High Efficiency
Variable Speed
Air Source Heat Pumps

Models covered by this manual:

A-Series

Air Source *AS01-R290* *AS02-R290* *AS03-R290*

Incorporating: **User Instructions**
Installation Instructions
Service Instructions
Guarantee Terms & Conditions

WARNING: This product contains the refrigerant R290. Any action requiring the product to be unpackaged or access gained to the internal parts must only be taken by personnel with knowledge of the properties of and risks associated with the refrigerant R290

Work on the refrigeration circuit and involving equipment for use with flammable refrigerants requires special training in addition to standard repair procedures for refrigerant equipment.

Obey instructions in relevant regulations and applicable laws.

INSTALLATION, COMMISSIONING & SERVICING

This appliance must be installed as described herein and the installation commissioned by competent persons as instructed. The Installation/Commissioning records (available at www.warmflow.co.uk/support/manuals-brochures) must be completed by the Installer and a copy of the installation/commissioning records must also be provided by the Installer to the Owner of the appliance. The Owner of the appliance must retain a copy of the installation/commissioning records provided.

This appliance must be serviced annually by competent persons, the Service Record completed on each occasion and proof of servicing (e.g. receipts / invoices) retained.

The complete guarantee policy statement is included in Section 6.

FAILURE TO COMMISSION, REGISTER AND ANNUALLY SERVICE THIS PRODUCT WILL INVALIDATE ALL GUARANTEES

TECHNICAL, SPARES & GUARANTEE CLAIMS

For technical advice about the installation, commissioning, servicing or use of this appliance, please contact the Warmflow Customer Care Centre by post, phone, fax or email at the addresses below. Please also refer to our website.

In the unlikely event that replacement components might be required within the guarantee period, please notify the Customer Care Centre in writing, by post, fax or email, stating the nature of the fault and the part number of the replacement components required.

Warmflow Customer Care Centre

Warmflow Engineering
Lissue Industrial Estate
Moira Road
Lisburn
BT28 2RF
Northern Ireland

Telephone

United Kingdom: 028 9262 1515
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Email

technical@warmflow.co.uk

Website

www.warmflow.co.uk

Contents

1 User Instructions

1.1 Intended Use

The Warmflow Air Source Heat Pump appliances are intended for the production of hot water for space heating and domestic hot water (DHW). The appliances can be used to provide heating and domestic hot water (DHW) via underfloor heating circuits, radiators and approved hot water cylinders. The appliances are designed to extract heat from the air.

1.2 Compliances

The Warmflow AS01-R290, AS02-R290 and AS03-R290 air source heat pump appliances are Microgeneration Certification Scheme (MCS) approved and hold both UKCA and CE markings. They are approved on the Renewable Heat Incentive Eligibility list and can be found on both the Product Characteristics Database (PCDB) as well as the Home-heating Appliance Register of Performance (HARP) database. As such the appliances comply with the following directives and are tested to the following standards:

- MCS 007 Issue 3.0 - Product Certification Scheme Requirements: Heat Pumps.
- 2006/95/EC - Low Voltage Directive.
- 2004/108/EC - Electromagnetic Compatibility Directive.
- 97/23/EC - Pressure Equipment Directive.
- 2002/96/EC – WEEE Directive
- 2002/95/EC – RoHs Directive
- EN14511 - Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.
- EN14825 - Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance.
- EN 60335-1 - Household and similar electrical appliances. Safety. General requirements.
- EN 60335-2-40 - Household and similar electrical appliances. Safety. Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers.
- EN 61000 - Electromagnetic compatibility (EMC). Limits.
- EN 378 - Refrigerating systems and heat pumps. Safety and environmental requirements.
- ENV 12102 - Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling. Measurement of airborne noise. Determination of the sound power level.

1.3 SAFETY ICONS

WARNING

Indicates instructions to avoid personal injury and/or material damage

ELECTRICITY

Indicates operations with a danger of electric shock.

HIGH TEMPERATURE

Indicates operations with a danger of burning due to flammable substances.

LOW TEMPERATURE

Indicates operations with a danger of frostbite.

EXPLOSIVE

Indicates operations with a danger of explosion.

HOT SURFACE

Indicates operations with a danger of burning.

ROTATING PARTS WITH AUTOMATIC START

Indicates operations with a danger of entanglement.

HAND PROTECTION

Safety gloves must be worn.

EYE PROTECTION

Eye protection must be worn.

1.4 SAFE HANDLING

The appliances have a dry mass ranging from 102kg (AS01-R290) to 202kg (AS03-R290). Use safe handling methods to move them to the installation site, remove the packaging base and during movement into the installation location.

Moving the appliances can be aided by using mechanical lifting aids.

Manoeuvring the appliances with or without mechanical aids will involve lifting, pushing and pulling.

Caution should be exercised during these operations.

Operatives should be knowledgeable in handling techniques when performing these tasks and the following precautions should be considered:

- Be physically capable.
- Grip the appliance at a low level.
- Use Personal Protective Equipment (PPE) as appropriate e.g. gloves, safety footwear.

During all manoeuvres and handling actions, every attempt should be made to ensure the following unless unavoidable and/or the weight is light:

- Keep back straight.
- Avoid twisting at the waist.
- Avoid upper body/top heavy bending.
- Always grip with the palm of the hand.
- Use designated hand holds.
- Keep load as close to the body as possible.
- Always use assistance if required.

1.5 SAFETY

The appliances are suitable only for installation in GB and IE and should be installed in accordance with the rules in force.

Installations must be carried out in accordance with the relevant requirements of:

- The appropriate Building Regulations, either the Building Regulations, The Building Regulations (Scotland), Building Regulations (Northern Ireland), Irish Building Regulations
- The Water Fittings Regulations or Water byelaws in Scotland
- The current I.E.T Wiring Regulations or in IE the current ETCI rules for electrical installation

Where no instructions are given, reference should be made to the relevant MCS and British Standard Codes of Practice.

Detailed recommendations are made in the following Standards:

MIS 3005 Requirements for MCS Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Microgeneration Heat Pump Systems

BS EN 12828 Heating systems in buildings: Design for water based heating systems

BS EN 12831 Heating systems in buildings: Method for calculation of the design heat load.

BS EN 14336 Heating systems in buildings: Installation and commissioning of water based heating systems.

BS EN 378-1:2016 Refrigerating systems and heat pumps — Safety and environmental requirements: Part 1: Basic requirements, definitions, classification and selection criteria.

BS EN 378-2:2016 Refrigerating systems and heat pumps — Safety and environmental requirements: Part 2: Design, construction, testing, marking and documentation.

BS EN 378-3:2016 +A1:2020 Refrigerating systems and heat pumps — Safety and environmental requirements: Part 3: Installation site and personal protection

GB -The Electricity at Work Regulations 1989 (SI1989/635).

NI - The Electricity At Work Regulations (Northern Ireland) 1991 (SR1991/13).

Ireland - Safety, Health and Welfare at Work (General Application) Regulations 2007 – Part 3: Electricity

ANYONE WORKING ON THE APPLIANCE MUST BE SUITABLY TRAINED AND COMPETENT. A RISK ASSESSMENT MUST BE CONDUCTED IN ACCORDANCE WITH HSE GUIDELINES.

1.6 Basic Operation

Heat flows from an area of higher temperature to an area of lower temperature. In much the same way that a water pump, pumps water from a low level to a higher level, a heat pump pumps heat from a source at a low temperature to a source at a higher temperature. The benefit of this is that natural sources such as the air and ground, which are at relatively low temperatures, can be used to heat buildings at a higher temperature. In order to do this the heat pump uses a relatively small amount of electrical energy. The proportion of electrical energy used to do this is much smaller than the heat power delivered to the building. The ratio of the heat power delivered to the electrical energy used determines the efficiency of the heat pump and is commonly known as the coefficient of performance (COP).

Heat is extracted from the air by blowing the air through a finned radiator, known as the evaporator, with a fan. The extracted energy from the air is transferred into the refrigerant which circulates around the evaporator. The heat pump then converts this low grade heat to a high

grade by compressing the refrigerant using the compressor. The compression of the refrigerant increases the pressure and the temperature. This high grade heat is then transferred to the heating system via another heat exchanger known as the condenser. The heat can now be used to provide space heating and DHW. The pressure of the refrigerant is then released through a throttling valve known as the expansion valve which also causes the temperature to drop and allows the cycle to start over again.

1.7 Product Data

Table 1 Product Data

Product Data		**AS01-R290**	**AS02-R290**	**AS03-R290**
Dimensions (mm)	Width	1167	1420	1250
	Depth	407	540	540
	Height	795	1080	1330
Weight (kg)		102	140	202
Electrical Supply		230V Single Phase @50Hz	230V Single Phase @50Hz	230V Single Phase @50Hz
Maximum Current (Amps)		14	25	35
Sound Pressure Level (dBA)*		43	41	48
Performance	COP @ A7W35	4.79	5.26	4.71
	COP @ A2W30	4.92	4.82	4.51
	COP @ A7W27	6.18	6.09	5.60
	COP @ A12W24	8.29	7.52	6.89
	COP @ A-7W34	3.23	3.20	3.31
	COP @ A7W55	3.07	3.07	3.19
	COP @ A-10W55	2.06	1.99	1.96
	Heat Output Range	3 - 9kW	5 - 15kW	8 - 22kW
	ErP Efficiency Class (35°C / 55°C)^	A+++ / A++	A+++ / A++	A+++ / A++
Operating Temp. (◦C)	Ambient Air, min/max	-25/43	-25/43	-25/43
	Heating Flow, min/max	20/75	20/75	20/75
Flow Rates (l/m)	Heating, min/max	10/20	16/30	28/60
Fluid Content (L)		1.0	1.53	2.51
Refrigerant	Type	R290	R290	R290
	Charge (kg)	0.50	0.85	1.30
Connections	Heating Flow & Return	1” female BSP	1” female BSP	1” female BSP

*Sound Levels have been independently tested in accordance with EN 12102.

^ ErP ratings have been independently tested in accordance with EN 14825.

