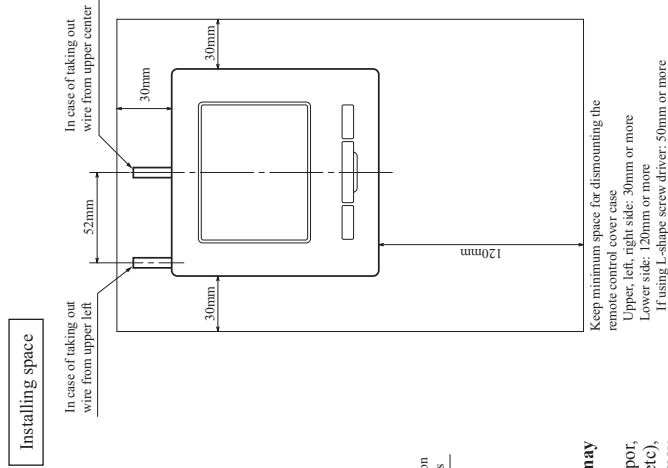
2. SPECIFICATIONS

2.1 Remote control

(1) Remote control for heat pump water heater (Model : RC-Q1EH)

NOTE: Please use ESA30EH together with the remote control “RC-Q1EH”.

(a) Outline dimensional drawing

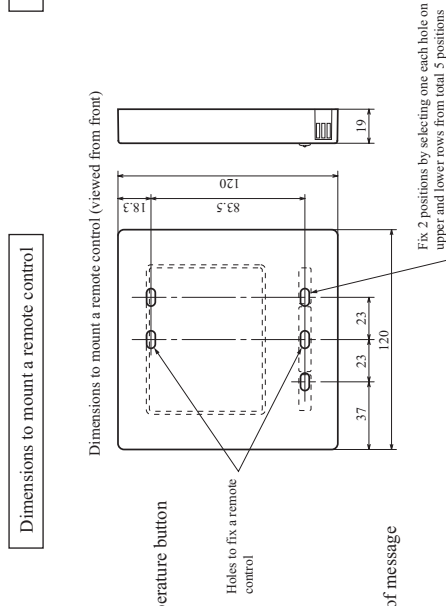


Electric wiring specifications

- (1) Remote control wire size: $0.3\text{mm}^2 \times 2$ cores shielding wire (MVVS) wire length: Available up to 600m

If the wire length exceeds 100m, be sure to change the size mentioned in following table. However the size passing through the inside of remote control should be 0.5mm^2 or smaller at the maximum and be changed to bigger size just after the wire coming out of remote control. When connecting wires, be sure to connect them securely without any contact failure and without getting moisture intruded.

Length (m)	Wire size shielding wire (MVVS)
100-within 200m	$0.5\text{mm}^2 \times 2$ cores
Within 300m	$0.75\text{mm}^2 \times 2$ cores
Within 400m	$1.25\text{mm}^2 \times 2$ cores
Within 600m	$2.0\text{mm}^2 \times 2$ cores



Installation of remote control

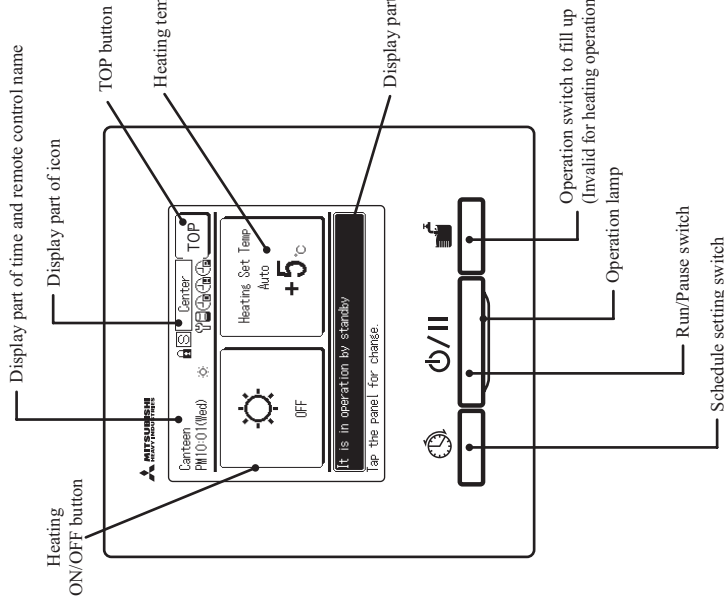
Please do not install a remote control at the place mentioned below. It may cause malfunction and deformation of remote control.

- (1) Do not install it at the special surrounding where inflammable gas may generate, intrude, retain or leak. If the remote control is used in the place where there are a lot of oil, vapor, organic solvent and corrosive gas (ammonia, sulfuric compound, acid and etc), or where acidic or alkaline liquid solution, or special spray, are used, it may cause electric shock, fire and failure due to remarkable decrease in performance and corrosion.

- (2) Do not install it in the place where much water vapor and/or dew condensation is generated. It may cause electric shock, fire and failure

- (3) If installing a remote control in the hospital and telecommunication service office, be sure to take measures against noise. Due to the influence of inverter devices, emergency generator, high harmonic medical equipment, wireless communication equipment and etc, it may cause malfunction and failure of the remote control. On the other hand, due to the influence from remote control to medical equipment and communication equipment, it may cause interference of medical action, interruption of broadcast and harmful effect by noise.

- (4) Do not install it on the place where it is exposed direct sunlight.
- (5) Do not install it near the equipment to generate heat.
- (6) Do not install it on the flat surface of wall.
- (7) Do not install it on the place where the surrounding temperature can increase to 40°C or higher or can decrease to 0°C or lower. It may cause discoloration, deformation, malfunction and failure.



In this figure, all information are displayed on the LCD at the same time for explanation, but, actually, only the necessary information is displayed at that time.

*As for the function of switches, buttons and displayed icons, please refer the user's manual of remote control RC-Q1EH for details.

(b) List of setting functions

Setting and display items		Detailed contents
1. Remote control network		
1	Multiple heat pump water heater control	Max. 16 sets of heat pump water heaters in one Superlink network can be connected to one remote control and controlled by it. Heat pump water heaters shall be set addresses.
2	Main or Sub remote control setting	2 remote controls can be connected to one remote control network. One of them is set "Main" and the other one is set "Sub".
2. TOP screen, switch operation		
1	Menu	Set the item of control, setting, confirm and etc. (See item 4 to 10)
2	Heating ON/OFF	Set the heating ON/OFF.
3	Heating temperature setting	Set the heating temperature.
4	Run/Pause switch	Start operation or pause operation
5	Schedule setting switch	Set schedule. See item 3 for details.
6	Switch for operation to fill up	Set the hot water amount 100% and start operation to top up . (Invalid in case of heating application)
3. Schedule settings		
1	Setting of weekly schedule	Set the operation pattern for one week. Set the valid/invalid of timer, ON/OFF of heating, time, heating setting temperature. ●It is available to set 8 operation patterns per day ●It is available to set time at 1 hour intervals. ●It is available to set all. (Week days/ Saturday & Sunday/All days)
2	Setting of day off	If day off is set, the operation of heat pump water heater to top up becomes invalid. ●It is available to set off day in every week ●It is available to set off day for specific period of time ●It is available to set off day on specific day.
3	Setting of peak cut	Reduce the power consumption by limiting the max. capacity. Set the start/end time of peak-cut and the peak-cut %. ●It is available to set peak-cut for whole week. ●It is available to set max 4 patterns per day ●It is available to set time at 5 minutes intervals ●It is available to select the peak-out % from 0, 40, 60, 80% ●It is available to set invalid. ●It is available to set all. (Week days/ Saturday & Sunday/All days)
4. Initial settings		
1	Clock setting	Set or correct the current date and time ●In case of power failure within 80 hours, the clock runs by the built-in battery for back-up.
2	Date and time display	On/Off, 12H/24H or display position of AM/PM can be set
3	Contrast	The contrast of LCD can be adjusted.
4	Backlight	On/Off and lighting time of backlight can be set.
5	Control sound	On/Off of beep sound at touch panel operation can be set

Setting and display items		Detailed contents
5. Administrator settings		Adminstrator password is required
1	Enable/Disable setting	<ul style="list-style-type: none"> ●Permission/prohibition setting of following operations can be set. [Run/Pause], [Operation to fill up], [Schedule setting] [Change set temp], [Change amount of top up]
2	Night tariff setting	In order to calculate the power consumption in day/night time, the time zone applied night tariff can be set.
3	HP unit selection	The heat pump water heater to be displayed on RC can be selected.
4	RC display setting	RC name and HP water heater name can be registered. On/Off of [Defrost operation display] and [Display status of HW amount] display can be set.
5	Step size of HW temperature	Step size of HW temperature (at 5°C or 1°C intervals) can be set. (Factory default is 5°C)
6	Change administrator password	Administrator password can be changed
7	User environment	By selecting the operation pattern of typical business type, the detailed operation pattern can be set easily.
6. Installation settings		Service password is required.
1	Installation date	If installation date is registered, next service date is displayed.
2	Company information	Contact company can be registered on the remote control. <ul style="list-style-type: none"> ●Name of contact company can be registered. ●Phone No. of contact company can be registered.
3	Test run	It is available to start test run.
	Primary setting of operation	It is available to start [Primary setting of operation].
	Water pump test run	It is available to start [Water pump test run].
7. RC function settings		Service password is required.
1	Main/Sub of RC	Main or Sub remote control setting can be done.
2	External input	When multiple heat pump water heaters are connected, the applicable range of water heaters of CnT input signal can be set.
3	Auto-restart	Control contents after recovering from power failure can be set.
8. Service & maintenance		Service password is required.
1	No. display of unit	Max. 16 sets of heat pump water heaters can be connected to a remote control. The connected heat pump water heaters can be checked.
2	Next service date	Next service date can be registered. On the service date, contact company is displayed on RC.
3	Error display	Up to 14 cases of error history (error code and date of occurrence) can be displayed.
4	Save HP unit setting	Setting contents of heat pump water heaters connected to the remote control can be saved in remote control as backup.
5	Special setting	[CPU reset] [Restore of default setting] [Touch panel calibration]
6	System OFF	All heat pump water heaters in one system can be stopped.
9. Contact company		Contact company and phone No. are displayed.
10. Check of RC setting		Current setting list of RC and HP water heater can be checked.

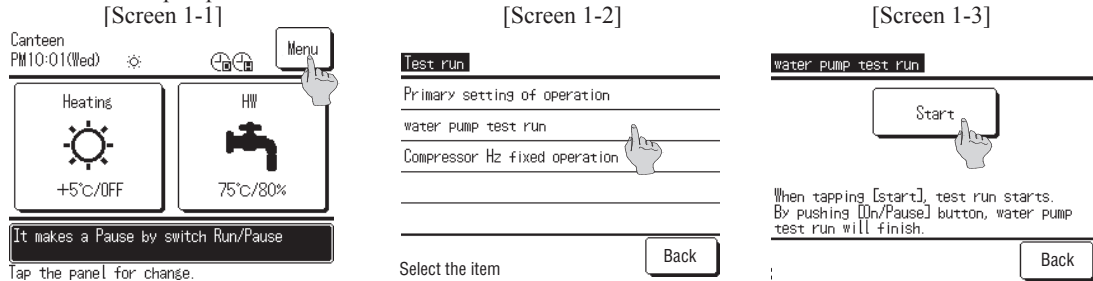
(c) Setting method of remote control for heat pump water heater

[At the initial use]

1) After the completion of installation, check that the feed water is surely supplied to the hot water supply system firstly and then turn the power ON.

After the completion of initial setting, TOP screen (Screen 1-1) is displayed on the remote control. *Operation mode is [Pause] [Menu]→[Installation setting]→[Input the service password (9999)]→[Test run (Screen 1-2)]→[Water pump test run (Screen 1-3)]
From this screen please start test run of water pump.

Complement: The test run of water pump can be started from the control of heat pump water heater as well. Refer to user’s manual for heat pump water heater for details.



[Caution 1]

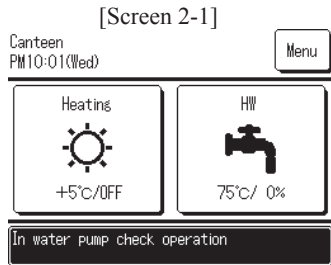
If starting operation by pushing [Run/Pause] switch before the end of water pump test run, the heat pump water heater may start the operation.

Since it may cause failure of heat pump water heater, **do not start operation until completion of water pump test run.**

2) When starting test run of water pump, the message of “In water pump check operation” is displayed on the TOP screen (Screen 2-1).

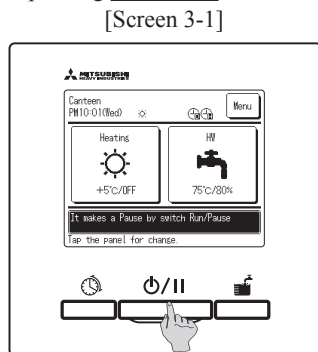
Purge air by operating test run of water pump.

Be sure to check the drain comes out by opening drain valve and air purge valve.



3) After completing test run of water pump, stop test run of water pump.

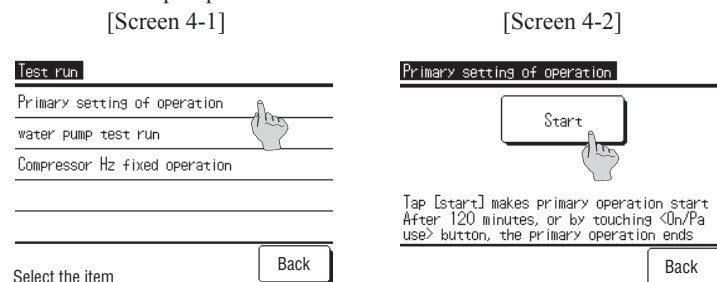
If pushing [Run/Pause] switch on the panel of remote control to stop operation, the water pump test run is stopped (Screen 3-1)



4) Start the “Primary setting of operation” of the heat pump water heater.

