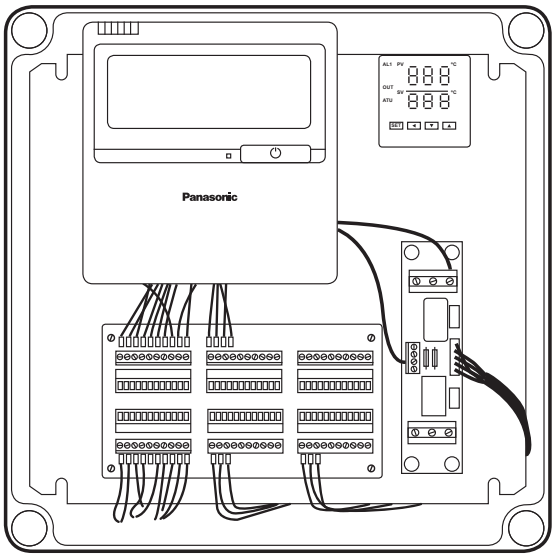
Panasonic

Air Handling Unit Kit

Installation Instructions



heatingandcoolingsystems

ECO i | ECO G | PAC i

Air Handling Unit Kit

Installation Instructions

Original Installation Instructions (English)
Preliminary version as at December 2014

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Table of Contents

1 General information and safety instructions

1.1 Introduction

This document contains the installation instructions for the Panasonic AHU Kits.

The following products are covered in this documentation:

- PAW-160MAH2 / PAW-160MAH2L
- PAW-280MAH2 / PAW-280MAH2L
- PAW-560MAH2 / PAW-560MAH2L
- PAW-280PAH2 / PAW-280PAH2L

AHU Kits connect Panasonic ECOi, ECO G and PACi outdoor units to third-party air handling unit systems, using the same refrigerant circuit as the VRF system.

Application examples for Panasonic AHU Kits are hotels, offices, server rooms or all large buildings where air quality control such as humidity control and fresh air is needed.

The installation should be performed only by qualified electricians in strict accordance with the installation instructions and especially with the safety instructions given in this document.

Where information in this document does not apply to all three VRF system ranges, but only to either ECOi, ECO G or PACi systems, this will be indicated by the relevant product range logos:

Important: Validity of this document

Due to the ongoing development and innovation of Panasonic products, this document and all the information contained herein is preliminary (as at December 2014). It may not reflect the current status of the relevant products. Preliminary or missing information will be updated and added on an ongoing basis and published at the discretion of Panasonic.

1.2 Structure and meaning of notices and symbols

Safety notices

WARNING

This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

This indicates a hazardous situation which, if not avoided, could result in property damage.

Other notices

Important

This indicates other important information or references to other useful sources of technical data and descriptions.

1.3 Safety instructions

WARNING

The following precautions need to be followed strictly, in order to avoid hazardous situations, which could result in death or serious injury.

Electric shock or fire may result from inadequate or incorrect installation or wiring procedures.

- ► System installation must only be performed by an experienced electrician.
- ► Arrange installation at the dealer where the system was purchased or use a professional installer.
- ► System installation must be performed in strict accordance to the installation procedures described in this document.

Damage to the circuit breakers may result from incorrect electrical wiring, insufficient electrical circuit capacity or use with other electrical devices.

- ► Always use a dedicated branch circuit for electrical wiring.
- ► Strictly avoid using other electrical devices within the same electrical circuit.
- ► Make sure the electrical circuit used has sufficient capacity.

Overheating or fire may result if connections or attachments are not secure.

- ► Use the specified cables (type and wiring diameter) for the electrical connections, and securely connect the cables.
- ► Run and fasten the cables securely so that external forces or pressure placed on the cables will not be transmitted to the connection terminals.

Suffocation can result if refrigerant gas leaks and exceeds the limit density in a small room.

- ► Installation of the refrigerant piping must only be performed by an experienced, qualified installer to minimize the risk of leaks.
- ► Install so that even if refrigerant gas leaks into the room, it will not exceed the limit density of 0.44 kg/m^3, in accordance with the local regulatioins for facility air conditioning equipment.
- ► If the refrigerant gas concentration does exceed the limit density, do one of the following:
  - install an opening in a neighbouring room
  - or install ventilation equipment triggered by gas leak detection sensors
  - or install an automatic pump-down system provided by the manufacturer of the equipment

Poisonous gas can result if refrigerant gas comes into contact with fire.

- ► After installation of refrigerant pipes, perform a dry nitrogen gas sealing test to check that there are no leaks.
- ► Ventilate the work area if refrigerant gas leaks during installation.

► Prevent the refrigerant gas from coming into contact with a fan heater, stove, range, or other source of fire.

Incorrect installation can result in falling equipment causing damage, injuries or other accidents.

► Install in a location that is fully strong enough to support the weight of the equipment.

► Perform installation that is secure enough to withstand earthquakes, whirlwinds, storms and other strong winds.

Frostbite injuries may result from coming into direct contact with the refrigerant gas.

► When handling refrigerant gas, be careful not to touch the refrigerant gas directly.

CAUTION

The following precautions need to be followed strictly, in order to avoid hazardous situations, which could result in minor or moderate injury.

Electric shock, shock and fires may result from incomplete grounding of the equipment or failure to install an earth leakage breaker.

► Be sure to ground equipment properly.

► Do not attach ground wires to gas pipes, water pipes, lightning arresters, or telephone ground lines.

► Always install an earth leakage breaker.

Ignition of flammable gas or inflammable materials may result from installing the system in locations where flammable gas can generate, enter, build up, or leak.

► Do not install the system in locations where flammable gas can occur in any way.

► Do not install in locations where volatile inflammable materials are handled.

1.4 Warranty policy

We can be held responsible for the quality and performance of the AHU Kit we supply.

However, we cannot be held responsible for the performances, operations and machine controls of your complete AHU system which incorporates our AHU Kit, nor for the components used in the refrigerant cycle of your AHU system (including, but not limited to, compressors, high-pressure switches, check valves, strainers, expansion valves, solenoid valves, 4-way valves, capillary tubes, accumulator tanks, and heat exchanger tubes), nor for any damages and defects caused in the process of installing our AHU Kit, by the system design and/or during assembly of your AHU system.

We do not publish the certificate to show conformity to the EMC and the product safety requirements applicable to your complete AHU system.

2 Ventilation theory and air handling units

2.1 Purpose of air-conditioning

The purpose of air-conditioning is to provide comfortable indoor air conditions for the room occupants and to provide energy saving potentials for the owner.

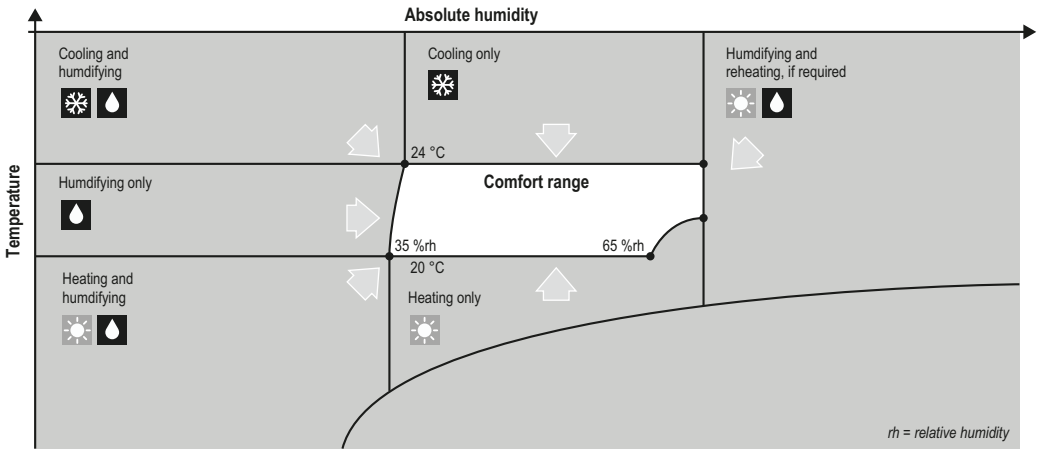
Comfort

If room occupants feel “comfortable“ in a given room, depends mainly on the following two factors:

- air temperature
- relative air humidity

However, optimum working or living conditions do not only exist at a specific setpoint of room temperature and room humidity, but also within a certain band width of the setpoint.

A temperature setpoint of 22 °C and a relative humidity setpoint of 45 % with variations of ±2 °C and ±15 %rh respectively are typical levels used for office spaces. Also, at high temperatures, maximum limitation of absolute humidity should be provided to avoid “muggy” conditions. Typically, this limit value lies at about 10 g/kg (H_2O).



Energy savings

Besides the advantages in terms of indoor air quality, air conditioning offers also an energy saving potential. For example, while uncontrolled ventilation through open windows leads to large amounts of heat being lost to the outside during the heating season or gained from the outside during the cooling season, air conditioning systems provide possibilities to utilize the extra “free” energy in heat recovery modules so that overall operating costs will be reduced.

The larger the area of the comfort range, the better the energy saving opportunities.

2.2 Purpose of ventilation

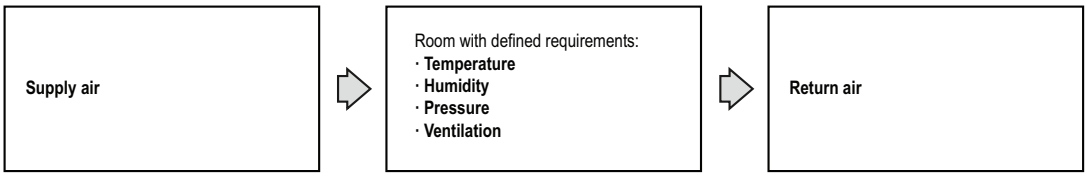
The purpose of ventilation is to introduce fresh air from outside into a building or room, in order to control indoor air quality and thermal comfort.

Ventilation demands

Ventilation must meet the following demands:

- Provide outside air (oxygen) for breathing
- Control of indoor air contaminants
- Covering of the building's thermal loads (temperature and humidity control)
- Setting of uniform conditions in the occupied zone

As the outside or ambient air varies in temperature, humidity, contamination etc., it must be specifically conditioned before being supplied to the target room, so that it meets the defined indoor air requirements. "Conditioning" means treating the ambient air by filtering, heating, cooling, humidifying, dehumidifying etc.



While the conditioned air (supply air) is being introduced to the building or room, return air, which no longer meets the defined indoor air requirements (e.g. in terms of temperature or humidity) is withdrawn from the room and rejected to the outside.

