Ecodan Air Source Heat Pump and Flow Temperature Controller

Design, Installation & Servicing Instructions

Flow Temperature Controller Model Number

PAC-IF021B-E

Ecodan Air Source Heat Pump Model Number

PUHZ-W50VHA-BS
PUHZ-W85VHA-BS
PUHZ-HW140VHA-BS / YHA-BS

ISSUE 1: 05-09

INTRODUCTION

Any water distribution and central heating installation must comply with the relevant recommendation of the current version of the Regulations and British Standards listed below:-

Building Regulations
I.E.E. Requirements for Electrical Installations (BS7671)
Water Regulations
Manual Handling Operations Regulations

British Standards BS6798, BS5449, BS5546, BS5440:1, BS5440:2, CP331:3, BS6700, BS7593 and BS7671.
Health and Safety Document No 635

Only Mitsubishi Approved Ecodan Installers should install the Ecodan system. Mitsubishi Electric's notes must not be taken as overriding statutory obligations.

When installing unvented hot water systems section G3 of the building regulations should be adhered to. An annual inspection would also be required to ensure safe, long term operation.

The information in this manual is provided to assist generally in the selection of equipment. The responsibility for the selection and specification of the equipment must however remain that of the customer and any Designers or Consultants concerned with the design and installation.

Please note: Mitsubishi Electric do not therefore accept any responsibility for matters of design, selection or specification or for the effectiveness of an installation containing one of our products unless we have been specifically requested to do so.

All goods are sold subject to our Conditions of Sale.

Important Note - Included in the AEI introduction pack is the Mitsubishi Electric homeowners 3 year guarantee registration card. Please use this card to register within 30 days of commissioning/occupation if new build, and ensure the homeowner benefits from Mitsubishi Electrics home owner 3 year guarantee for the Ecodan heat pump boiler. This needs to be completed by both the Approved Installer and the current homeowner (or signature of developer if new build). The registration card is free post and is logged by our warranty department. In the unlikely event of failure of the Ecodan heat pump boiler, return of the card ensures that the homeowner's warranty claim is hassle free. For additional supplies of the 3 year guarantee card please contact our Heating department on 01707 278666.

PLEASE NOTE - If you do not complete and return the registration card the product will only be under warranty for 12 months.

CONTENTS

ISSUE 1: 05-09

Checklist for Mitsubishi Ecodan and Flow Temperature Controller (FTC)

This checklist has been created to help you understand the differences from other types of heating systems you may have installed. We suggest you use this checklist as a helpful summary of the main differences from conventional heating systems, but you will also need to understand and comply with all of the technical details contained within this document to ensure a successful installation. For further assistance please contact Mitsubishi Technical Support Helpline on 0870 3000 300.

Primary System Circuit

- It is very important that the primary system is cleansed using a suitable cleansing agent such as Fernox F3 to ensure that any flux residues / installation debris is removed.
- The heat pump and external connecting pipework require protection against freezing. For this reason a combined anti-freeze and inhibitor product such as Fernox Alpha-11 must be used in the correct quantity.
- The Fernox Boiler Buddy should be fitted internally on the heat pump return to help protect the heat pump from any heating system contamination and provide an ongoing visual indication of the system water condition.

Interconnection Between Ecodan and Flow Temperature Controller

- A 4 core power and signal cable is needed between the internal FTC and the external Ecodan. This cable should be a minimum of 1.5mm sq and is NOT supplied with the package.

Radiator System Circuit

- As the heat pump generates lower temperatures than a conventional boiler the radiators should have been designed to suit the lower mean temperature. These need to be calculated using the design tool supplied on the AEI training course.

Room Thermostat

- A 2 channel digital programmer is required to control the Ecodan & FTC an external room thermostat and cylinder thermostat will also be required.

Retrofit Situations

- The heat exchanger in the heat pump should be protected from particulate contaminates in the water circuit. When fitting in a retrofit situation the existing radiator circuit MUST be chemically cleaned and thoroughly flushed before installation.

Ecodan Air Source Heat Pump

- Must be mounted external to the property in a suitable location using the installation manual for details and with a minimum distance of 150mm from the nearest wall.
- Cold air is blown from the front of the unit - it should be positioned in a location where this will not cause a nuisance.
- It should be mounted on the anti-vibration mounts, these are NOT provided with the equipment.
- The anti-vibration flexible hoses should be fitted to the flow /return pipe-work.
- Condensate water may be produced which will drain away from the unit. It is suggested that a gravel filled channel as a soakaway, or a similar arrangement to suit the location is installed to overcome this.
- The internally and externally flow / return pipework **must** be insulated and waterproofed externally to prevent freezing.

Externally Mounted Temperature Sensor

- An external temperature sensor is positioned at the rear of the air source heat pump. Care should be taken to ensure this is not in-uenced by direct sunlight.

SYSTEM DESIGN

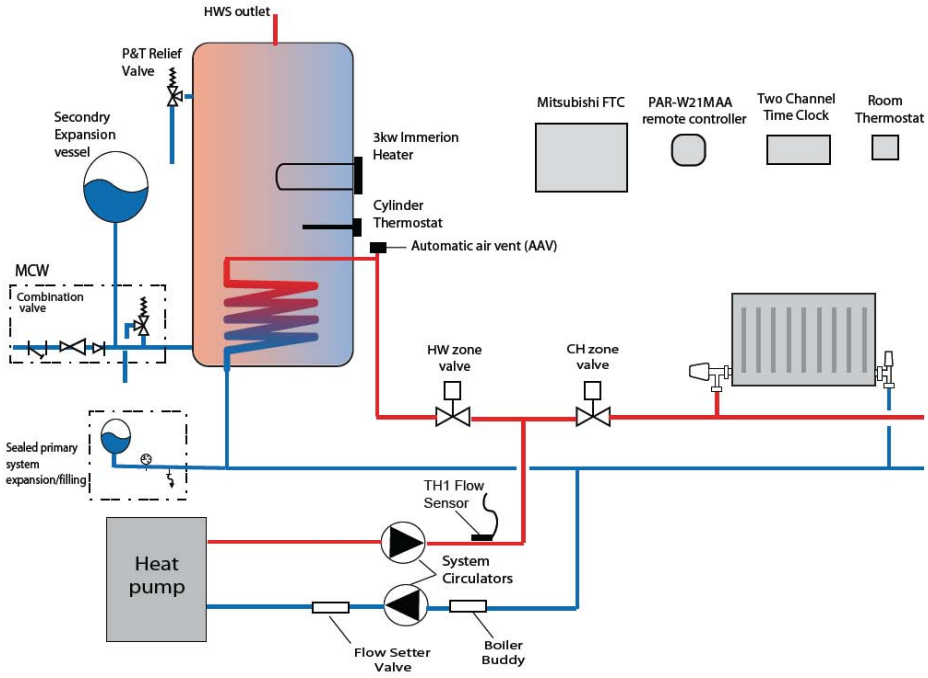


Fig 1.1

Standard Single Zone Pipework Schematic

The Ecodan air source heat pump extracts heat from the outside air and transfers this into a property in the form of hot water as a conventional heating system does.

The Ecodan and FTC system is controlled by conventional heating system control equipment. A two channel time clock is required for ON and OFF periods, a cylinder thermostat for DHW temperature and a room thermostat for space temperature.

Due to the outputs available domestic hot water always takes priority over space heating. The Flow Temperature Controller (FTC) targets a preset flow temperature on the TH1 sensor and communicates with the Ecodan until this temperature is achieved. A high flow temperature is required in hot water heating to raise the DHW store then the temperature is reduced in space heating to increase the efficiencies.

The Ecodan ASHP and FTC combination can be used in conjunction with a more conventional domestic hot water cylinder. This cylinder can be either vented or unvented but must meet Mitsubishi Electric's recommended specification stated on page 14 of this manual. An immersed thermostat should be used to achieve a true representation of the actual water storage temperature. A domestic hot water immersion heater is required in the storage cylinder , this should be programmed to coincide with a hot water heat up once every seven days as protection against legionella bacteria.

Mounted in the rear of the Ecodan is an outside temperature compensation sensor this will modulate the flow temperature in heating mode to increase the efficiencies of the system.

Due to the lower flow temperatures provided by the Ecodan air source heat pump heat emmiters need to be larger than conventional boiler systems. Underfloor heating is ideal due to its large surface area but if radiators are sized correctly the efficiencies

SYSTEM DESIGN

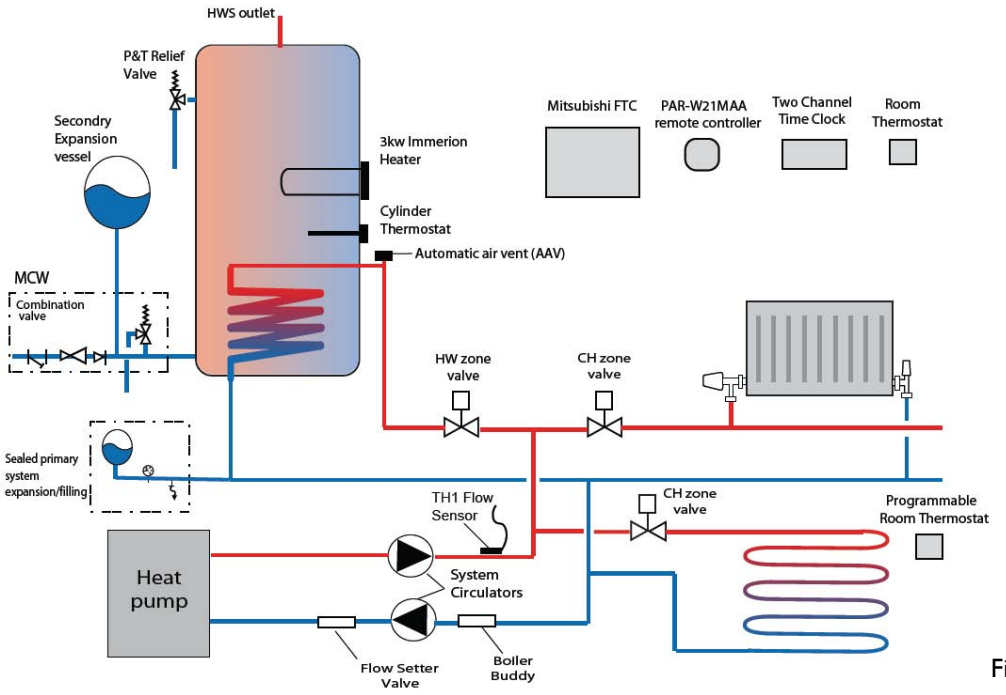


Fig 1.2

Standard Twin Zone Pipework Schematic

Multiple heating zones can be connected to the Ecodan system in the same way as a conventional heating system. When the system is installed and commissioned the control equipment will automatically switch between hot water and heating modes as and when required.