Table 2 Product Technical Parameters

Model		AS01-R290	AS02-R290	AS03-R290	
Air-to-water heat pump	Yes				
Water-to-water heat pump	No				
Brine-to-water heat pump	No				
Low-temperature heat pump	No				
Equipped with a supplementary heater	No				
Heat pump combination heater	No				
	Symbol	Value			Unit
Rated heat output	*Prated*	9	15	22	kW
Declared Capacity of heating for part load at indoor temp. 20°C and outdoor temp., T_j (~ 55°C)					
T_j = -7°C	*Pdh*	4.2	8.0	10.5	kW
T_j = 2°C	*Pdh*	2.7	4.9	6.4	kW
T_j = 7°C	*Pdh*	2.6	5.7	7.4	kW
T_j = 12°C	*Pdh*	2.8	6.1	7.0	kW
T_j = bivalent temperature	*Pdh*	4.2	8.0	10.5	kW
T_j = operation limit temperature	*Pdh*	4.7	9.0	12.0	kW
Bivalent temperature	*Tbiv*	-7	-7	-7	°C
Cycling interval capacity for heating	*Pcych*	-	-	-	kW
Degradation coefficient	*Cdh*	0.99	0.99	0.99	
Seasonal Space Heating Energy Efficiency	*ηs*	146	147	145	%
T_j = -7°C	*COPd*	2.32	2.38	2.31	
T_j = 2°C	*COPd*	3.66	3.16	3.64	
T_j = 7°C	*COPd*	4.64	4.84	4.68	
T_j = 12°C	*COPd*	6.32	6.08	6.18	
T_j = bivalent temperature	*COPd*	2.32	2.38	2.31	
T_j = operation limit temperature	*COPd*	2.06	1.99	1.96	
Operation limit temperature	*TOL*	-10	-10	-10	°C
Cycling interval capacity for heating	*COPcyc*	-	-	-	
Heating water operating limit temperature	*WTOL*	75	75	75	°C
Power consumption in modes other than active					
Off mode	P_{OFF}	0.010	0.009	0.011	kW
Thermostat-off mode	P_{TO}	0.010	0.009	0.011	kW
Standby mode	P_{SB}	0.010	0.009	0.011	kW
Crankcase heater mode	P_{CK}	0.042	0.042	0.058	kW
Other items					
Capacity control	*Variable*				
Sound power level outdoor	*LWA*	60	57	64	dB
Annual energy consumption	*QHE*	2623	4959	6587	kWh
Rated air flow rate	-	4050	5620	8740	m^3/h

Table 3 Product Fiche

Supplier	Warmflow	Warmflow	Warmflow
Model	AS01-R290	AS02-R290	AS03-R290
Energy Efficiency Class	A+++	A+++	A+++
Rated Heat Output (kW)	9	15	22
Seasonal Space Heating Energy Efficiency	197	193	183
Annual Energy Consumption, GCV (kWh)	2031	3988	5587
Sound Power Level, LWA (dB)	60	57	64
Rated Heat Output in Colder Climate (kW)	9	15	22
Seasonal Space Heating Energy Efficiency in Colder Climate	197	193	183
Annual Energy Consumption in Colder Climate, GCV (kWh)	2423	4758	6666
Rated Heat Output in Warmer Climate (kW)	9	15	22
Seasonal Space Heating Energy Efficiency in Warmer Climate	197	193	183
Annual Energy Consumption in Warmer Climate, GCV (kWh)	1313	1579	3613

1.7.1 Starting Current

The AS01-R290, AS02-R290 and AS03-R290 air source heat pump appliances are all inverter driven. This means they ramp up slowly and therefore do not require a large starting current which is required with fixed speed appliances. In the majority of situations the starting current will be less than 1Amp. The starting current will also always be below the rated current of the appliance. Below is the typical starting profile showing the current draw from off to typical running speed.

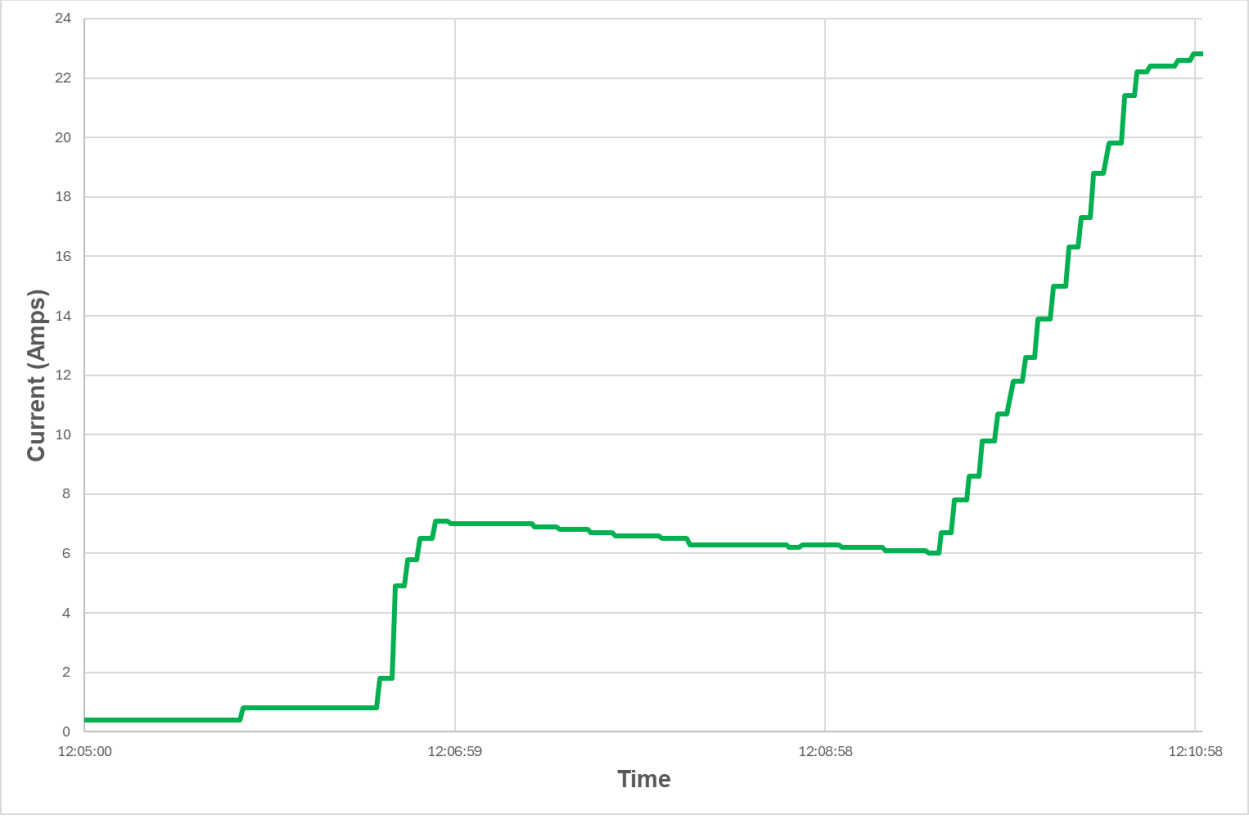


Figure 1 Typical Starting Current

1.8 Construction

The Warmflow air source heat pumps are housed in a powder-coated galvanised metal casing complete with enclosure box in which a cable entry terminal is mounted.

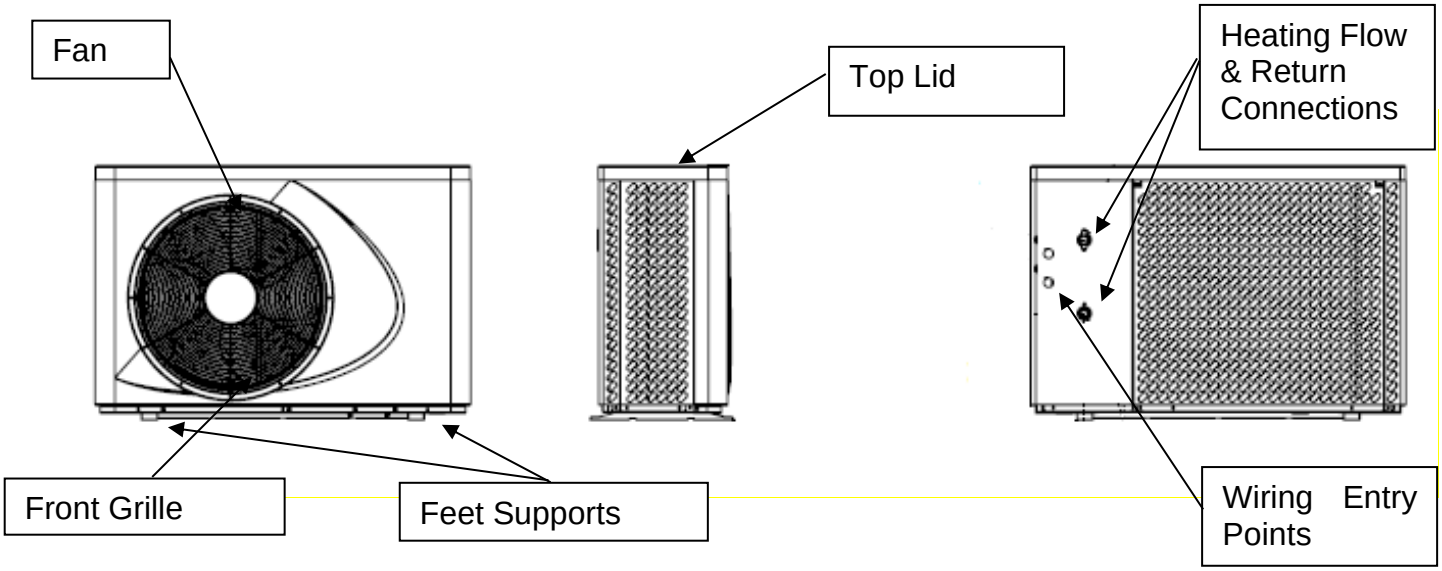


Figure 2 Typical Construction

Upon delivery, it is important that the appliance is unpacked carefully and checked for any sign of damage. If something is missing or damaged please report it to Warmflow immediately. The appliances are secured to the shipping pallet using screws which must be removed.

NOTE: For coastal areas or other areas subjected to higher levels of corrosion, appliances can be supplied with a Blygold coating applied to the evaporator to help protect it. Please contact Warmflow for more details.

1.9 Supplied Components

Together with the appliance, a number of additional components are supplied to aid installation. The following items are supplied with each appliance:

- 1no. DHW Cylinder Temperature Sensor
- 4no. Anti-Vibration Mounts
- 1no. Touchscreen Controller complete with wiring and wall mount

Upon delivery, it is important to check that all components are included. If something is missing or damaged please report it to Warmflow immediately.

1.10 Storage / Transport

The appliances come on a pallet (Dimensions of shipping sizes are shown below) and are secured to the pallet using screws. If the appliances are to be stored prior to installation, they must be kept indoors in storage conditions at a temperature of between 5°C and 60°C with a humidity level between 10%RH and 80%RH in order to provide a non-condensing environment. The appliances must not be stacked in storage or during transport. During transport the appliances must be kept in an upright position and should never be allowed to tilt more than 45° during loading or unloading.