[Menu]→[Installation setting]→[Input the service password (9999)]→[Test run (Screen 4-1)]→[Primary setting of operation (Screen 4-2)]
According to these procedures, please start the primary setting of operation.

Complement: The primary setting of operation can be started from the control of heat pump water heater as well. Refer to user’s manual for heat pump water heater for details.



5) When starting the primary setting of operation, the message of “In Primary operation” is displayed on the TOP screen (Screen 5-1).

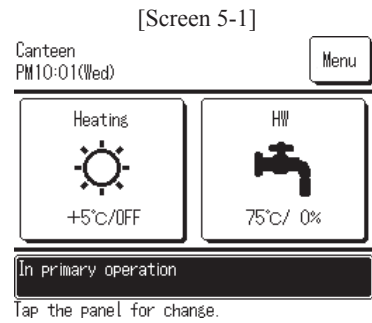
When completing the primary setting of operation, the heat pump water heater is stopped and the message of “In primary operation” is disappeared (Screen 1-1).

Be sure to check the drain comes out by opening drain valve and air purge valve.

[Caution 2]

Since the heat pump unit is paused after the end of this operation, the heat pump water heater does not start the operation.

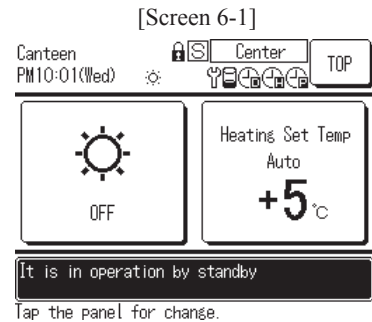
However, for anti-freezing of water in the pipe, water pump and compressor may start operation.



6) After completion of primary setting of operation, set the necessary items with the remote control and start operation of the heat pump water heater by pushing [Run/Pause] switch. (Screen 3-1)

When the heat pump water heater is operating as heating, the message of “It is in operation heating” is displayed on the TOP screen (Screen 6-1).

Complement: As for the setting method by remote control, please refer to the next item [Setting example] or user’s manual.



[Setting example]

[Setting method] and [Operation pattern of heat pump water heater] for following setting conditions are shown below.

- ① The heating temperature ThH-1 is 30°C.
- ② The heating temperature is set as Auto with shift temperature +5°C.
- ③ The heating operation is done from 8:00 to 17:00 for office use.
- ④ For combination use (HW & Heating), the heating operation is done between 8:00 to 17:00 and the operation to top up is done between 17:00 to 8:00.

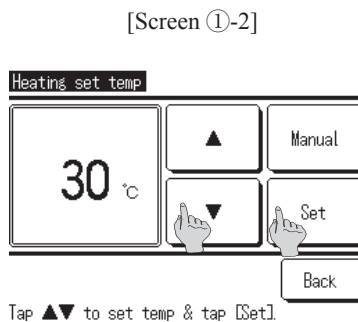
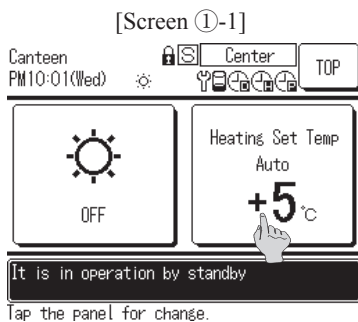
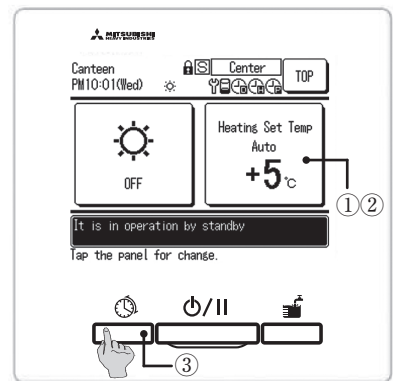
1) Setting method (* Please see user’s manual for details.)

The position of buttons and switches are shown in the right figure.

The above setting conditions ① to ③ can be set by pushing the buttons and switches shown in the right here.

a) Set the heating temperature ThH-1 at 30°C

- ① When tapping [Heating temperature setting] button on Heating TOP screen (Screen ①-1), the setting of heating temperature screen is displayed.
- ② Tap Auto/Manual button to display Manual on the button. Then set the heating setting temperature (ThH-1) by tapping ▲▼ buttons and tap [Set] button (Screen ①-2).

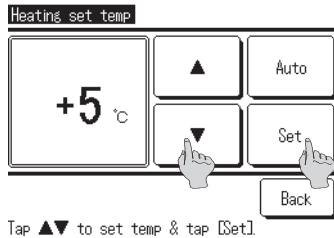


b) Set the shift temperature +5°C with heating mode “Auto”

- ① In case of heating mode “Auto”, the heating setting temperature (ThH-1) is determined by the outside air temperature. Set the shift temperature by tapping ▲▼ buttons and tap [Set] button (Screen ②-1).

Info: In case of heating mode “Auto”, the determination of heating setting temperature is following the commission regulation (EU) No.813/2013.

[Screen ②-1]



Tap ▲▼ to set temp & tap [Set].

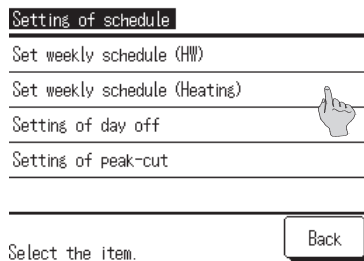
c) Set the time period for the heating operation with “Auto” mode

- ① When pushing [Schedule setting] switch, [Setting of schedule] menu screen is displayed. (Screen ③-1)
- ② When tapping [Setting of weekly schedule (Heating)], the [Weekly timer] screen is displayed. Tap [Week days] button (Screen ③-2). The screen for confirming the set contents is displayed (Screen ③-3).

<Complement> Select the day to be set from [Week days], [Sat, Sun], [All days] and [Each day] buttons.

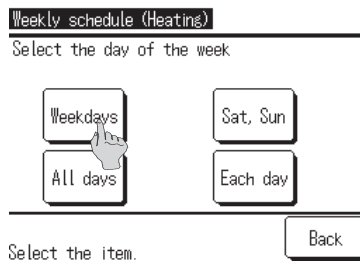
- [Week days] Set all days from Monday to Friday.
- [Sat, Sun] Set the days of Saturday and Sunday.
- [All days] Set all days from Monday to Sunday.
- [Each day] Set each day.

[Screen ③-1]



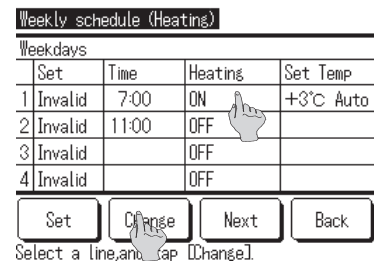
Select the item.

[Screen ③-2]



Select the item.

[Screen ③-3]

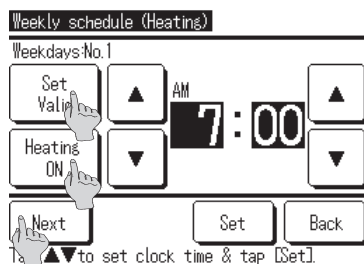


Select a line, and tap [Change].

- ③ Set the timer on the item 1 to start heating operation at 8:00. When tapping the line of item 1, this line is highlighted in reverse. Tap [Change] button.

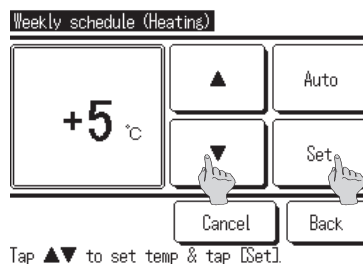
- ④ [Heating setting screen (Screen ③-4)] is displayed. Tap [Valid/Invalid] button to display “Valid”, and tap [ON/OFF] button to display ON. [Next] button appears, and tap [Next] button.

[Screen ③-4]



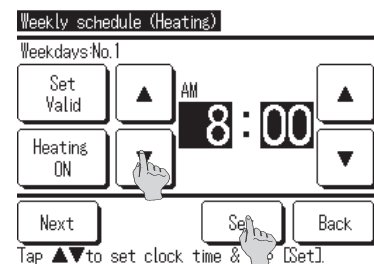
Tap ▲▼ to set clock time & tap [Set].

[Screen ③-5]



Tap ▲▼ to set temp & tap [Set].

[Screen ③-6]

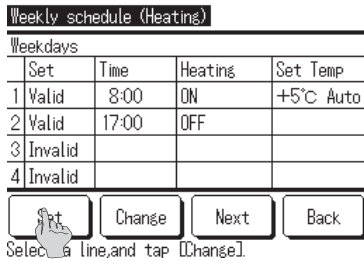


Tap ▲▼ to set clock time & tap [Set].

- ⑤ [Heating temperature setting screen (Screen ③-5)] is now displayed. Tap the **Auto/Manual** button to display “Auto” and tap **Set** button.
- ⑥ [Heating setting screen (Screen ③-6)] is again displayed. Set the time at 8:00 with **▲▼** button and tap **Set**.
- ⑦ In order to set OFF timer at 17:00, tap item 2 and change as ③,④ (With Set “Valid” and Heating “OFF”) and ⑥.
- ⑧ When these 2 timers are set (screen ③-7), tap **Set** button.

Since [the acknowledge screen (screen ③-8)] for confirming all contents is displayed, tap **Yes** to save all settings.

[Screen ③-7]



[Screen ③-8]



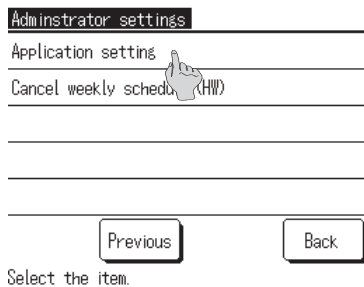
d) Set the heating operation “Auto” (+5°C) between 8:00 to 17:00, and the operation to top up (75°C) between 17:00 to 8:00.

- ① If the application is not “HW & Heating”, please set the application.

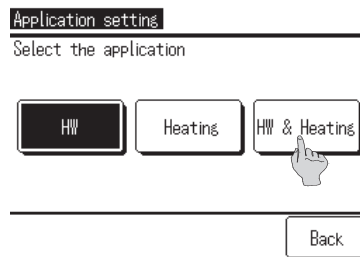
[Menu]→[Administrator setting (Screen ④-1)]→[Application setting (screen ④-2)]

Notice: Before setting application, tap Run/Pause switch and tap **Pause** button. If the unit is not in Pause, the application cannot be changed.

[Screen ④-1]



[Screen ④-2]

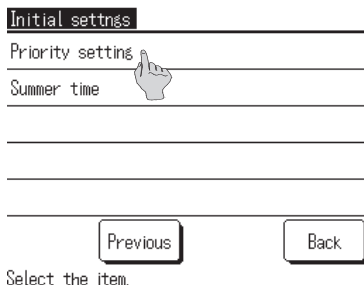


- ② Set the priority as “Heating”.

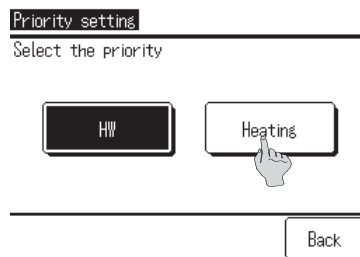
[Menu]→[Initial setting(Screen ④-3)]→[Priority setting(screen ④-4)]

Notice: When the priority is set as “Heating”, the heating operation takes precedence even if the target HW amount is not achieved.

[Screen ④-3]



[Screen ④-4]



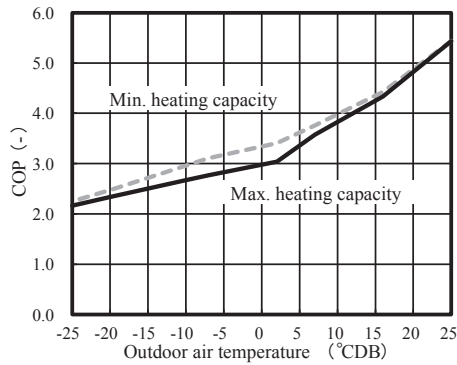
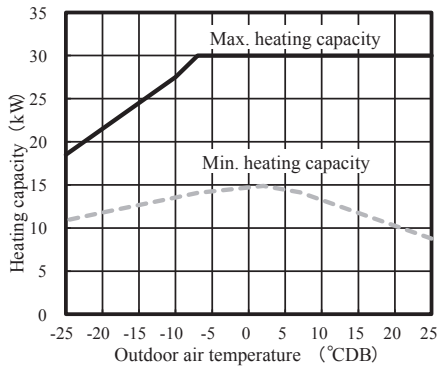
- ③ Set the heating schedule as c) above.

- ④ Set the HW schedule with HW amount 100% between 17:00 and 8:00, with HW target temperature 75°C. (For more detail, please see the user’s manual and technical manual for hot water.)