Thus, a constant indoor air exchange is maintained by the mechanical ventilation system.

Recommended indoor air requirements

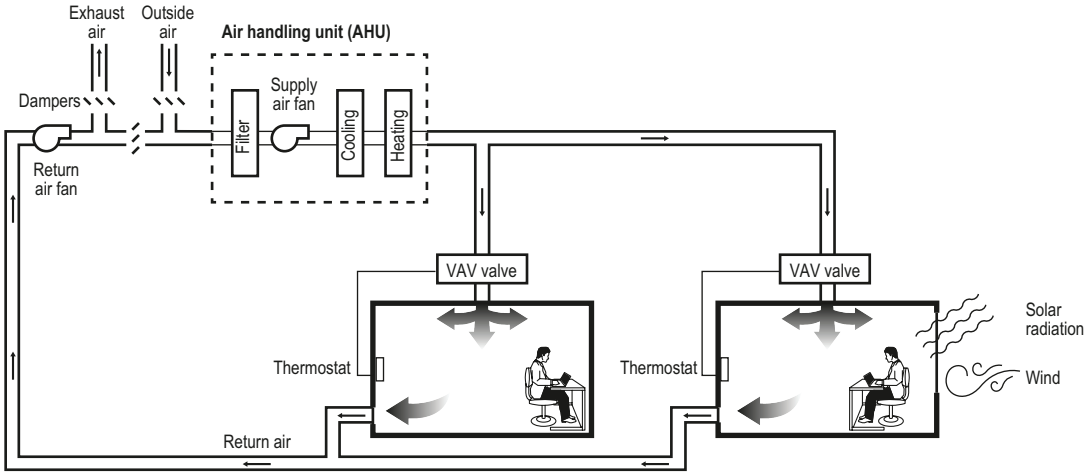
Organizations concerned with setting quality standards for the HVAC industry (Heating, Ventilation and Air Conditioning), like e.g. ASHRAE or Eurovent, give recommendations for indoor air quality criteria depending on the intended use of the room.

The ASHRAE recommendations for residential and commercial applications are as follows:

- **Temperature**: ranging from 20 to 24 °C
- **Humidity**: ranging from 35 to 65 %rh
- **Pressure**: slightly positive pressure to reduce outside air infiltration
- **Ventilation**: ranging from 4 to 8 complete air changes per hour

In order to fulfil the ventilation demands and to meet the recommended indoor air requirements, mechanical ventilation systems comprising air filters, supply and return air ventilators, cooling

and heating coils, variable air volume (VAV) valves, thermostats and other air-handling equipment are used.

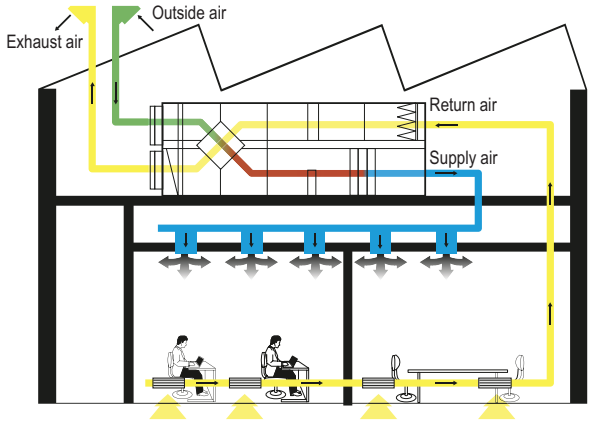


2.3 Mechanical ventilation systems

Main components of mechanical ventilation systems

The main components of a mechanical ventilation system are the following:

- Air handling unit (AHU)
- Air ducts
- Air distribution elements



Types of mechanical ventilation systems

Mechanical ventilation systems can be subdivided based on the pressure relation between the ventilated space and the ambient environment.

In most cases, the pressure in ventilated spaces is equal to the atmospheric pressure of the outside. This means that the air-flow delivered to a space equals the airflow brought back from a space. Such spaces are described as neutral or balanced.

However, in mechanical ventilation systems the supply air and return air flows might be sized differently, when necessary. In these cases, a building can be either pressurized or depressurized:

- **Pressurized**:

  The pressure within the ventilated space is positive (higher) compared to the outside pressure. This means, a certain amount of air is exfiltrated from the space through openings and cracks.

  Examples are clean rooms, operation theatres etc.

- **Depressurized**:

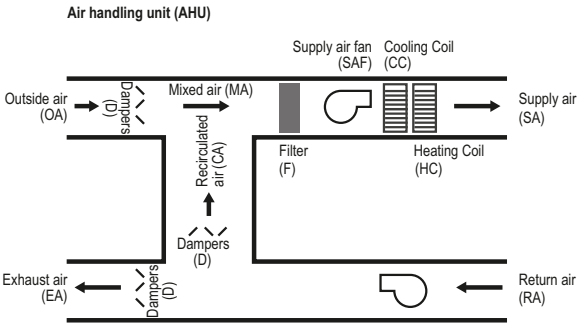
  The pressure within the ventilated space is negative (lower) compared to the outside pressure. This means, a certain amount of air is infiltrated to the space through openings and cracks.

  Examples are kitchens, toilets, laboratories working with toxic substances etc.

2.4 Air handling units

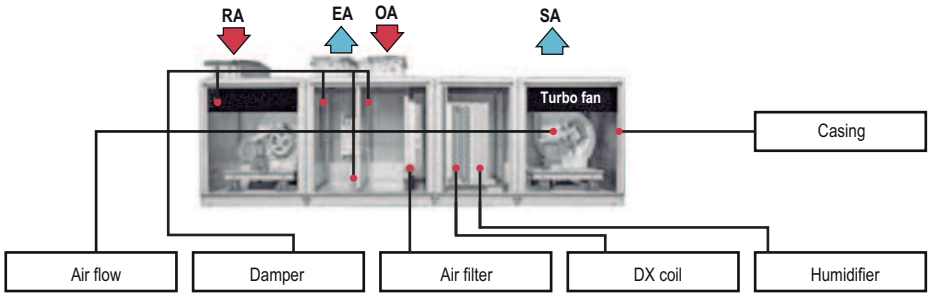
Main components of air handling units

The main components of an air handling unit are shown in the following graphic.



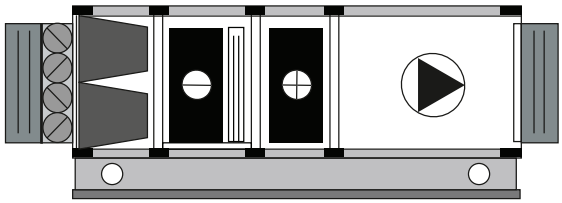
Air handling units can be manufactured targeted at the specific purpose for which they will be used. Possible features comprise, but are not limited to the following non-exhaustive list of characteristics:

- Construction: monoblock or split in separate delivery sections
- Installation location: indoor, outdoor
- Execution: horizontal, vertical, double deck or side-by-side
- Design: e.g. standard, hygienic, explosion-proof or anti-grease
- DX coil: with or without (see below the example of an AHU system with DX coil)
- Heat recovery: with or without
- Size: ranging from 150 m^3/h to 100000 m^3/h
- Applying European standards: EN1886; EN13053

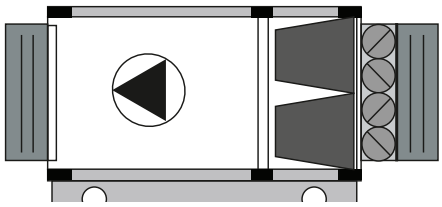


Main types of air handling units

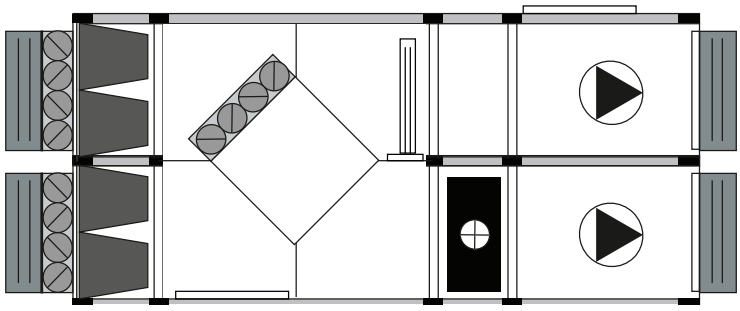
Supply type



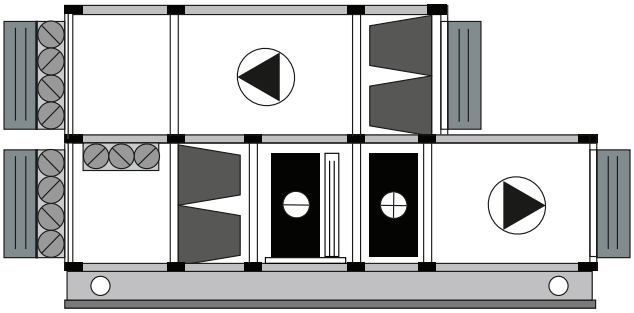
Exhaust type



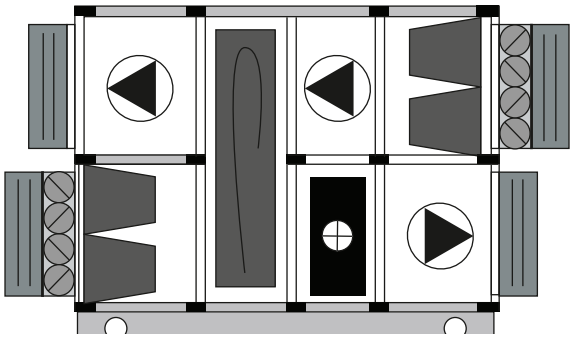
Supply/Exhaust type with cross-flow heat exchanger