Table 4 Shipping Details

Product Data		AS01-R290	AS02-R290	AS03-R290
Shipping Dimensions (mm)	Width	1300	1420	1380
	Depth	485	540	570
	Height	940	1080	1480
Shipping Weight (kg)		120	160	220

2 Air Source Heat Pump Installation

The Warmflow air source heat pumps require installation by a Warmflow or MCS approved installer. The appliance can be installed as part of a new system or retrofitted into an existing system, however it is important that the system design is capable of facilitating the required flow rates and can dissipate heat efficiently.

2.1 General

The appliance is to be located outdoors only. The appliance should be installed on a suitable mounting in order to ensure the evaporator sits at least 150mm above the ground. Flexible feet are available separately from Warmflow in order to provide this gain in height. This should then be installed on a smooth horizontal surface capable of supporting the weight of the appliance together with any accessories and other plant. The area in which the appliance is installed must have good ventilation and not be susceptible to strong gusts of wind. There should be no other heat sources, flammable materials or sources of ignition close to the installation area. Please see Figure 6 and Figure 7 for further details. The appliance needs to have a soakaway beneath or close by the appliance for removal of the condensing water which accumulates beneath the evaporator (see section 2.5 for details).

In order to keep noise and vibration to a minimum, it is important that the appliances anti-vibration mountings are secured and in full contact with the base surface. Accessories packs are available with a set of flexible hoses for the flow and return of the heating circuit. These should be installed to further reduce the transmission of noise and vibration into the building structure.

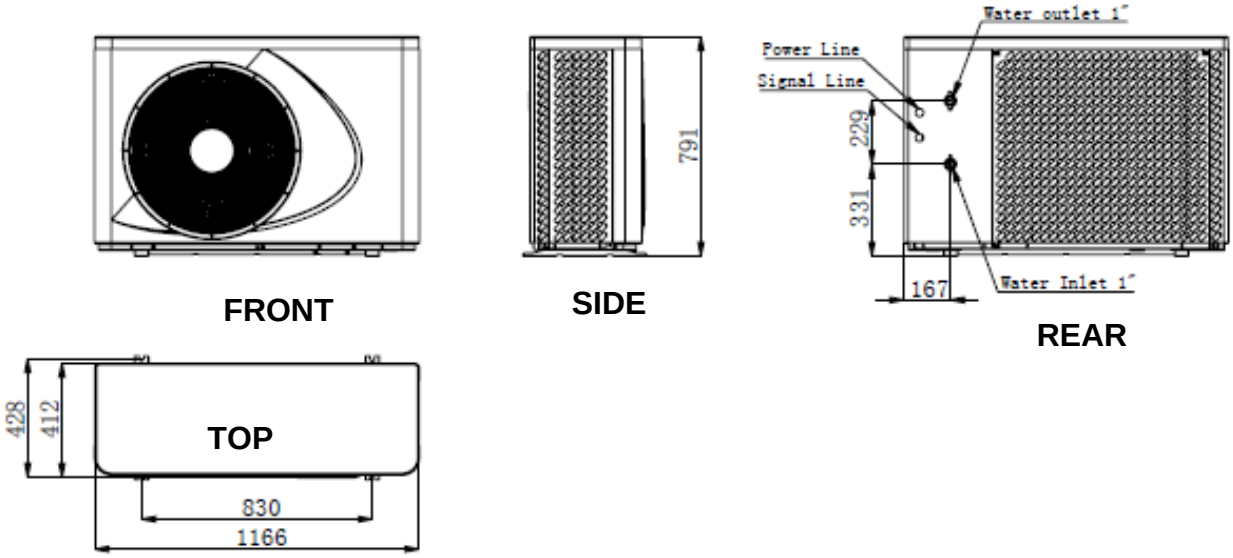


Figure 3 AS01-R290 Casing Dimensions & Heating Connection Locations

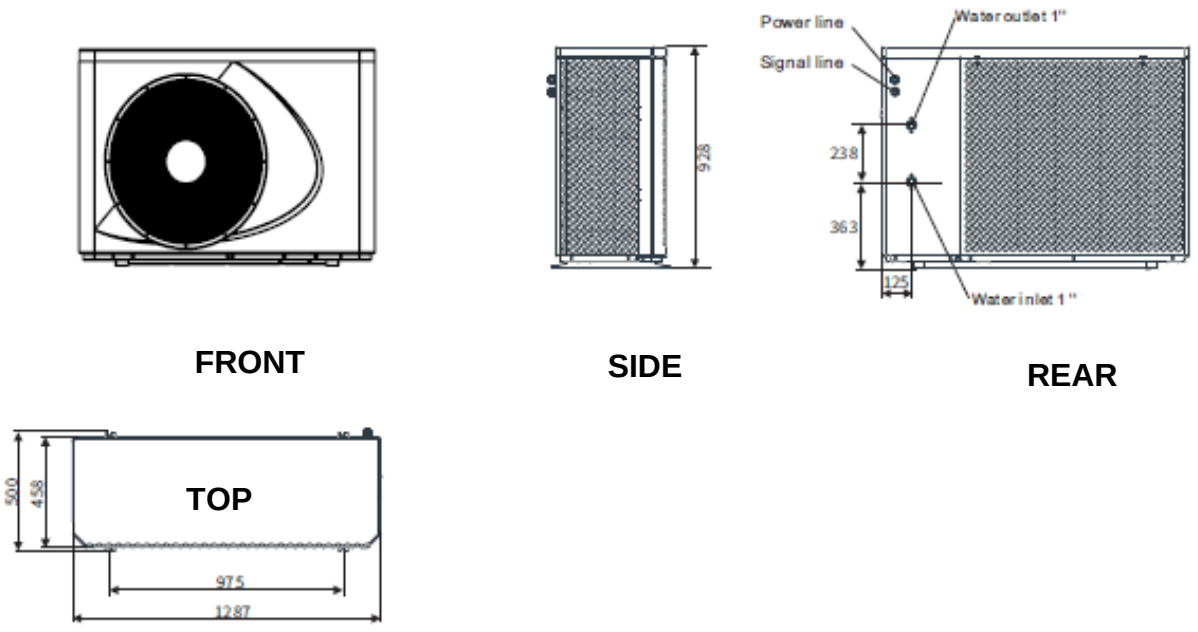


Figure 4 AS02-R290 Casing Dimensions & Heating Connection Locations

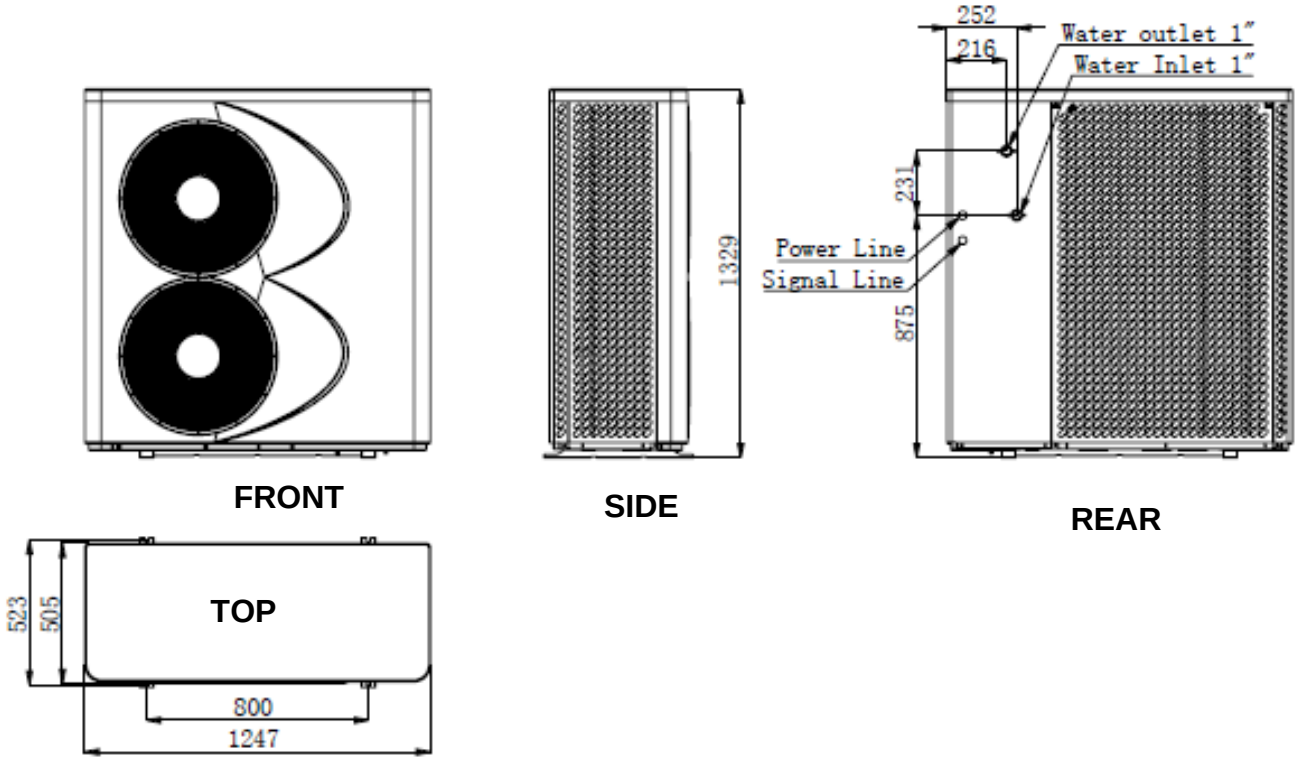


Figure 5 AS03-R290 Casing Dimensions & Heating Connection Locations

The heating flow and return connections are located on the rear panel of the AS01-R290, AS02-R290 and AS03-R290 appliances as shown in the images above. The heating flow (Water Outlet) is the top connection with the heating return (Water Inlet) at the bottom.

2.2 Installation location

In order to maximise air flow and provide access for maintenance, a minimum clearance of 500mm must be provided to each side, 1500mm provided to the front and 200mm provided to the rear of the appliance. There must also be a minimum clearance of 1000mm above the appliance. These dimensions are shown below. In addition, due to the flammability of the R290 refrigerant gas the exclusion zones for potential sources of ignition (hot surfaces, flames and gases, mechanically generated sparks and electrical apparatus), openings into the dwelling, other fuel storage or below ground features where the gas could collect must be observed. Note: Covered manholes and trapped drains do not pose a risk of a significant volume of gas collecting. Therefore, these features are permitted within the exclusion zone. Please see Figure 6 and Figure 7 for further details.