Each of the three Ecodan models require sufficient primary flow rate for adequate operation. Due to the large resistances caused by the plate heat exchanger in the Ecodan unit it is necessary to install two domestic circulators in series to produce the required flow rates. Pipe diameters may also need to increase on the larger 14kW model to assist in reducing the resistance, required flow rates are stated in the following section of this manual.

A flow setter valve is supplied with each system to give an indication of the actual flow rate achieved. It should be installed in the common flow or return pipe work to the Ecodan. Details of this can be found on page 13 of this manual.

The TH1 flow sensor should be mounted and fully insulated to the common FLOW pipe from the Ecodan.

Automatic air vents must be installed at the highest point of the primary system. The slightest amount of air in the system can reduce efficiencies and even cause the Ecodan to fault.

Even though the secondary hot water side can be either vented or unvented the primary loop must always be unvented as the loop must contain a 25% antifreeze concentration.

To comply with this requirement the hardness of the mains water should be checked by the installer and if necessary the optional factory fitted in-line scale inhibitor should be specified at the time of order for hardness.

PUHZ-W50VHA-BS

Specifications		PUHZ-W50VHA-BS
Dimensions (mm)	Width	950
	Depth	330+30*
	Height	740
Weight (kg)		64
Airflow (m3/min)		50
Nominal sound level (dBA)		45 ◊
Low noise mode (dBA) @ 7°C		40
Guaranteed operating range	(Outdoor)	- 15 ~ +35°C
Electrical Supply		220-240v, 50Hz
Phase		Single
Running current (A) [Max]		5.4 [13]
Fuse Rating (MCB sizes BS EN 60947-2) (A)		16
Heating A2/W35	Capacity (kW)	5.0
	COP	3.13
	Power Input (kW)	1.6
	Nominal Flow Rate (L/min)	14.3
Heating A7/W35	Capacity (kW)	5.0
	COP	4.1
	Power Input (kW)	1.22
	Nominal Flow Rate (L/min)	14.3
Primary Flow Rate	Maximum (L/min)	25.8
	Minimum (L/min)	10

* Grille
◊ At distance of 1m from the outdoor unit

PUHZ-W85VHA-BS

Specifications		PUHZ-W85VHA-BS
Dimensions (mm)	Width	950
	Depth	330+30*
	Height	943
Weight (kg)		77
Airflow (m3/min)		55
Nominal sound level (dBA)		48 ◊
Low noise mode (dBA) @ 7°C		42
Guaranteed operating range	(Outdoor)	- 20 ~ +35°C
Electrical Supply		220-240v, 50Hz
Phase		Single
Running current (A) [Max]		10.3 [23]
Fuse Rating (MCB sizes BS EN 60947-2) (A)		25
Heating A2/W35	Capacity (kW)	8.5
	COP	2.95
	Power Input (kW)	2.88
	Nominal Flow Rate (L/min)	25.8
Heating A7/W35	Capacity (kW)	9.0
	COP	3.85
	Power Input (kW)	2.34
	Nominal Flow Rate (L/min)	25.8
Primary Flow Rate	Maximum (L/min)	25.8
	Minimum (L/min)	10

* Grille
◊ At distance of 1m from the outdoor unit

PUHZ-HW140VHA-BS /YHA-BS

Specifications		PUHZ-HW140VHA-BS/ YHA-BS
Dimensions (mm)	Width	1020
	Depth	330+30*
	Height	1350
Weight (kg)		134 / 148
Airflow (m3/min)		100
Nominal sound level (dBA)		53 ◊
Low noise mode (dBA) @ 7°C		46
Guaranteed operating range	(Outdoor)	- 25 ~ +35°C
Electrical Supply		220-240v, 50Hz / 380-415v, 50Hz
Phase		Single / 3 Phase
Running current (A) [Max]		14.9 [35] / 5.1 [13]
Fuse Rating (MCB sizes BS EN 60947-2) (A)		40 / 16
Heating A2/W35	Capacity (kW)	14
	COP	2.69
	Power Input (kW)	5.21
	Nominal Flow Rate (L/min)	40.1
Heating A7/W35	Capacity (kW)	14.0
	COP	4.19
	Power Input (kW)	3.34
	Nominal Flow Rate (L/min)	40.1
Primary Flow Rate	Maximum (L/min)	40.1
	Minimum (L/min)	20.0

* Grille
◊ At distance of 1m from the outdoor unit

SYSTEM DESIGN

Model Selection Data

When checking the suitability of the heat pump it is recommend that complete heat loss calculations are completed for the external building fabric plus half of the ventilation losses. This should then be directly compared to the Ecodan heat pump model 5kW, 8.5 kW or 14kW.

When the Ecodan system is being used to supply domestic hot water a hot water storage appliance, will be required. The cylinder capacity required needs to be calculated in the correct way set out in BS 6700 / NHBC for storage cylinders.

Electricity Supply

A mains supply rated to suit the capacity of the Ecodan is required, this must have a means of isolation within 1 metre of the appliance itself. The circuit and heat pump should be protected by a 30mA rated RCD. This appliance **MUST BE EARTHED.**

All external wiring to the appliance must be in accordance with the latest I.E.E. Wiring Regulation, and any local regulations which may apply.

The appliance shall be supplied from a suitably rated double pole isolator with a contact separation of at least 3mm in both poles.

In the event of an electrical fault after installation of the appliance, electrical checks must be carried out i.e. Earth Continuity, Short Circuit, Polarity, and Resistance to Earth. The heat pump **MUST BE DISCONNECTED BEFORE** these tests are carried out.

The 4 core interconnecting cable between the FTC and Ecodan **MUST** have a means of isolation within 1 metre of the FTC. Cores S1, S2 and S3 should **ALL** be switched through the isolator. This isolator must be turned ON prior to outdoor unit power being turned ON.

Care should be taken not to run communication cables (flow sensor, remote controller cable) close to or with mains 240 volt cables.

Control equipment (pumps, zone valves, thermostats etc) must have a separate circuit from
the Ecodan system and should be protected by the required fuse rating.

FTC Location

The Flow Temperature Controller should be mounted in a dry area using the mounting holes pre-fabricated in the steel casing. It is usually installed in an airing cupboard or in a loft space close to the control equipment.

Heat Pump Location

The Ecodan air source heat pump should be installed following the procedures detailed in the relevant installation manuals.

Flow Temperature Controller

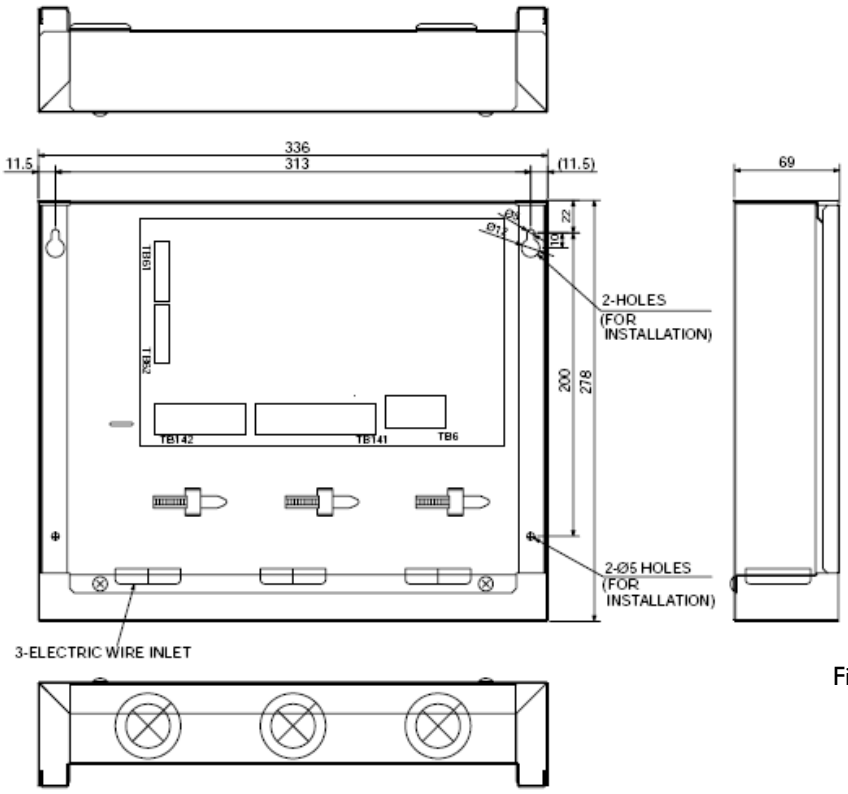
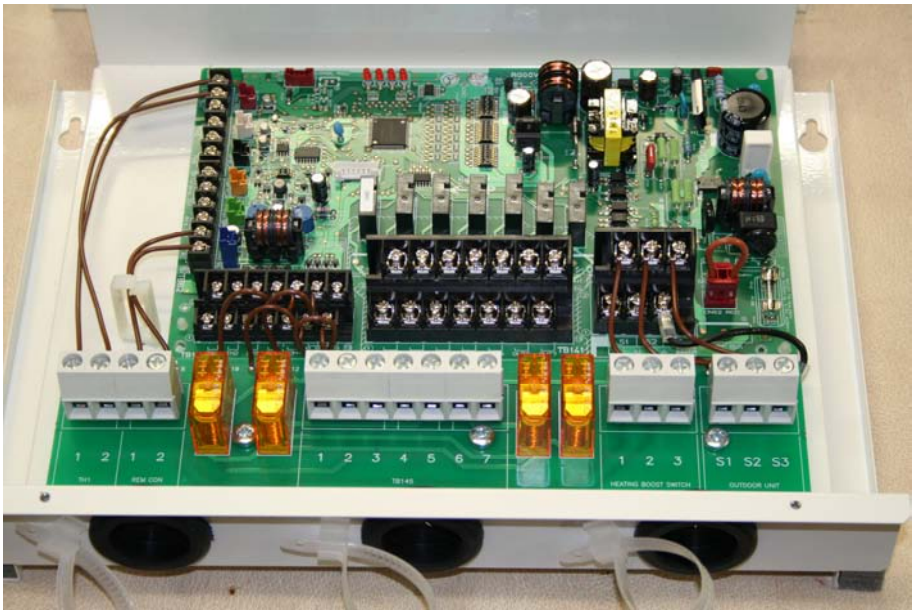


Fig 1.3



Pipe work Installation

Heat Pump Heating System Design

General

The Mitsubishi Electric Ecodan Air Source Heat Pump has been designed to be incorporated into a conventional heating system, either a vented or unvented domestic hot water store is required to supply water for showers sinks etc, these cylinders must meet the specifications set out later in the manual.

The heating system design and installation must comply with the requirements of BS 6798 and BS 5449 for the performance parameters chosen for the system.

Heat Pump Sizing

When sizing the Ecodan ASHP a heat loss calculation should be completed for the property as set out in BS5449:1990. The output of the heat pump should then be chosen to directly meet this demand.