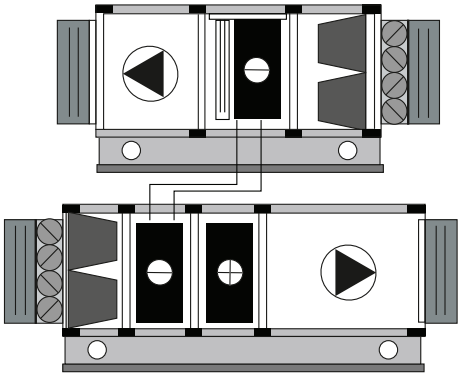
Supply/Exhaust type with mixing chamber



Supply exhaust type with rotary heat exchanger

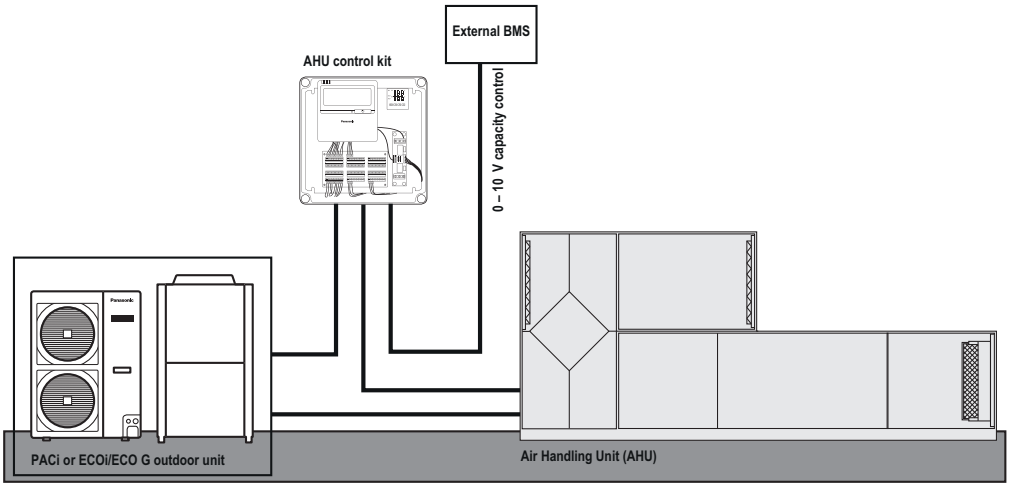


Supply/Exhaust type with glycol heat exchanger



Connecting AHU systems via the AHU Kit to ECOi/ECO G or PACi outdoor units

The following graphic shows an example for connecting a third-party air handling unit via the Panasonic AHU Kit to Panasonic ECOi/ECO G or PACi outdoor units.



Demand control on the outdoor unit managed by external 0–10 V signal

1 This schematic layout applies to the advanced AHU Kit version only, because it features an in-built CZ-CAPBC2 interface handling the 0–10 V control. This enables two control alternatives:
   - Capacity control through external BMS via 0–10 V signal
   - Capacity control through in-built supply air or ambient temperature sensor

2 As the “light” version of the AHU Kit does not include an in-built CZ-CAPBC2 interface for handling the 0–10 V control, this schematic layout does not apply to the “light” AHU Kit version.

3 Product description

3.1 General description

AHU Kits connect Panasonic ECOi, ECO G and PACi outdoor units to third-party air handling unit systems, using the same refrigerant circuit as the VRF system.

Application examples for Panasonic AHU Kits are hotels, offices, server rooms or all large buildings where air quality control such as humidity and temperature control and fresh air is needed.

The Panasonic AHU Kits offer a wealth of connectivity possibilities so that they can be easily integrated into many systems.

The new AHU Kit has been developed to better meet customer demand:

- Two versions available depending on the required functionality (light or advanced version)
- IP65 enclosure providing the possibility for outdoor installation
- 0–10 V demand control (included on the CZ-CAPBC2 interface)*
- Easy control by BMS

* Only available with ECOi and PACi Elite units from 6 kW up to 14 kW (for PACi Elite units from 20/25 kW available on request)

Features and benefits

- The system is controlled by the air intake (or room return air) temperature in the same way as a standard indoor unit. Selectable modes: Automatic / Cooling / Heating / Fan / Dry (equivalent to Cooling).
- Easy integration into BMS or AHU control systems using demand control: 40 to 115 % (5 % steps) of nominal current by 0–10 V input signal (advanced version only)
- Room supply air temperature can be controlled by the additional thermostat, its supply air temperature sensor and the 0–10 V input signal for enhanced comfort and efficiency (advanced version only).
- Target temperature setting based on ambient temperature with CZ-CAPBC2 using 0–10 V signal (advanced version only).
- Connectable with P-LINK system.
- Fan control signal from the PCB can be used for controlling the air volume of an external fan (High/Mid/Low and LL for Th-OFF). (Need to change the fan control circuit wiring at field.)
- Defrost operation signal, Thermo-ON/OFF states output
- Drain pump control (Drain-pump and the float switch to be supplied in local)
- Basic humidifier control output (humidifier field supplied)
- Alarm and operation output

3.2 Scope of supply

The AHU Kits are supplied in two versions, “light” or “advanced”, and can be selected based on the required functionality.

The light version, denominated by the letter “L” in the model name, contains the following components:

- IP65 case
- Control unit including transformer
- Relays
- Terminal boards
- Remote controller (CZ-RTC2)
- PCBs for the expansion and RAP valves
- PCB for T10 connection (PAW-T10)
- Expansion valve (only for ECOi and ECO G)
- Refrigerant temperature sensors (E1, E2/E3)
- Air intake and air outlet temperature sensors (TA, BL)

In addition to this, the advanced version, without the letter “L” in the model name, contains also the following components:

- Thermostat including an additional temperature sensor to be used either for room supply air or ambient air temperature
- Interface for 0–10 V control (CZ-CAPBC2)

The heat exchanger, fan and fan motor must be field supplied.

Control functions provided as standard by integral components

CZ-RTC2 Timer remote controller

- Operation-ON/OFF
- Mode selection
- Temperature setting
- Parameter settings

Additional Thermostat (advanced version only)

- Target temperature setting based on ambient temperature with proportional integral logic*
- Demand control based on room supply air temperature to enhance comfort and efficiency*

* Only one of these two options can be chosen at a time.

CZ-CAPBC2 Mini seri-para I/O unit (advanced version only)

- Easy integration in external AHU control systems and BMS
- Demand control: 40 to 115 % (5 % steps) of nominal current by 0–10 V input signal*
- Target temperature setting by 0–10 V or 0–140 Ω input signal*
- Room supply air temperature output by 4–20 mA signal
- Mode select or/and ON/OFF control
- Fan operation control
- Operation status output/ Alarm output
- Thermostat ON/OFF control

* Demand control by external BMS cannot be combined with the demand control or target temperature setting accomplished by the thermostat. However, if simultaneous demand control and target temperature setting is needed, this can only be achieved by using a second (optional) CZ-CAPBC2 interface.

PAW-T10 PCB to connect to T10 connector

- Dry contact PCB for easy control of the unit
- Operation ON/OFF input signal
- Remote control prohibition
- Operation ON status output signal, maximum 230 V / 5 A (NO/NC)
- Alarm status output signal, maximum 230 V / 5 A (NO/NC)

PAW-OCT, DC12 V outlet, OPTION terminal

- Output signal for Cooling/Heating/Fan status
- Output signal for Defrost operation indication
- Output signal for Thermostat-ON status

Additional contacts available

- External humidifier control (ON/OFF) 230 V AC 3 A
- External fan control (ON/OFF) 12 V DC
- External filter status signal potential free
- External float switch signal potential free
- External leakage detection sensor or TH. OFF contact potential free (possible usage for external blow out temperature control)

3.3 System lineup

System lineup – ECOi systems

Capacity HP	Capacity kW	Outdoor unit combination			AHU Kit combination		
5	16	all ECOi outdoor units			PAW-160MAH2(L)[1]	–	–
10	28	U-10ME1E81	–	–	PAW-280MAH2(L)[2]	–	–
20	56	U-20ME1E81	–	–	PAW-560MAH2(L)[3]	–	–
30	84	U-16ME1E81	U-14ME1E81	–	PAW-560MAH2(L)	PAW-280MAH2(L)	–
40	112	U-20ME1E81	U-20ME1E81	–	PAW-560MAH2(L)	PAW-560MAH2(L)	–
50	140	U-18ME1E81	U-16ME1E81	U-16ME1E81	PAW-560MAH2(L)	PAW-560MAH2(L)	PAW-280MAH2(L)
60	168	U-20ME1E81	U-20ME1E81	U-20ME1E81	PAW-560MAH2(L)	PAW-560MAH2(L)	PAW-560MAH2(L)

1 PAW-160MAH2(L):
- PAW-160MAH2(L) can be installed in combination with all ECOi 2-pipe and 3-pipe outdoor units like any other standard indoor unit.
- Mixed installation with standard indoor units is possible. However, in this case one additional RAP valve (CZ-P160RVK2) must be installed in the unit connection pipe, unless the unit is exclusively used in cooling only operation.

2 PAW-280MAH2(L):
- Mixed installation with standard indoor units is possible. However, in this case two additional RAP valves (2 x CZ-P160RVK2) must be installed in the unit connection pipe, unless the unit is exclusively used in cooling only operation.
- Connection to ECOi 3-way systems is not allowed.

3 PAW-560MAH2(L):
- Mixed installation with standard indoor units is not allowed.
- Connection to ECOi 3-way systems is not allowed.

System lineup – ECO G systems

Capacity HP	Capacity kW	Outdoor unit	AHU Kit
5	16	all ECO G outdoor units	PAW-160MAH2(L)[1]
10	28	all ECO G outdoor units	PAW-280MAH2(L)[2]
20	56	U-20GE2E5	PAW-560MAH2(L)[3]

1 PAW-160MAH2(L):
- PAW-160MAH2(L) can be installed in combination with all ECO G outdoor units like any other standard indoor unit.
- Mixed installation with standard indoor units is possible. However, in this case one additional RAP valve (CZ-P160RVK2) must be installed in the unit connection pipe, unless the unit is exclusively used in cooling only operation.

2 PAW-280MAH2(L):
- PAW-280MAH2(L) an be installed in combination with all ECO G outdoor units like any other standard indoor unit.
- Mixed installation with standard indoor units is possible. However, in this case two additional RAP valves (2 x CZ-P160RVK2) must be installed in the unit connection pipe, unless the unit is exclusively used in cooling only operation.

3 PAW-560MAH2(L):
- With PAW-560MAH2(L), only 1-to-1 installations are allowed (1 x U-20GE2E5 + 1 x PAW-560MAH2(L)). Combinations with more than 1 outdoor unit or more than 1 AHU Kit are not possible.
- Mixed installation with standard indoor units is not allowed.
- Connection to ECO G 3-way systems is not allowed.