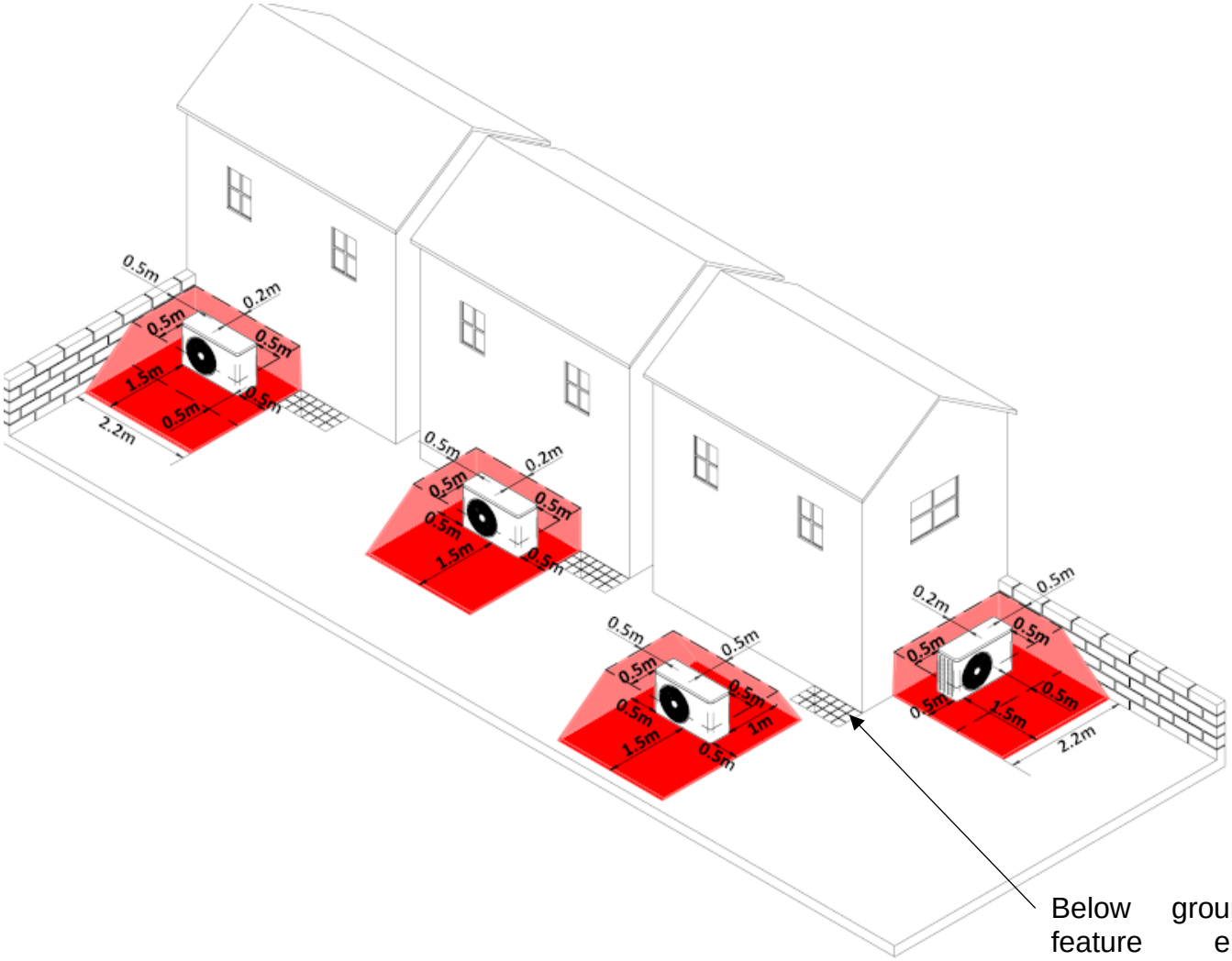
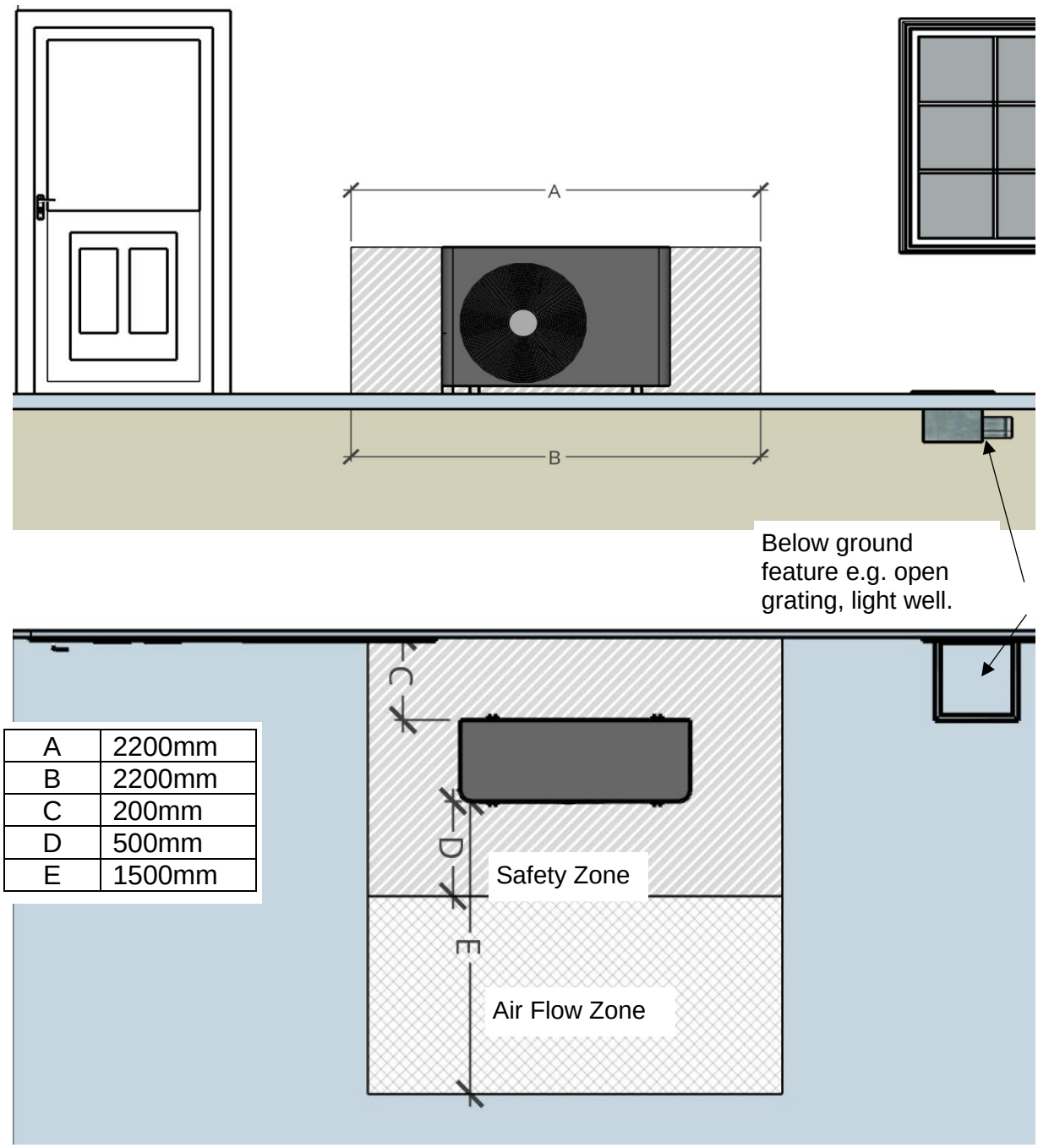


Figure 6 Safe Area Clearances

Note: The 200mm minimum clearance at the rear of the appliance is only permitted providing the appliance is mounted with an elevation of minimum 150mm from ground level.



A	2200mm
B	2200mm
C	200mm
D	500mm
E	1500mm

Figure 7 Safe Zones for Ground Installation Near a Wall

2.3 Unpacking

The appliance is supplied on a small pallet and is covered with a cardboard box. The cardboard box should be removed to reveal the appliance with the supplied components. The appliance is attached to the pallet using screws. These must be removed before trying to remove the appliance from the pallet. The appliance can then be slid off the pallet and located into position. Care should be taken to ensure that the appliance does not tilt more than 45° when being moved around as this can cause internal damage.

If damage is found to the appliance before or during unpacking, the appliance should be isolated in a well-ventilated area and inspected by a competent person. The damage must be assessed to determine if the damage could result in a refrigerant leak.

Note: The R290 refrigerant is a colourless, odourless, flammable gas. It can only be detected using specialist equipment.

2.4 Heating Circuit Connection

2.4.1 Heating Medium

The heating system must be completely flushed to remove impurities and deposits from sealants and fluxes. The heating circuit must be flushed, purged and pressure tested according to MCS guide MIS3005 and to the relevant Building Regulations. **Note: Flushing and cleaning of the heating system must take place BEFORE the appliance is connected to the heating system.** Thereafter, a suitable treatment/thermal fluid, such as Warmflow HPC Fluid, must be added to the heating medium circuit to protect the appliance and heating system against freezing, corrosion, scale and biological growth.

Treatments/thermal fluids added to the heating medium circuit must be added in accordance with the treatment/thermal fluid manufacturer's use instructions. If for any reason, heating medium is removed or lost from the heating medium circuit, and where there is a need to top up the heating system, the concentration of treatment/thermal fluid must be checked and adjusted as necessary in order to ensure adequate protection against freezing, corrosion, scale and biological growth going forward. Treatment/thermal fluid concentrations must also be checked and adjusted as necessary as part of annual servicing as a matter of routine.

2.4.2 Freeze Protection

Frost can damage the air source heat pump appliance and heating system. To prevent damage, the appliance software is equipped with a freeze protection function (see section 2.4.6). However, in the event of a power failure, the appliance's freeze protection function will be compromised, and alternative freeze protection measures must be deployed at appliance installation in order to protect the heating medium circuit against freezing in these circumstances.

As per 2.4.1 above, a suitable treatment/thermal fluid such as Warmflow HPC Fluid, when correctly added to the heating medium circuit will provide long term protection against freezing, as well as corrosion, scale and biological growth.

If antifreeze valves are to be used to protect the system against freezing, these must be installed at all low points in the installation pipework. Antifreeze valves must in all regards be installed in accordance with the valve manufacturer's instructions.

Due to the potential for leakage and loss of heating medium from the heating medium circuit due to issues of compatibility between thermal fluids and some antifreeze valves, Warmflow strongly advises against the combined use of thermal fluid and antifreeze valves together.

Where thermal fluid is not to be used due to the application of antifreeze valves, the Installer must protect the appliance and heating medium circuit from corrosion, scale and biological growth through the addition of appropriate treatments, which are compatible with antifreeze valves. All such treatments must be used in accordance with the treatment manufacturer's instructions. It may also be necessary to adjust the Antifreeze Temperature (Parameter A04 – see section 3.2).