Heat Pump Primary Circuit

The heat pump primary circuit must be unvented due to the concentration of anti-freeze required in the pipework.

Flexible hoses are supplied with the package which should be installed to connect the heat pump to the system pipework to prevent resonance into the fabric of a property.

The flow pipe from the heat pump should be connected to the bottom connection of the external plate heat exchanger.

External pipework should be fully installed using Armoflex or similar. All joints taped and either weather-rapped or put into trunking.

Central Heating Circuits

These should be sized in the normal way to suit the flow and return temperatures for the required system. Balancing of a radiator circuit is essential to achieve the best performance from the Ecodan Heat Pump.

If the heat pump is being fitted to an existing heating system, this **must** be thoroughly flushed/cleaned before the appliance is installed.

Plastic Pipework

Plastic pipework can be used internally as long as it is recommended by the manufacturer and installed in accordance with their recommendations. Barrier type plastic pipework should always be used for these systems.

It is important to ensure that if the system is installed using plastic pipework it is designed and sized using the characteristics for plastic pipework.

Pipe Work Installation

Fernox Boiler Buddy

A Fernox Boiler Buddy is provided with the package, this **must** be fitted internally on the return circuit as close to the heat pump as possible. It should be installed fully in accordance with the manufacturers instructions included later in the manual.

Flow Setter Valve

A flow setter Valve is provided with the package to give an indication of the water flow rate through the primary pipework. Each model of Ecodan has a minimum and a maximum flow rate shown in table 1.1 which must be achieved for the system to operate correctly.

The valve can be installed in wither the flow or return pipework to the Ecodan ASHP.

A flow rate indication can then be taken from the bottom of the float

Anti-Vibration Equipment

Flexible hoses are supplied with the Ecodan package and should be installed to connect the heat pump to the system pipework.

Anti-vibration mountings (i.e. Tico-pad) should be installed under the mountings of the heat pump to prevent excessive vibration.

	Ecodan required system flow rate	
Ecodan Model	Minimum Flow Rate (l/m)	Maximum Flow Rate (l/m)
PUHZ-W50VHA-BS	6.5	14.3 *
PUHZ-W85VHA-BS	10	25.8 *
PUHZ-HW140VHA-BS	20	40 *

Table 1.1

* To achieve good system efficiencies higher flow rates are recommended.

Note: As a rule of thumb for the average household application the following combinations can be used, however please note these are for guidance only and must be checked by the designer and installer beforehand.

PUHZ-W50VHA-BS: 22mm pipework and 2x15/50 circulating pumps.
PUHZ-W85VHA-BS: 22mm pipework and 2x15/50 circulating pumps.
PUHZ-HW140VHA-BS: 28mm pipework and 2 x 15/60 circulating pumps.

Domestic Hotwater Storage Cylinders

Due to the low flow temperatures supplied by Air Source Heat Pumps the type of domestic Hotwater Cylinder used in conjunction should meet a certain criteria to achieve the best possible performance and efficiencies.

The recommendations are stated in table 1.2 below

	Domestic Hotwater Storage Cylinder Specifications			
Ecodan Model	**Capacity (l)**	**Material**	**Primary Surface Area (m^2)**	**Stat Pocket**
PUHZ-W50VHA-BS	Calculate as BS1566	Copper	2	Insertion
PUHZ-W85VHA-BS	Calculate as BS1566	Copper	3	Insertion
PUHZ-HW140VHA-BS	Calculate as BS1566	Copper	3	Insertion

Electrical Work

All electrical work should be completed as recommended in the relevant Ecodan installation guide supplied with the heat pump. These are also available to download from www.mitsubishielectric.co.uk/heating

Notes:

1. Wiring size must comply with the applicable local and national codes.
2. Power supply cables and the cables between Interface unit/Flow temp. controller and outdoor unit shall not be lighter than polychloroprene sheathed flexible cables. (Design 60245 IEC 57)
3. Be sure to connect the cables between Interface unit/Flow temp. controller and outdoor unit directly to the units (no intermediate connections are allowed). Intermediate connections may result in communication errors. If water enters at the intermediate connection point, it may cause insufficient insulation to ground or a poor electrical contact . (If an intermediate connection is necessary, be sure to take measures to prevent water from entering the cables.)
4. Install an earth longer than other cables.

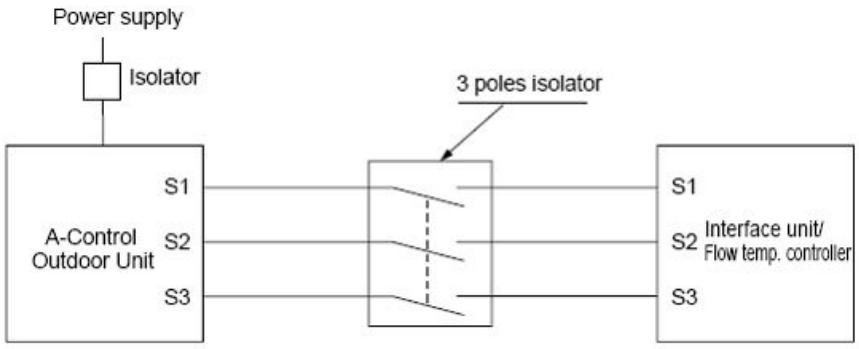


Fig 1.4

Warning;
In case of A-control wiring, there is high voltage potential on the S3 terminal caused by electrical circuit design that has no electrical insulation between power line and communication signal line. Therefore, please turn off the main power supply when servicing. And do not touch the S1, S2, S3 terminals when the power is energized. If isolator should be used between indoor unit and outdoor unit, please use 3-pole type.

Electrical Connection - Heat Pump

The outdoor unit power supply patterns vary on models.
The following connection patterns are available.

Fig 1.5

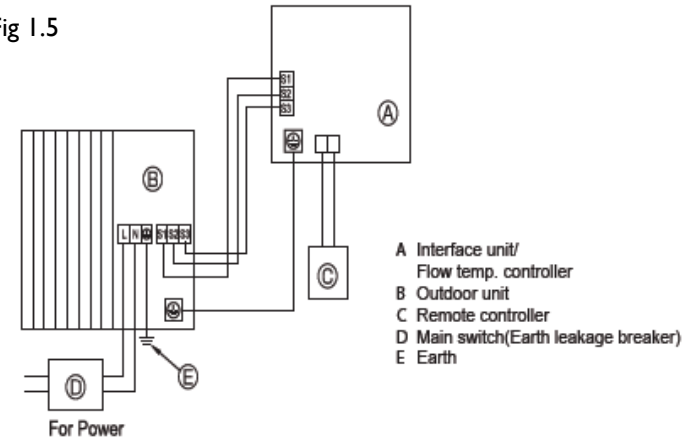
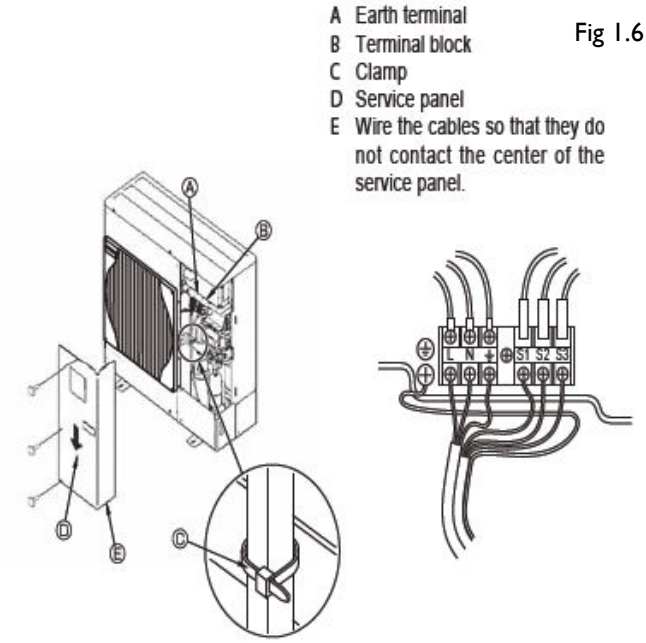
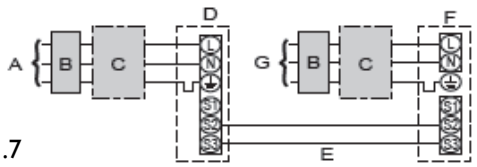


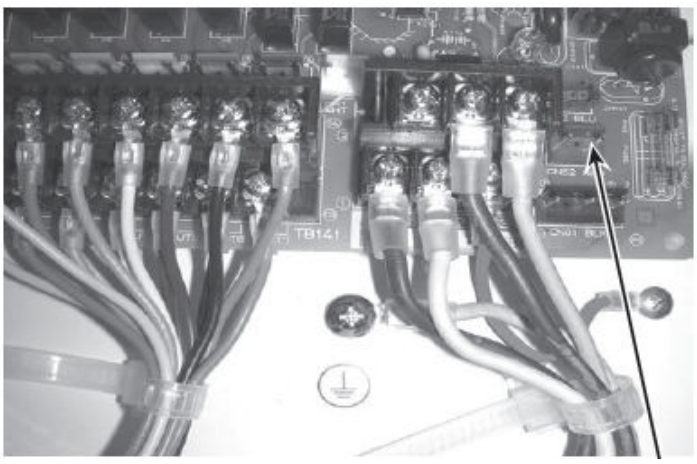
Fig 1.6



IMPORTANT NOTE
Please be aware that if the above wiring configuration is used the warning label supplied with the FTC MUST be attached to front panel of the FTC to indicate the equipment has two sources of isolation.