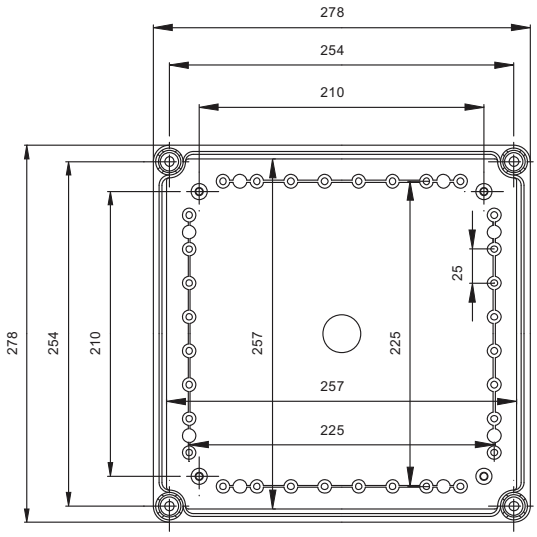
System lineup – PACi systems

Capacity (kW)	Outdoor unit[1]				AHU Kit
	PACi Standard		PACi Elite		
	Single-phase units	Three-phase units	Single-phase units	Three-phase units	
5.0	–	–	U-50PE1E5	–	PAW-280PAH2(L)[2]
6.0	U-60PEY1E5	–	U-60PE1E5A	–	
7.1	U-71PEY1E5	–	U-71PE1E5A	U-71PE1E8A	
10.0	U-100PEY1E5	U-100PEY1E8	U-100PE1E5A	U-100PE1E8A	
12.5	U-125PEY1E5	U-125PEY1E8	U-125PE1E5A	U-125PE1E8A	
14.0	–	U-140PEY1E8	U-140PE1E5A	U-140PE1E8A	
20.0	–	–	–	U-200PE1E8	
25.0	–	–	–	U-250PE1E8	

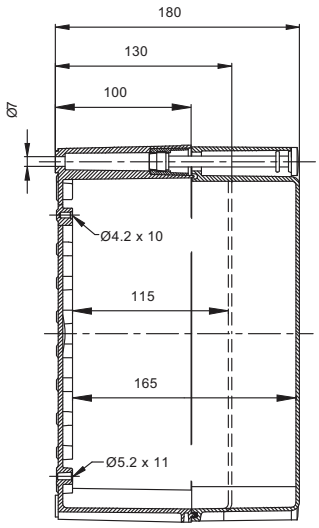
1 With PACi systems, only 1-to-1 installations are allowed (1 x PACi outdoor unit + 1 x PAW-280PAH2(L)). Combinations with more than 1 outdoor unit or more than 1 AHU Kit are not possible.
2 Mixed installation with standard indoor units is not allowed.

3.4 AHU Kit dimensions and exterior view

AHU Kit dimensions

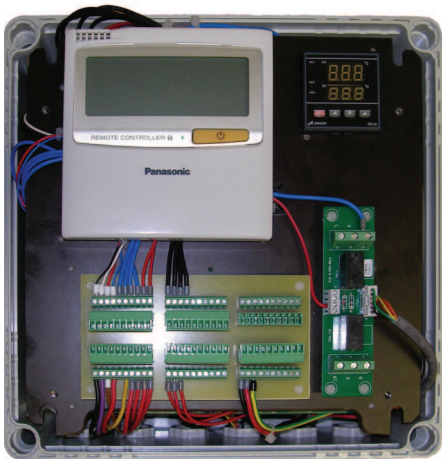


Front view (transparent cover removed)



Side view

Exterior view of the AHU Kit



AHU Kit including
PCB, power transformer, terminal block

ECO i
ECO G

Expansion valve

Thermistor x2
(Refrigerant: E1, E3)

Thermistor x2
(Air: TA, BL)

PAC i

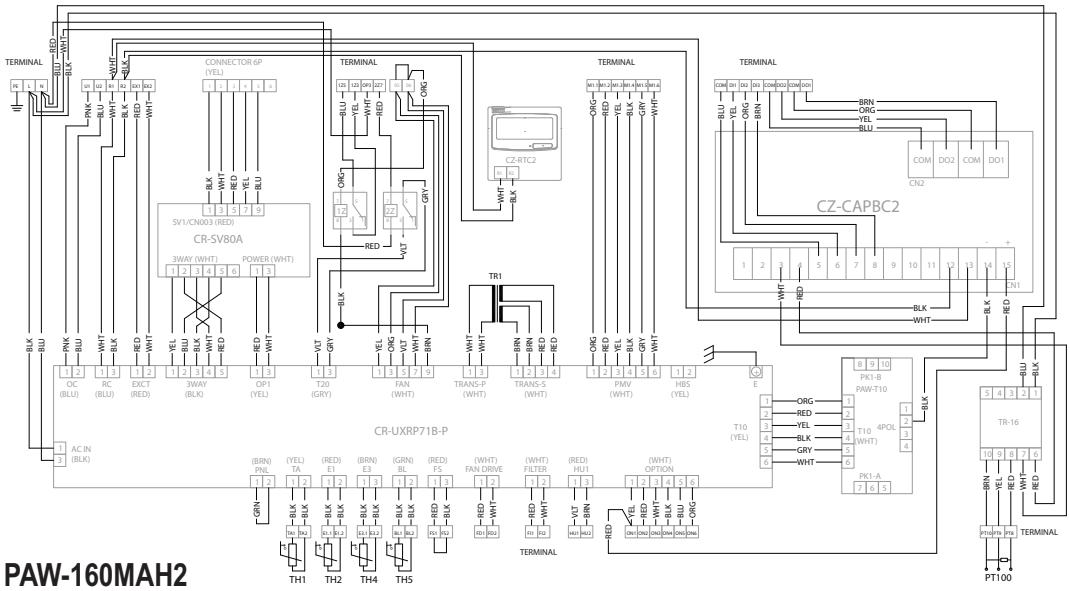
Thermistor x2
(Refrigerant: E1, E2)

Thermistor
(Air: TA)

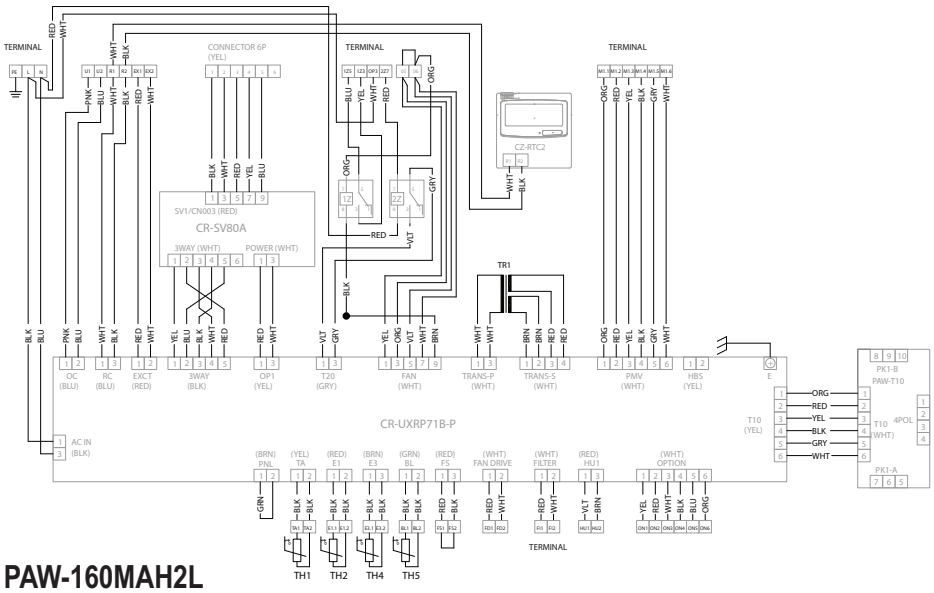
Note: AHU Kit shown with transparent front cover removed.

3.5 Wiring layout

Wiring layout – ECOi and ECO G systems



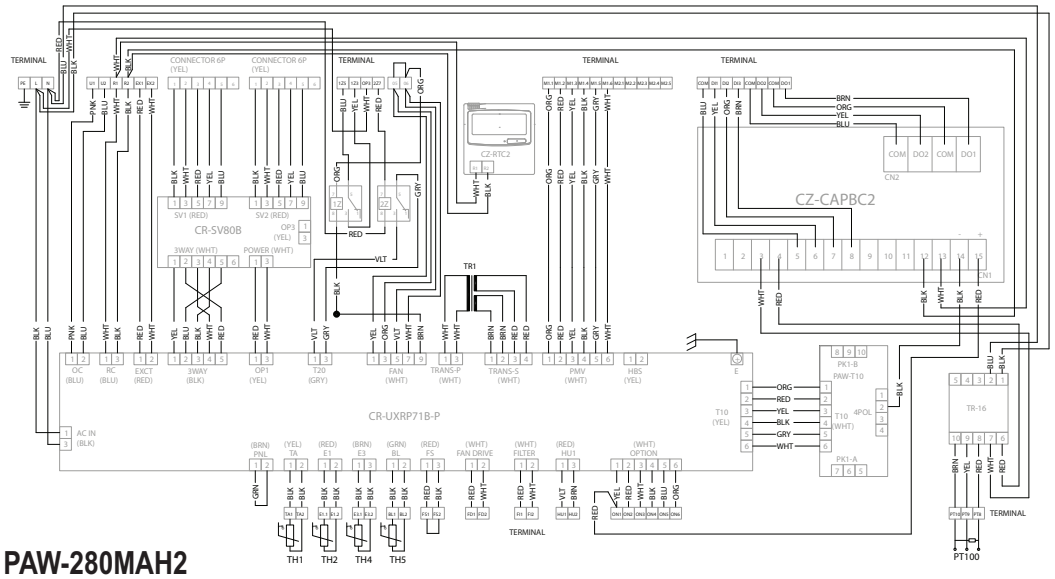
PAW-160MAH2



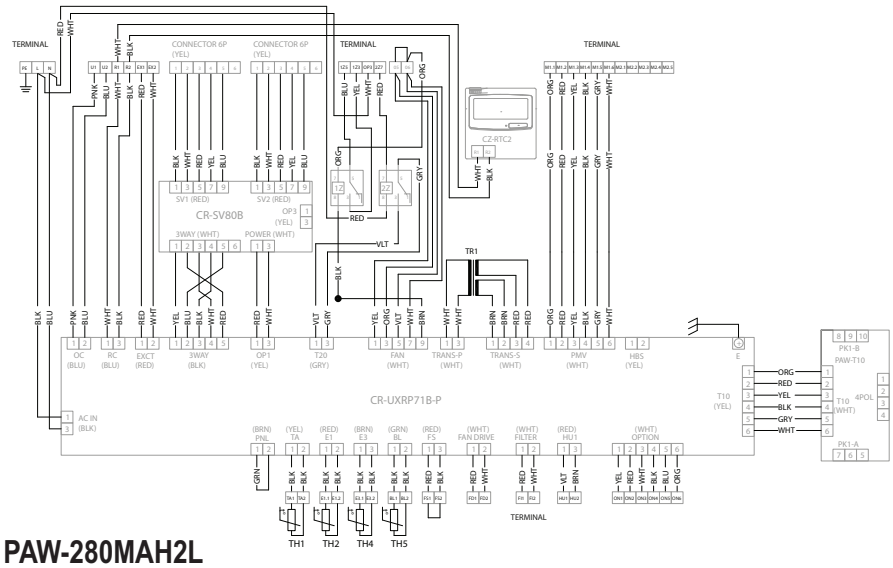
PAW-160MAH2L

TH1	Air intake temperature sensor	CZ-CAPBC2*	External signal control PCB
TH2	Indoor coil thermistor E1	CR-SV80A	RAP valve control PCB
TH4	Indoor coil thermistor E3	CR-UXRP71B-P	Main PCB
TH5	Air outlet temperature sensor	PAW-T10	External signal control PCB
PT100*	Supply air temperature sensor	1Z / 2Z	Auxiliary power relay
CZ-RTC2	Remote controller	TR1	Power transformer
TR-16*	Thermostat		