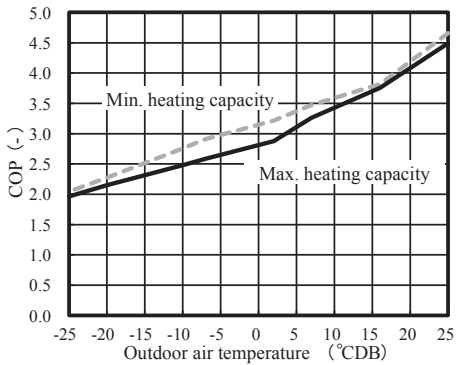
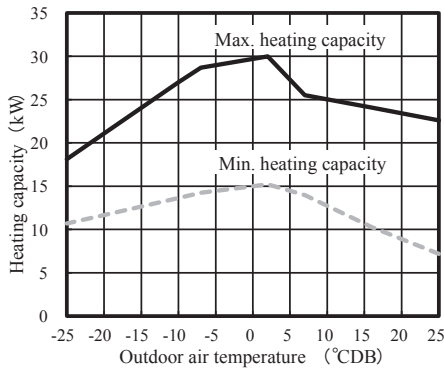
2.2 Heating performance characteristics

(1) $\Delta t=5$ degree

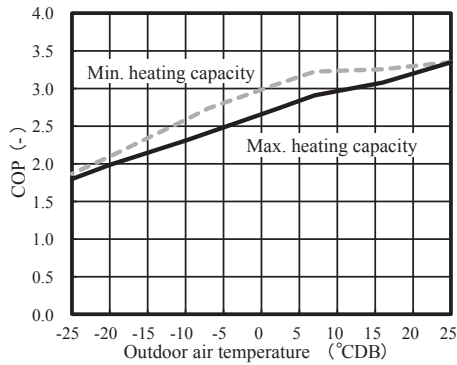
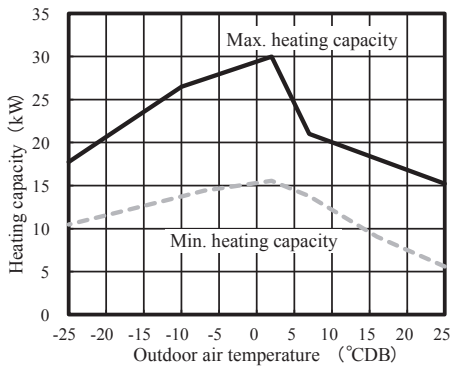
Q-ton inlet temperature 20°C / Inlet temperature of floor heating panel (RC setting) 25°C



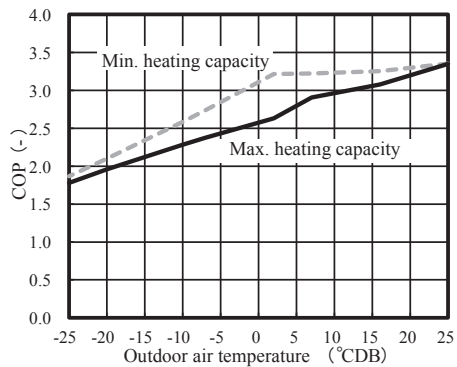
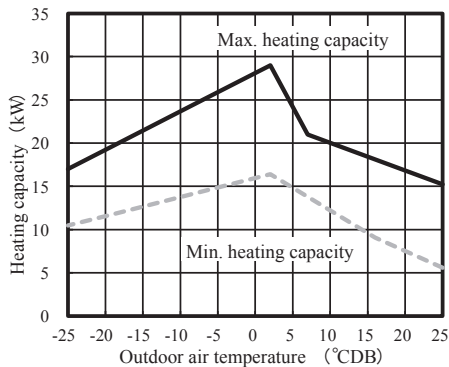
Q-ton inlet temperature 25°C / Inlet temperature of floor heating panel (RC setting) 30°C



Q-ton inlet temperature 30°C / Inlet temperature of floor heating panel (RC setting) 35°C

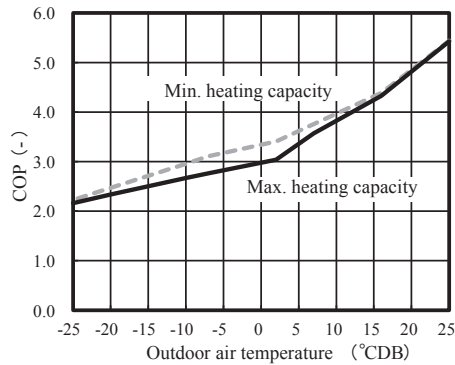
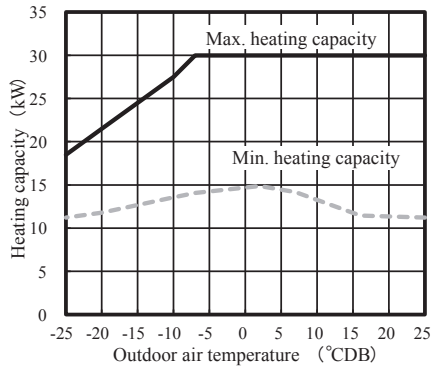


Q-ton inlet temperature 35°C / Inlet temperature of floor heating panel (RC setting) 40°C

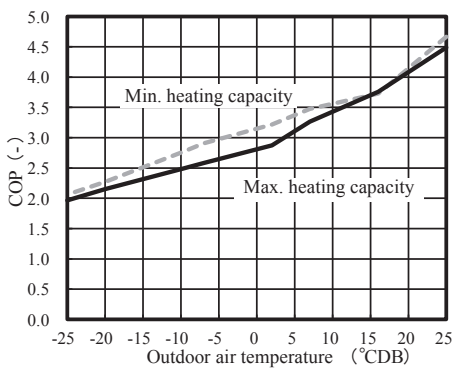
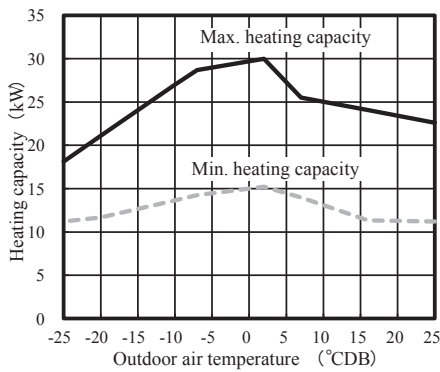


(2) $\Delta t=10$ degree

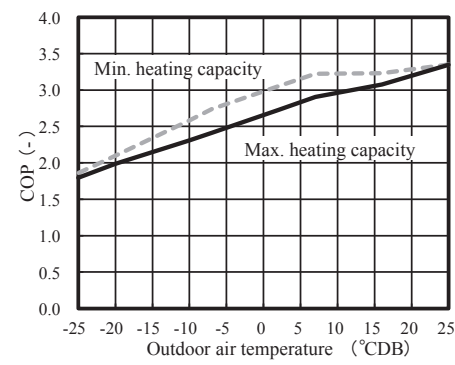
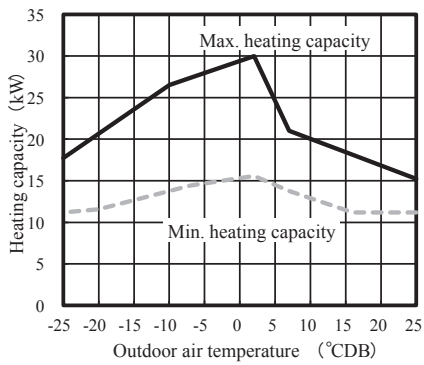
Q-ton inlet temperature 20°C / Inlet temperature of floor heating panel (RC setting) 30°C



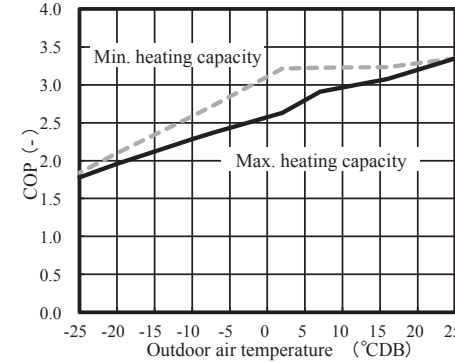
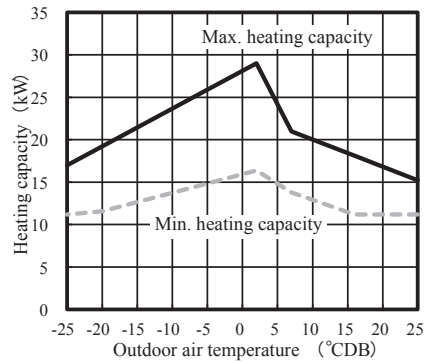
Q-ton inlet temperature 25°C / Inlet temperature of floor heating panel (RC setting) 35°C



Q-ton inlet temperature 30°C / Inlet temperature of floor heating panel (RC setting) 40°C

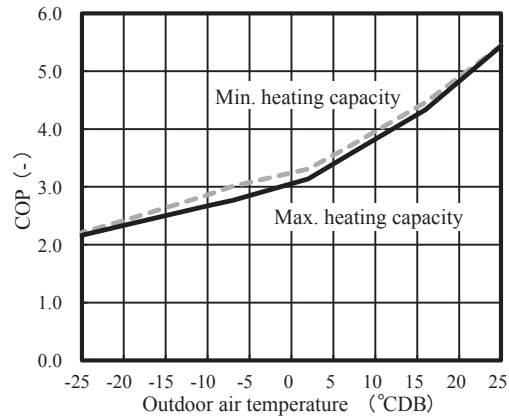
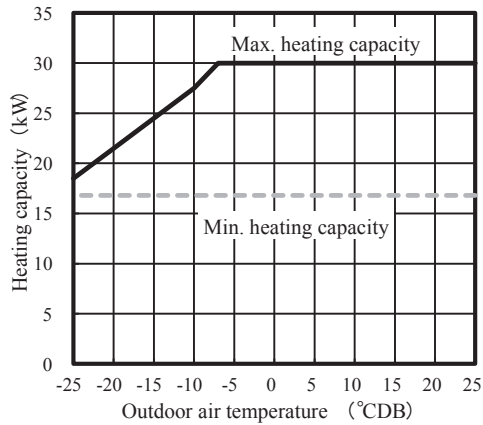


Q-ton inlet temperature 35°C / Inlet temperature of floor heating panel (RC setting) 45°C

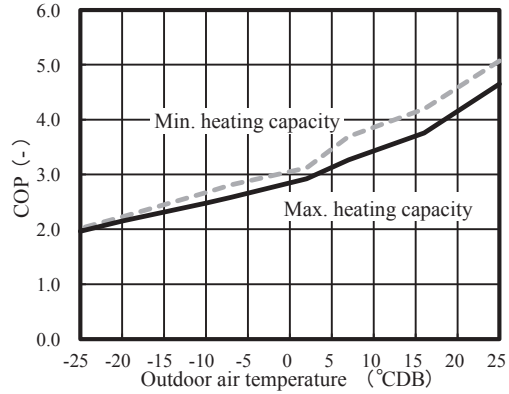
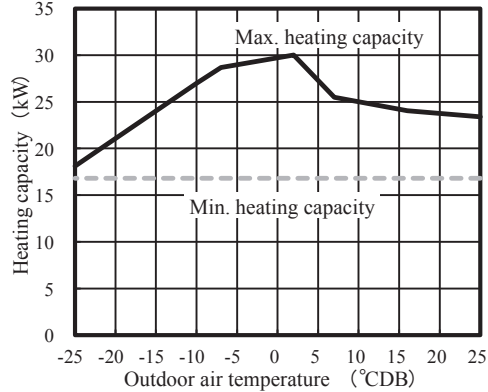


(3) $\Delta t=15$ degree

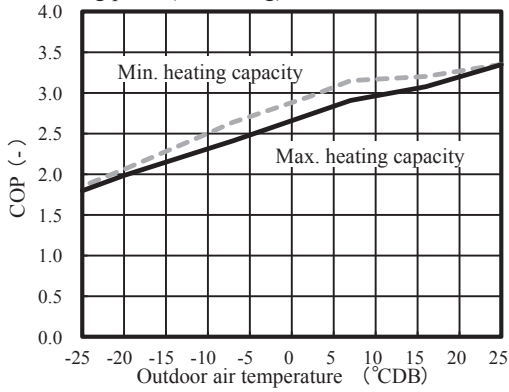
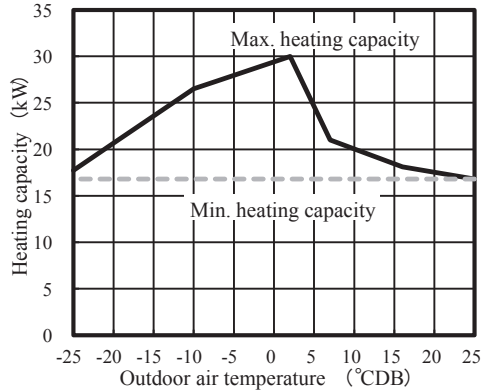
Q-ton inlet temperature 20°C / Inlet temperature of floor heating panel (RC setting) 35°C



Q-ton inlet temperature 25°C / Inlet temperature of floor heating panel (RC setting) 40°C



Q-ton inlet temperature 30°C / Inlet temperature of floor heating panel (RC setting) 45°C



* ΔT is differential temperature between inlet and outlet of floor heating panel.

Notes 1) The data in this table don't include the power consumption of anti-freezing heater (191W).

In case outdoor air temperature $\leq 3^\circ\text{C}$, please consider the power consumption of anti-freezing heater.

2) The performance decrement of defrost operation are considered in this figure.

But heating performance may change in the climate condition and the installation environment.

3) In case of floor heating panel inlet temperature $> 35^\circ\text{C}$, set the differential temperature between inlet and outlet temperature at 10°C or more to ensure heating capacity. Set with 7-segment P08 in software setting.

Please see 3.1 (8) for more detail of software setting.

