



Water Heating Unit Control Box

ACH1

FOR INSTALLERS

INSTALLATION MANUAL

For safe and correct use, please read this installation manual thoroughly before installing the ACH1 control box.

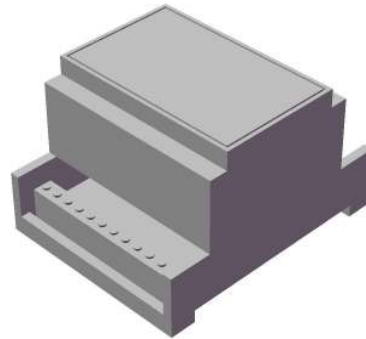
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[Fig. 2-1]

1



2



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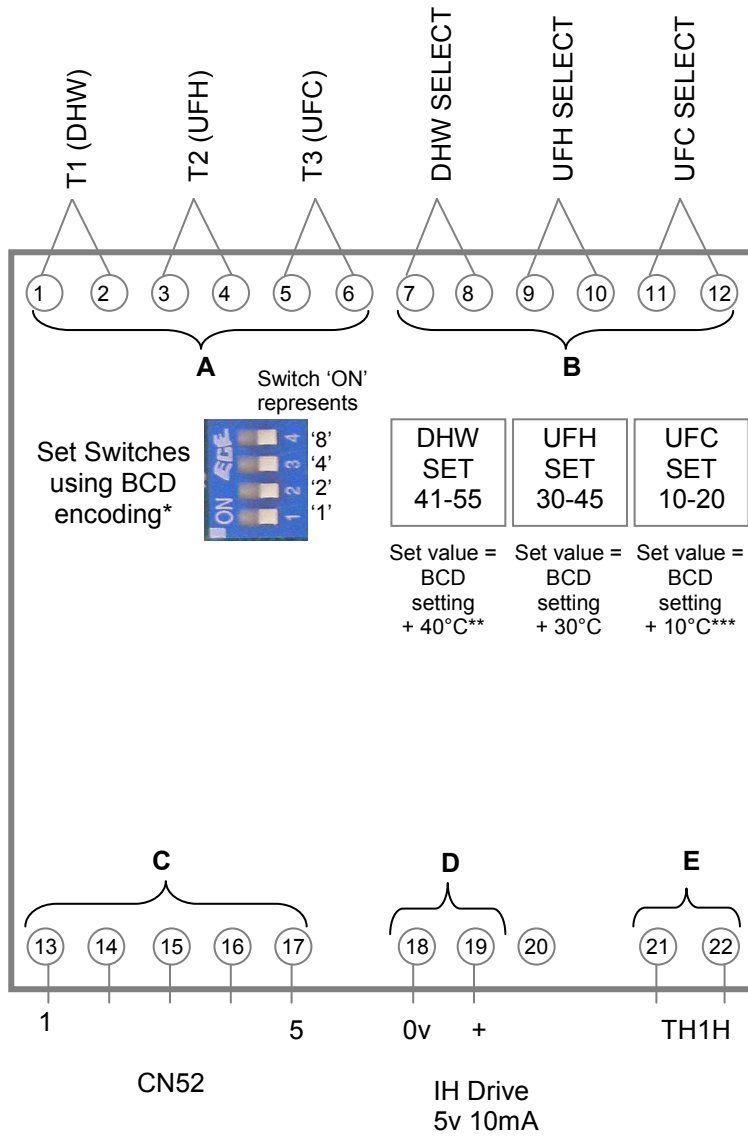
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- 1 Thermistor x 3
- 2 ACH1 box
- 3 5 wire adapter
- 4 Installation manual

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[Fig. 5.1]

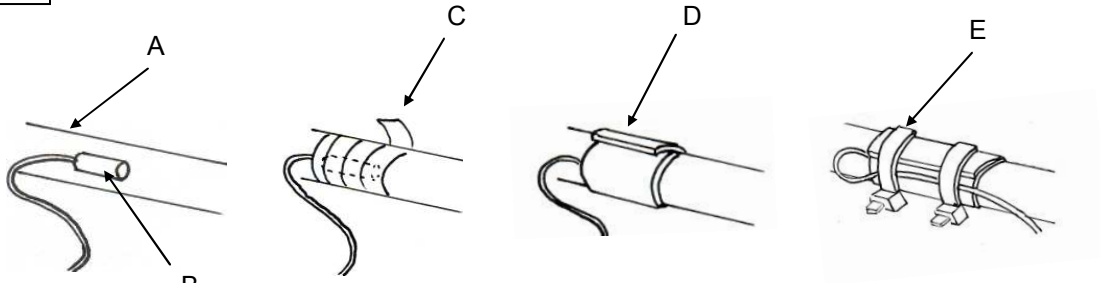


- A Thermistors (5K NTC, R = 5K Beta = 3980 : at 25°C
- B Mode select (require volt free inputs)
- C 5 wire connector to CN52 on PQFY (1 = black)
- D Immersion heater output
- E Connection to TH1H on PQFY