* Not included in PAW-160MAH2L



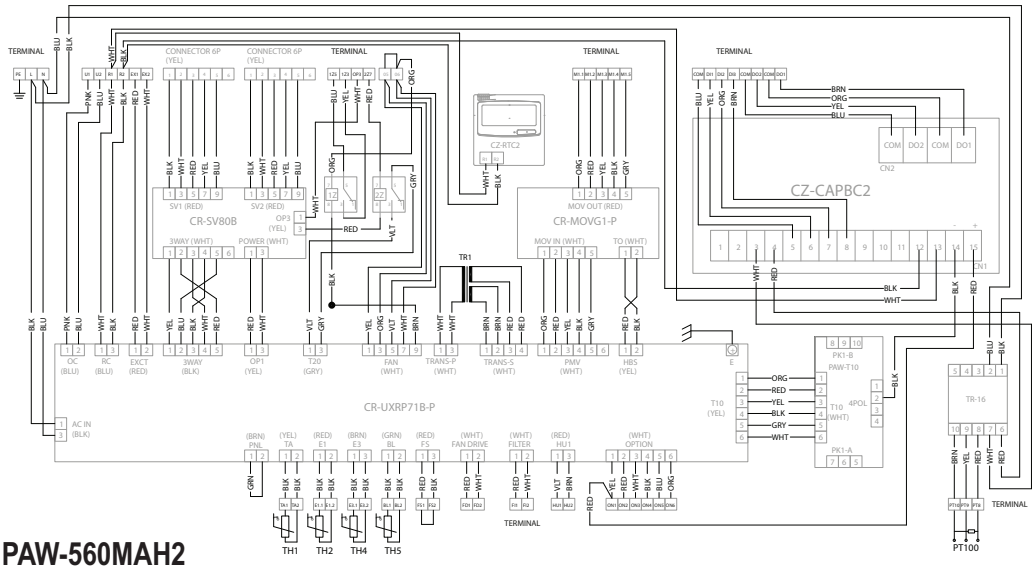
PAW-280MAH2



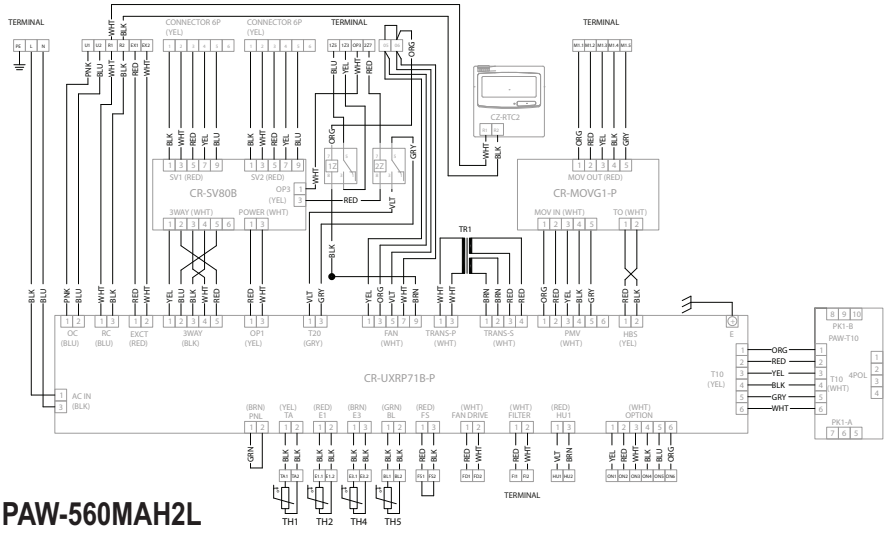
PAW-280MAH2L

TH1	Air intake temperature sensor	CZ-CAPBC2*	External signal control PCB
TH2	Indoor coil thermistor E1	CR-SV80B	RAP valve control PCB
TH4	Indoor coil thermistor E3	CR-UXRP71B-P	Main PCB
TH5	Air outlet temperature sensor	PAW-T10	External signal control PCB
PT100*	Supply air temperature sensor	1Z / 2Z	Auxiliary power relay
CZ-RTC2	Remote controller	TR1	Power transformer
TR-16*	Thermostat		

* Not included in PAW-280MAH2L



PAW-560MAH2

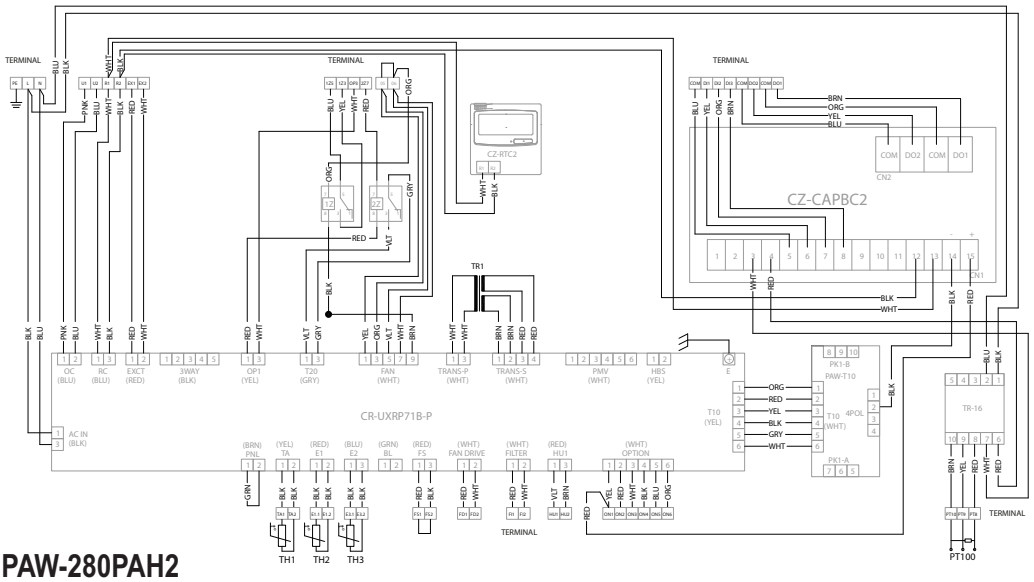


PAW-560MAH2L

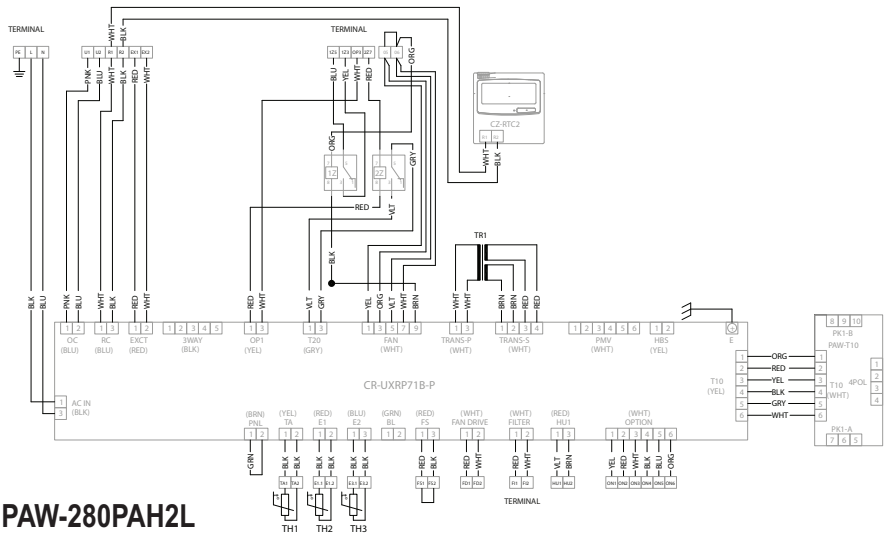
TH1	Air intake temperature sensor	CZ-CAPBC2*	External signal control PCB
TH2	Indoor coil thermistor E1	CR-MOVG1-P	Motorized valve PCB
TH4	Indoor coil thermistor E3	CR-SV80B	RAP valve control PCB
TH5	Air outlet temperature sensor	CR-UXRP71B-P	Main PCB
PT100*	Supply air temperature sensor	PAW-T10	External signal control PCB
CZ-RTC2	Remote controller	1Z / 2Z	Auxiliary power relay
TR-16*	Thermostat	TR1	Power transformer

* Not included in PAW-560MAH2L

PACi Wiring layout – PACi systems



PAW-280PAH2



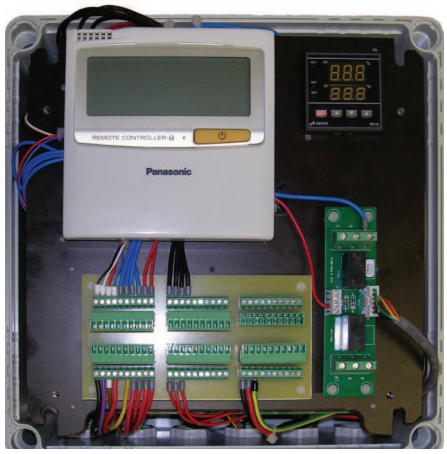
PAW-280PAH2L

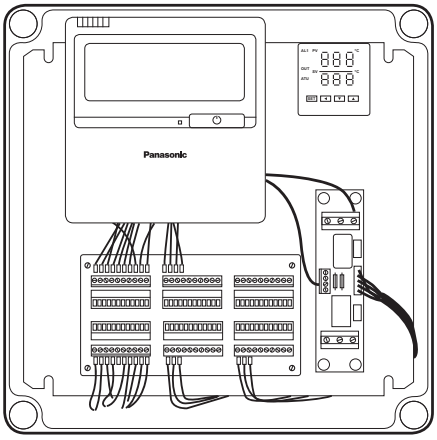
TH1	Air intake temperature sensor	CZ-CAPBC2*	External signal control PCB
TH2	Indoor coil thermistor E1	CR-UXRP71B-P	Main PCB
TH4	Indoor coil thermistor E3	PAW-T10	External signal control PCB
PT100*	Supply air temperature sensor	1Z / 2Z	Auxiliary power relay
CZ-RTC2	Remote controller	TR1	Power transformer
TR-16*	Thermostat		