Maximum heating capacity at $\Delta t=5$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 25°C	25	30.0	5.5	5.43
	16	30.0	6.9	4.33
	7	30.0	8.4	3.57
	2	30.0	9.9	3.04
	-7	30.0	10.8	2.77
	-10	27.5	10.3	2.67
	-20	21.5	9.2	2.34
25°C / 30°C	-25	18.5	8.6	2.16
	25	22.6	5.0	4.49
	16	24.1	6.4	3.76
	7	25.5	7.8	3.26
	2	30.0	10.4	2.88
	-7	28.7	11.1	2.58
	-10	27.0	10.9	2.48
30°C / 35°C	-20	21.1	9.8	2.15
	-25	18.1	9.2	1.97
	25	15.2	4.5	3.35
	16	18.1	5.9	3.08
	7	21.0	7.2	2.91
	2	30.0	11.0	2.73
	-7	27.4	11.4	2.41
35°C / 40°C	-10	26.5	11.5	2.31
	-20	20.7	10.4	1.99
	-25	17.7	9.9	1.80
	25	15.2	4.5	3.35
	16	18.1	5.9	3.08
	7	21.0	7.2	2.91
	2	29.0	11.0	2.63

Minimum heating capacity at $\Delta t=5$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 25°C	25	8.8	1.6	5.44
	16	11.5	2.6	4.43
	7	14.2	3.8	3.76
	2	14.9	4.4	3.41
	-7	14.1	4.5	3.11
	-10	13.5	4.6	2.96
	-20	11.8	4.8	2.47
	-25	10.9	4.9	2.25
	25°C / 30°C	25	7.2	1.5
16		10.3	2.7	3.82
7		14.0	4.0	3.47
2		15.2	4.7	3.22
-7		14.2	4.9	2.91
-10		13.7	5.0	2.76
-20		11.7	5.1	2.27
-25		10.7	5.2	2.04
30°C / 35°C		25	5.6	1.7
	16	9.1	2.8	3.25
	7	13.8	4.3	3.22
	2	15.6	5.1	3.05
	-7	14.4	5.3	2.74
	-10	13.8	5.3	2.58
	-20	11.6	5.5	2.10
	-25	10.5	5.6	1.87
	35°C / 40°C	25	5.6	1.7
16		9.1	2.8	3.25
7		13.8	4.3	3.22
2		16.4	5.1	3.22
-7		14.4	5.3	2.74
-10		13.8	5.3	2.58
-20		11.6	5.5	2.10
-25		10.5	5.6	1.87

Maximum heating capacity at $\Delta t=10$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 30°C	25	30.0	5.5	5.43
	16	30.0	6.9	4.33
	7	30.0	8.4	3.57
	2	30.0	9.9	3.04
	-7	30.0	10.8	2.77
	-10	27.5	10.3	2.67
	-20	21.5	9.2	2.34
	-25	18.5	8.6	2.16
25°C / 35°C	25	22.6	5.0	4.49
	16	24.1	6.4	3.76
	7	25.5	7.8	3.26
	2	30.0	10.4	2.88
	-7	28.7	11.1	2.58
	-10	27.0	10.9	2.48
	-20	21.1	9.8	2.15
	-25	18.1	9.2	1.97
30°C / 40°C	25	15.2	4.5	3.35
	16	18.1	5.9	3.08
	7	21.0	7.2	2.91
	2	30.0	11.0	2.73
	-7	27.4	11.4	2.41
	-10	26.5	11.5	2.31
	-20	20.7	10.4	1.99
	-25	17.7	9.9	1.80
35°C / 45°C	25	15.2	4.5	3.35
	16	18.1	5.9	3.08
	7	21.0	7.2	2.91
	2	29.0	11.0	2.63
	-7	25.0	10.5	2.37
	-10	23.7	10.4	2.28
	-20	19.2	9.8	1.96
	-25	17.0	9.6	1.78

Minimum heating capacity at $\Delta t=10$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 30°C	25	11.2	2.1	5.44
	16	11.5	2.6	4.39
	7	14.2	3.8	3.76
	2	14.9	4.4	3.41
	-7	14.1	4.5	3.11
	-10	13.5	4.6	2.96
	-20	11.8	4.8	2.47
	-25	11.2	4.9	2.23
	25°C / 35°C	25	11.2	2.4
16		11.3	3.0	3.73
7		14.0	4.0	3.47
2		15.2	4.7	3.22
-7		14.2	4.9	2.91
-10		13.7	5.0	2.76
-20		11.7	5.1	2.27
-25		11.2	5.4	2.06
30°C / 40°C		25	11.2	3.3
	16	11.2	3.5	3.23
	7	13.8	4.3	3.22
	2	15.6	5.1	3.05
	-7	14.4	5.3	2.74
	-10	13.8	5.3	2.58
	-20	11.6	5.5	2.10
	-25	11.2	6.0	1.86
	35°C / 45°C	25	11.2	3.3
16		11.2	3.5	3.23
7		13.8	4.3	3.22
2		16.4	5.1	3.22
-7		14.4	5.3	2.74
-10		13.8	5.3	2.58
-20		11.6	5.5	2.10
-25		11.2	6.1	1.84

Maximum heating capacity at $\Delta t=15$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 35°C	25	30.0	5.5	5.43
	16	30.0	6.9	4.33
	7	30.0	8.4	3.57
	2	30.0	9.6	3.14
	-7	30.0	10.8	2.77
	-10	27.5	10.3	2.67
	-20	21.5	9.2	2.34
	-25	18.5	8.6	2.16
25°C / 40°C	25	23.4	5.0	4.65
	16	24.1	6.4	3.76
	7	25.5	7.8	3.26
	2	30.0	10.3	2.92
	-7	28.7	11.1	2.58
	-10	27.0	10.9	2.48
	-20	21.1	9.8	2.15
	-25	18.1	9.2	1.97
30°C / 45°C	25	16.8	4.5	3.35
	16	18.1	5.9	3.08
	7	21.0	7.2	2.91
	2	30.0	11.0	2.73
	-7	27.4	11.4	2.41
	-10	26.5	11.5	2.31
	-20	20.7	10.4	1.99
	-25	17.7	9.9	1.80

Minimum heating capacity at $\Delta t=15$ degree

Q-ton inlet temperature / Inlet temperature of floor heating panel (RC setting)	Outdoor air temperature °C	Heating capacity kW	Power consumption kW	COP
20°C / 35°C	25	16.8	1.6	5.44
	16	16.8	3.8	4.46
	7	16.8	3.8	3.71
	2	16.8	5.1	3.31
	-7	16.8	5.6	3.01
	-10	16.8	5.9	2.86
	-20	16.8	6.9	2.42
	-25	16.8	7.6	2.21
	25°C / 40°C	25	16.8	3.3
16		16.8	4.0	4.19
7		16.8	4.6	3.69
2		16.8	5.4	3.12
-7		16.8	6.0	2.81
-10		16.8	6.3	2.67
-20		16.8	7.5	2.23
-25		16.8	8.3	2.01
30°C / 45°C		25	16.8	5.0
	16	16.8	5.2	3.20
	7	16.8	5.3	3.15
	2	16.8	5.7	2.95
	-7	16.8	6.4	2.64
	-10	16.8	6.7	2.50
	-20	16.8	8.2	2.06
	-25	16.8	9.1	1.85

2.3 Control

(1) Functional components for refrigerant cycle

For functional components other than those listed below, please see the **TECHNICAL MANUAL for DHW system**.

	Symbol	Name of component	Function	Details
1	CM1	Inverter scrotary compressor	The compressor speed is controlled to maintain nominal heating capacity according to the outdoor air temperature, return water temperature and heating temperature set by remote control. Control range of compressor speed: 42-104rps The target speed of compressor can be checked with Mente PC.	-
3	EEVG1	Electronic expansion valve for gas cooler	EEVG1 is used for discharge pipe temperature control. The target temperature of discharge pipe is decided by outdoor air temperature, return water inlet temperature and heating temperature set by remote control. Control range of target discharge pipe temperature: 77-125°C The target discharge pipe temperature can be checked with Mente PC.	-

(2) Functional components for water cycle

Please see the **TECHNICAL MANUAL for DHW system**.

(3) Control of refrigerant piping system

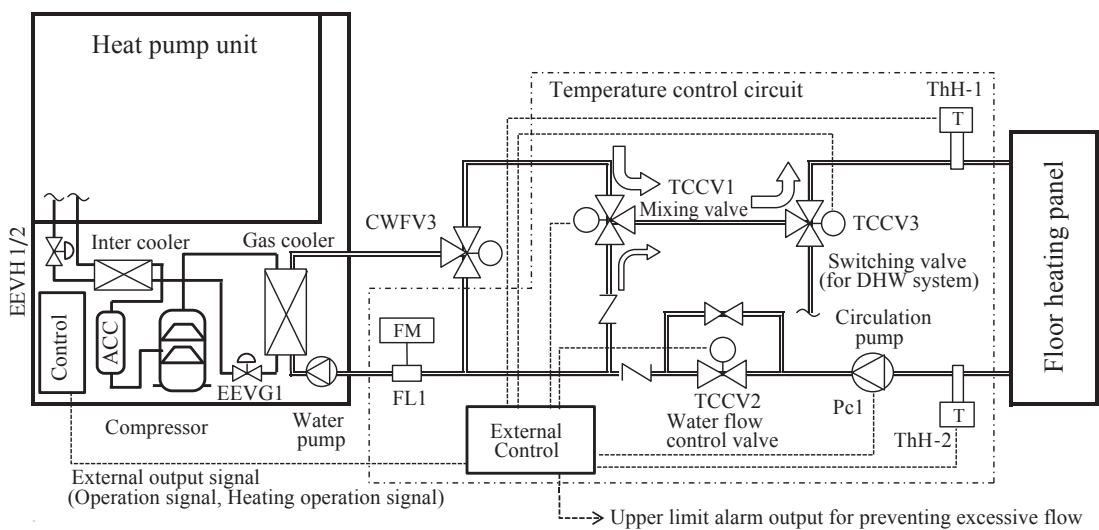
Control of refrigerant piping system is same as DHW operation. Please see the **TECHNICAL MANUAL for DHW system**.

(4) Water circuit system control

For water circuit system control in DHW operation (water heater operation), please see the **TECHNICAL MANUAL for DHW system**.

(4)-1 Water circuit system control at heating operation

In heating mode, water pump in heat pump unit run at constant speed. Water flow volume and inlet temperature at floor heating panel are controlled by the temperature control circuit.



(4)-2 Water flow volume control

Water flow volume is controlled at a constant flow rate by the mixing valve (TCCV1), and flow meter (FL1) in temperature control circuit. When the water flow volume increases, the mixing valve is adjusted to increase the water flow volume to be recirculated. If the water flow volume decreases, reduce the water flow volume recycled.

Be sure to provide an excessive flow alarm output for the external control. Do not continue using the floor heating system with the alarm.

(4)-3 Temperature control

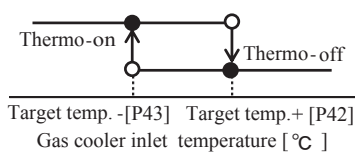
Temperature difference between inlet and outlet water to floor heating panel is controlled at a constant by the flow regulating valve (TCCV2) and temperature sensor ThH-1 and ThH-2.

When the water flow volume increases, the mixing valve is adjusted to increase the water flow volume to be recirculated.

If the water flow volume decreases, reduce the water flow volume recycled.

(4)-4 Thermo off control

When the gas cooler inlet temperature becomes higher than the specified temperature, the heat pump unit is thermo-off as shown below. The compressor stops while thermo-off.



Target temp. = The target inlet temperature of the heating panel - [P08]
 [P08] : Differential temperature between inlet/outlet of heating panel

[P42], [P43] : Differential temperature set by software switch setting.
 (default: 0.5°C)

(4)-5 Operation priority in case of Combination system (DHW and space heating)

The priority of hot water operation and heating operation is decided by setting in remote control as follows.

- When the priority setting of the remote control is "HW".
 (Priority: High) Fill up > Anti-legionella > Top up > Keep warm > **Heating** > Night defrost > Anti-freeze (Priority: Low)
- When the priority setting of the remote control is "Heating".
 (Priority: High) Fill up > Anti-legionella > **Heating** > Top up > Keep warm > Night defrost > Anti-freeze (Priority: Low)

Even the priority setting is "Heating", top up is operated if the HW amount is below the lower limit HW amount set by software setting [P07].

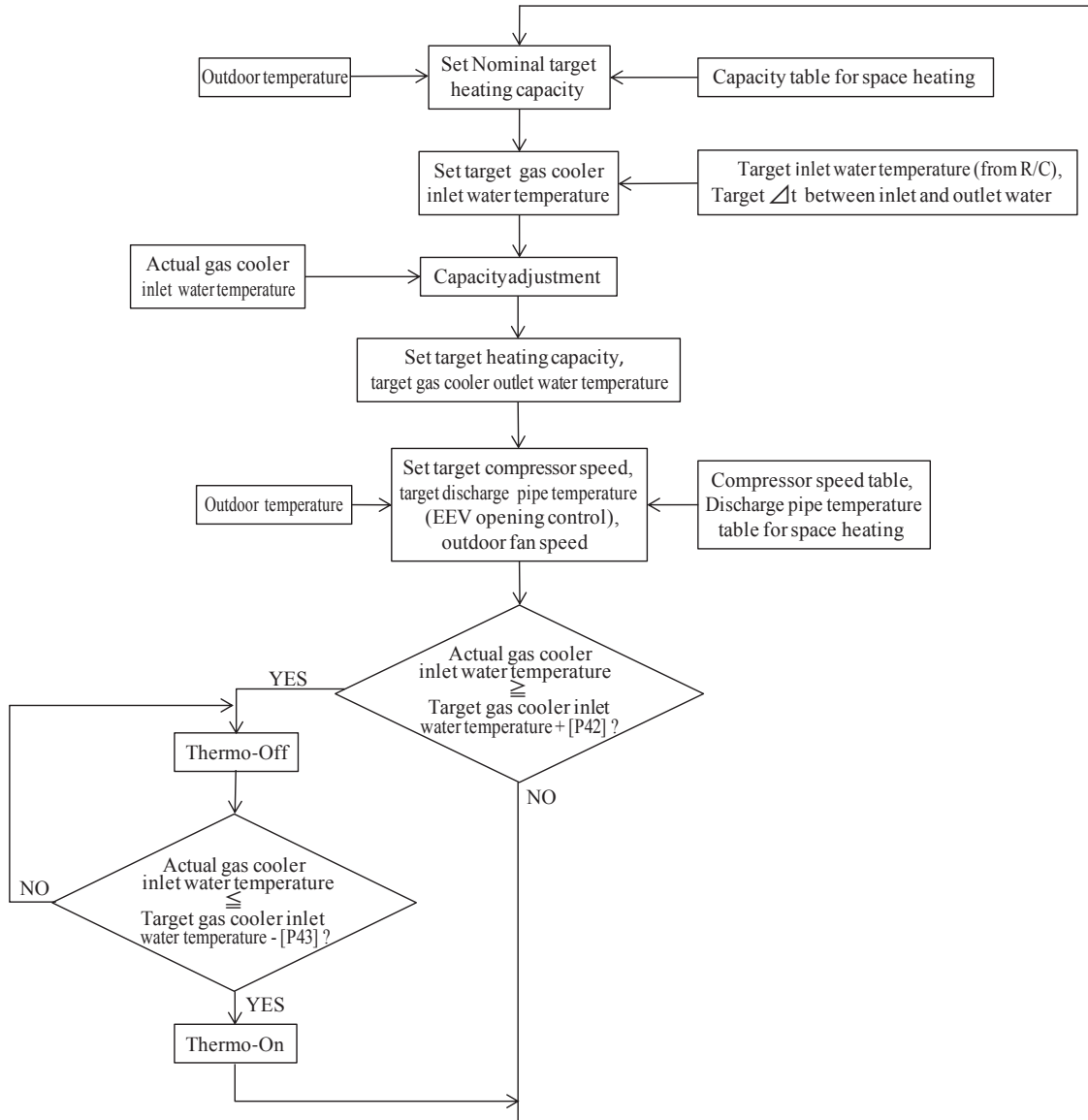
(4)-6 External output signal

External output terminal CnZ1 and CnZ2 can be assigned "Heating operation output". Set value "15" of software setting and connect to the external control. For details, see 3.1(7)7-2.