Fig 1.7





A Outdoor unit power supply
B Earth leakage breaker
C Wiring circuit breaker or isolating switch
D Outdoor unit
E Interface unit/outdoor unit connecting cables
F Interface unit
G Interface unit power supply

If the interface and outdoor units have separate power supplies, refer to the table below:

	Separate power supply specifications
Interface unit controller connector (CNS2) connection change	Disconnected
Outdoor unit DIP switch settings (when using separate interface unit/outdoor unit power supplies only)	ON / OFF: 1 2 3 (SW8) Set the SW8-3 to ON

Electrical Connection - Flow temperature Controller

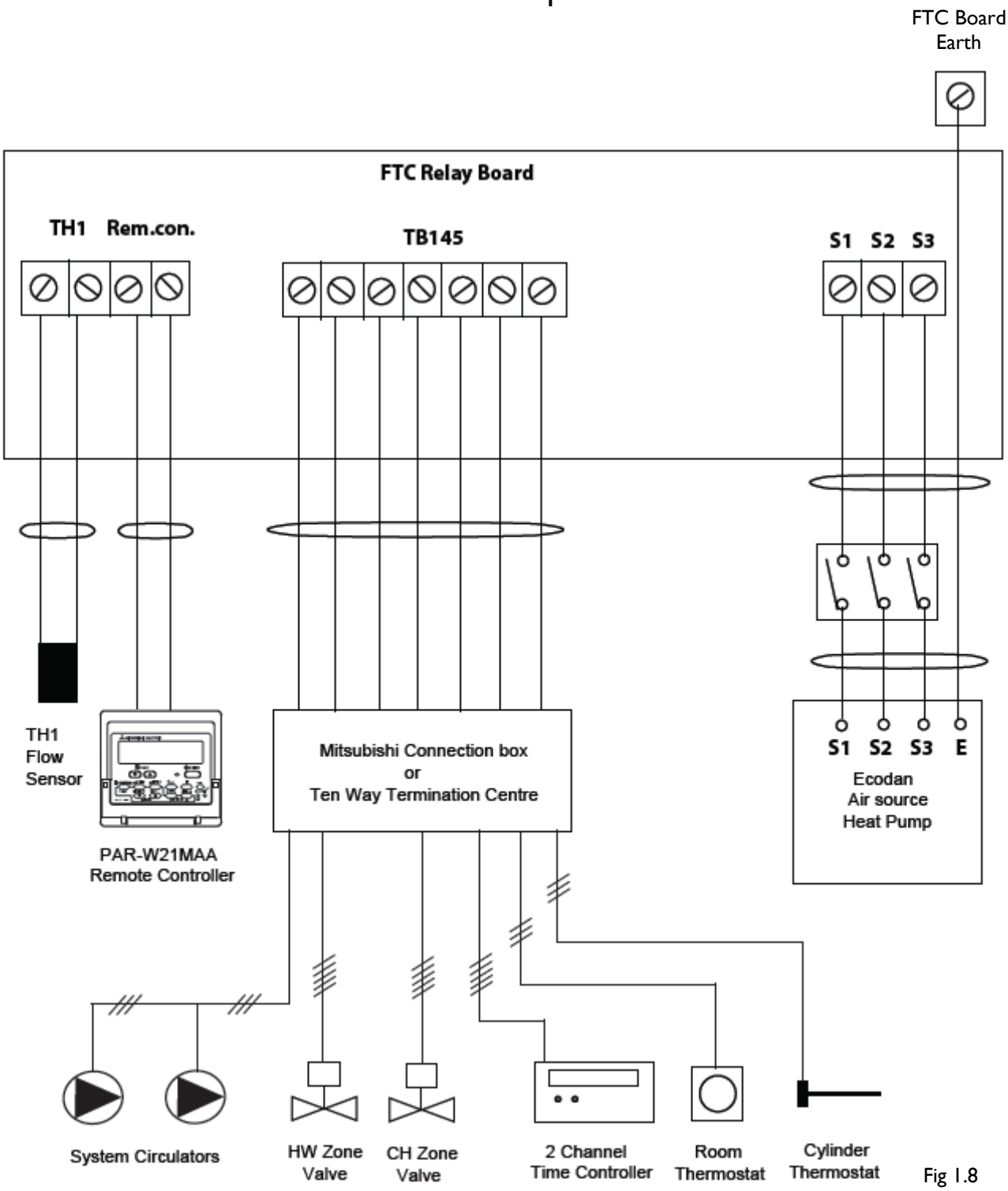


Fig 1.8

Single Heating Zone Wiring Termination Schematic

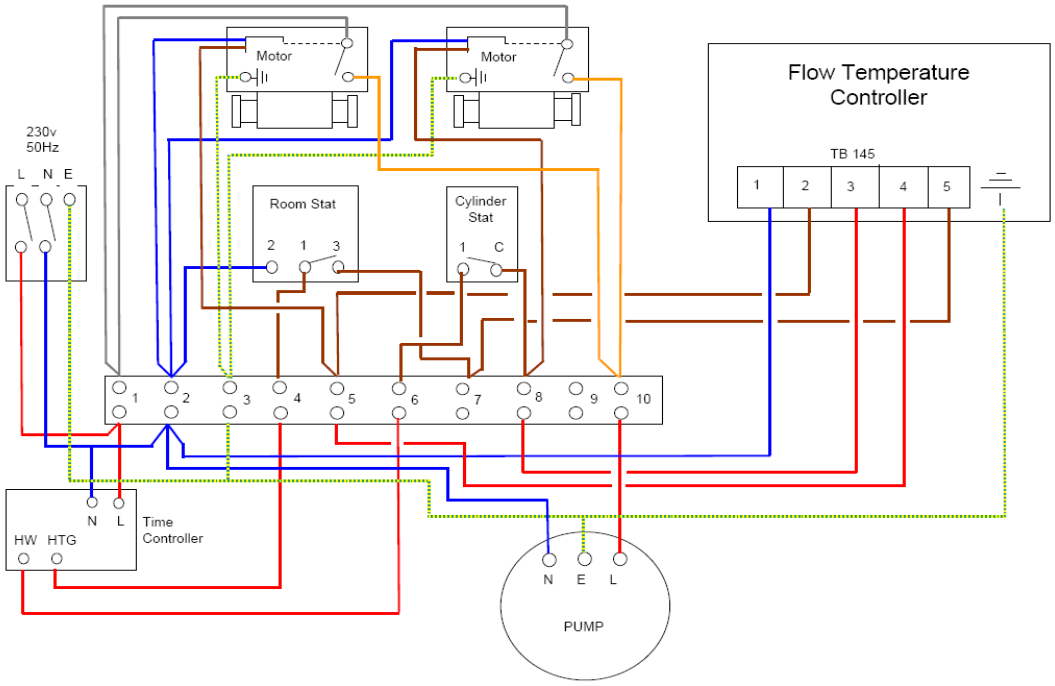
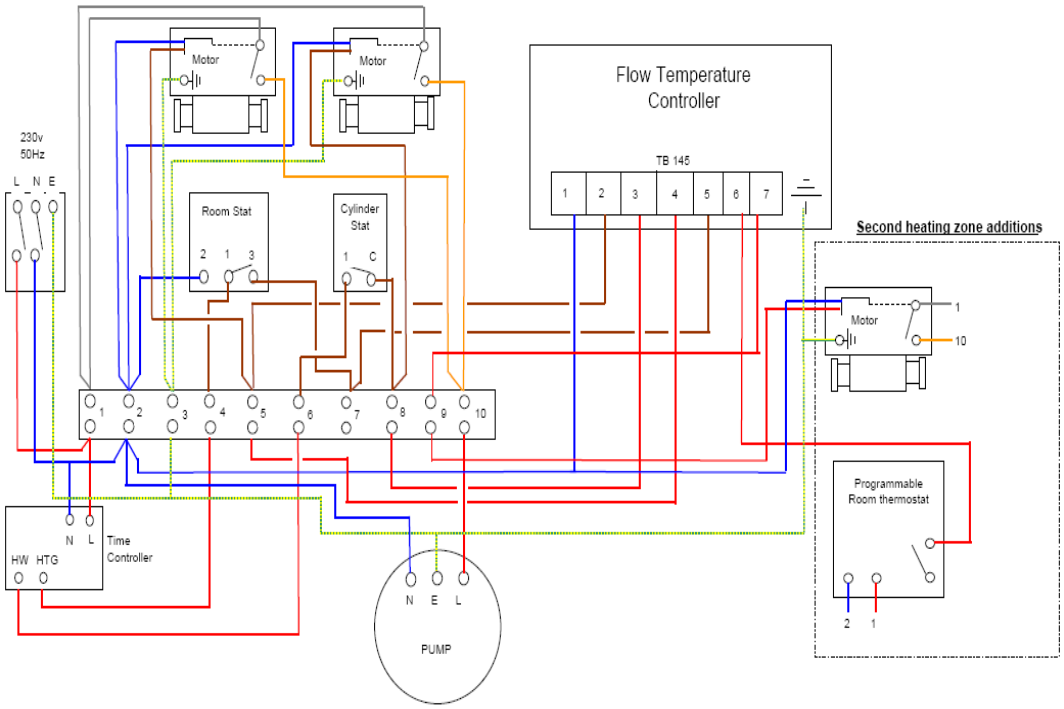


Fig 1.9

Two Heating Zone Wiring Termination Schematic



Additional zone valve room stat required

Fig 1.10

WIRING DIAGRAMS

S-Plan Wiring with 1 Heating Zone

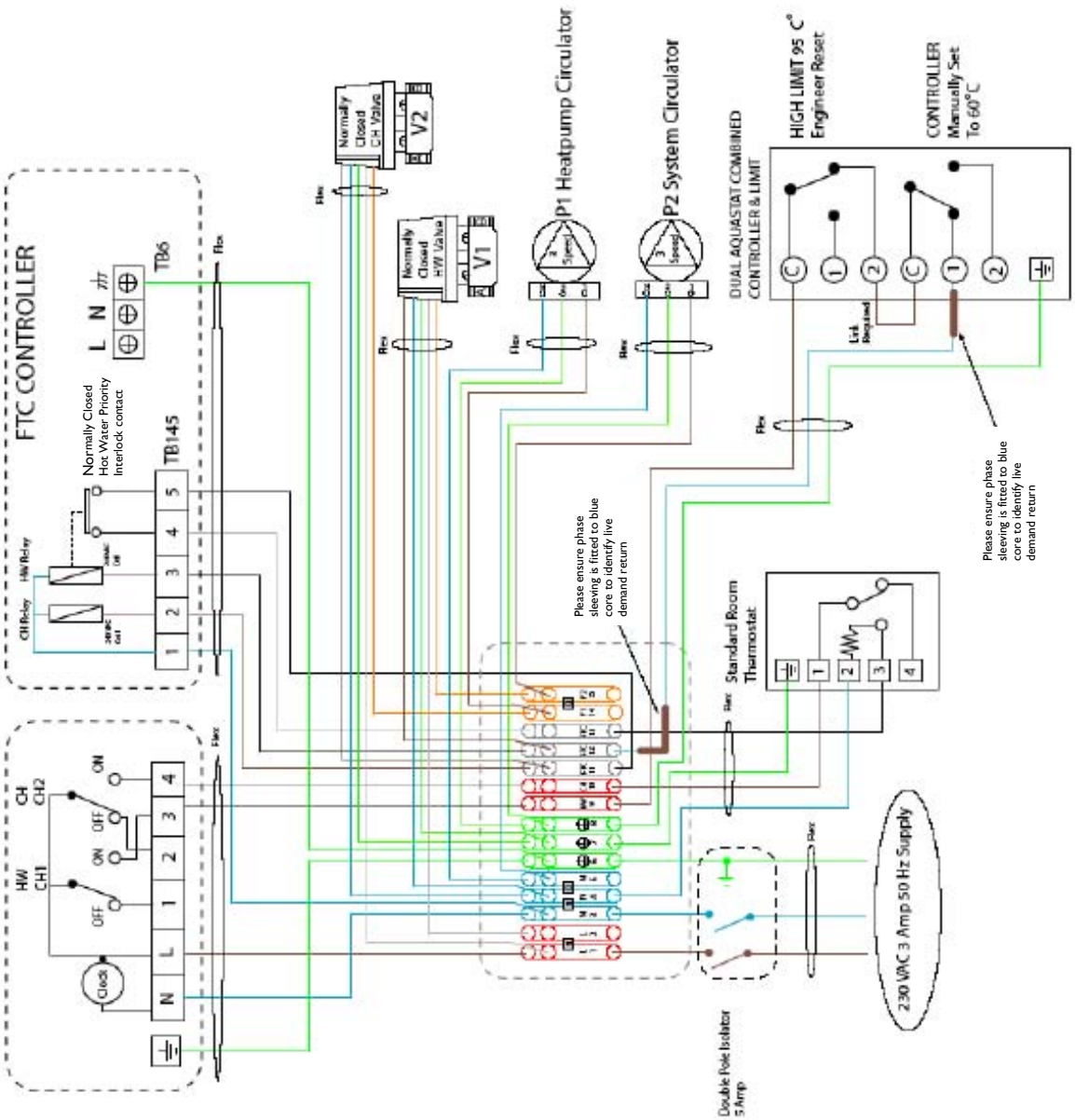


Fig 1.11

WIRE COLOUR LEGEND	
R	Red
Bl	Blue
Br	Brown
B	Black
Or	Orange
Y	Yellow
Wh	White
G/Y	Green / Yellow
Gr	Grey
G	Green