If for any reason, such treatments are removed or lost from the heating medium circuit, and where there is a need to top up the heating system, the concentration of treatments used must be checked and adjusted as necessary in order to ensure adequate protection against corrosion, scale and biological growth going forward. Treatment concentrations must also be checked and adjusted as necessary as part of annual servicing as a matter of routine.

Note: The activation of antifreeze valves will result in a loss of fluid from the heating circuit and consequently a loss of protection treatments for corrosion, scale and biological growth. The heating circuit must be re-commissioned by a Warmflow engineer or other trained and competent engineer and the concentration of protection treatments checked before operating the appliance. Refilling the heating circuit from a cold water main is not permitted. The use of automatic filling devices is prohibited by Water Regulations.

2.4.3 Heating Connections to the Heat Pump

The appliance comes with female union fittings for the heating flow and return connections. Accessories packs are available with flexible hoses and connections to attach to the female unions on the appliance. These should be used to reduce any vibration or noise which may be transferred to rigid pipe or the building structure.

2.4.4 Heating Circuit and Integrated Circulator

A variable speed high efficiency circulator for the heating circuit is provided within the casing of each appliance. The circulators have been sized to accommodate the majority of heating systems based on the heat output of each appliance. However, due to the variation in each system, checking that the minimum required flow rate is achievable is essential. Heating Circuit and Integrated CirculatorTable 5 Heating flow rate requirements below shows the minimum and maximum required flow rates for each appliance at minimum and maximum heat outputs respectfully.

Heating Circuit and Integrated CirculatorTable 5 Heating flow rate requirements

Heat Pump	Heat Output (kW)		Required Flow Rate - l/min (m^3/h)		Min circuit volume (L)
	Minimum	Maximum	@ Min. Output	@ Max. Output	
AS01-R290	3	9	10 (0.6)	20 (1.2)	18
AS02-R290	5	15	16 (0.96)	30 (1.8)	30
AS03-R290	8	22	28 (1.68)	60 (3.6)	50

2.4.5 Bypass / Open Zones

It is essential that the heating circuit can always achieve a minimum flow rate of at least 10 litres per minute even when no zones are calling for heat. This can be achieved by fitting a bypass between the flow and return or by leaving a number of zones/radiators permanently on. This will significantly reduce short cycling and nuisance alarms such as low flow rate. It is also essential to provide freeze protection as detailed in section 2.4.6.

2.4.6 Freeze Protection

Freeze protection works in a number of ways depending on the current operation and conditions at the appliance. When the appliance is running, freeze protection is enabled if the outlet water temperature is more than 2°C below the inlet water temperature and is also less than 5°C. This may be the case if the appliance is trying to defrost but there is not enough energy in the heating system to utilise. When these conditions are met, the appliance will stop the compressor but continue to run the circulating pump. The appliance will exit this freeze protection mode when the outlet water temperature rises above 7°C and the suction pressure in the refrigeration circuit is above 0bar.

NOTE: If this type of Freeze Protection is triggered 3 times within 30 minutes, the appliance will not start up. Power to the appliance needs to be turned OFF and then back ON in order to perform a reset and confirm that everything is OK with the system. The appliance will start up and operate as normal after this reset.

When the appliance is not running or is in standby mode, there are two stages of freeze protection built into the appliance. In the first stage, if the temperature of the heating medium falls below 4°C within the appliance and the ambient temperature is less than 0°C, the appliance will

automatically start up the circulating pump to increase the heating medium temperature and prevent it from freezing. Therefore, the appliance needs to have a permanent electricity supply and be connected to a heating system which can always provide a complete circuit in order to achieve the minimum heating flow rate. The appliance will exit freeze protection mode when the heating medium temperature rises above 8°C or the ambient temperature rises above 1°C.

In the second stage, if the temperature of the heating medium falls below 2°C within the appliance and the ambient temperature is less than 0°C, the appliance will automatically start up the compressor and run in heating mode to increase the medium temperature and prevent it from freezing. Again, the appliance needs to have a permanent electricity supply and be connected to a heating system which can always provide a complete circuit in order to achieve the minimum heating flow rate. The appliance will exit freeze protection mode when the heating medium temperature rises above 15°C or the ambient temperature rises above 1°C.

2.4.7 Heating Circuit Line Components

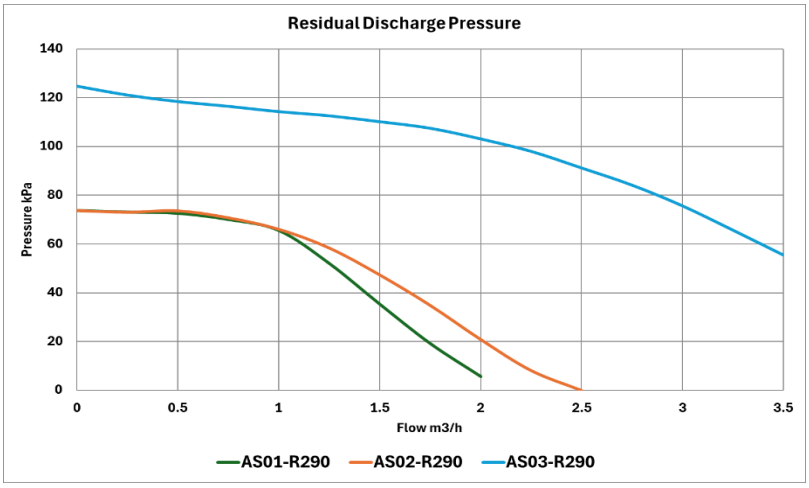
Together with the heating system, associated pipework and manifolds, the heating circuit will also require the following items, expansion vessel, strainer/filter, filling loop, drain valve, pressure gauge, pressure relief valve and isolation valves. A full flow 3-port motorised valve may also be required for some systems; this can be ordered separately, please contact Warmflow for details. Please see section 2.9 for more details of installing and wiring the 3-port motorised valve. These air source heat pump appliances come with the following items included integrally, a high flow circulating pump, a manual air vent, flow switch and temperature sensors. Accessories packs are available with a strainer/filter, isolating valves, and a set of flexible hoses to aid installation.

NOTE: When designing and constructing the heating system for connection to the air source heat pump, it is crucial to guarantee a constant and sufficient flow through the appliance. The design of the heating installation and the components used in its construction must maintain at least the circulation requirements as specified in Heating Circuit and Integrated CirculatorTable 5 Heating flow rate requirements**.**

Note that flow through the system may be influenced by various factors including but not limited to: piping and hose sizing/configuration/complexity, restrictive fittings & bends, system fouling, airlocks, large temperature differentials, etc. Warmflow advises installers to use only components that maximise bore size and optimise flow performance, tailored to the specific requirements of the installation.

NB: In order to protect the product from blockage, inefficiency and operational failure, it is critical that a strainer/filter is fitted to the return of the heating circuit. Only strainers with a mesh size of 500 microns or smaller must be utilised.

To assist with system design and achieving optimum flow rates, the graph below shows the residual pressure available from each appliance model.