Address of 7-segment LED is below

- CnZ1 : [P23] (Factory default "0": Operation output)
- CnZ2 : [P24] (Factory default "1": Error output)

(4)-7 Outline of heating operation



2.4 Technical information of European regulations

(1) Lot1

(a) Summary

This document is intended to clarify that the water heater manufactured by us is adapted to European ErP (Ecodesign requirements for energy-related Products) directive Lot1 (space heater and combination heater) and Lot2 (water heater and water storage tanks).

These units are electric mains-operated heat pump combination heaters with a rated heating capacity of 30kW and less and are assessed on the basis of the above-mentioned directive.

(b) Applied Directives and Standard

DIRECTIVE

“DIRECTIVE 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products”

“DIRECTIVE 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products”

REGULATION

“COMMISSION DELEGATED REGULATION (EU) No.811/2013 of 18 February 2013 ” supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of spec heater, temperature control and solar device and packages of combination heater, temperature control and solar device

“COMMISSION DELEGATED REGULATION (EU) No. 813/2013 of 2 August 2013”

Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters

(c) Target Model

Heat Pump Combination Heater	ESA30EH-25
Hot Water Storage Tank	GXM-R-500 × 2 or GX-1000-RB

(d) Specification of the apparatus

1) The name and address of the supplier

Manufacture's name and address
MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD. 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, 100-8332, Japan http://www.mhi-mth.co.jp
Branch name and address
MITSUBISHI HEAVY INDUSTRIES AIR-CONDITIONING EUROPE, LTD. 5 The Square, Stockley Park, Uxbridge, Middlesex, UB11 1ET, UK Tel : +44-333-207-4072 Fax : +44-333-207-4089 http://www.mhiae.com

2) Heating energy efficiency

Model name	ESA30EH-25	
Water heater load profile	XXL	
Seasonal space heating energy efficiency class	A ⁺	
Water heating energy efficiency class	A	
Rated heat output	Average	27kW
	Warmer	30kW
	Colder	19kW
Annual energy consumption for space heating	Average	14822kWh
	Warmer	9199kWh
	Colder	15499kWh
Annual energy consumption for water heating	Average	1909kWh
	Warmer	1683kWh
	Colder	3467kWh
Seasonal space heating energy efficiency	Average	146%
	Warmer	174%
	Colder	127%
Water heating energy efficiency	Average	114%
	Warmer	130%
	Colder	63%
Off peak operation	Correspond	
Sound power level	77 dB(A)	

Storage tank

Lapesa Grupo Empresarial, S. L	
Model name	GXM-R-500×2 or GX-1000-RB
Energy efficiency class	C
Standing loss	100W×2 or 125 W
Storage volume	500L×2 or 1000 L

PCM011B021

(e) Technical Information

1) Function

Manufacturer's specification for intended use;

The appliance is with an outdoor unit and indoor unit. The outdoor unit is an air/water heat pumps including electrical-ly driven compressor. The indoor unit is a domestic hot water storage tank and floor heating panel.

2) Technical data of water heater

Model name	ESA30EH-25
Rated voltage (V)	3N~, 380 / 400 / 415
Rated frequency (Hz)	50 / 60
Rated heating capacity (kW)	30
Net weight (kg)	375
Refrigerant	R744 (CO ₂)
Mass of refrigerant (kg)	8.5

Sound power level	Criteria	Judgement
77	≤78	○

※The sound power level is measured under heating conditions at outdoor air temperature 7°CDB/6°CWB, and water inlet temperature 30°C.

3. APPLICATION DATA

PCM012D022

3.1 Installation work for air to water heat pump water heater

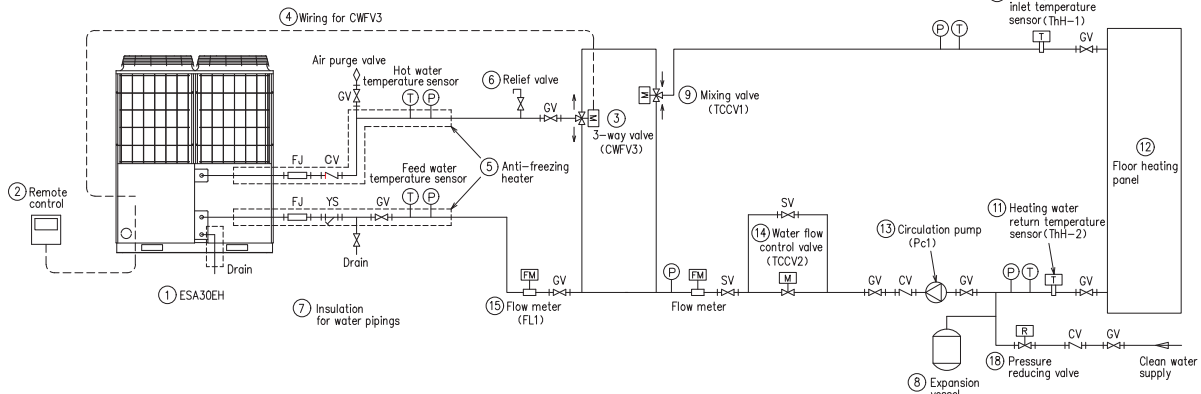
- ⊙ This instruction shows for the installation work of the space heating system with Q-ton.
- ⊙ Please read this manual carefully to install the space heating system before starting the installation work.
- ⊙ About general part of the installation procedure, please also read "INSTALLATION MANUAL for DHW system".
- ⊙ Safety precautions are described in "INSTALLATION MANUAL for DHW system", so be sure to read them.

(1) Before installation

Check the model, electrical specifications, piping, necessary option parts and etc, and install properly.

1-1 Standard space heating system diagram

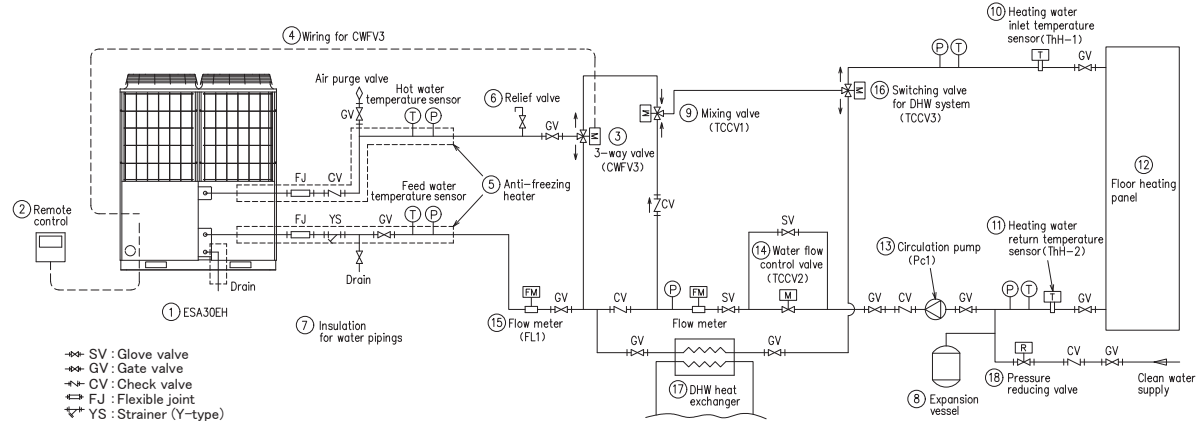
(1) For the purpose of space heating only



CAUTION

- Read this manual before starting installation work and proceed installation work properly according to this manual.
- For the piping work, option parts are required, please refer to the catalog and etc for this unit.
- Be sure to install the earth leakage breaker. (It should be impulse withstanding type.)
- If you run the unit by keeping without the discharge pipe temperature sensor, the suction pipe temperature sensor and the pressure sensors, there is a high risk for the compressor be broken. Be sure to avoid such operation.

(2) For the purpose of combination system with space heating and DHW



1-2 Component list of space heating system

Part name	Model	General description
① Heat pump unit	ESA30EH-25	For outdoor temperature -25°C.
② Remote control for heat pump water heater (Option part)	RC-Q1EH	For setting hot water temperature.
③ 3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit. (wiring length 0.7m, AC200V, 50mA) IP56 (Indoor specifications)
④ Wiring kit for CWFV3 (Option part)	MTH-Q6E (20m length wire) or MTH-Q7E (10m length wire)	For connecting heat pump. (Connect to the 3-way valve, CWFV3, switching to anti-freezing circuit and control it).

Locally procured parts

Part name	Model	General description
⑤ Anti-freezing water heater	—	When outdoor air temperature becomes below 0°C, be sure to install the trace heating on the water pipe. (10W/m)
⑥ Relief valve	—	For preventing from increasing pressure in the system during heating up the water. (Working pressure: 450±30kPa or lower.)
⑦ Insulation	—	Heat resistance ≥ 120°C (30mm or thicker glass wool whose density is 48kg/m³)
⑧ Expansion vessel	—	—
⑨ Mixing valve, TCCV1	—	For adjusting the flow rate. (Electric proportional valve, Piping size:40A, Input signal:4-20mA, Driving torque:12Nm)
⑩ Heating water inlet temperature sensor	—	Termocouple:Type K
⑪ Heating water return temperature sensor	—	Termocouple:Type K
⑫ Floor heating panel	—	—
⑬ Circulation pump, Pc1	—	For circulating hot water of space heating system. Flow rate:5160L/h or more Head:More than pressure loss between floor heating panel and TCCV1
⑭ Water flow control valve, TCCV2	—	For adjusting the inlet/outlet temperature difference constant. (Piping size:40A, Input signal:4-20mA, Motor:Synchronous, Rated torque: 7Nm, Opening/Closing time: 17/14s [50/60Hz])
⑮ Flow meter, FL1	—	For adjusting the return flow rate to the heat pump constant. (Piping size:20A, measurable up to 20L/min)
⑯ Switching valve, TCCV3	—	For switching between space heating and DHW. This is only used for the combination system with space heating and DHW. (Power source:AC 220-240V, Piping size:40A, Rated torque:1.9Nm, Opening/Closing time: 6/5s [50/60Hz])
⑰ DHW heat exchanger	—	For the combination system with space heating and DHW.
⑱ Pressure reducing valve	—	Setting pressure ≤ 400kPa. Connecting pipe size ≥ 32A. (If the feed water pressure exceeds 400kPa, be sure to mount it.)
- TIC1, TIC2	Fuji Electric: PXF4-2 ※	For adjusting the flow rate by controlling the opening of ⑨ TCCV1 to keep the inlet/outlet temp. difference of ⑫ floor heating panel constant.
- TIC3	Fuji Electric: PXH9 ※	For adjusting the opening of ⑭ TCCV2 to keep the amount of water that returns to the heat pump unit constant.

※Recommended model

(2) Installation location

See the installation manual for hot water supply.

(3) Carrying in and installation of unit

See the installation manual for hot water supply.

(4) Water piping work

4-1 General description

See the installation manual for hot water supply.

4-2 Water piping work

- When doing piping work of the space heating, be sure not to interfere the service space of the heat pump unit. Regarding the service space, please refer to (2).

4-2.1 Limitation of piping length between the heat pump unit and temperature control circuit and indirected heat exchanger for DHW system

Be sure to install the heat pump unit and temperature control circuit and indirected heat exchanger for DHW system in the shortest piping length from the view point of saving energy. Piping length and height difference shall be within a following range.

Limitation of piping length

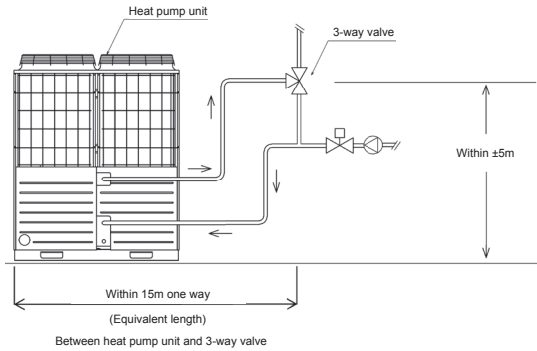
- Piping length: Within 15m one way (equivalent length for pipe size 20A)
- Height difference: Within ±5m
 - When the heat pump unit is installed below the unvented cylinder and the height difference exceeds 2m, be sure to install relief valve (setting pressure: 400kPa) in the vicinity of the inlet port of the heat pump unit.

4-2.2 Pressure loss of the pipe and joint

See the installation manual for hot water supply.

4-3 System diagram

See the installation manual for hot water supply.



(5) Insulation work and water proofing work unit

See the installation manual for hot water supply.

(6) Electrical wiring work for the heat pump unit

See the installation manual for hot water supply.