* See table 2.1 for more detailed explanation of BCD encoding
 ** All DHW switches OFF gives 45°C with Immersion Heater Signal
 *** UFC settings above 20 are treated as 20

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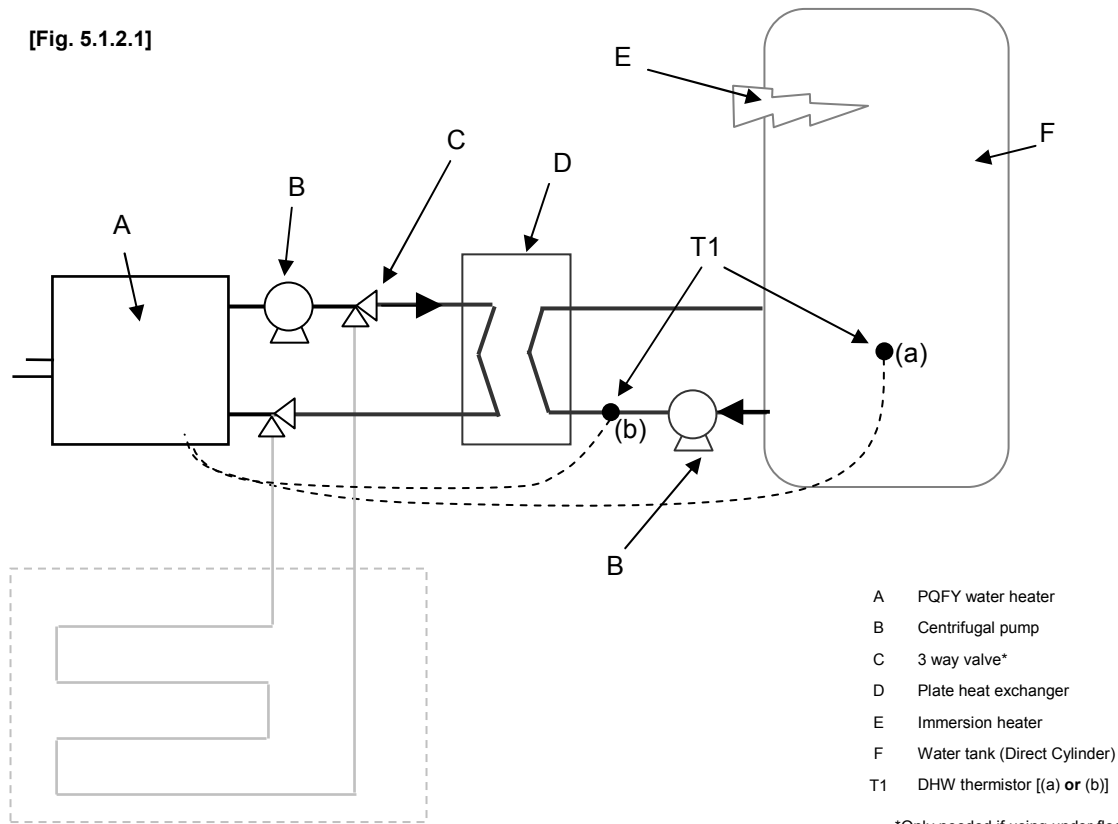
[Fig. 5.1.1]