WIRING DIAGRAMS

S-Plan Wiring with 2 Heating Zones

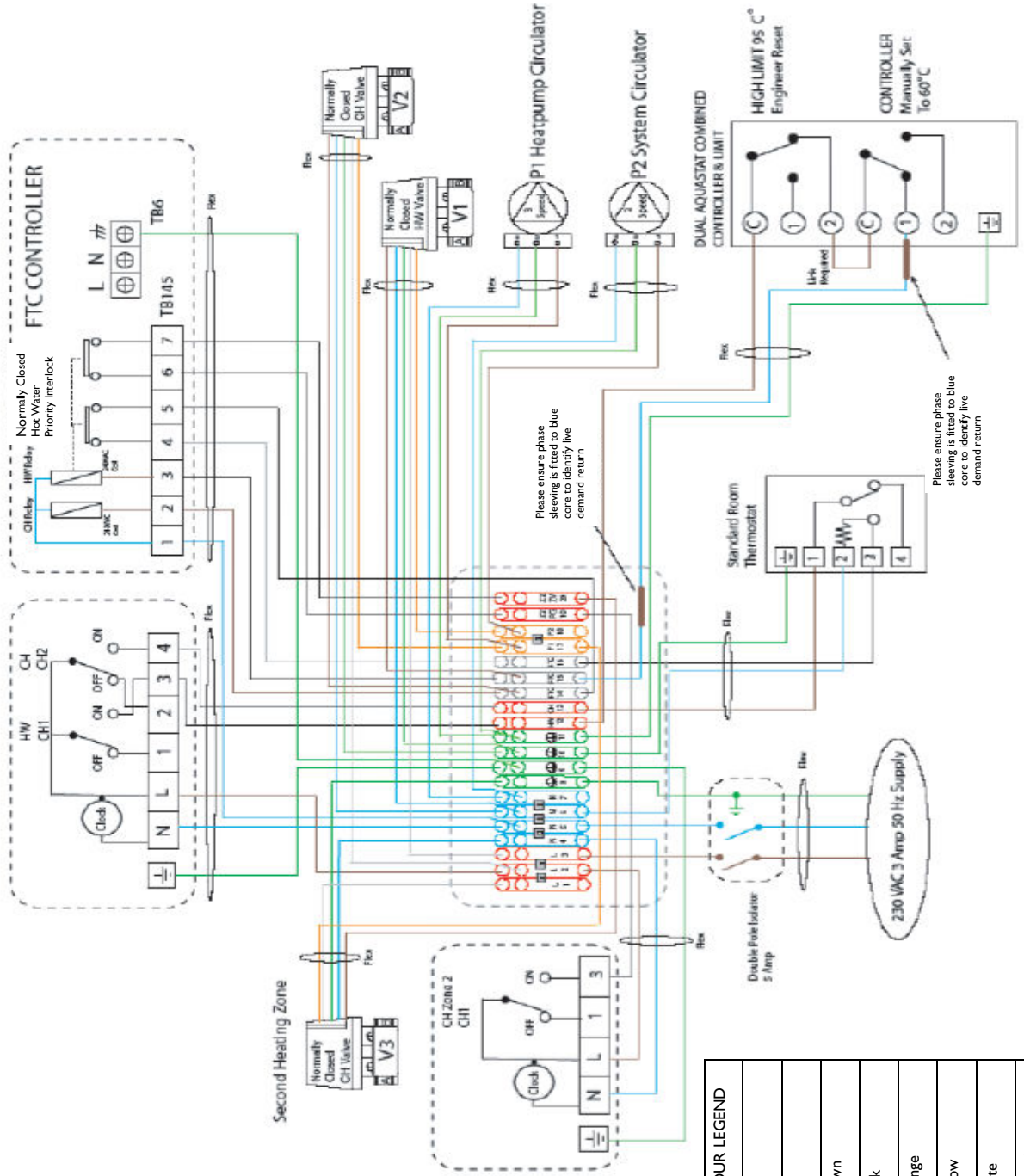


Fig 1.12

WIRE COLOUR LEGEND	
R	Red
Bl	Blue
Br	Brown
B	Black
Or	Orange
Y	Yellow
Wh	White
G/Y	Green / Yellow
Gr	Grey
G	Green

Electrical Connection

Boost Heat Switch

A standard two way switch or time clock should be wired to the boost heat terminals on the FTC as shown in FIG 1.13 If the Ecodan system is switched off for a sustained period of time and the property cools down, the boost switch will override the economical low flow temperatures of "Eco-Heating" and target a high pre-set temperature to raise the property to its design temperature in a shorter period of time. "Eco-Heating" should be re-selected when the design temperature is reached to make use of the systems high efficiencies.

TH1 Flow Sensor

A flow thermistor and cable is supplied with the FTC package. The sensor should be fixed and insulated to common FLOW pipe FROM the Ecodan Heat Pump as indicated in FIG 1.14. The purpose of the thermistor is to allow the Heat Pump to modulate its output dependant upon the operation mode and the required load of the property. It does this by achieving pre-set flow temperatures programmed through the PAR-W21MAA remote controller.

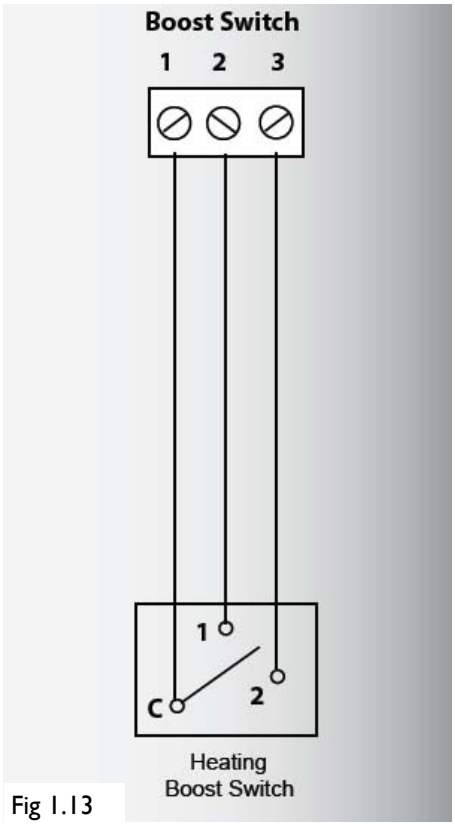
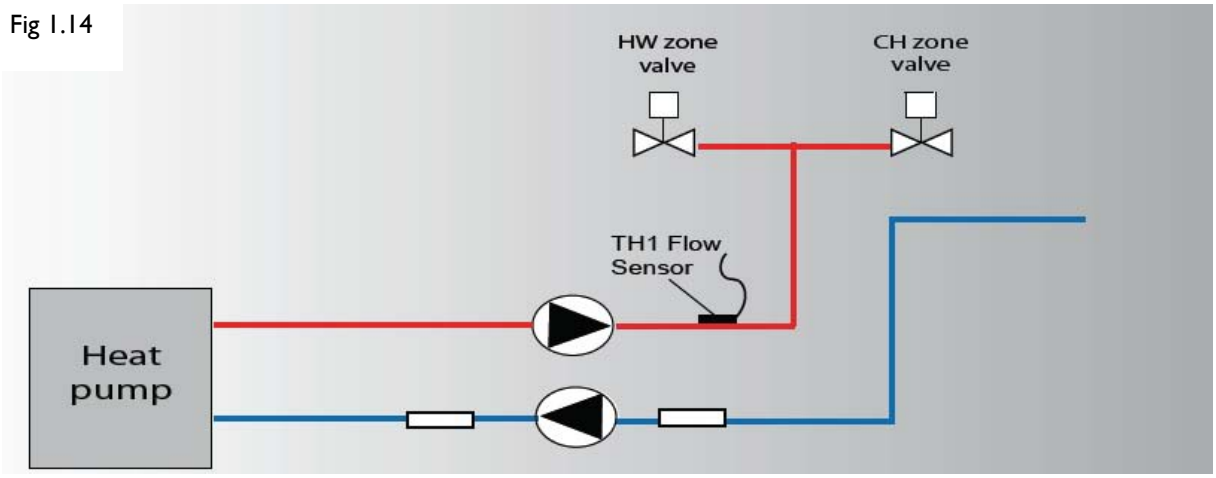


Fig 1.13

Fig 1.14



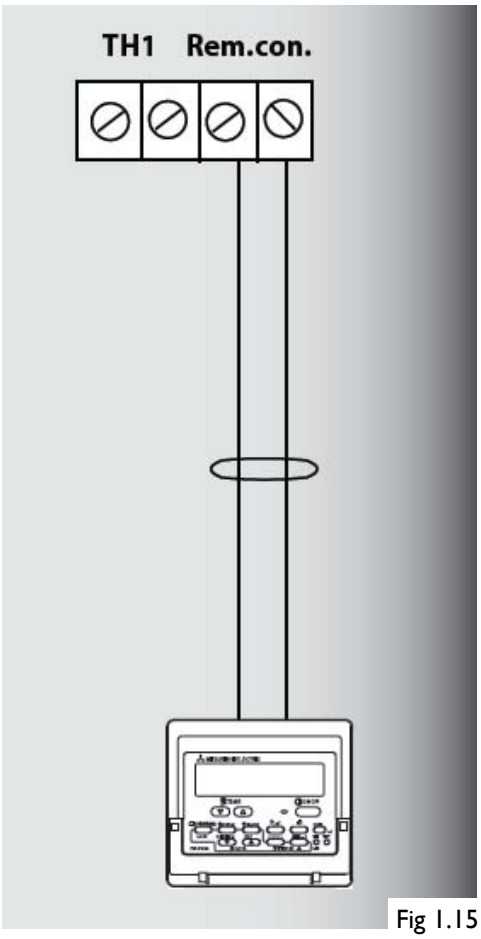


Fig 1.15

Electrical Connection

PAR-W21MAA Remote Controller

The PAR-W21MAA controller is supplied with the FTC package. Its primary function is as a commissioning tool to set the target flow temperatures for each mode. It has a display which shows the target and actual flow temperatures as well as the operating mode. FIG 1.16.