(7) Electrical wiring work for temperature control circuit

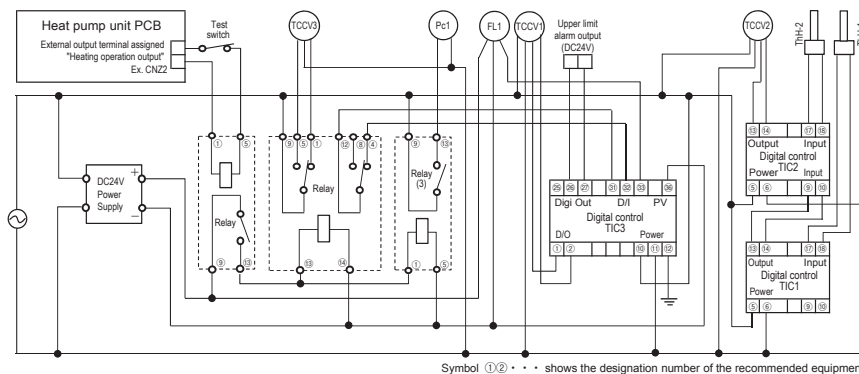
In this chapter, only the connection method for space heating system is described. About wire connecting method for hot water supply system, please see the installation manual for hot water supply.

- In the area where the outdoor air temperature becomes below 0°C, it is necessary to apply the anti-freeze pipe heater on the water pipe in which water may freeze. Please prepare the exclusive power source for the anti-freeze pipe heater.
 - * As a guide, the anti-freeze pipe heater output is 10W per 1m of piping length (In case of enough insulation thickness) After checking the specifications of heater, please select the breaker size and wire size.
- Electrical instruction work must be performed by an electrical service provider qualified by a power provider of the country.
- Electrical installation work must be executed according to the technical standard and other regulations applicable to electrical installation in the countries.
- ⚠ Please install an earth leakage breaker without fail.** The installation of an earth leakage breaker is compulsory in order to prevent electric shocks or fire accidents. (Please use an impulse withstanding type one to prevent an earth leakage breaker's false activation.)

Please note

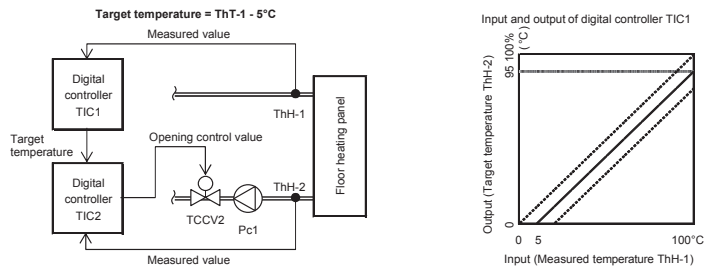
- Use only copper wires. Do not use any supply cord other than the one specified in parenthesis for each type of cord mention below.
 - Braided cord (Cord designation 60245 IEC 51), if allowed in the relevant part 2.
 - Ordinary tough rubber sheathed cord (Cord designation 60245 IEC 53)
 - Flat twin tinsel cord (Cord designation 60227 IEC 41)
 - Ordinary polyvinyl chloride sheathed cord (Cord designation 60227 IEC 53)
 Please do not use any cord other than polychloroprene sheathed flexible cord (Cord designation 60245 IEC 57) for heat pump unit use.
- A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.
- Be sure to do grounding work. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod or telephone grounding wire. Improper grounding may cause electric shocks or malfunction. Never connect the grounding wire to a gas pipe, because, if gas leaks, it could cause explosion or ignition.
- The installation of an impulse withstanding type earth leakage breaker is necessary.** A fail to install an earth leakage breaker may cause electric shocks or fire accident. Do not turn on the power until the electrical work is completed.
- Please do not use a phase advance capacitor for power factor improvement under any circumstances. (It does not improve power factor, while it can cause an anomalous overheat accident.)
- For power cables, be sure to use conduits
- Please **do not lay electronic control wires (signal wire) and other high current cables together.** Laying them together may cause malfunction or failure due to affection of electric noise.
- Power cables and signal wires must always be connected to the terminal blocks respectively and secured them with cable fastening clamps provided in the unit.
- Clamp cables so that they may not touch the pipe, etc.
- When cables are connected, please make sure to check no loose connection or disconnection at connecting coupling of all electrical components in the control box and then attach the cover to control box securely. (Improper cover attachment can result in malfunction or a failure of the unit, if water penetrates into the control box)
- Make sure to use circuit breakers (earth leakage breaker and circuit breaker) of proper capacity. Use of breakers with larger capacity may result in trouble on components or fire accident. The circuit breaker should isolate all poles under over current.
- Install an isolator or a cut-off switch on the power line in accordance with the local codes and regulations. The isolator shall be locked to keep the power line in OFF state in conformity with EN60204-1.
- After maintenance service, be sure to restore all wiring, bundling wire and wiring route to their original state in order for them not to touch to the metal parts.

7-1 Wiring work



7-2 Setting procedure of digital controller TIC1 and TIC2

Digital controller TIC1 and TIC2 adjust the flow rate by controlling the opening of the motor valve (TCCV2) to keep the temperature difference of the floor heating panel between the inlet (ThT-1) and outlet (ThT-2) constant.



Setting parameter of digital controller TIC1 and TIC2 in case of using recommended equipment.

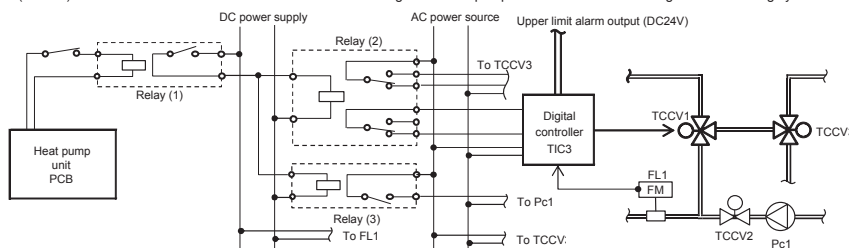
No.	Parameter	Display	Digital controller TIC1 value	Digital controller TIC2 value	Remarks
SV			5	(Remote)	Differential temperature of inlet and outlet of floor heating panel. Setting range: 5°C ~ 15°C. Set to the temperature set by 7-segment P08 in software.
Operation control parameter					
3		REM	LoCL(*)	REM	Switching between local SV and remote SV operation.
58		REV	no--	rv--	Normal/reverse options
59		SVL	5	0(*)	Lower limit of SV
60		SVH	20	100(*)	Upper limit of SV
63		PLC1	-5.0(*)	10	Lower limit setting of output
67		PCUt	0(*)	1	Setting of output limiter
Ch1 PID (control parameter)					
50		P	100	40	Proportional band
51		I	0	50	Integral time
52		D	0	0	Derivative time
Ch6 SET (setup parameters)					
530		PVt	K1(*)	K1(*)	Setting of input: K type thermocouple
531		PVb	0.0(*)	0.0(*)	Lower limit setting of range
532		PVf	100.0	100.0	Upper limit setting of range
538		IF	5.0(*)	5.0(*)	Input filter constant

(*)default

7-3 Setting procedure of digital controller TIC3

The controller TIC3 adjusts the opening of the mixing valve (TCCV1) to keep the amount of water returned to the heat pump unit constant. It also receives the heating operation output signal from the heat pump unit and starts and stops the circulation pump (Pc1).

In the case of DHW combination system, it switches the switching valve (TCCV3) by the heating operation output signal. The upper limit alarm output (DC24V) from TIC3 is used for alarm of excessive flow returning to the heat pump unit. Do not continue using the floor heating system with the alarm.



Setting parameter of digital controller TIC3 in case of using recommended equipment.

Channel	Item	Number	Parameter	Setting	Remark
SV				16	Q-ton flow rate (16L/min)
1	Operation Parameter	16	AL3	17	Upper limit (17L/min)
2	Control Parameter	1	P1	50	Proportional band
		2	i1	30	Integral time
		3	d1	2.0	Derivative time
8	I/O Definition	1	Pv1F	50	Full-scale of input
		2	Pv1B	0	Base-scale of input
		4	Pv1T	26	Input type
		12	P1TF	5	Input filter constant
9	System definition	42	di04	1	1:Standby
		53-56	d01-d04	*	* Default setting
A	Alarm setting	9	A	1	1:Upper limit (abs.)

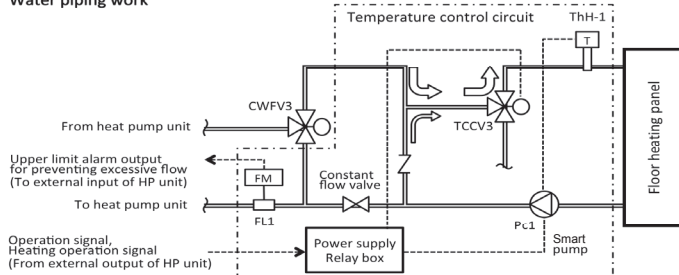
Remark
A constant flow valve can be used instead of the flow meter (FL1) and Mixing valve (TCCV1). In this case, please install the constant flow valve at the position of the flow meter and replace the mixing valve with a cheese joint.

Note
The flow meter and mixing valve or constant flow valve are important parts for the heat pump unit to control the capacity and temperature. Excessive flow rate not only prevents proper control of capacity and temperature, but also may cause the deterioration of product lifetime.

7-4 In case of using a variable speed pump for Pc1 (circulation pump)

The use of a variable speed pump for the circulation pump is an easy and efficient way to construct temperature control circuits. In addition, by using a smart pump with temperature control, digital controller TIC1 and TIC2 can be omitted. An example of the temperature control circuit using a smart pump is shown below.

Water piping work

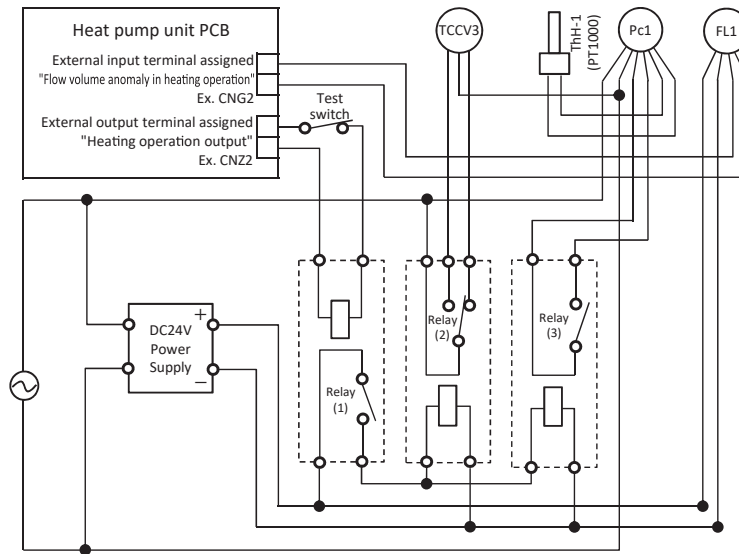


Recommend parts specification

Smart pump	
Manufacturer	Wilo
Model	Stratos MAXO series
Mains connection	1~230 V ±10%, 50/60 Hz
Insulation class	F
Protection class	IPX4D
Constant flow valve	
Manufacturer	CALEFFI
Model	FLOWMATIC © (PICV) 145 series

* The recommended pump "Wilo stratos MAXO series" requires PT1000 for the temperature sensor ThH-1.

Electrical wiring work



Be sure to use a flow meter with upper limit flow volume alarm and connect to the external input of heat pump unit. Recommended pump requires PT1000 for the temperature sensor ThH-1.

Setting of pump

		Item	Setting
Set auto control	Settings assistant	Application	Heating
		System type	Basic control modes
		Control mode	Constant temperature differential (ΔT -const)
	Setpoints	Temperature (ΔT -c)	5°C*
	Options	-	-
External interfaces	Function control input (DI1)	External OFF	
	Function Analog input (AI1)	PT1000	

* Set to the temperature set by 7-segment P08 in software setting.

Wiring connectin of pump

Item	Assignment	Terminal	Remark
External input (Heating operation)	DI 1	31,33	Digital input for potential-free contact
External input (Temperature ThH-1)	AI 1	12,13	PT1000

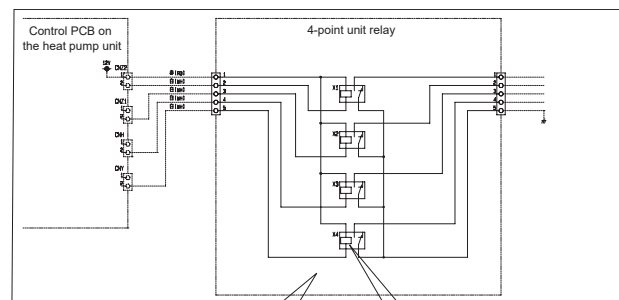
(8) Control setting

In this chapter, only the controller setting for space heating system is described. About general setting, please see the "INSTALLATION MANUAL for DHW system".

(1) Software setting

About setting procedure of 7-segment display, please see the "INSTALLATION MANUAL for DHW system" 8-(4).

Code No.	Data display		Minimum unit	Remark
	Contents	Display range		
P01	No. tank water temperature sensor	9:(Factory default) 0 - 9	1 piece	Heating only : 0 Combination : actual number
P07	Lower limit of hot water strage	10:(Factory default) 0 - 100	5%	Stop heating operation if hot water strage is lower than this value. *For heating dedicated usage, P07 should be set as "0".
P08	Differential temperature between ThH-1 and ThH-2	5:(Factory default) 0 - 15	1°C	
P09	Differential temperature between ThX-1 and ThX-2	0:(Factory default) 0 - 15	1°C	
P23	Function assignment of CNZ1	0:(Factory default) 0 - 20	1	Either CNZ1 or CNZ2 must be assigned to (16) heating operation output. See 7-2 for detail.
P24	Function assignment of CNZ2	1:(Factory default) 0 - 20	1	



Example of use

4-point unit relay (Ex. Omron G6D-F4B)

Coil resistance 720Ω or more

Note:
If external input/output is used, please use relay board to break off from the original circuit. If not, it may not work properly due to the occurrence of sneak current.