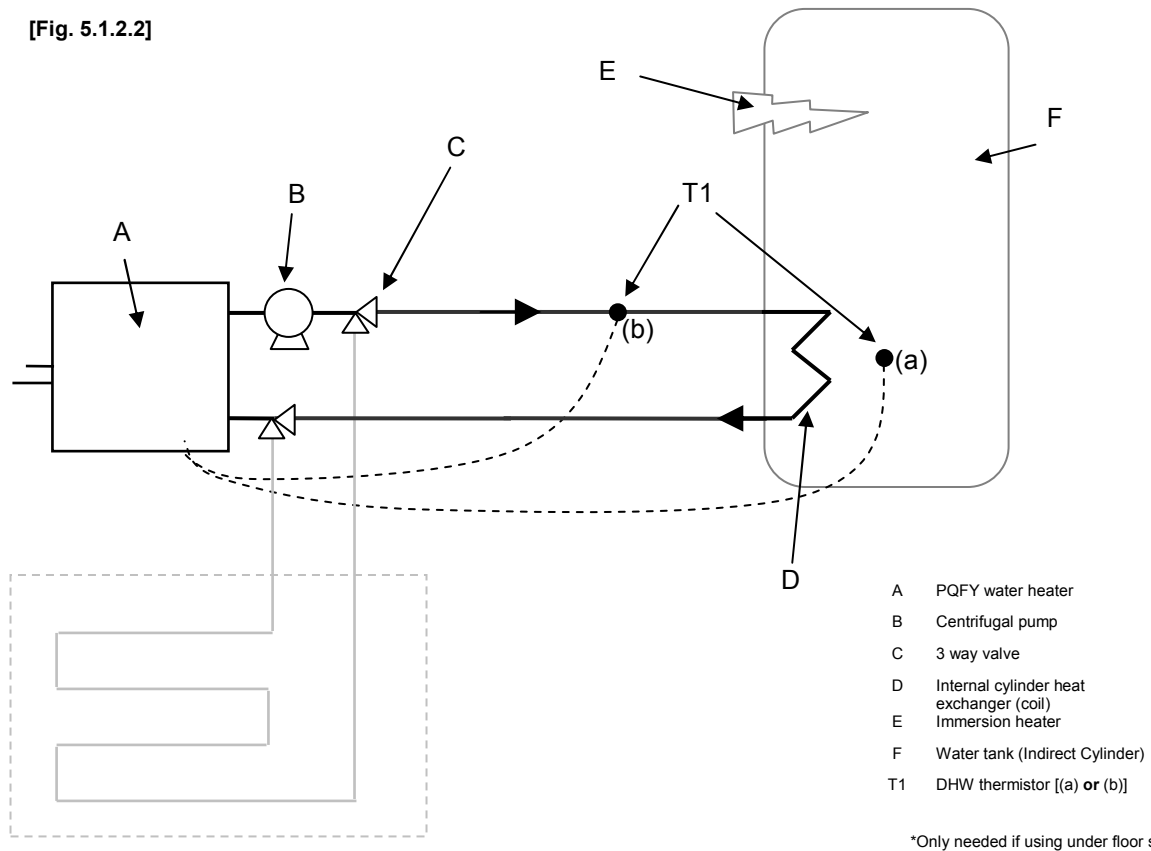
- A Water pipe
- B Thermistor
- C Aluminium tape (field supply)
- D Insulation
- E Tie band

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[Fig. 5.1.2.1]

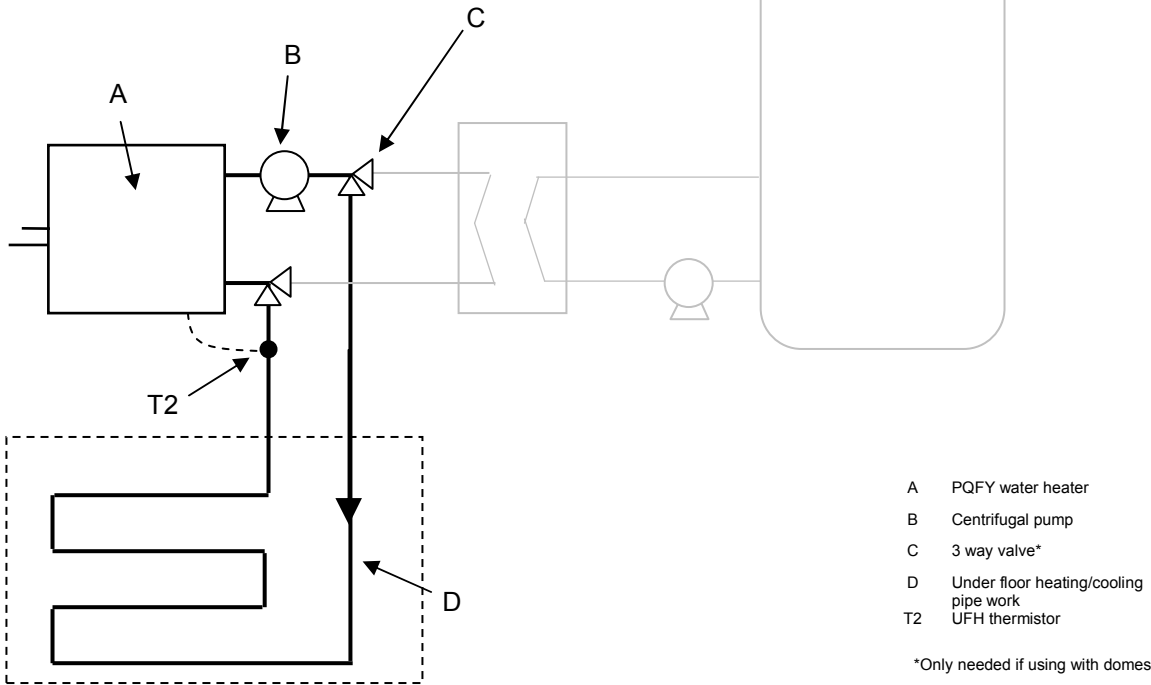
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[Fig. 5.1.2.2]