* Not included in PAW-280PAH2L

3.6 AHU Kit enclosure configuration

AHU Kit enclosure configuration

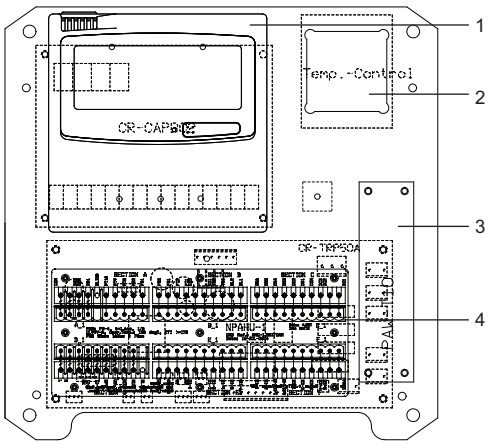




Note: AHU Kit shown with transparent front cover removed.

Mounting boards

Upper mounting board

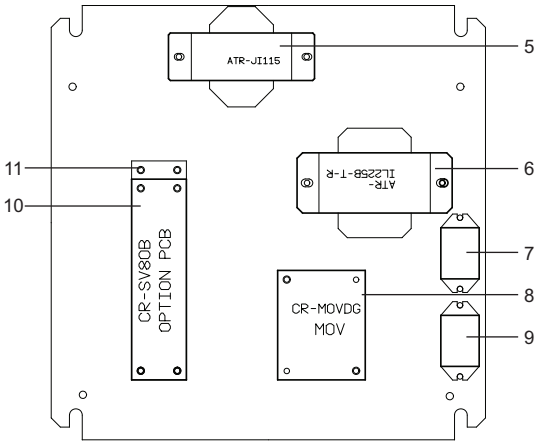


Upper mounting board

1 Remote controller (CZ-RTC2)
2 Thermostat (TR-16)
3 External signal control PCB (PAW-T10)
4 Terminal board with 6 connectors (labelled Section A to Section F) each with 20 contacts[1]

1 For details see “5.4 Terminal block layout”.

Lower mounting board



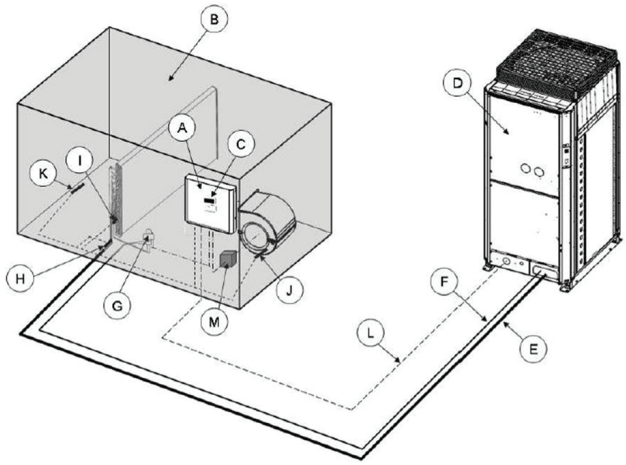
Lower mounting board
5 Auxiliary transformer
6 Transformer
7 Relay
8 Single motorized valve PCB
9 Relay
10 Single RAP valve control PCB[2]
11 Double RAP valve control PCB[2]

2 Depending on the model used, the single RAP valve control PCB (10) or double RAP valve control PCB (11) is mounted in this position.

3.7 System Overview

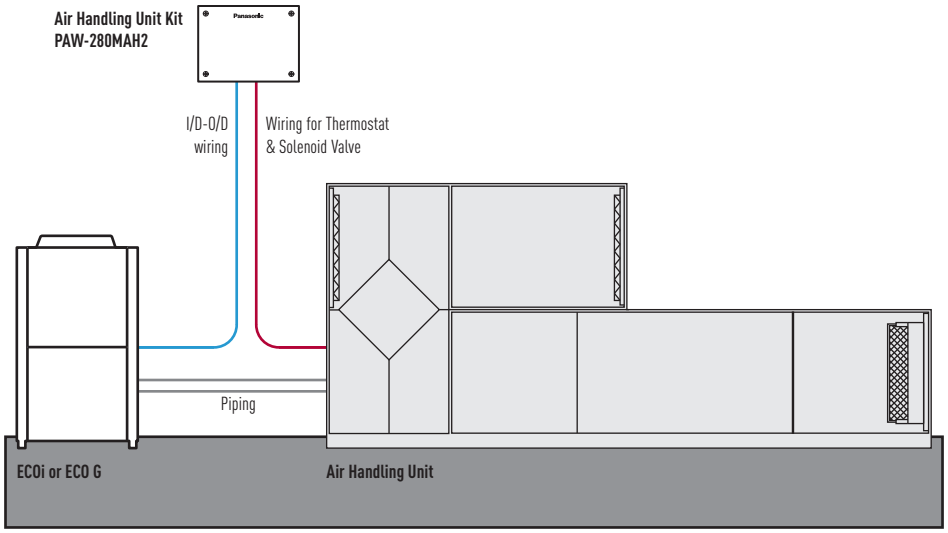
System Overview – ECOi systems

Single-connection system

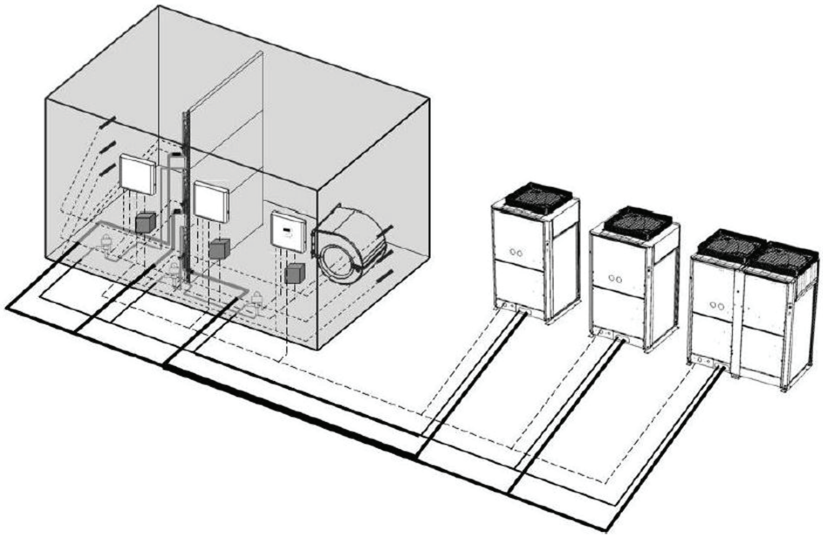


A AHU Kit enclosure (complete)
B AHU system (field supplied)
C Remote controller (integrated in AHU Kit enclosure)
D Outdoor unit
E Liquid piping (field supplied)
F Gas piping (field supplied)
G Electronic expansion valve
H Thermistor for liquid pipe
I Thermistor for gas pipe
J Thermistor for suction air
K Thermistor for discharge air
L Inter-unit wiring
M Magnetic relay for operating the blower (field supplied)

System example for ECOi single-connection system



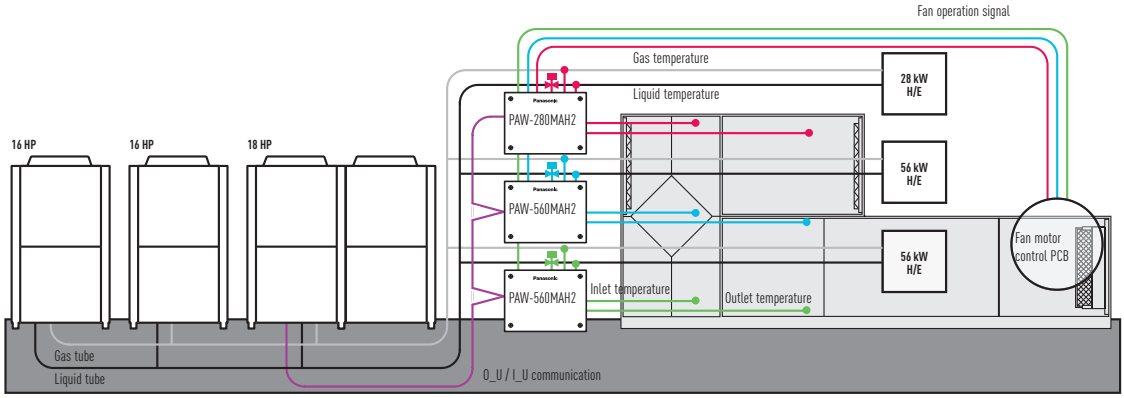
Multi-connection system



Note:
The following restrictions apply only if PAW-560MAH2(L) is used alone or in combination with other AHU Kits. For all other AHU Kits and AHU Kit combinations without PAW-560MAH2(L) no such restrictions apply.

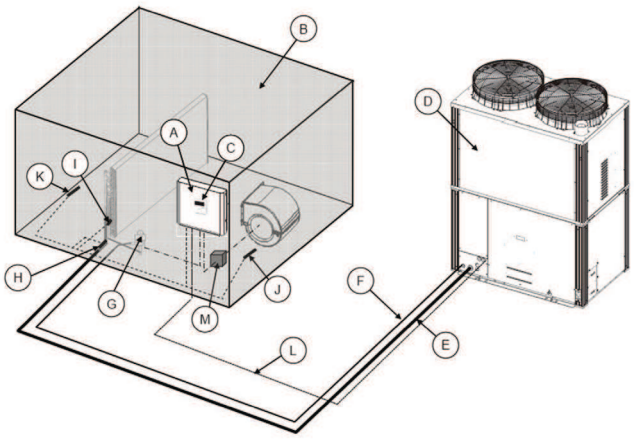
1 All AHU heat exchangers belonging to the same refrigerant circuit have to be installed in the same chassis equipped with one single fan motor.
2 One AHU Kit and correspondingly one magnetic relay is required for each heat exchanger. All AHU Kits have to be wired to the fan motor.
3 All AHU Kits shall be connected and controlled by group control wiring of remote controller.