If the system is ever in a fault condition a 2 digit code will "flash" on this controller FIG 1.17.

The controller should be wired as shown in FIG 1.15 and care should be taken not to run the control cable with mains voltage cables.

Fig 1.16

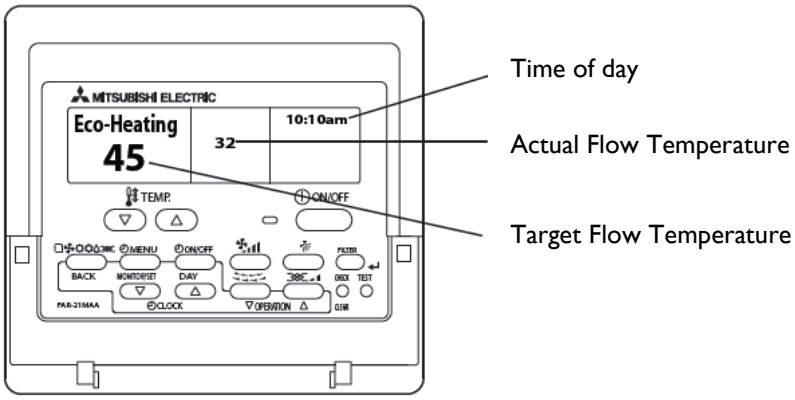
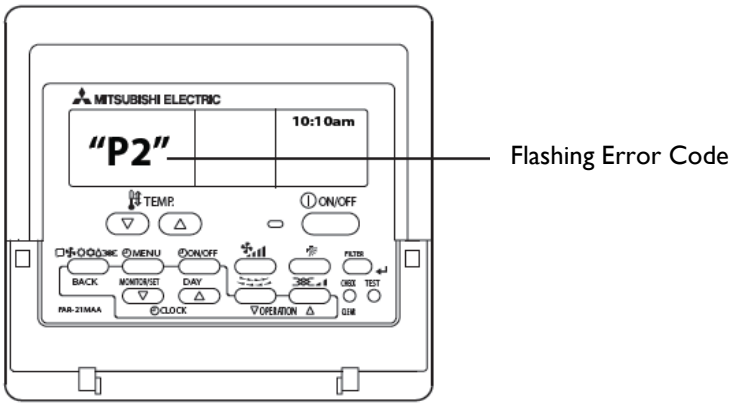


Fig 1.17



Setting the Target Flow Temperature

THE TARGET FLOW TEMPERATURES FOR EACH MODE MUST BE PRESET USING THE PAR-W21MAA REMOTE CONTROLLER

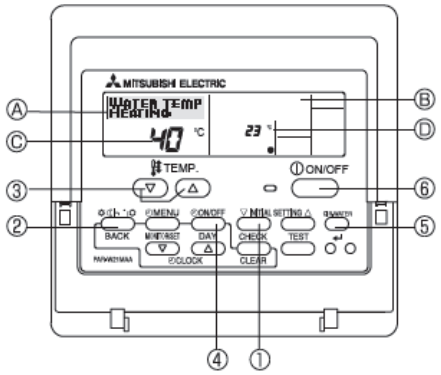


Fig 1.18

(1) Press the (INITIAL SETTING▽) button ① for 3 seconds to activate the initial setting mode.

(2) [DISPLAY Ⓐ]

WATER TEMP HEATING → WATER TEMP HEATING ECO (No. 1*) → WATER TEMP HEATING ECO (No. 2*) → WATER TEMP HOT WATER

* No.1 or No.2 is indicated in display Ⓑ.

Press (MODE) button ② to switch to the next parameter setting.

<Target temperature in heating mode>

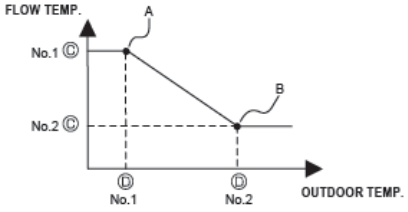
WATER TEMP HEATING — Set target flow water temperature in Heating mode with [TEMP] buttons ((▽) and (△)) ③.

<Parameters for Heating ECO mode>

Set following 4 parameters in HEATING ECO mode with [TEMP] buttons ((▽) and (△)) ③.
HEATING ECO mode= Weather compensation mode
Target flow water temperature varies according to the outdoor temperature.

WATER TEMP HEATING ECO — No.1 Display Ⓒ shows target flow temperature. Display Ⓓ shows outdoor temperature.

WATER TEMP HEATING ECO — No. 2 Display Ⓒ shows target flow temperature. Display Ⓓ shows outdoor temperature.



Press (ON/OFF) button ④ to switch Ⓒ ⇄ Ⓓ alternately. (The blinking figure can be changed.)

Note:

- Heating ECO mode sets the set temperature depending on the outdoor temperature.
- The parameters except the above 4 parameters cannot be set. (The characteristic is linear between the point A and B.)
- When the "EXTERNAL INPUT (analogue signal)" is used, the "HEATING ECO MODE" is invalid.

<Target temperature in HOT WATER mode>

WATER TEMP HOT WATER — Set target flow water temperature in HOT WATER mode with [TEMP] buttons ((▽) and (△)) ③.

Setting the Target Flow Temperature

Recommended Flow Temperatures

HEATING MODE

It is recommended that a flow temperature of **55°C** is entered for heating mode. This will be the target flow
temperature when the heating boost switch is turned ON and will give a high output at reduced efficiencies when
required.

ECO-HEATING MODE

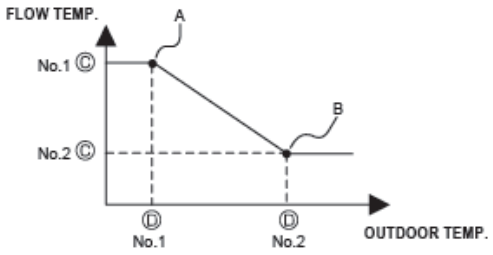
Eco-Heating or weather compensated heating reduces the target flow temperature as the outside temperature increases this increases the overall efficiency of the system greatly.

The required temperatures are very much dependant on the type and load of the property, the lower they are set the more economical the system becomes.

The temperatures should be set so that the heat pump is operating constantly with the minimal amount of stops and starts while maintaining the heat losses from the property. If the heat pump is stopping and starting frequently when the design temperature of the property is met then the target temperatures should be lowered to prolong the
operation and increase the efficiency. If the temperature of the property is slowly decreasing when the heat pump is achieving the flow temperatures then they should be increased. This may require multiple visits to a property after the installation.

Recommended starting temperatures are shown below.

WATER TEMP HEATING ECO	No.1	Display Ⓒ 55°C Display Ⓓ -3°C
WATER TEMP HEATING ECO	No.1	Display Ⓒ 35°C Display Ⓓ 17°C



Hot Water Mode

The flow temperature in hot water mode should be high to raise the storage temperature as high as possible from the heat pump, a temperature of **58° C** is recommended.

System Commissioning Procedure

The Ecdoan Heat Pump **must** be energised 12 hours before it is operated by a demand from the system controls.

Ensure that anti-freeze and inhibitor is added to the primary loop at a concentration of 25%.

Once the above period is over turn on the power to the control equipment (S-Plan) and initiate a constant demand for both hotwater and heating modes through the 2 channel timeclock, make sure the room themostat is up fully and the cylinder thermostat is set to no more than 55°C.

Check that the Hotwater zone valve is the only one energised and the system circulators are running. With the circulating pumps running check the flow rate on the flow setter valve falls within the requirements for the model shown in table 1.1. The PAR-W21MAA controller should at this point indicate Hotwater heating in the top left as shown in FIG 1.19. It should also show the actual flow temperature as a small figure in the centre and the target temperature to the left FIG 1.20. in hotwater heating this should have been set to 58 as detailed in the previous section of this manual.

As the domestic hot water store raises in temperature the actual flow temperature will slowly increase until it meets the target. Hotwater heating will **NOT** cease until the cylinder thermostat temperature is satisfied, this means that the cylinder thermostat should be set to no more than 55° C otherwise space heating will not occur until the hot water time clock demand is switched off.

Once the cylinder thermostat is satisfied make a note of the time period the heat pump has taken to recover the whole cylinder. At this point the Hotwater mode indication on the PAR-W21MAA remote will change to "ECO-Heating" and a lower target flow will be indicated dependant on the ambient temperature FIG 1.21. To override this for commissioning purposes the boost heat switch can be turned ON to target a higher flow temperature. With heating mode again using the setter valve check the flow rates are in the required band for the heat pump model.

The heating system **must** be correctly balanced to ensure correct flow through every radiator. If the system has two heating zones check that both zone valves operate independently.

Fig 1.19

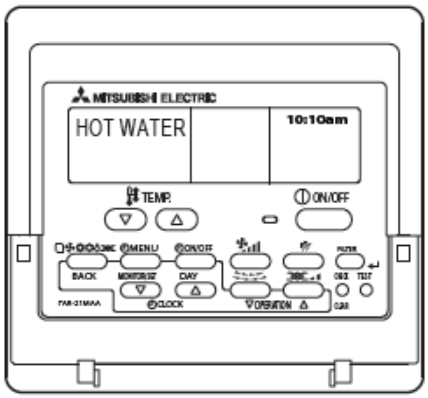


Fig 1.20

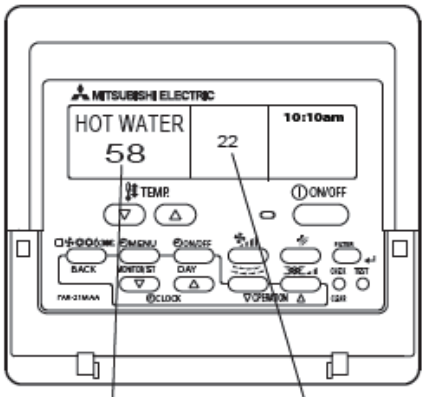
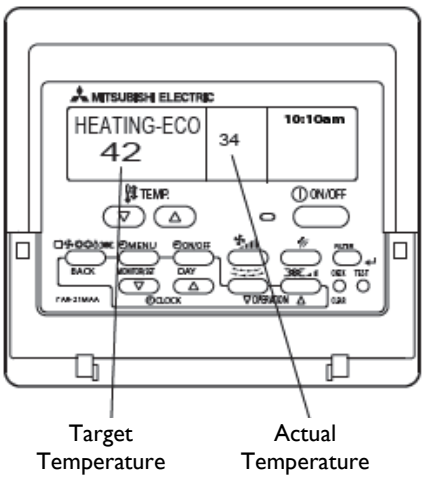


Fig 1.21



Time Clock Operation Patterns

The Ecodan system incorporates hotwater demand priority this means that if there is a demand for both modes hotwater will always occur before space heating.