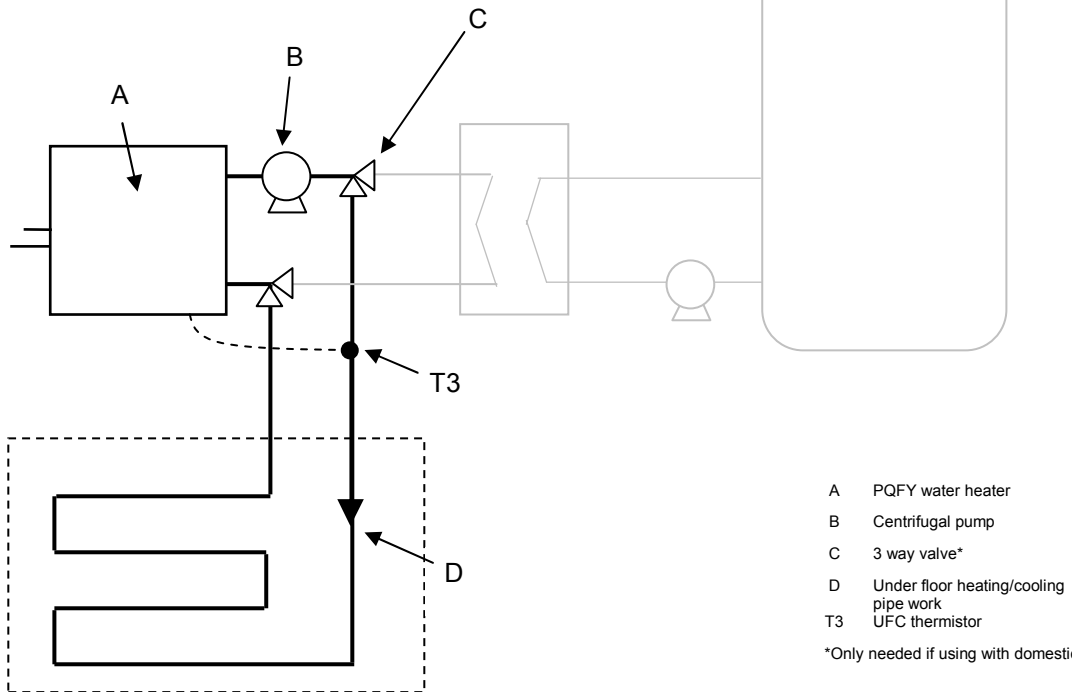
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[Fig. 5.1.3]