(9) Commissioning and handover

- (1) Before test run
- (a) Be sure to check whether **1MΩ or bigger of insulation resistance can be detected by measuring with 500V meggar tester between power terminal and grounding.**
 - (b) Before turning the power on, if the resistance between A and B of signal wiring terminal is **100Ω or lower**, the power cables may be connected to the signal wiring terminal. Be sure to check resistance of signal wiring terminal.
 - (c) Be sure to **turn the power on 6 hours before starting operation in order to supply power to the crankcase heater.**
 - (d) Be sure to check **the bottom of the compressor becomes warm.** (Outdoor air temperature + 5°C or higher)
- (2) Test run
- (a) Test run procedure
- In case of the operation for the first time, [Water pump test run], [Primary setting of operation] and [Valve open/close check operation] are required. Please proceed test operation according to following procedure.**
- 1) After completion of installation work, be sure to check water is fed to the hot water supply system and then turn the power on.
 - 2) Start water pump test run and purge air from the hot water supply system.
 - [In case of space heating system]
 - Set application setting of remote control to "Heating" at first (refer to installation manual of remote control)
 - Set P07 on 7-segment display as "0".
 - Water pump test run can be done from the menu of remote control.
 - Menu→Installation setting→Service password (9999)→Test run→Water pump test run
 - * Water pump will start several 10 seconds later. Be sure to check well drainage by opening the drain valve.
 - [In case of combination system]
 - Change application setting from "Combination" to "DHW".
 - Menu→Installation setting→Service password (9999)→Application setting→DHW
 - Water pump test run can be done from the menu of remote control. (same as in case of space heating)
 - 3) After completion of water pump test run, please proceed primary setting operation of heat pump unit.
 - [In case of space heating system]
 - Primary setting operation can be done from the menu of remote control.
 - Menu→Installation setting→Service password (9999)→Test run→Primary setting of operation
 - * Primary setting operation will start several minutes later. During primary setting operation, the message of "In Primary operation" is displayed on the TOP screen of remote control.

- [In case of combination system]
 Change application setting from "DHW" to "Heating".
 Primary setting operation can be done from the menu of remote control. (same as in case of space heating)
 After completion of primary setting operation, please change application setting from "Heating" to "Combination".
- 4) After completion of primary setting operation, please proceed to start test run by pushing Run/Pause switch.
 When starting operation, the message of "It is in operation to top up" is displayed on the TOP screen of remote control.
 Please check operation status of heat pump unit by MentePC and check whether the each function is actuated normally.
 - 5) After completion of test run, be sure to clean up the strainer.
 After cleaning the strainer, check no leak from hot water supply system and then purge air again.

Complement
Water pump test run and primary setting operation can be done by switching ON the DIP switch (SW5-2) on the control PCB of heat pump unit.

CAUTION
Before completion of water pump test run, anti-freezing operation does not start in spite of pausing. Therefore if there is a risk to freeze water in the piping or if keeping the system without operating for long term, be sure to drain off the water from the hot water supply system.

- (b) Contents of primary setting operation
- In order to decide the opening of flow regulator appropriate to the external pump head, the following operations are done.
- 1) In order to decide the initial opening of flow regulator (CWFV1), it is operated by changing the hot water outlet temperature automatically.
 In this case, it may be operated with different temperature from the hot water temperature set by remote control.
 - 2) Primary setting operation will end within 60 minutes ordinarily.

(10) Inspection report

The check list below is specific to space heating system and combination system.

(1) Project information

Project name	Heat pump unit		Checker	Hot water strage tank		Date	Remarks
Unit No.	Model name	Serial No.	Model Name	Serial No.			
①							
②							
③							

(2) Check list for installation

○:OK △:shall be revised —:No item

Check items	Standard	Checked result			Remark
		①	②	③	
Installation work					
In case of combination use, is the indirect heat exchanger installed between the heat pump and the HW strage unit ?	Check technical manual (System diagram)				
Are there enough service spaces for the temperature control circuit and circuration pump secured ?	Check technical manual (Installation space)				
Water piping work					
Is the expansion vessel installed ?	Check technical manual (System diagram)				
Electric work					
Are two output signal connectors of CNZ1 or CNZ2 assigned as Heating operation output and connected with control of temperature control circuit following installation manual ?	Check technical manual (System diagram)				

(3) Check list for commissioning

○:OK △:shall be revised —:No item

Check items	Standard	Checked result			Remark
		①	②	③	
Before start commissioning					
Is the initial setting of remote control set as "Heating" or "Combination" ?	Heating system only : "Heating" Combination system : "Combination"				See the installation manual of remote control
Is the setting of P08 on PCB of heat pump unit set as the correct temperature designed for floor heating panel ?	Refer the technical manual of floor heating panel (can adjust 3-10°C)				Initial setting : 5°C*
In case of combination use, is the setting of P09 on PCB of heat pump unit set as the correct temperature designed for indirect heat exchanger ?	Adjust to designed temperature. (can adjust 3-10°C)				Initial setting : 0°C*
Temperature control circuit					
Does the flow rate at FL1 conform with the set value?	Same as set temperature				Initial setting : 16 L/min*
Does the circuration pump (Pc1) start and stop in conjunction with the heating operation?	Check operation				
Floor heater panel					
Does the ThH-1 temperature conform with the set temp by remote control ?	Same as set temperature				
Does the differential temperature between ThH-1 and ThH-2 conform with the set temperature by software setting of P08 ?	Same as set temperature				
Indirect heat exchanger (in case of combination system)					
Does the differential temperature between ThH-1 and ThH-2 conform with the set temperature by software setting of P08 ?	Same as set temperature				
Does the circuration pump (Pc2) start and stop in conjunction with the tapping operation?	Check operation				

ThH-1 : Inlet temperature of floor heating panel
 ThH-2 : Outlet temperature of floor heating panel
 ThX-1 : Inlet temperature of indirect heat exchanger (heat pump side)
 ThX-2 : Outlet temperature of indirect heat exchanger (HW strage unit side)

* See the "INSTALLATION MANUAL for DHW system" 8-(4) for detail.

Operation data of the heat pump unit (Should attach Mente PC data)

[Date of acquisition :]

Measured items	Unit	Measured result		
		①	②	③
Water circuit				
Hot water outlet temperature	°C			
Inlet temp of floor heating panel	°C			
Heating temperature set with remote control	°C			
Differential temperature between inlet and outlet temperature of floor heating panel	°C			
Differential temperature set with software setting of P08	°C			
Refrigerant circuit				
High pressure	MPa			
Intermediate pressure	MPa			
Low pressure	MPa			
Compressor speed	rps			
Operating current	A			
Discharge pipe temperature	°C			
Suction pipe temperature	°C			
Under-dome temperature	°C			
Suction superheat	°C			
Outdoor fan				
Outdoor air temperature	°C			
Outdoor fan speed	min ⁻¹			

In case of DHW operation in combination system, please use table of "INSTALLATION MANUAL of DHW system".

(11) The behavior after power recovery

- * The behavior after power reset (earth leakage breaker turns ON) is same as the behavior after power recovery.
- * The behavior after CPU reset, and Initializing is described as well.

Behavior	Case	Power failure backup function (*1)	Period of power failure	Remote control display (After the end of control after power recovery)	Behavior	Date and time (†2)	HW temperature setting	Target HW amount setting	Setting of off day	Peak cut time setting	Run/Pause(*3)	
After power recovery (After power ON)	A	Valid (Factory default)	< 80Hr	<p>Top screen is displayed</p> <p>This image is when the application setting is "Combination".</p>	<p>The unit is recovered as same status as before power failure.</p> <p>① If in operation before power failure It is in [Run] mode after power recovery and if the current HW amount is less than the set amount, the heat pump water heater starts operation to top up. * If the day of power recovery is off day, it is recovered in [Pause] mode and when it becomes working day, it starts operation.</p> <p>② If it is in [Pause] before power failure It is in [Pause] mode after power recovery and the heat pump water heater does not start operation. If you want to start operation, please push [Run/Pause] switch.</p>	○	○	○	○	○	○	
	B		≥ 80Hr	<p>Date setting screen is displayed</p> <p>This image is when the application setting is "Combination".</p>	<p>After setting date, time and application, TOP screen is displayed.</p> <p>The unit is recovered as same status as before power failure, but until date and time setting is done, the heat pump water heater does not start operation to top up. * The behavior after power recovery is same as case A. * Since the set date and time is lost, it is necessary to set date and time again.</p>	×	○	○	○	○	×	
	C			<p>Top screen is displayed</p> <p>This image is when the application setting is "Combination".</p>	<p>Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before power failure. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.</p>	○	○	○	○	○	○	×
	D			<p>Date setting screen is displayed</p> <p>This image is when the application setting is "Combination".</p>	<p>After setting date, time and application, TOP screen is displayed.</p> <p>Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before power failure. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch. * Since the set date and time is lost, it is necessary to set date and time again.</p>	×	○	○	○	○	○	×
CPU reset (*3)	E	Valid	-	Same as case A	Unit is recovered as same status as before	○	○	○	○	○	○	
	F	Invalid	-	Same as case C	* The behavior after power recovery is same as case A. Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before CPU reset. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.	○	○	○	○	○	○	
Initializing (*4)	G	Despite of Valid/Invalid	-	Main/Sub setting screen is displayed	Despite of the operation status before initializing, R/C and all heat pump water heaters connected becomes factory default. Since the date and time setting is retained, the unit is recovered in [Pause] mode, after Main/Sub setting of R/C. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.	×	×	×	×	×	×	

[Remarks]

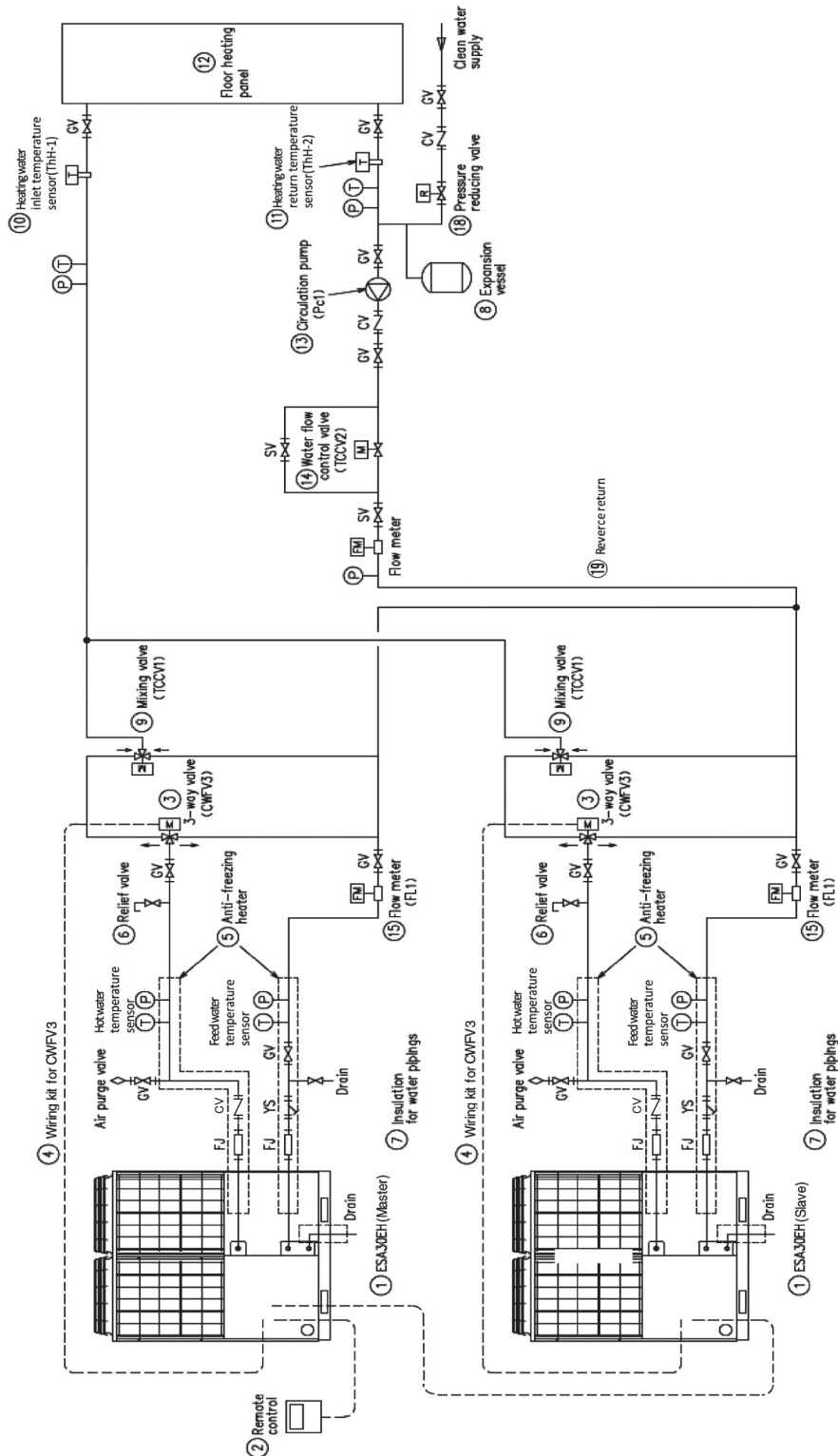
- *1 Power failure backup function
For example, in case of [Run] before power failure, the unit starts operation automatically after power recovery.
- *2 Time setting
The setting is memorized in the memory of R/C with built-in battery. With battery it is memorized for 80 hours after power failure.
- *3 CPU reset
If the battery is exhausted and memory of set time is lost, set the [date and time] again.
- *4 Initializing
R/C and all heat pump water heaters can be reinitialized. All settings of R/C and heat pump water heaters are back to the factory default, except the [date and time] setting.
- *5 Pause
[Pause] is the status that the operation to top up is stopped, but the unit may start operation for anti-freeze of water.

3.2 Setting and operation models for space heating and configuration of master-slave units

(1) Introduction

With the sealed master-slave connection, a heat pump water heater is set as the master unit for a floor heating panel, and up to 3 heat pump water heaters are connected as slave units to the master unit. Where two or more heat pump water heaters can be connected as master units to a floor heating panel, each master heat pump water heater starts or stops independently depending on the inlet water temperature of the floor heating panel, set by remote control. With the master-slave connection, however, the master unit controls collectively the start and stop of its slave units. In this case, project design, installation and maintenance is simplified compared to the case where two or more master units are connected to a single floor heating panel. It is in fact sufficient for the inlet/outlet water temperature sensors to be connected to the master unit only.