Due to this the periods at which hotwater and space heating are programmed to operate are extremely important. The hotwater heat up times should be programmed to occur during periods when space heating is not required, this is usually the early hours of the morning and early afternoon.

Using the hotwater recovery time period taken during the commissioning stage ON and OFF times **must** be programmed by the commissioning engineer into the 2 channel timeclock, for example if the cylinder took 1 hour to reach 55°C then the hotwater ON time should be for example 3.00am and the OFF should be 4.15am leaving a 15 minutes additional buffer. After this OFF time space heating will be allowed operate as required.

Important Note - If the hotwater demand is left ON continuous operation rather than being timeclocked to switch OFF then the homeowner may experience unnecessary high running costs.

Economical Time Clock Patterns & Flow Temperatures

To gain the full benefits from the Ecodan system the target flow temperatures and timeclock patterns need to be configured to suit the actual property demands.

The most economical way of operating the system is to have it running at the lowest flow temperature possible to suit the properties thermal losses.

To do this the heating demand from the time clock should be left constantly operational and the flow temperatures should be reduced to a point where the property is maintained at the design temperature (usually 21°C) without being switched ON and OFF from the room thermostat or TRV's. 7-day timer clocks with night time set-back can also offer good system efficiencies.

Important Note - If the heating demand is left on continuous operation and the target flow temperatures are not reduced to their lowest possible then the homeowner may experience unnecessarily high running costs.

Example timeclock patterns
Below is an example of a standard timeclock pattern please note this is for reference only as the inputted times should suit the site environment and the homeowners preferences.

Heating mode - continuous operation with reduced flow temperatures

Hotwater mode - 3.00am ON
↓
4.15am OFF
↓
2.00pm ON
↓
3.15pm OFF

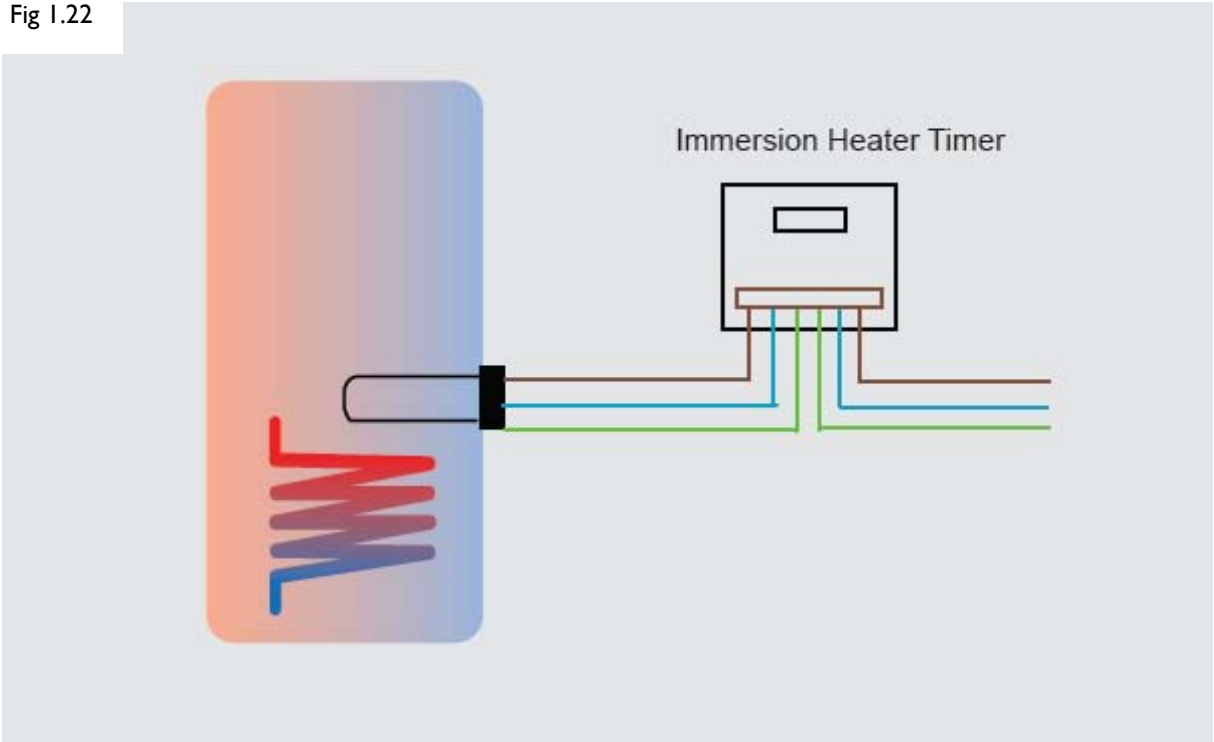
Domestic Hotwater Immersion Heater

As the Ecodan ASHP can only recover a domestic hotwater cylinder to 55° C precautions should be made to raise the temperature to 60°C periodically for pasteurisation.

This is carried out by an immersed electric heater situated in the body of the hotwater cylinder. The heater should be timed to operate after the Ecodan has completed a hotwater recovery thus completing the lowest temperature rise possible (from 55°C to 60°C). Please note the larger the temperature rise completed by the immersion heater the less efficient the system becomes.

To determine the ON time of the immersion heater the recovery period taken during the commissioning stage should be used. The ON time from the immersion heater should be the ON time of the Ecodan hotwater heating + the recovery period taken during the commissioning stage.

Fig 1.22



SERVICE, MAINTENANCE & TROUBLESHOOTING

Service & Maintenance

The Ecodan Air Source Heat Pump must be maintained on and annual basis. A maintenance check sheet is supplied to all Approved Ecodan Installers who attend the training course and is also available to download from www.mitsubishielectric.co.uk/heating

The basic requirements are,
Clean the outdoor heat exchanger
Visual inspection for oil or leaks
Check the integrity of the pipework insulation
Check for loose electrical connections
Check compressor operating current
Check and record compressor operating period number of ON/OFF's and running current.

BasicTroubleshooting

Below is a list of basic problems and actions.
For a full list of Ecodan fault codes, synopsis and remedial actions please consult the relevant service manual available to download from www.mitsubishielectric.co.uk/heating

Water does not heat well	• Clean the filter of water piping. (Flow is reduced when the filter is dirty or clogged.) • Check the temperature adjustment and adjust the set temperature. • Make sure that there is plenty of space around the outdoor unit.
Water or vapour is emitted from the outdoor unit	• During the heating mode, water may form and drip from the heat exchanger of outdoor unit • During the defrosting mode, water on the heat exchanger of outdoor unit—evaporates and water vapour may be emitted.
The operation indicator does not appear in the remote controller display	• Turn on the power switch. ◉Will appear in the remote controller display.
 appears in the remote controller display.	• This is the normal display, the system is waiting for a signal to operate from the control equipment
When restarting the outdoor unit soon after stopping it, it does not operate even though there is a demand from the control equipment.	• Wait approximately 3 minutes. (Operation has stopped to protect the outdoor unit.)
"PLEASE WAIT" appears in the remote controller display.	• The initial settings are being performed. Wait approximately 3 minutes. • If the remote controller is not only for FTC, change it
An error code appears in the remote controller display	• The protection devices have operated to protect the FTC and outdoor unit • Consult the error code section of the relevant service manual or call the technical support helpline on 0870 3000 300 for assistance

FERNOX BOILER BUDDY

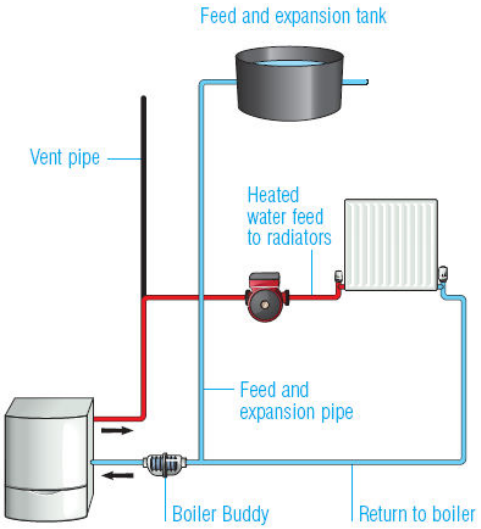
Designed to complement Fernox's extensive range of chemical water treatment products, the Boiler Buddy is a premium quality in-line, high efficiency magnetic filter with patented flux plates developed for use in Formula 1 motor racing. Unlike other conventional or magnetic filters, Boiler Buddy not only traps magnetite to sub-micron levels, it does so without restricting the water flow, even when full. Boiler Buddy also offers a unique opportunity for condition monitoring of the system. Its transparent housing enables the build-up of debris to be observed; acting as an early warning sign of inherent problems which might result in pumps or valves seizing and ultimate system failure.

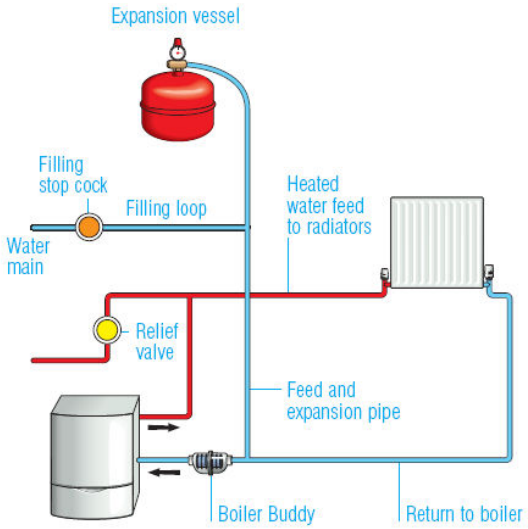
Application

The Boiler Buddy can be connected directly to **22 mm** copper pipework using conventional pump connectors (it is also compatible with **15 mm** with the appropriate adapter. It is not recommended for 28 mm systems, as it will restrict the water flow) Boiler Buddy can be installed vertically or horizontally. The unit is designed to slot into the space provided after removing a circulator pump when fitting a condensing boiler into an existing system (ideally it should be fitted on the return close to the boiler itself.) The off-set inlet and outlet ports enable Boiler Buddy to be fitted flush against a wall in existing pipework. System cleaning can be undertaken when a Boiler Buddy is installed by simply isolating and removing the unit at the connection points and powerflushing across the connections.