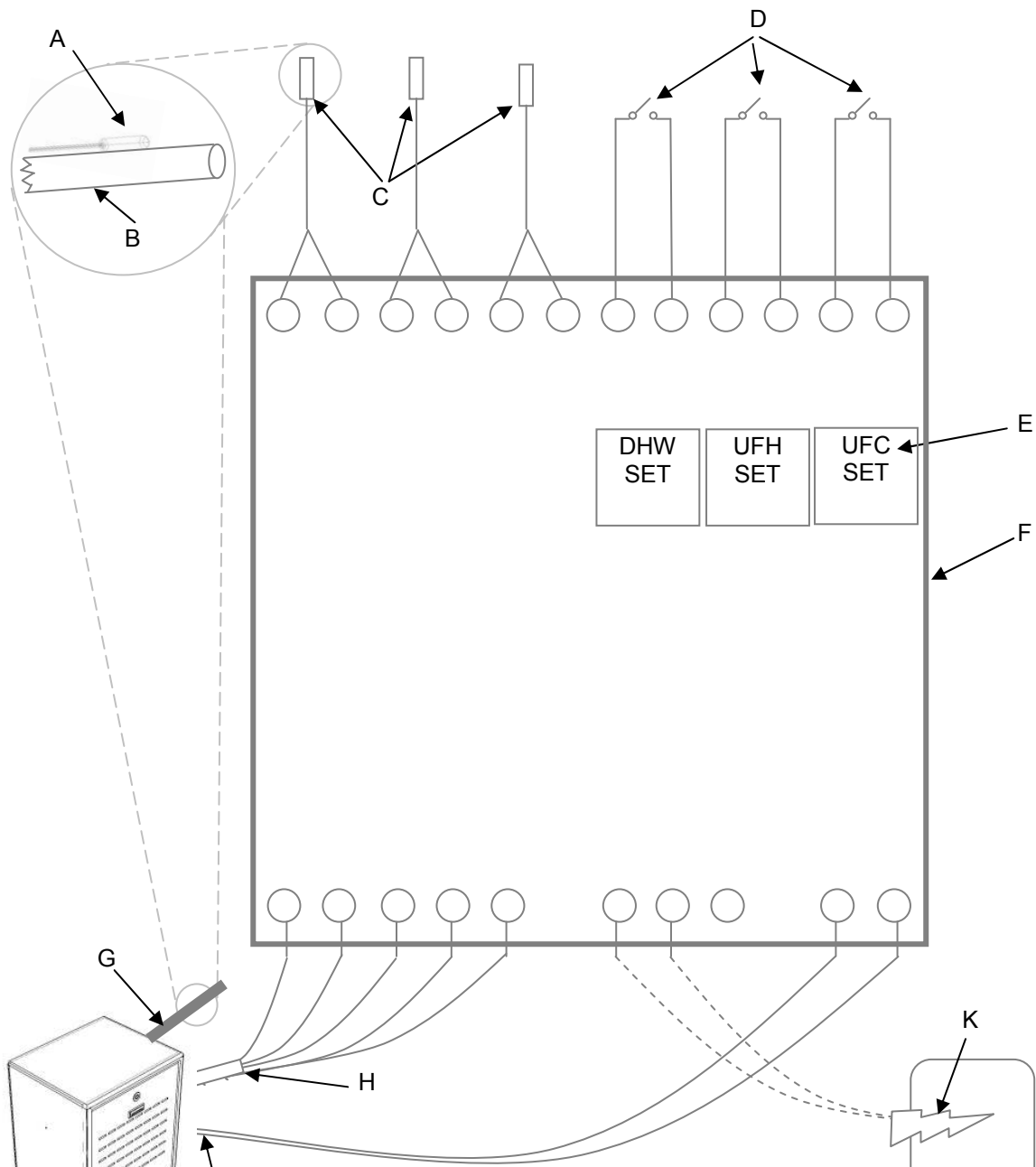
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[Fig. 5.1.4]



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[Fig. 5.2]




- A Thermistor
- B Water pipe/cylinder (see fig 5.3... to see where to attach to)
- C Thermistors
- D Volt free contacts
- E Dip switches (temperature set)
- F ACH1 box
- G Water pipe/cylinder (see B)
- H 5 wire adapter (plug attaches to CN52 on PQFY)
- I TH1H connection (attach to 'inlet air' TH1H on PQFY)
- J PQFY water heater unit
- K Immersion heater
- L Water tank

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[Fig. 6.1]

1 = ON
0 = OFF

 Binary	DHW temperature (°C)	UFH temperature (°C)	UFC temperature (°C)
0000	45*	30	10
0001	41	31	11
0010	42	32	12
0011	43	33	13
0100	44	34	14
0101	45	35	15
0110	46	36	16
0111	47	37	17
1000	48	38	18
1001	49	39	19
1010	50	40	20
1011	51	41	20
1100	52	42	20
1101	53	43	20
1110	54	44	20
1111	55	45	20

*Note: DHW [0000] (all OFF) causes heat pump boiler to heat to 45°C, followed by signal for immersion heater to 60°C

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1. Safety precautions

1.1. Before installation and electric work

- Before installing the unit, make sure you read all the “Safety precautions”.
 - The “Safety precautions” provide very important points regarding safety. Make sure you follow them.

Symbols used in the text

⚠ Warning:

Describes precautions that should be observed to prevent danger of injury or death to the user.

⚠ Caution:

Describes precautions that should be observed to prevent damage to the unit.

⚠ Warning:
Carefully read the labels affixed to the main unit.

⚠ Warning:

- **Ask the dealer or an authorised technician to install the controller.**
 - Improper installation by the user may result in water leakage, electric shock, or fire.
- **Use the specified cables for wiring. Make the connections securely so that the outside force of the cable is not applied to the terminals.**
 - Inadequate connection and fastening may generate heat and cause a fire.
- **Never repair the unit. If the controller must be repaired, consult the dealer.**
 - If the unit is repaired improperly, electric shock, or fire may result.
- **Install the controller according to this Installation Manual.**
 - If the unit is installed improperly, electric shock, or fire may result.
- **Have all electric work done by a licensed electrician according to "Electric Facility Engineering Standard" and "Interior Wire Regulations" and the instructions given in this manual and always use a special circuit.**
 - If the power source capacity is inadequate or electric work is performed improperly, electric shock or fire may result.
- **Keep the electric parts away from water (washing water etc.).**
 - It might result in electric shock, fire or smoke.
- **When moving and reinstalling the ACH1 unit, consult the dealer or an authorised technician.**
 - If the controller is installed improperly, electric shock, or fire may result.
- **To dispose of this product, consult your dealer.**

1.3. Before installation

⚠ Caution:

- **Do not install the unit where combustible gas may leak.**
 - If the gas leaks and accumulates around the unit, an explosion may result.
- **Do not use the control box where food, pets, plants, precision instruments, or artwork are kept.**
- **Do not use the control box in special environments.**
 - Oil, steam, sulphuric smoke, etc. can significantly reduce the performance of the air conditioner or damage its parts.