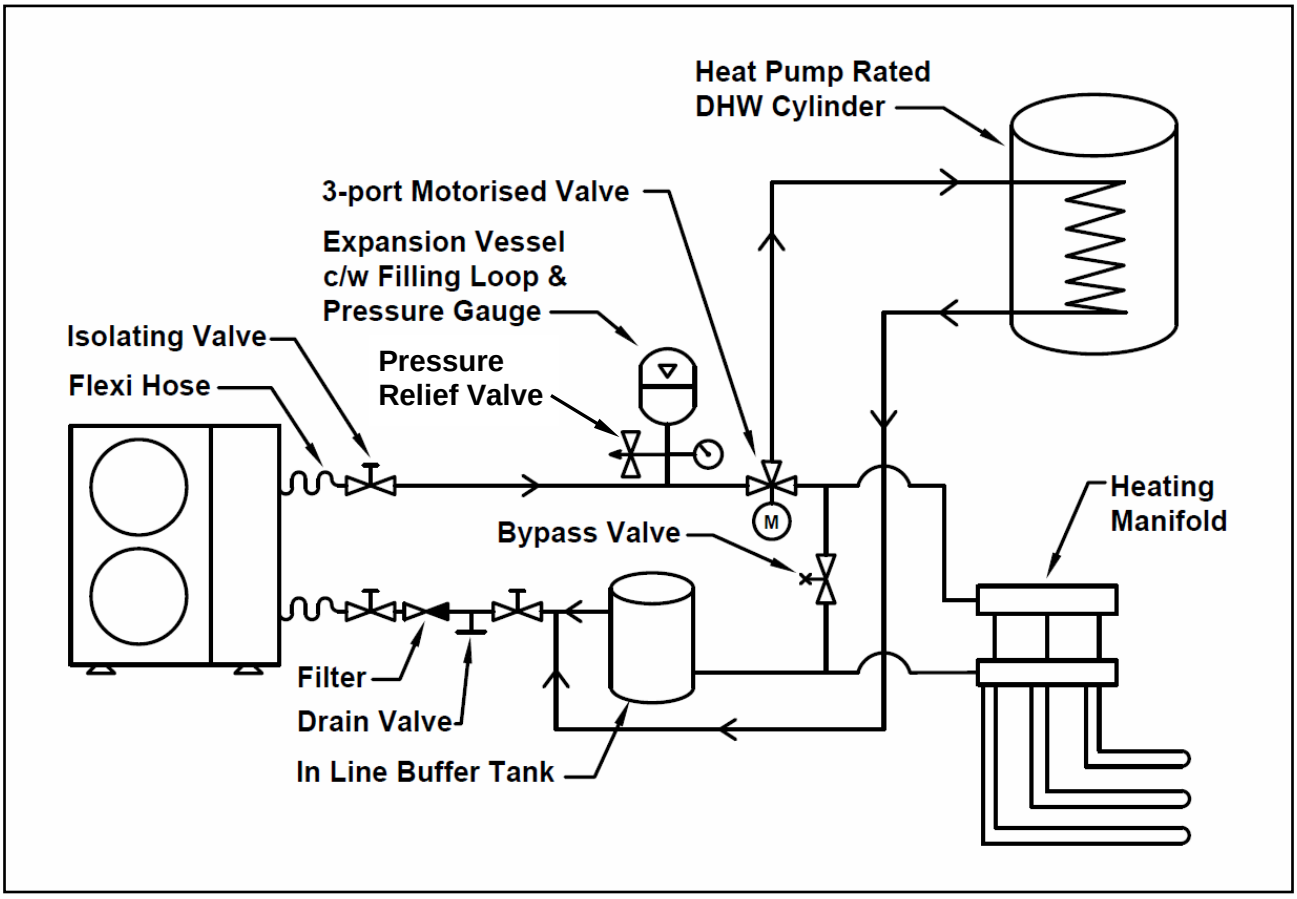


Figure 8 Heating & DHW Schematic

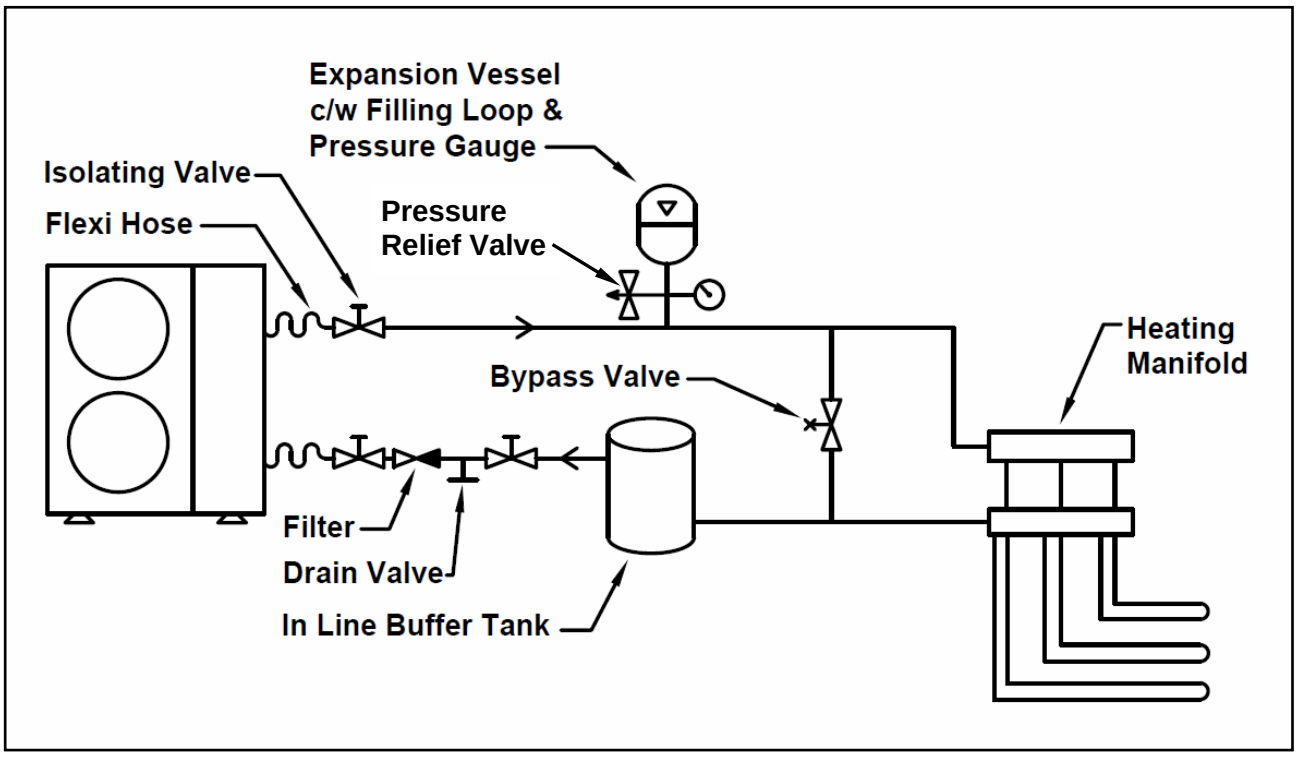


Figure 9 Heating Only Schematic

2.5 Defrosting

Due to the nature of the heat pump operating cycle, frost and ice may build-up on the evaporator. The appliance senses this build-up and then performs a defrost cycle to remove the ice. As a result, the ice is melted and collects in the drip tray. The drip tray is heated to prevent this water from refreezing. Holes in the bottom of the drip tray allow the water to exit the heat pump.

Adequate provision should be made to prevent condensate from collecting around the appliance. A soakaway underneath the appliance must be provided according to the diagram shown in Figure 10. Dimension A must be ≥ 600mm.

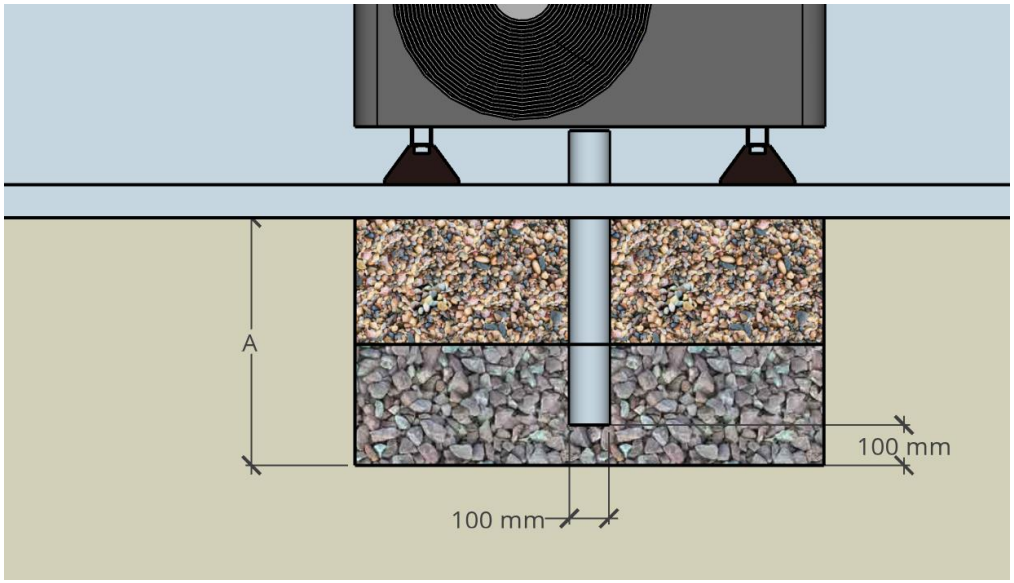


Figure 10 Soakaway Detail.

2.6 Air Vent

Each appliance features a manual air vent located at the top of the internal pipework in the appliance. This is to allow air to be removed from the appliance when it is filling.

NOTE: A piece of clear plastic piping should be pre-fitted to the air vent. This can be used to locate the air vent by following the pipe. Before opening it, ensure no water is sprayed onto any electrical components in the casing.

2.7 Buffer tank

In order to perform the defrost cycle, the air source heat pump runs in reverse mode. The defrost cycle takes a small amount of heat from the heating system and uses it to melt any ice which may have formed on the appliance's evaporator. Frost or ice which has formed on the evaporator will interfere with the operation of heat pump and it is therefore vital that it is thawed to remove it. The heat pump will defrost regularly in order to maintain its performance. To ensure the availability of sufficient heat for the purposes of defrosting, it is recommended that an in-line buffer tank is incorporated on the return heating pipework to the appliance. An in-line buffer tank accessory is available separately from Warmflow.

If an in-line buffer tank is not incorporated into the installation, a calculation must be performed to determine the circulating volume of water which is available to the appliance for the purposes of defrosting. The minimum circulating volume required for each appliance model is given in Table 5. The calculation below is used to calculate the actual circulating volume. This actual volume must always be equal to or greater than the minimum circulating volume indicated for the appliance in Heating Circuit and Integrated CirculatorTable 5 Heating flow rate requirements and must also be recorded in the Installation & Commissioning records.

In all cases an open circuit must always be maintained to allow defrosting to occur.

Model Volume (l)	+	Total Pipe Volume (l)	+	Total Emitter Volume * (l)	=	Actual Circulating Volume (l)
See Table 1 for Model Fluid Content		See Appendix A for guidance		See Appendix A for guidance		

* = Radiators without TRVs, open UFH loops, etc.

2.8 Bypass Valve

In order to provide sufficient flow rates and to facilitate defrosting, it is essential that the heating circuit can always achieve a minimum flow rate of at least 10 litres per minute even when no zones are calling for heat. This can be achieved by fitting a bypass between the flow and return or by leaving a number of zones/radiators permanently on. This will significantly reduce short cycling and nuisance alarms such as low flow rate. It is also essential to provide freeze protection as detailed in section 2.4.6. An open circuit must always be maintained to allow defrosting to occur.

2.9 3-Port Motorised Valve

A full flow 3-port motorised valve is available separately. This 3-port motorised valve has a number of operating positions and comes in two parts, the valve body and the actuator. It is essential that the valve body position and actuator are positioned correctly to ensure appropriate functionality. The valve body position is adjusted by a 'T' on top of the valve. The default position of the 'T' is shown on the left in Figure 11 below. The default position is for heating with flow from A to B.

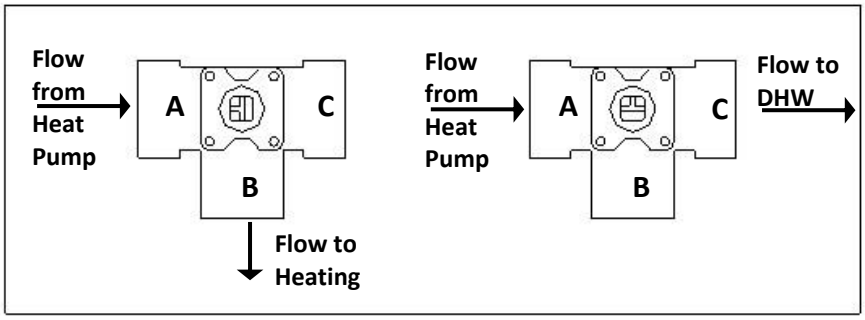


Figure 11 3-port Motorised Valve Body Positions

The valve turns clockwise when DHW is enabled as shown on the right in Figure 11 above with flow from A to C. With the valve body in the default position, the actuator should then be set to the default position as shown on the left in Figure 12 below. This can be achieved by holding down the clutch release button (located on the right side of the actuator) and rotating the lever into the correct position. The actuator should then be clipped onto the valve body. A rotation switch can be found on the right side of the actuator and must be in the 'CW' (clockwise) position.