How to install a Boiler Buddy

Boiler Buddy has a transparent body casing so that the build-up of contamination on the core can be observed in service. It has been designed to be fitted where it can be inspected and removed for cleaning and should be installed in the central heating return line as close to the boiler as possible. There are a variety of installations but in general the open-vented system and the sealed system are typical.





Points to consider

- When selecting a position to install a Boiler Buddy beware of electrical connections in the vicinity, as these will be hazardous if they come into contact with water.
- Install the Boiler Buddy with both an upstream and downstream servicing valve.
- Boiler Buddy is designed for use with standard 11/2" BSP x 22 mm pump servicing valves (on a 15 mm system we recommend fitting 22 to 15 mm reducing sets instead of three 22 mm olive in the pump servicing valves).
- Boiler Buddy has a face-to-face dimension of 130 mm.
- If standard pump servicing valves are used, a total space of 250 mm is required for installation.
- During installation ensure that all copper or plastic swarf is removed from joints and does not enter the water pipework. If soldered joints are being used to construct the pipework, ensure solder or flux is wiped away to avoid corroding plastic parts. Do **NOT** undertake any soldering while the Boiler Buddy is in the pipework. Boiler Buddy **MUST** be removed before soldering any joints.
- Once installed, secure the tamper-proof tag to avoid accidental opening. The tag must be replaced after cleaning the core. Complete the Boiler Buddy installation sticker and apply to the boiler.
- Run the system and check for leaks.

After Installation

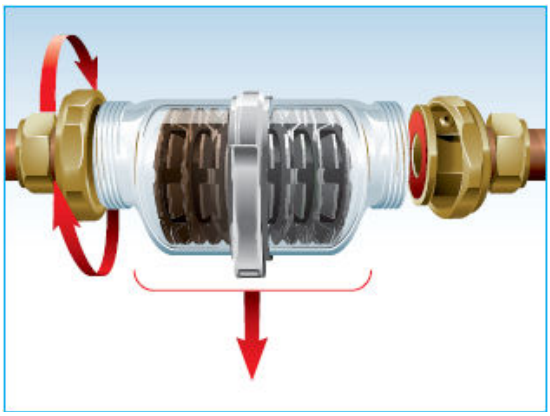
- The Boiler Buddy has no moving parts and needs no adjustment once in service.
- The body casing is transparent so that build-up of contamination can be observed.
- It is normal for the magnet nearest the inlet of the Boiler Buddy to become full first. Once this is full the next magnet will clog up followed by the next and so on. The Boiler Buddy has six magnets, we recommend cleaning the core when three magnets become full.
- It is recommended the Boiler Buddy is inspected and cleaned annually.
- Boiler Buddy is designed to last the life of the central heating system. More frequent cleaning of the core is an indication that the system has not been treated correctly with Fernox Protectors, Restorers and cleansers.

How to service and clean a Boiler Buddy

Before removing the Boiler Buddy, place a container underneath the pipework to retain any water that may drip.

1 Isolate the Boiler Buddy from the system, by simply closing the quarter turn valves on the pump service connector.

2 Once the Boiler Buddy has been isolated it can be removed. Undo the two 11/2" BSP union nuts. Once these have been fully unscrewed the Boiler Buddy can be pulled out between the two flat faces. The two fibre washers may stick to the flat surface and tear on removal of the Boiler Buddy, this is normal.

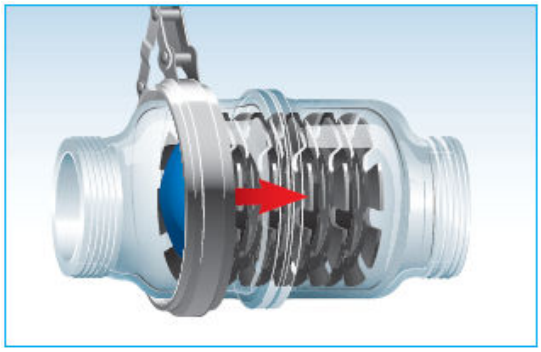


WARNING: Under no circumstances attempt to remove the Boiler Buddy from the system by removing the body clamp.

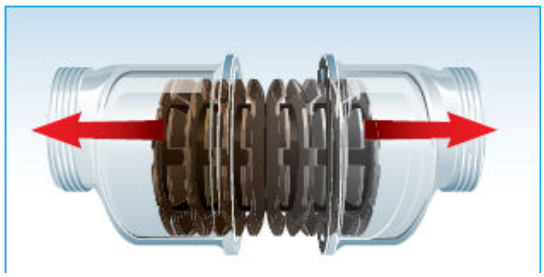
Once the Boiler Buddy has been safely removed from the system it can be disassembled. Fernox recommends that waterproof gloves are worn when cleaning the Boiler Buddy.

3 Cut off the tamper-proof tag

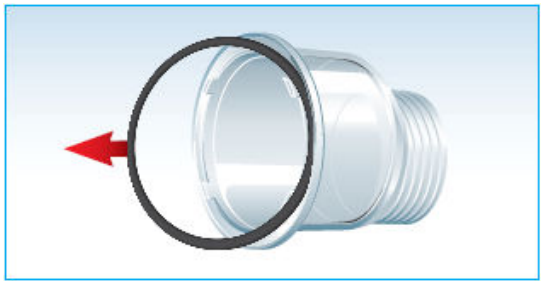
4 Open the latch on the body clamp and slide off the complete clamp over one end of the body



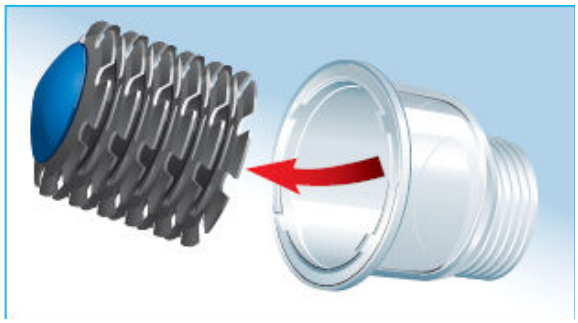
5 Pull the two halves apart



6 Remove the 'o' ring



7 Remove the complete core



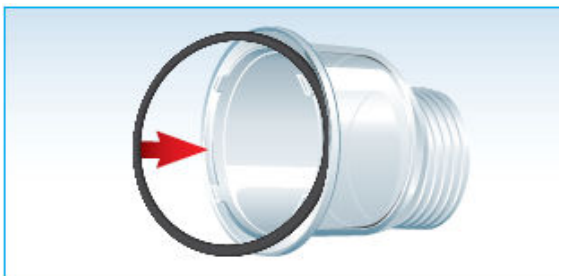
8 To clean the core either use a stiff brush or hold under running water perpendicular to the core (ensure that any magnetite is disposed of safely)

9 Wipe clean the inside surface of each half of the body casing

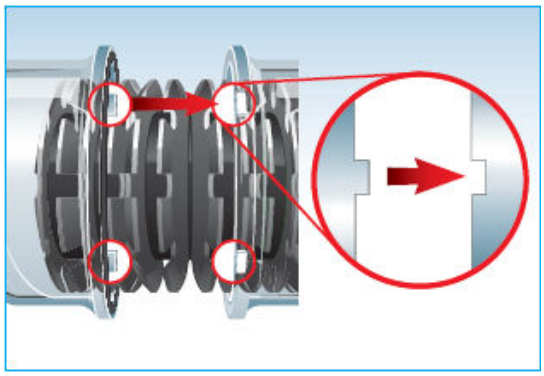
Once the core has been cleaned the Boiler Buddy can be reassembled.

10 Place the clean core into the cleaned body casing

11 Place the new 'o' ring into position in the groove



12 Place the other body half over the 'o' ring; there are locator pins to help the correct alignment of the two parts



13 Once the body is assembled, place the body clamp over the flange and push the lever on the latch to the secured position

14 Pass the replacement tamper-proof tag through the slot in the latch ensuring that it also passes through the bridge on the latch. This will guard against accidental opening of the clamp

15 Using two new fibre washers place the Boiler Buddy back into the pipework between the two (pump) servicing valves

16 Tighten the union nuts until finger tight, after which use a spanner to tighten 1.8th of a turn or until secure. CAUTION: The body casing is a plastic part and will fail if excessive force is used

17 The servicing valves can be opened and flow of water will be observed through the Boiler Buddy

18 Run the heating system and check for leaks

Spare parts

The Boiler Buddy is designed to last the life of the heating system. The following spare parts are available from Fernox:

✓ 'O' ring
✓ Tamper-proof tag
✓ Spare clamp
✓ Spare core

FERNOX ALPH-11

Protector Alphi-11

- Protects against corrosion and limescale
- Maintains efficiency so extending system life
- Prevents bacterial contamination
- Compatible with all metals and materials commonly used in heating systems
- Non-toxic, environmentally friendly
- Combined anti-freeze and protector
- Protects heating, chilled water and solar systems

Product Uses

Fernox Protector Alphi-11 is a combined anti-freeze and inhibitor, which gives long term protection of domestic central heating systems against the internal corrosion and limescale formation. It prevents corrosion of all metals found in these systems i.e. ferrous metals, copper and copper allows and aluminium. It is especially recommended for use in solar systems. Fernox Protector Alphi-11 is compatible with all metals and materials commonly used in central heating systems.

For continued protection we recommend Protector levels are checked regularly (annually). The concentration of the product can be easily measured on site used a Fernox 'One Drop' Protector test kit.

Physical Properties

Fernox Protector Alph-11 contains mon-propylene glycol.

Colour:	Colourless
Odour:	Mild
Form:	Clear liquid
pH (conic)	5.7—6.1
pH (sol. 25%)	7.0—7.5
SG:	1.04 at 20°C

Application and Dosage

The minimum recommended "in use" concentration of the product is 25% in order to ensure adequate corrosion protection. This concentration will protect down to –11°C. A concentration of 40% will protect down to –22°C. Alphi-11 Protector can be introduced via the feed and expansion tank or other suitable point of application, e.g. radiator, using a Fernox Injector. Introduce into the system after having drained a quantity of water at least equal to the amount of Alphi-11 to be added. Engage the circulating pump and have the system online for a few hours to achieve an even distribution.

Concentration	25%	30%	35%	40%
Protection	-11°C	-15°C	-18°C	-22°C

In single feed indirect cylinders, e.g. "Primatic" or similar, potable water chemicals must be used.

We recommend untreated systems are thoroughly cleansed and flushed, in accordance with BS7593 and Benchmark, using Fernox Cleaner F3 before treating with Fernox Alphi-11 Protector as existing debris can damage the installation.

Packaging, Handling and Storage

Fernox Protector Alphi-11 is supplied in 5 and 25 litre containers.

Fernox Protector Alphi-11 is classified as non-hazardous and non-irritant, but as with all chemicals keep out of reach of children. Do not mix with other chemicals with the exception of Fernox products. No not take internally. In case of contact with eyes or skin, rinse immediately with plenty of water.

Ecodan and Flow Temperature Controller (FTC), Service and Maintenance Manual

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

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