1.3.1. Before installation - electrical work

⚠ Caution:

- **Do not wash the control box.**
 - Washing them may cause an electric shock.
- **Be very careful about product transportation.**
- **Safely dispose of the packing materials.**
 - Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries.
 - Tear apart and throw away plastic packaging bags so that children will not play with them - If children play with a plastic bag which has not been torn apart, they face the risk of suffocation.

1.3.2. Before starting the test run

⚠ Caution:

- **Do not touch the switches with wet fingers.**
 - Touching a switch with wet fingers can cause electric shock.
- **Do not operate the control box with the panels and guards removed.**
- **Do not turn off the power immediately after stopping operation.**
 - Always wait at least five minutes before turning off the power. Otherwise problems may occur.

2. Accessories

The unit is provided with the following accessories:
[Fig. 2.1]

No	Accessories	No supplied
1	Thermistor	3
2	5 wire adapter	1
3	ACH1	1

3. System components

- ACH1 Control box
- PQFY water heating unit
- Outdoor unit (any type)
- DHW thermistor
- UFH thermistor
- UFC thermistor
- 5 wire adapter

4. Selecting an installation site

- Avoid locations in direct sunlight.
- Avoid locations exposed to steam or oil vapour.
- Avoid locations where combustible gas may leak, settle or be generated.
- Avoid installation near machines emitting high-frequency waves.
- Avoid places where acidic solutions are frequently handled.
- Avoid places where sulphur-based or other sprays are frequently used.

5. Electrical wiring

Precautions on electrical wiring

Warning:

Electrical work should be done by qualified electrical engineers in accordance with "Engineering Standards for Electrical Installation" and supplied installation manuals. Special circuits should also be used. If the power circuit lacks capacity or has an installation failure, it may cause a risk of electric shock or fire.

- Install the unit to prevent any of the control circuit cables (remote controller, transmission cables) from direct contact with the power cable outside the unit.
- Ensure that there is no slack on all wire connections.
- Some cables (power, remote controller, transmission cables) above the ceiling may be prone to be bitten by mice. Insert the cables into metal pipes for protection.
- Never connect the power cable to leads for the transmission cables. Otherwise the cables could be broken.

Types of control cables

Wiring transmission cables

- Types of transmission cables
Design wiring in accordance with the following table
- Cable diameter
More than 1.25 mm²

5.1. Connecting the thermistor cables

The ACH1 control box is required for the Heat Pump Boiler (PQFY) to switch between domestic hot water and under floor piping heating and cooling modes. The extra interface, i.e., the ACH1 control box is necessary because when operating in heating, a different temperature must be monitored often from a different position than when the system is operating in cooling. Thermistor cables (T1, T2, and T3) are attached to 'A' terminals [See figure 5.1]. Thermistors are attached to pipe/cylinder [see figure 5.1.1]. For further details on setting up the unit and the unit logic, see section 6.

Caution:

Do not route the thermistor cables together with power cables.

Caution:

When the lead wire is too long, cut it to the appropriate length. Do not bind it in the box.

Caution:

Take proper measures not to miswire.

5.1.2 Connecting the Domestic Hot Water (DHW) thermistor T1

Direct cylinder with plate heat exchanger

[Fig 5.1.2.1]

The thermistor can be attached to different parts of the system depending on the set up and the availability of connection points.

Note¹: Thermistor (T1) attached to terminals 1 & 2 on ACH1 unit [Fig 5.1].

Note²: If the water heated from the HPB at 45°C is in a separate tank to the immersion heater taking the water temperature up to 60°C, the 45°C water must be kept circulating to maintain legionella control.

- Type (a) – T1 attached to cylinder
 - Set temperature to no more than 45°C (0101).
 - Immersion function available – set temperature to 45°C (0000 – all OFF).
 - When 44°C is achieved on T1, the immersion signal comes on and heats to 60°C. For more information see Unit Logic [section 6]*.
- Type (b) - T1 attached to inlet to the plate heat exchanger (cylinder water outlet)
 - Set temperature to no more than 45°C (0101).
 - No immersion heater function available.

Indirect Cylinder

[Fig 5.1.2.2]

The thermistor can be attached to different parts of the system depending on the set up and the availability of connection points.