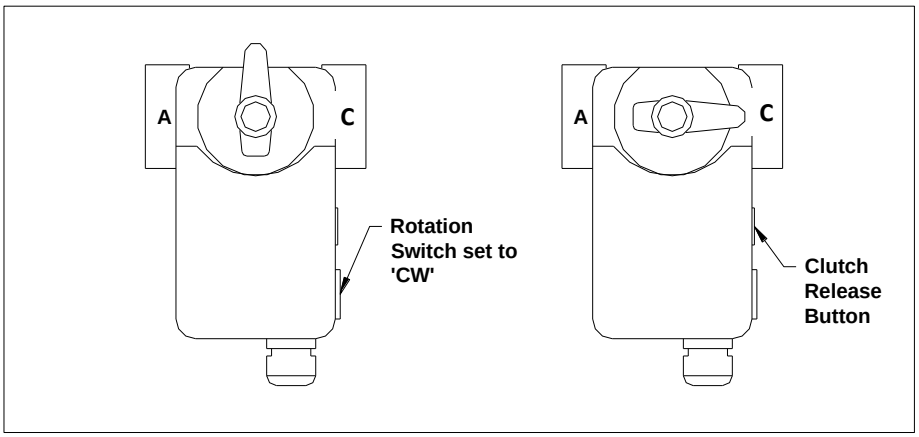


Figure 12 3-port Motorised Valve Actuator Positions

The valve turns clockwise when DHW is enabled as shown on the right in the figure above.

The valve actuator is 230V ac and has 3 wires, a brown, a blue and a white wire. The brown wire is the permanent live to the valve to power it in order to return to the default position and should be wired into the permanent live connection in the installers wiring enclosure. The white wire is the switched power which powers the valve to the DHW position when DHW mode is active. The blue wire is the neutral. See Figure 14-for terminal connections in the installers wiring enclosure.

2.10 Electrical Installation

Together with the connection to the mains, there are a number of sensors and input/output connections which must be made with the heat pump. These connections are to be made in the installers wiring enclosure. The installers wiring enclosure can be found under the removable right hand side panel of the heat pump casing.

The installer's wiring enclosure contains the entire necessary connection terminals for installation.

Electrical installation including cable sizing and protection should only be undertaken by a qualified electrician in accordance with the latest Institute of Electrical Engineers (IEE) regulations.

Consideration must be given to the potential for electrical interference caused by the proximity of power cables to the User Interface and separation between the two must be maximised at installation.

2.10.1 Incoming Supply

The AS01-R290, AS02-R290 & AS03-R290 appliances all require a single phase $230V_{ac}$ 50Hz electricity supply compliant with EN50160, 230V -6% +10% (i.e. 216.2 V – 253.0 V). Note: Fluctuations in the voltage characteristics of the electricity supply may adversely affect the operation of the appliance as well as its warranty.

The AS01-R290 is rated at 14Amps whilst the AS02-R290 is rated at 25Amps and the AS03-R290 is rated at 35Amps. As these appliances are variable speed, during starting the compressor speed is ramped up slowly meaning there is not a high starting current commonly associated with fixed speed appliances and as such there is no need for a very large power supply or the use of starting capacitors.

The appliances must be protected by a Type C MCB and RCD according to the table below.

Table 6 Electrical Installation Specification

Appliance	Minimum Wire Gauge	MCB Rating (Type C)	RCD Rating (Type F)
AS01-R290	2.5mm^2	20A	30mA ≤0.1 seconds
AS02-R290	4.0mm^2	32A	30mA ≤0.1 seconds
AS03-R290	6.0mm^2	40A	30mA ≤0.1 seconds

NOTE: The incoming power supply must be connected via an isolating switch with a minimum breaking gap of 3mm. Cable cross sectional areas should be calculated according to the current at full load together with the on-site conditions and the cable length between the heat pump and the main consumer unit, the above table lists minimum recommendations only.

2.10.2 Digital Inputs

The appliance can also be controlled remotely from an external controller such as a timeclock or room thermostat instead of the internal timeclock. To enable remote control, parameter H07 must be changed from 'Display Control' to 'Remote Control'. This will activate the digital input connections in the installers wiring enclosure. These connections are all 'volt free' and therefore no voltage should be connected into any of them, they are enabled by connecting the relevant terminals together.

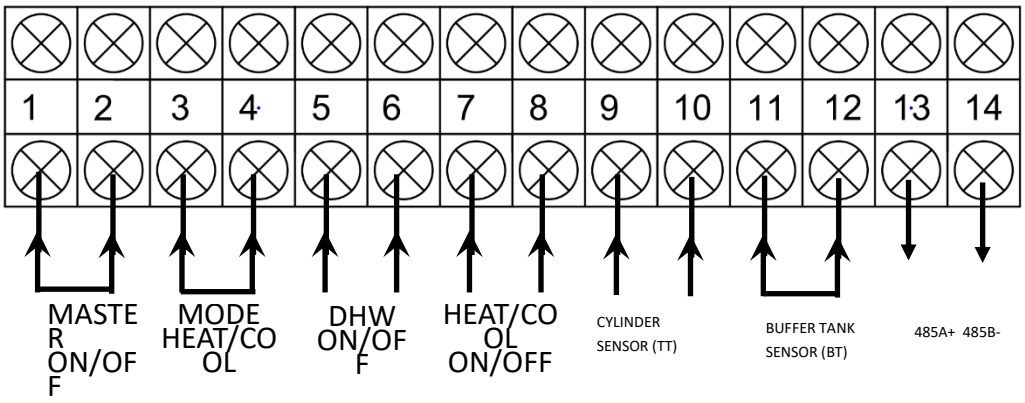


Figure 13 Installer's Digital Input Connections (ASXX-R290)

A link wire should be placed between the terminals for the 'Master On/Off' and also between terminals for the 'Mode Heat/Cool' function. This will ensure the appliance is on and set in heating mode. Volt-free connections can then be made to the 'DHW On/Off' and 'Heat/Cool On/Off' from a remote source such as a timeclock, programmer or room stat. Connecting the terminals for 'DHW On/Off' (5 & 6) will set the appliance into DHW mode. Connecting the terminals for 'Heat/Cool On/Off' (7 & 8) will set the appliance into heating mode (provided the link wire is connected between the 'Mode Heat/Cool' terminals.

NOTE: Connections are volt-free, no voltage should be connected into any of them. Connecting any kind of voltage to the terminals will damage the control board inside the appliance.

2.10.3 Temperature Sensors

There is one additional temperature sensor which needs to be connected to the appliance in order to achieve full functionality. This sensor is a DHW storage temperature sensor. The sensor is supplied with the appliance but the wiring to it may need to be extended. The wires should be ran separately to any power transmission cables, however, if they need to run close to or in the same conduit as power transmission cables, then shielded cable must be used. The type of temperature sensor to be used is NTC 10kΩ.

The DHW storage temperature sensor is used to control the DHW heating requirements. It must be connected or this will cause a fault and trigger an alarm. The appliance will arrive with a link wire complete with a built-in resistor in order to give a reading and enable the appliance to operate. The link wire which is wired into the 'TT' (9 & 10) terminals of the installer's wiring enclosure needs to be removed and replaced with the supplied DHW storage temperature sensor. The sensor should be located in a stat pocket on the DHW storage cylinder to give an accurate indication of the cylinder's temperature. If the appliance is only to be used for space heating, the link wire complete with resistor should not be removed from the 'TT' terminals.

A link wire complete with a built-in resistor which is wired into the 'BT' (11 & 12) terminals on the appliance is required in order to give a reading and enable the appliance to operate. This link wire should not be removed unless the appliance is set to target the Buffer Tank temperature. In this case the link resistor should be removed and replaced with a sensor located in the Buffer Tank.

2.10.4 Digital Outputs

The digital outputs section allows the connection of ancillaries which are turned on or off via the appliances controller. **The total rated current of all the outputs together must be less than 3.0 Amps. Items such as immersion heaters and high powered pumps can still be controlled by the outputs but they MUST be connected via a relay with an external power supply.** The following outputs can be controlled by connecting into the appropriate connection blocks.

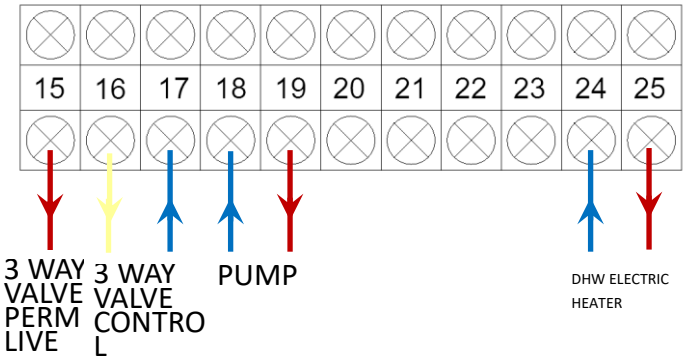


Figure 14 Installer's Digital Output Connections (ASXX-R290)

3 Port Motorised Valve –The 3 Port Motorised valve is detailed in section 2.9. The valve actuator is 230V ac and has 3 wires, a brown, a blue and a white wire. The brown wire is the permanent live to the valve and should be wired into the permanent live terminal 15. The white wire is the switched power which powers the valve to the DHW position and should be wired into the 3 Way Valve control terminal 16. The blue wire is the neutral and should be wired into the neutral terminal 17.

Pump – The default output configuration is for controlling an auxiliary pump which may be used to activate an auxiliary DHW pump (as fitted to the Warmflow Nero Heat Pump Cylinders). The pump live should be wired into the Aux pump live terminal 19. The pump neutral and should be

wired into the Aux pump neutral terminal 18. This output is protected with a 3 Amp fuse. See parameter H40 for alternative configurations.

DHW Electric Heater (Immersion) – This output (230Vac) is for controlling an immersion heater in the DHW storage cylinder. **As the immersion heater will have a high electrical load, it must be wired via a relay or contactor (240V) with an external power supply**. The live output terminal 25 and neutral terminal 24 should be wired to the coil of the relay which then will switch the external power supply to the immersion heater. Cable cross sectional areas should be calculated according to the current at full load together with the on-site conditions and the cable length between the relay, the immersion heater and the consumer unit.

A DHW storage cylinder immersion may be called to switch on to provide thermal disinfection of the DHW cylinder. This may be the case if a DHW storage temperature of 60°C cannot be achieved by the heat pump alone. This functionality is enabled by default (parameter G05 = ON (1)) Thermal disinfection times, duration and temperature can then be set in the engineer's menu using parameters G01 to G04. The control settings of the immersion should be set during commissioning.

2.10.5 User Interface (Controller)

The user interface (controller) needs to be connected by plugging it into the corresponding plug which can be found in the installer's wiring terminal. The interface can be plugged directly into the appliance or further away in the property by using the supplied extension cable. This extension cable is 10m long and this can be further extended up to a maximum length of 200m. The extension cable can be extended by joining with a 4-core screened cable with wire gauge of 0.5mm^2. The cable should be joined in such a way so that the connectors are located at each end for joining to the appliance or the interface as appropriate.