(2) System diagram



(3) Component list

	Part name	Model	General description
①	Heat pump water heater	ESA30EH-25	For outdoor air temperature -25°C
②	Remote control for heat pump water heater (Option part)	RC-Q1EH	For setting the inlet temperature of the floor heating panel.
③	3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit (wiring length 0.7m, AC200V,50mA)
④	Wiring kit for CWFV3 (Option part)	MTH-Q6E (20m length of wire) MTH-Q7E (10m length of wire)	MTH-Q1E or -Q2E has only one set of relay wiring for CWFV3 (MTH-Q4E). For the master-slave connection, provide an MTH-Q6E or MTH-Q7E for each slave unit.
⑤	Anti-freezing water heater (Locally procured)	—	When outdoor air temperature becomes below 0°C, be sure to install this heater on the water pipe (10W/m).
⑥	Relief valve (Locally procured)	—	For preventing from increasing pressure in the system during heating up the water. (Working pressure: 450±30kPa or lower.)
⑦	Insulation (Locally procured)	—	Heat resistance ≥ 120°C For the water piping: 30mm or thicker glass wool whose density is 48kg/m ³ .
⑧	Expansion vessel (Locally procured)	—	—
⑨	Mixing valve, TCCV1 (Locally procured)	—	For adjusting the flow rate. (Electric proportional valve, Piping size:40A, Input signal:4-20mA, Driving torque:12Nm)
⑩	Heating water inlet temperature sensor (Locally procured)	—	Termocouple:Type K
⑪	Heating water return temperature sensor (Locally procured)	—	Termocouple:Type K
⑫	Floor heating panel (Locally procured)	—	—
⑬	Circulation pump, Pc1 (Locally procured)	—	For circulating hot water of space heating system. Flow rate:5160L/h or more Head:More than pressure loss between floor heating panel and TCCV1
⑭	Water flow control valve, TCCV2 (Locally procured)	—	For adjusting the inlet/outlet temperature difference constant. (Piping size:40A, Input signal:4-20mA, Motor:Synchronous, Rated torque: 7Nm, Opening/Closing time: 17/14s [50/60Hz])
⑮	Flow meter, FL1 (Locally procured)	—	For adjusting the return flow rate to the heat pump constant. (Pipingsize:20A, measurable up to 20L/min)
⑯	Pressure reducing valve (Locally procured)	—	Setting pressure ≤ 400kPa. Connecting pipe size ≥ 32A. (If the feed water pressure exceeds 400kPa, be sure to mount it.)

(4) Address setting

Please see the technical document for DHW system.

3.3 External input and output

(1) Additional external input terminal for space heating operation

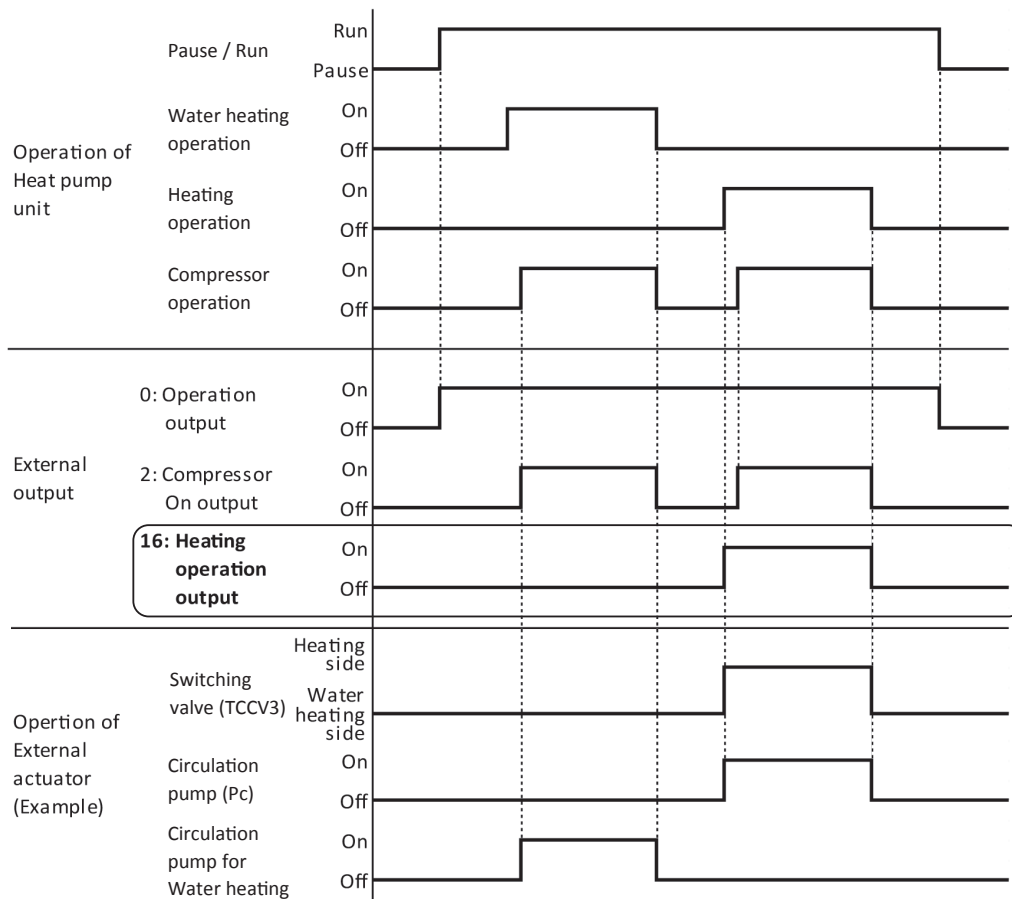
In addition to conventional functions, the output shown in the table below has been added for space heating.

Name		Usage (★Factory default)	Specification	Remarks
External output	CnH	Operation output	DC12V output(10mA)	Operation signal also output during antifreezing operation.
	CnY	Error output		—
	CnZ1	Set with 7-segment control (*1)		★0: Operation output
	CnZ2			★1: Error output

(*1) 0: Operation output, 1: Error output, 2: Compressor On output, 3: Fan On output, 4: Dry-up water output, 5: Water pump (DCWP) operation command output, 6: Anti-freezing water circuit output, 7: Defrost operation output, 8: Output of operation to top up, (9: Output of operation to keep warm) 13: Auto-backup operation output, 14: Remote control On output, 15: Hot water amount output 16: Heating operation output (Added for space heating)

() for open tank only

(2) Transition of external output and operation statuses



4. Additional 7-segment display for space heating

Code No.	Data display		Minimum unit	Remark
	Contents	Display range		
P01	Number of tank water temperature sensor	<u>9:(Factory default)</u> 0 - 9	1 piece	Heating only : 0 Combination : actual number
P07	Lower limit of hot water strage	<u>10:(Factory default)</u> 0 - 100	5%	Stop heating operation if hot water strage is lower than this value *For heating dedicated usage,P07 should be set as "0".
P08	Differential temperature between ThH-1 and ThH-2	<u>5:(Factory default)</u> 0 - 15	1°C	
P09	Differential temperature between ThX-1 and ThX-2	<u>0:(Factory default)</u> 0 - 15	1°C	
P23	Function assignment of CNZ1	<u>0:(Factory default)</u> 0 - 20	1	Either CNZ1 or CNZ2 must be assinged to (16) Heating operation output. See 3.1 (7) 7-2 Setting procedure of digital controller TIC 1 and TIC 2
P24	Function assignment of CNZ2	<u>1:(Factory default)</u> 0 - 20	1	

ThH-1 : Inlet temperature of floor heating panel

ThH-2 : Outlet temperature of floor heating panel

ThX-1 : Inlet temperature of indirect heat exchanger (heat pump side)

ThX-2 : Outlet temperature of indirect heat exchanger (HW strage unit side)

5. Option part : Modbus interface

(1) Specifications

Description	INTERFACE KIT
Model name	RCI-MDQE
Operation temperature	0 °C to 40 °C
Operation humidity	less than 90 % RH, non-condensing
Stock temperature	-20 °C to +70 °C
Stock humidity	40 % RH to 90 % RH, non-condensing
Power source	DC 18 V (XY Line)
External dimensions (H x W x D)	100 x 85 x 35 mm (Metal Box)
Weight	350 g

Modbus communication parameters (DIP switch settings)

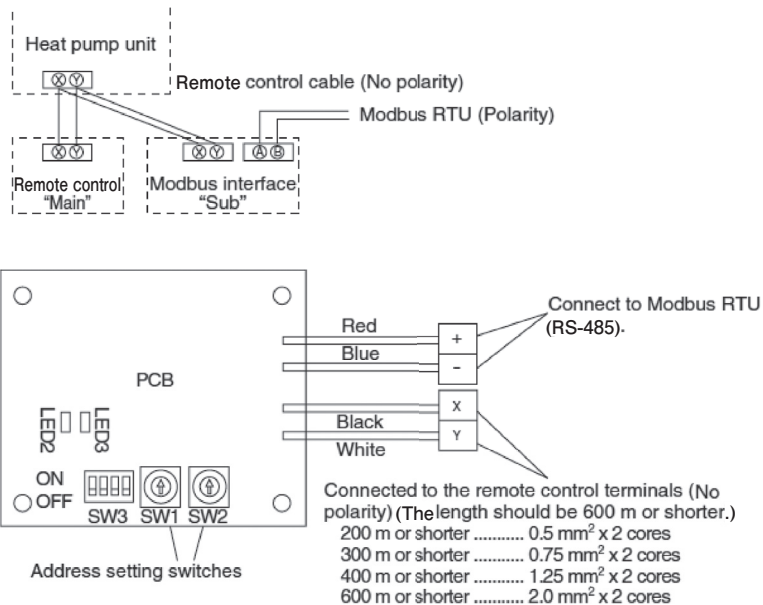
Baud rate	9600 bps (Default), 19200 bps
Stop bit (Parity)	Stop Bit 1 (Even/Odd parity), Stop Bit 2 (No polarity) (Default)

(2) Modbus Functions

Device type	Slave
Transmission mode	RTU
Control	Send the setting from Modbus master device to the Heat pump water heater.
Supervision	Send the data or the abnormal condition of a Heat pump water heater to Modbus master.

(3) Connection

- The device must be installed in accordance with national wiring regulations.
- Please do the grounding work. Please do not connect earth line with gas pipes, water pipes, lightning rods and grounding line of telephone.
- Please do not turn on the power source (local switch) until all of the works are completed.



Signal line specification

Line type	MVVS
Line diameter	0.75-1.25 mm ²
Line length	Up to 1200 m

Ground both ends of the shielded wire.

(4) Installation work

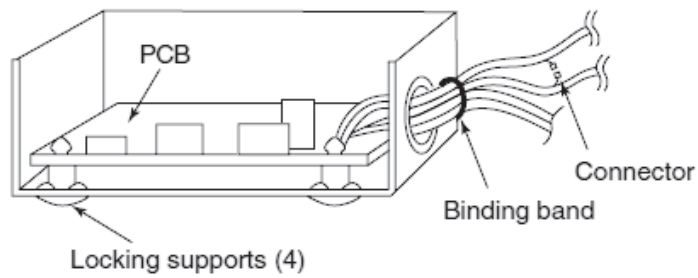
Please install in an indoor location that is not exposed to electromagnetic waves, water, dust, or other foreign substances.

The operating temperature range of this product is from 0 °C to 40 °C.

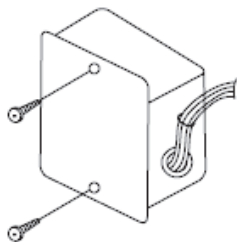
Install in a location where the ambient temperature remains within the operating temperature range.

However, if the operating temperature range is exceeded, be sure to implement corrective measures such as installation of a cooling fan.

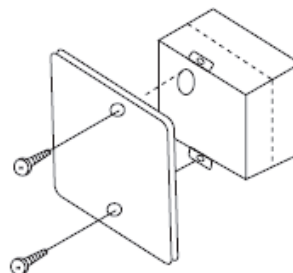
Be aware that continued usage of this device outside the operating temperature range can result in operation problems.



▲ Put the metal cover on.



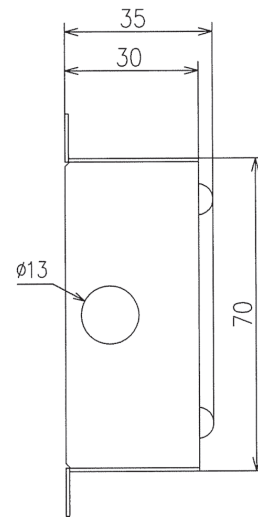
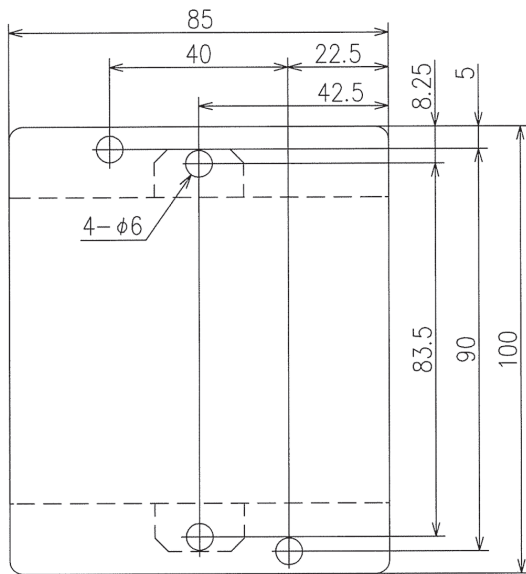
▲ When installed on the back of the remote control, mount it directly on the remote control bottom case.



Connect the connector in case of termination as shown in the below figure.



(5) Outline drawing (Metal box)



AIR TO WATER HEAT PUMP



MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD.
2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, 100-8332, Japan
<http://www.mhi-mth.co.jp/en/>

Because of our policy of continuous improvement, we reserve the right to make changes in all specifications without notice.