Note: Thermistor (T1) attached to terminals 1 & 2 on ACH1 unit [Fig 5.1].

- Type (a) – T1 attached to cylinder
 - Set temperature to no more than 45°C (0101).
 - Immersion function available – set temperature to 45°C (0000 – all OFF).
 - *See as above.
- Type (b) - T1 attached to inlet to cylinder pipe (PQFY water outlet)
 - Set temperature to 53°C (1101) on ACH1.
 - In order to increase the output temperature of the water it is necessary to increase the condensing temperature of the Heat Pump. This is achieved by setting a Dip Switch as follows.
 - PUMY-P100/125/140YMH, PUMY-P100/125/140VMH, SW 6-6 to the ON position.
 - All City Multi P200 and above, SW3-7 to the ON position.
 - *ONLY USE WHEN TANK SURFACE IS INACCESSABLE.*
 - No immersion heater function available.

5.3.3 Connecting the Under Floor Heating (UFH) thermistor T2

[Fig 5.1.3]

Note: thermistor (T2) attached to terminals 3 and 4 on ACH1 unit [Fig 5.1].

- T2 attached to water inlet to PQFY (return from under floor system)
 - Set temperature to desired return temperature from under floor system.
 - i.e. 35°C (0101) return temperature would typically mean an outlet temperature to under floor system of 45°C, giving at temperature difference of 10°C.

5.3.4 Connecting the Under Floor Cooling (UFC) thermistor T3

[Fig 5.1.4]

Note: thermistor (T3) attached to terminals 5 and 6 on ACH1 unit [Fig 5.1].

- T3 attached to water outlet from PQFY (outlet to under floor system)
 - Set temperature to desired outlet temperature from under floor system, typically minimum allowable to avoid condensation on the floor surface.
 - i.e. no less than 18°C (1000) for laminate flooring.

5.2. Connecting to the PQFY unit

5.2.1. Five Wire Adapter

[Fig 5.1 [C] and 5.2]

Attach the 5 wires on the adapter to ACH1 (CN52) starting with black to terminal 13, followed by red (14), white (15), yellow (16) and green (17). Insert plug end to CN52 on the PQFY water heating unit PCB. Please note power to the ACH1 box is provided through the 5 wire adapter.

Note:

Ensure that the wiring is not pinched when fitting the terminal box cover. Pinching the wiring may cut it.

⚠ Caution:

Install wiring so that it is not tight and under tension. Wiring under tension may break, or overheat and burn.

- After wiring is complete, make sure again that there is no slack on the connections, and attach the cover onto the control box in the reverse order removal.

5.2.1. TH1H

[Fig. 5.2 [E] & 5.3]

Attach 2 core Non-polarised 1.25mm shielded wire to both terminals 21 and 22, and then feed back to PQFY TH1H terminals 'inlet air' on PCB (see PQFY manual).

Note:

Ensure that the wiring is not pinched when fitting the terminal box cover. Pinching the wiring may cut it.

⚠ Caution:

Install wiring so that it is not tight and under tension. Wiring under tension may break, or overheat and burn.

- After wiring is complete, make sure again that there is no slack on the connections, and attach the cover onto the control box in the reverse order removal.

5.3. Connecting the Immersion Signal

If immersion heating is required (check set up [Section 5.1.2]), then a connection has to be made between the ACH1 unit and the immersion heater. When water has reached 44°C, the IH drive will become energised, and send a signal to the immersion heater to start.

Attach 2 core 1.25mm shielded wire to both terminals 18 and 19 on the ACH1 [Fig 5.1 [D]] and then to immersion heater, noting polarity.

Note:

Ensure that the wiring is not pinched when fitting the terminal box cover. Pinching the wiring may cut it.

⚠ Caution:

Install wiring so that it is not tight and under tension. Wiring under tension may break, or overheat and burn.

- After wiring is complete, make sure again that there is no slack on the connections, and attach the cover onto the control box in the reverse order removal.

5.4. Connecting the Mode Select

Attach 2 core 1.25mm shielded wire on the following terminal blocks on ACH1 [Fig 5.1 [B]].

- For DHW select, connect wires between terminals 7 and 8.
- For UFH select, connect wires between terminals 9 and 10.
- For UFC select, connect wires between terminals 11 and 12.

When a volt free connection is made, the mode will become selected and the unit will operate accordingly.

Note:

Ensure that the wiring is not pinched when fitting the terminal box cover. Pinching the wiring may cut it.

⚠ Caution:

Install wiring so that it is not tight and under tension. Wiring under tension may break, or overheat and burn.

- After wiring is complete, make sure again that there is no slack on the connections, and attach the cover onto the control box in the reverse order removal.