System example for ECOi multi-connection system (140 kW capacity)



ECO G System Overview – ECO G systems

Single-connection[1] or multiple-connection[2] systems

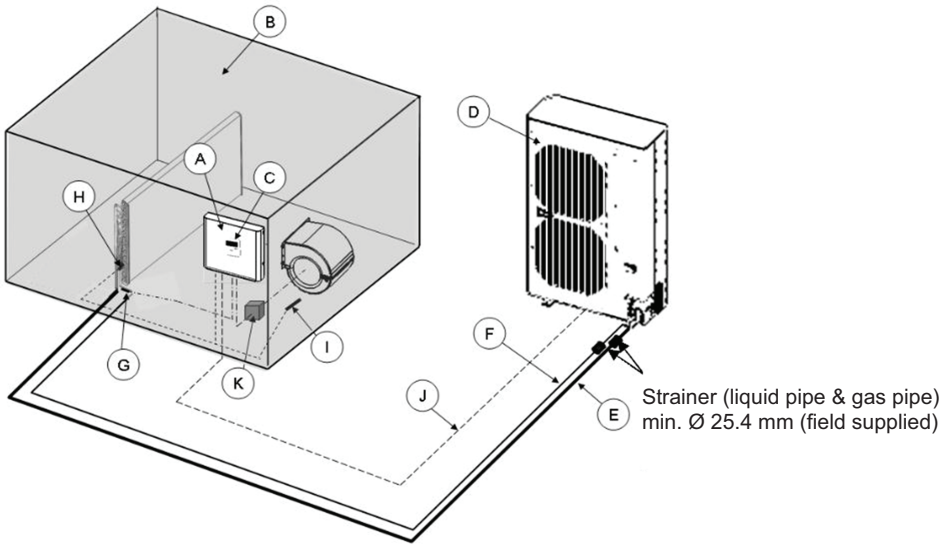


A	AHU Kit enclosure (complete)	H	Thermistor for liquid pipe (E1)
B	AHU system (field supplied)	I	Thermistor for gas pipe (E3)
C	Remote controller (integrated in AHU Kit enclosure)	J	Thermistor for suction air (TA)
D	Outdoor unit	K	Thermistor for discharge air (BL)
E	Liquid piping (field supplied)	L	Inter-unit wiring
F	Gas piping (field supplied)	M	Magnetic relay for operating the blower (field supplied)
G	Electronic expansion valve		

1 Single-connection system shown here as an example.
2 Multi-connection systems are only possible in combination with PAW-160MAH2(L) or PAW-280MAH2(L). However, with PAW-560MAH2(L) only 1-to-1 installations are allowed.

System Overview – PACi systems

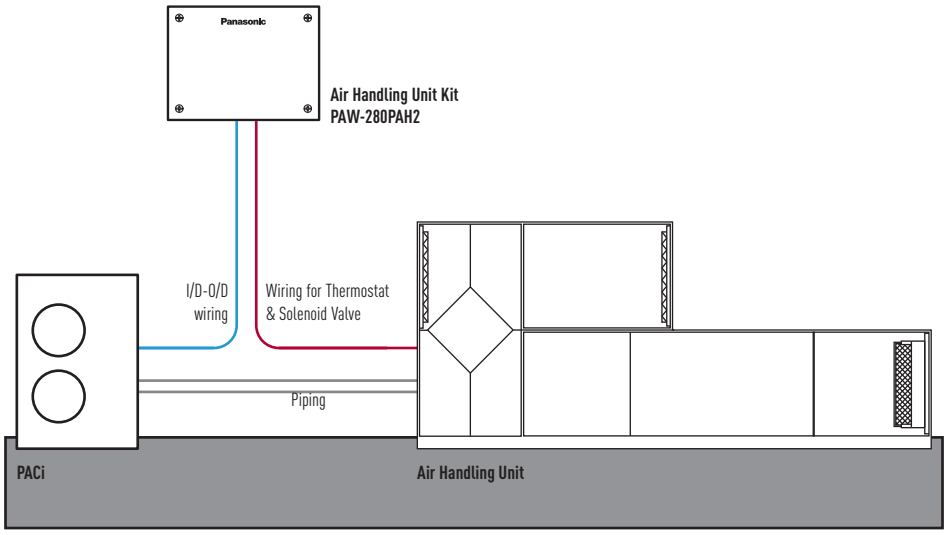
Single-connection[1] system only



A	AHU Kit enclosure (complete)
B	AHU system (field supplied)
C	Remote controller (integrated in AHU Kit enclosure)
D	Outdoor unit
E	Liquid piping (field supplied)
F	Gas piping (field supplied)
G	Thermistor for liquid pipe (E1)
H	Thermistor for heat exchanger pipe middle (E2)
I	Thermistor for suction air (TA)
J	Inter-unit wiring
K	Magnetic relay for operating the blower (field supplied)

1 With all PACi outdoor units only 1-to-1 installations are allowed.

System example for PACi single-connection system



3.8 Technical data and limitations

Important

Apart from the technical data and limitations given in the following tables, the technical data and limitations of the relevant outdoor units, local wiring and piping design regulations and approved best practices need to be observed in installation procedures.

Technical data and limitations – ECOi and ECO G systems

HP			5	10	20
Model			PAW-160MAH2(L)	PAW-280MAH2(L)	PAW-560MAH2(L)
Nominal cooling capacity		kW	14.0	28.0	56.0
Nominal heating capacity		kW	16.0	31.5	63.0
Air volume (Cooling)	Min	m^3/h	1,140	3,500	7,000
	Max	m^3/h	2,600	5,000	10,000
AHU DX coil heat exchanger volume	Min	dm^3	1.7	2.8	5.6
	Max	dm^3	2.8	5.4	10.7
Bypass factor			0.9 (recommended)	0.9 (recommended)	0.9 (recommended)
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 3.98	4.80 / 4.53	4.25 / 3,98
Protection class			IP65	IP65	IP65
Piping length	Min / Max	m	10 / 100	10 / 100	10 / 100
Max. branch pipe length		m	12	12	12
Max. branch pipe length difference after first branch		m	10	10	10
Elevation difference (in/out)	Max	m	10	10	10
Piping connections	Liquid pipe	Inch (mm)	3/8 (9.52)	3/8 (9.52)	5/8 (15.88)
	Gas pipe	Inch (mm)	5/8 (15.88)	7/8 (22.22)	1 1/8 (28.58)
Intake temperature of AHU Kit	Cooling (Min / Max)	°C	18 / 32 °C DB (13 / 23 °C WB)	18 / 32 °C DB (13 / 23 °C WB)	18 / 32 °C DB (13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

HP			30[1]	40[1]	50[1]	60[1]
Model			PAW-280MAH2(L) + PAW-560MAH2(L)	PAW-560MAH2(L) + PAW-560MAH2(L)	PAW-560MAH2(L) + PAW-560MAH2(L) + PAW-280MAH2(L)	PAW-560MAH2(L) + PAW-560MAH2(L) + PAW-560MAH2(L)
Nominal cooling capacity		kW	84.0	112.0	140.0	168.0
Nominal heating capacity		kW	95.0	127.0	155.0	189.0
Air volume (Cooling)	Min	m^3/h	15,000	20,000	25,000	30,000
	Max	m^3/h	10,500	14,000	17,500	21,000
AHU DX coil heat exchanger volume	Min	dm^3	8.4	11.2	14.0	32.1
	Max	dm^3	16.1	21.4	26.8	16.8
Bypass factor			0.9 (recommended)	0.9 (recommended)	0.9 (recommended)	0.9 (recommended)
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	for dimensions of single enclosure: see upper table			
Net weight		kg	for net weight of single enclosure: see upper table			
Protection class			IP65	IP65	IP65	IP65
Piping length	Min / Max	m	10 / 100	10 / 100	10 / 100	10 / 100
Max. branch pipe length		m	12	12	12	12
Maxi.branch pipe length difference after first branch		m	10	10	10	10
Elevation difference (in/out)	Max	m	10	10	10	10
Piping connections	Liquid pipe	Inch (mm)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)
	Gas pipe	Inch (mm)	1 1/4 (31.75)	1 1/2 (38.15)	1 1/2 (38.15)	1 1/2 (38.15)
Intake temperature of AHU Kit	Cooling (Min / Max)	°C	18 / 32 °C DB (13 / 23 °C WB)	18 / 32 °C DB (13 / 23 °C WB)	18 / 32 °C DB (13 / 23 °C WB)	18 / 32 °C DB (13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

1 Not applicable for ECO G systems.

Technical data and limitations – PACi systems

AHU Kit			PAW-280PAH2(L)			
Outdoor unit	PACi Standard	1-phase	U-60PEY1E5	U-71PEY1E5	U-100PEY1E5	U-125PEY1E5
Nominal cooling capacity		kW	6.0	7.1	10.0	12.5
Nominal heating capacity		kW	7.0	8.0	11.2	14.0
Air volume (Cooling)	Min (factory)	m^3/h	540	540	840	1,140
	Max (factory)	m^3/h	960	960	1,980	2,100
Air volume (Cooling), subject to restrictions[1]	Max	m^3/h	1,450	1,600	2,400	2,500
AHU DX coil heat exchanger volume	Min (factory)	dm^3	1.3	1.3	1.5	1.5
	Max (factory)	dm^3	1.4	1.4	1.9	1.9
AHU DX coil heat exchanger volume, subject to restrictions[2]	Max	dm^3	1.8	2.0	2.8	2.75
	Additional ref. charge	kg/dm^3	0.9	0.9	0.9	0.9
	Max. additional refrigerant charge	kg	0.36	0.54	0.81	0.76
	Max. pipe length	m	40	35	30	30
	Max. ambient temp. for pump down	°C	n/a	n/a	35	25
Heat exchanger front area	Min	m^2	–	–	0.43	0.43
	Max	m^2	–	–	0.51	0.51
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53
Protection class			IP65	IP65	IP65	IP65
Piping length	Min / Max	m	3 / 40	3 / 35	5 / 30	5 / 30
Precharged length	Max	m	20	20	15	15
Additional refrigerant charge		g/m	40	40	50	50
Piping connections	Liquid pipe	Inch (mm)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)
	Gas pipe	Inch (mm)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)
Intake temperature of AHU Kit[1]	Cooling (Min / Max)	°C	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB
			(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