Notes:

- Check that the bunch of wires do not come off even if they are pulled strongly.

6. Setting up the Unit and Unit Logic

The ACH1 box can be used for different solutions. The unit can run all modes (DHW, UFH and UFC) on one PQFY system, but follows logic to enable the best performance possible from the system. There can be any combination of modes. The next section details different scenarios and explains how the unit responds.

Note: a PAR21 controller is needed along side the ACH1 and set to Auto mode 28°C. To see how this applies and is implemented please see the PQFY manual.

6.1. DHW no Immersion Heater (IH)

Used when standalone immersion control is available.

- Volt free connection is made between terminals 7 and 8 [Fig 5.3]
- Unit will sense temperature from T1 thermistor (connected on terminals 1 and 2)
- Desired temperature can be set on dipswitch (DHW) whereby ON = 1, OFF = 0 (see table 6.1 for binary coding and corresponding temperatures in each mode)
 - Unit can be set from 41°C (0001) up to 55°C (1111)
- Unit will switch off when T1 senses the set temperature.
- Thermistors work to a diversity of ±1°C.

6.2. DHW with Immersion Heater

Immersion can only be used when T1 is attached to the tank as in [5.3.2. type (a)] *and* when the immersion is submerged in the same tank as the water heated from the PQFY.

- Volt free connection is made between terminals 7 and 8 [Fig 5.3]
- Unit will sense from T1 thermistor (connected terminals 1 and 2)
- Temperature set to 45°C (0000) all OFF on DHW dipswitch.
- When T1 reaches 44°C, a signal will be sent to the IH to come on and stay on until 60°C is sensed on T1 even if the DHW signal is lost on terminals 7 and 8.
- If T1 drops below 45°C, the PQFY will come on and the immersion will switch off. IH will then come on again at 44°C until T1 has achieved 60°C.
- If DHW signal is lost and T1 is below 45°C and 60°C hasn't been achieved within one DHW cycle (i.e. signal is not renewed), immersion will come on and heat the water to 60°C.
- Once 60°C is reached on T1 (legionella is controlled) in any case within one cycle (signal is not renewed), the immersion will not come on again. The immersion will only be re-started if the DHW signal is lost, then renewed.

6.3. UFH

Used when under floor heating only is required.

- Volt free connection is made between terminals 9 and 10 [Fig 5.3]
- Unit will sense from T2 thermistor (connected terminals 3 and 4)
- Desired temperature can be set on dipswitch (DHW) whereby ON = 1, OFF = 0 (see table 2.1 for binary coding and corresponding temperatures in each mode)
 - Unit can be set from 30°C (0000) up to 45°C (1111)
- Unit will switch off when T2 senses the set temperature.

6.4. UFC

Used when under floor cooling only is required.

- Volt free connection is made between terminals 11 and 12 [Fig 5.3]
- Unit will sense from T3 thermistor (connected terminals 5 and 6)
- Desired temperature can be set on dipswitch (DHW) whereby ON = 1, OFF = 0 (see table 2.1 for binary coding and corresponding temperatures in each mode)
 - Unit can be set from 10°C (0000) up to 20°C (1011). Note anything above 1011 will equal a set temperature of 20°C.
- Unit will switch off when T3 senses the set temperature.

6.5. DHW and UFH

In this case the DHW takes priority over the under floor heating. It is more important to have DHW than space heating, so until the water is up to temperature (45°C), the system will control to the DHW set point. This may mean that water slightly hotter than 45°C being applied to the under floor heating system for a period of time.

- The system will operate as in 6.2, with the system being controlled from T1 until the set point has been achieved.
- After which point the UFH signal (T2) will take control as in 6.3.
- If using DHW with IH signal output; once DHW is heated to 45°C, IH will come on and stay on until 60°C at the same time UFH signal (T2) will take over.

6.6. DHW and UFC

The same priority takes place with DHW and UFC, DHW is more important than UFC.

- The system will operate as in 6.2, with the system being controlled from T1 until the set point has been achieved.
- After which point the UFC signal (T3) will take control as in 6.4.
- If using DHW with IH signal output; once DHW is heated to 45°C, IH will come on and stay on until 60°C at the same time UFC signal (T3) will take over.

6.7. UFH and UFC

Both will work when independently required. If both modes are requested simultaneously there will be NO operation.

7. Initial setting and test run

See PQFY manual for commissioning and testing.

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

The product at hand is based on the following EU regulations:

- Low Voltage Directive 73/23/EEC
- Electromagnetic Compatibility Directive 89/336/EEC

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

mitsubishi electric uk

MITSUBISHI ELECTRIC UK, TRAVELLERS LANE, HATFIELD, HERTDFORSHIRE, AL10 8XB