AHU Kit			PAW-280PAH2(L)		
Outdoor unit	PACi Standard	3-phase	U-100PEY1E8	U-125PEY1E8	U-140PEY1E8
Nominal cooling capacity		kW	10.0	12.5	14.0
Nominal heating capacity		kW	11.2	14.0	16.0
Air volume (Cooling)	Min (factory)	m^3/h	840	1,140	1,140
	Max (factory)	m^3/h	1,980	2,100	2,160
Air volume (Cooling), subject to restrictions[1]	Max	m^3/h	2,400	2,500	2,600
AHU DX coil heat exchanger volume	Min (factory)	dm^3	1.5	1.5	1.5
	Max (factory)	dm^3	1.9	1.9	1.9
AHU DX coil heat exchanger volume, subject to restrictions[2]	Max	dm^3	2.8	2.75	2.8
	Additional ref. charge	kg/dm^3	0.9	0.9	0.9
	Max. additional refrigerant charge	kg	0.81	0.76	0.81
	Max. pipe length	m	30	30	30
	Max. ambient temp. for pump down	°C	35	25	n/a
Heat exchanger front area	Min	m^2	0.43	0.43	0.43
	Max	m^2	0.51	0.51	0.51
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53
Protection class			IP65	IP65	IP65
Piping length	Min / Max	m	5 / 30	5 / 30	5 / 30
Precharged length	Max	m	15	15	15
Additional refrigerant charge		g/m	50	50	50
Piping connections	Liquid pipe	Inch (mm)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)
	Gas pipe	Inch (mm)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)
Intake temperature of AHU Kit[1]	Cooling (Min / Max)	°C	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB
			(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

To be continued on next page.

Technical data and limitations – PACi systems (cont.)

AHU Kit			PAW-280PAH2(L)					
Outdoor unit	PACi Elite	1-phase	U-50PE1E5	U-60PE1E5A	U-71PE1E5A	U-100PE1E5A	U-125PE1E5A	U-140PE1E5A
Nominal cooling capacity		kW	5.0	6.0	7.1	10.0	12.5	14.0
Nominal heating capacity		kW	5.6	7.0	8.0	11.2	14.0	16.0
Air volume (Cooling)	Min (factory)	m^3/h	480	540	720	840	1,140	1,140
	Max (factory)	m^3/h	780	960	1,500	1,980	2,100	2,160
Air volume (Cooling), subject to restrictions[1]	Max	m^3/h	1,080	1,600	1,800	2,400	2,600	2,700
AHU DX coil heat exchanger volume	Min (factory)	dm^3	–	–	–	1.7	1.7	1.7
	Max (factory)	dm^3	1.3	1.4	1.8	2.1	2.1	2.1
AHU DX coil heat exchanger volume, subject to restrictions[2]	Max	dm^3	1.5	1.8	2.2	3.0	3.0	3.0
	Additional ref. charge	kg/dm^3	0.9	0.9	0.9	0.9	0.9	0.9
	Max. additional refrigerant charge	kg	0.18	0.36	0.36	0.81	0.81	0.81
	Max. pipe length	m	30	40	40	30	30	30
	Max. ambient temp. for pump down	°C	n/a	35	35	25	25	25
Heat exchanger front area	Min	m^2	–	–	–	0.43	0.43	0.43
	Max	m^2	–	–	–	0.51	0.51	0.51
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53
Protection class			IP65	IP65	IP65	IP65	IP65	IP65
Piping length	Min / Max	m	3 / 30	5 / 40	5 / 40	5 / 30	5 / 30	5 / 30
Precharged length	Max	m	20	20	20	20	20	20
Additional refrigerant charge		g/m	20	50	50	50	50	50
Piping connections	Liquid pipe	Inch (mm)	1/4" (6,35)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)
	Gas pipe	Inch (mm)	1/2" (12,7)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)
Intake temperature of AHU Kit[1]	Cooling (Min / Max)	°C	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB
			(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

AHU Kit			PAW-280PAH2(L)			
Outdoor unit	PACi Elite	3-phase	U-71PE1E8A	U-100PE1E8A	U-125PE1E8A	U-140PE1E8A
Nominal cooling capacity		kW	7.1	10.0	12.5	14.0
Nominal heating capacity		kW	8.0	11.2	14.0	16.0
Air volume (Cooling)	Min (factory)	m^3/h	720	840	1,140	1,140
	Max (factory)	m^3/h	1,500	1,980	2,100	2,160
Air volume (Cooling), subject to restrictions[1]	Max	m^3/h	1,800	2,400	2,600	2,700
AHU DX coil heat exchanger volume	Min (factory)	dm^3	–	1.7	1.7	1.7
	Max (factory)	dm^3	1.8	2.1	2.1	2.1
AHU DX coil heat exchanger volume, subject to restrictions[2]	Max	dm^3	2.2	3.0	3.0	3.0
	Additional ref. charge	kg/dm^3	0.9	0.9	0.9	0.9
	Max. additional refrigerant charge	kg	0.36	0.81	0.81	0.81
	Max. pipe length	m	40	30	30	30
	Max. ambient temp. for pump down	°C	35	25	25	25
Heat exchanger front area	Min	m^2	–	0.43	0.43	0.43
	Max	m^2	–	0.51	0.51	0.51
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53	4.25 / 4.53
Protection class			IP65	IP65	IP65	IP65
Piping length	Min / Max	m	5 / 40	5 / 30	5 / 30	5 / 30
Precharged length	Max	m	20	20	20	20
Additional refrigerant charge		g/m	50	50	50	50
Piping connections	Liquid pipe	Inch (mm)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)	3/8" (9,52)
	Gas pipe	Inch (mm)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)	5/8" (15,88)
Intake temperature of AHU Kit[1]	Cooling (Min / Max)	°C	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB	18 / 32 °C DB
			(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)	(13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB	-10 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB	-20 / 15 °C WB

To be continued on next page.

Technical data and limitations – PACi systems (cont.)

AHU Kit			PAW-280PAH2(L)	
Outdoor unit	PACi Elite	3-phase	U-200PE1E8	U-250PE1E8
Nominal cooling capacity		kW	20.0	25.0
Nominal heating capacity		kW	22.4	28.0
Air volume (Cooling)	Min (factory)	m^3/h	1,680	2,280
	Max (factory)	m^3/h	3,960	4,440
Air volume (Cooling), subject to restrictions[1]	Max	m^3/h	4,300	5,400
AHU DX coil heat exchanger volume	Min (factory)	dm^3	2.3	2.7
	Max (factory)	dm^3	4.3	4.3
AHU DX coil heat exchanger volume, subject to restrictions[2]	Max	dm^3	5.7	7.1
	Additional ref. charge	kg/dm^3	0.9	0.9
	Max. additional refrigerant charge	kg	1.25	2.51
	Max. pipe length	m	n/a	n/a
	Max. ambient temp. for pump down	°C	n/a	n/a
Heat exchanger front area	Min	m^2	0.54	0.66
	Max	m^2	1.0	1.0
Power source		V / ph / Hz	230 / 1 / 50	230 / 1 / 50
Dimensions (enclosure)	H x W x D	mm	278 x 278 x 180	278 x 278 x 180
Net weight	Advanced / Light	kg	4.25 / 4.53	4.25 / 4.53
Protection class			IP65	IP65
Piping length	Min / Max	m	5 / 70	5 / 70
Precharged length	Max	m	30	30
Additional refrigerant charge		g/m	40	80
Piping connections	Liquid pipe	Inch (mm)	3/8" (9,52)	1/2" (12,7)
	Gas pipe	Inch (mm)	1" (25,4)	1" (25,4)
Intake temperature of AHU Kit[1]	Cooling (Min / Max)	°C	18 / 32 °C DB	18 / 32 °C DB
			(13 / 23 °C WB)	(13 / 23 °C WB)
	Heating (Min / Max)	°C	16 / 30 °C DB	16 / 30 °C DB
Ambient temperature (outdoor unit)	Cooling (Min / Max)	°C	-15 / 43 °C DB	-15 / 43 °C DB
	Heating (Min / Max)	°C	-20 / 15 °C WB	-20 / 15 °C WB

1 This (higher) maximum allowed air volume is subject to a restriction of the "Intake temperature of AHU Kit" to 30 °C DB (instead of 32 °C DB). Without this restriction, only the (lower) factory-set maximum air volume is allowed.

2 This (higher) maximum AHU DX coil heat exchanger volume is subject to the following restrictions:

- an additional refrigerant charge on top of the additional refrigerant charge, which needed, when pipe length exceeds the maximum allowed with standard shipment charge (see calculation example below)
- AND a reduced maximum pipe length
- AND an ambient air temperature limit above which no pump down must be performed

Calculation example for total additional refrigerant charge

Unit: U-60PE1E5
Pipe length: 40 meter
AHU DX coil (supplied by AHU manufacturer): 1,7 dm^3
Refrigerant charge at shipment fitted for pipe length within 30 m
Pipes additional refrigerant charge: 0,05 kg/m
AHU DX coil additional refrigerant charge: 0,9 kg/dm^3
Refrigerant charge at shipment fitted for AHU DX coil volume within 1,4 dm^3

Total additional refrigerant charge calculation
((1.7 dm^3 – 1.4 dm^3) x 0.9 kg/dm^3) + (10 m x 0.05 kg/m) = 0.27 kg + 0.50 kg = 0.77 kg

Calculation example for number of passes in the heat exchanger

The minimum number of passes in the AHU heat exchanger is restricted. The limit is calculated by the formula:

Minimum number of passes
= Number of steps × Distance between tube sheets × Number of rows × 1.5×10^{-4}
The calculated value must then be rounded up to the next integer number.

Example
Number of steps: 12

Distance between tube sheets: 1,000 mm
Number of row: 3

Minimum number of passes = $12 \times 3 \times 1.5 \times 10^{-4} = 5.4$
This value must be rounded up to 6.

This means that the minimum number of passes is 6 passes.

NOTICE

Nuisance tripping of high-pressure switch

The outdoor unit is equipped with a high-pressure switch, which stops the operation of the air-conditioning unit for protection when the set high-pressure limit is exceeded. Nuisance tripping of the high-pressure switch may occur in heating mode if the heat exchanger pipe thermistor (E2) is not properly positioned or if the limit is not properly set.

- ► Position the heat exchanger pipe thermistor (E2) correctly and set the limit properly in accordance with the instructions given in this document.