2.10.6 DTU Module

The Data Transfer Unit (DTU) is a communication module which when connected to the air source heat pump, provides remote control and diagnostics through a cloud server. The DTU module connects to the cloud server via the 4G Telephone Network. The module consists of a control box with display LEDs, an antenna and wiring to connect it to the air source heat pump's control board.

The DTU module wiring is connected to the 485_A3, 485_B3 and GND terminals on the main control board. This is shown more clearly on the wiring diagram located inside the electrical control panel.

The DTU module is located beside the installer's wiring terminals on the air source heat pump as it is not waterproof. The antenna, which is waterproof is also located inside the appliance. The signal strength is shown by the display LEDs on the DTU module. If the signal strength is less than medium the antenna must be moved outside the appliance casing and attached to the casing using the adhesive pad on the base.

Once installed, the appliance can be set up using the Warmlink App together with the QR Code on the side of the appliance. For more details and help with registration, please see the Warmlink App or visit www.warmflow.co.uk.

Warmlink access is currently complimentary and subscription-free; however, charges may apply for this service in the future.

GSM access dependant on service provider coverage.

3 User Interface

The appliance's user control interface has been designed to maximise the ease of use and efficiency of the heating system. The interface is a touchscreen with all interactions being performed on the screen itself.

On powering the appliance up, a start up screen will be displayed. The screen displays the firmware and software version which are installed on the controller. If the version number is not shown, this means there is a communication fault and the screen will turn off after 15 seconds. Check the wiring connections between the controller and the appliance if this occurs.

3.1 Home Screen Icons

All interactions with the heat pump are via this user interface which should be located in a suitable location in the property. The interface allows the modification of parameters such as time clocks, temperature set points, heating & DHW functions, together with commissioning and service settings. The home screen appears as shown in Figure 15.

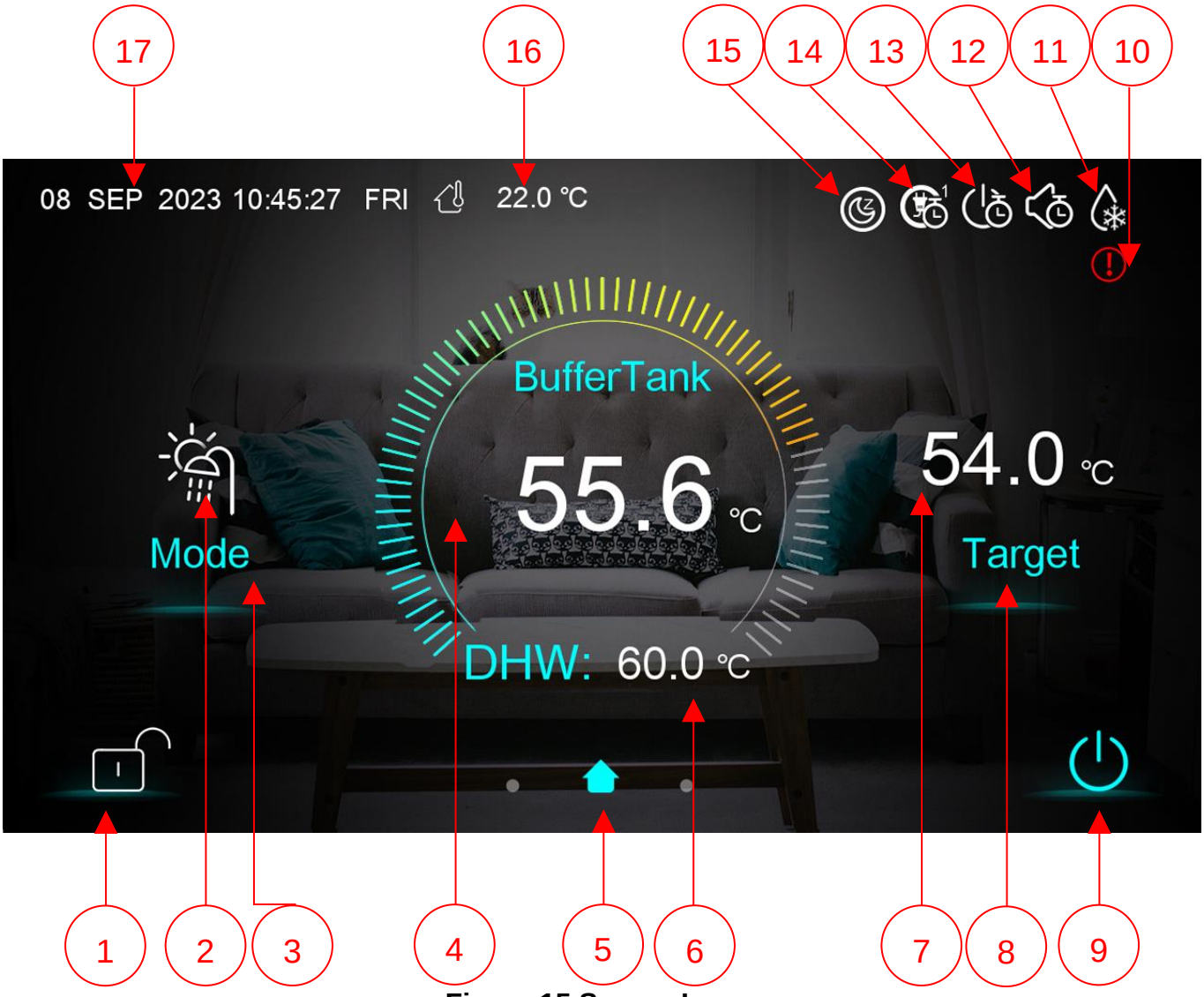


Figure 15 Screen Icons

There are a number of icons/buttons on the home screen as shown in Figure 4. The meaning and features of these are explained in the table below:

1	LOCK Button - Press this button to lock the display. This function prevents unwanted adjustments of parameters or changing of functions and timeclock on/off periods. When the lock function is activated, the display will ignore all key presses. To unlock the device, press the Lock Button again and then enter the password. The password is '0022'. Once entered, all functionality will be restored. The button will turn green to show that the LOCK function is enabled. The button will appear white when the function is not enabled.
2	Running mode icon: This icon indicates the current active mode. There are 3 modes, namely: Heating, Hot water, DHW + Heating
3	MODE Button - Press this button to switch between operating MODES. Pressing the button will bring up the following menu screen where the required MODE can then be selected.
4	Control temperature: This value displays the current Control Temperature. The value displayed depends on the control temperature selected - Outlet, Room, Buffer Tank or Inlet.
5	Main interface icon: This icon indicates that the current page is the main interface page.
6	DHW temperature: This value displays the DHW Cylinder Temperature when the appliance is in DHW mode. If the appliance is not in DHW mode this value is not shown.
7	Target Temperature. This value displays the Target Temperature of the current mode.
8	Target Temperature Setting Button - Press this button to enter the Target Temperature Setting Interface. This will allow the target temperature of the current mode be set.
9	ON/OFF Button - Press this button to switch the appliance from OFF to ON or vice versa. When the appliance is switched ON, the symbol on the button will be blue and the screen will appear in colour as shown above. When the appliance is switched OFF, the symbol on the button will be white and the screen will be greyed out as shown in the Figure 5.
10	Alarm/Fault Icon – This icon will flash when a fault or alarm is active. Pressing the icon will bring up the Fault History Sub-Menu.
11	Defrosting Icon – The Defrosting Icon indicates that the appliance is currently in Defrost Mode. The defrosting icon will continue to show until defrosting is complete.
12	Mute timer icon: This icon will be displayed after the mute timer function is enabled.
13	Power on/off timer icon: This icon will be displayed after the power on/off timer function is enabled.

14	Mode, Temp & Power timer icon: This icon will be displayed when this timer function is enabled.
15	Smart Grid (SG) Ready Icon: This icon will be displayed when SG Ready function is enabled. SG Ready includes five modes: Solar Sleep Mode, Solar Low Mode, Solar Medium Mode, Solar High Mode, Normal Mode.
16	Ambient Temperature – This value displays the current Ambient Temperature.
17	Time And Date – This line of text indicates the current Time and Date.

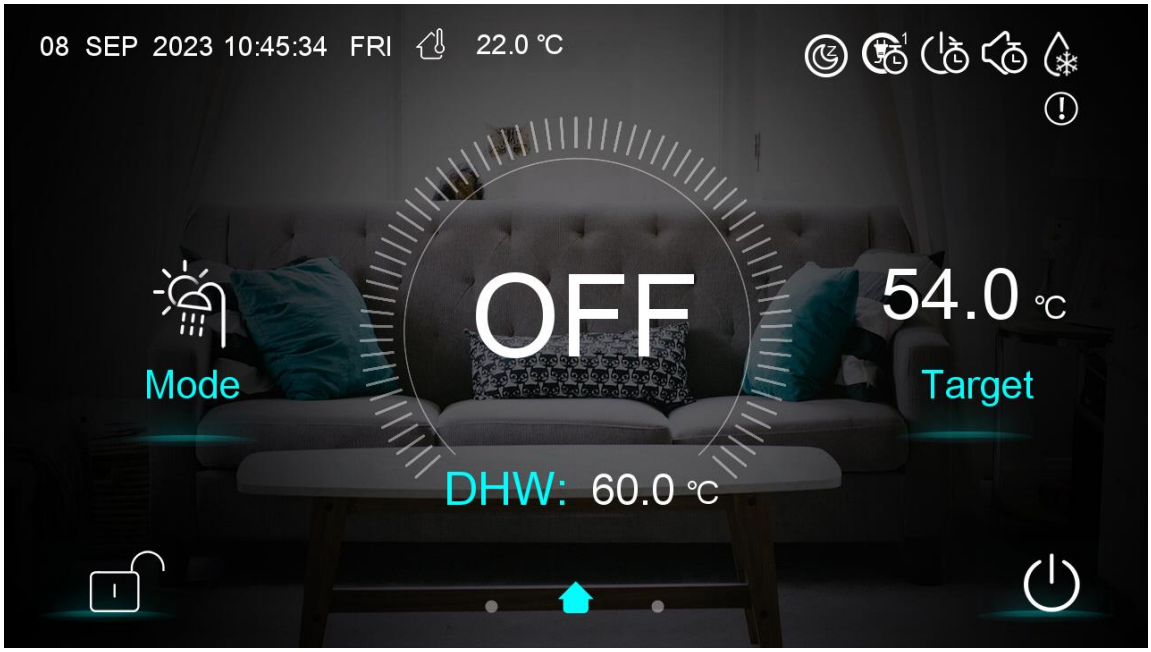


Figure 16 OFF Screen Display

3.1.1 MODE Button.

Press this button to switch between operating MODES. Pressing the button will bring up the following menu screen where the required MODE can then be selected.

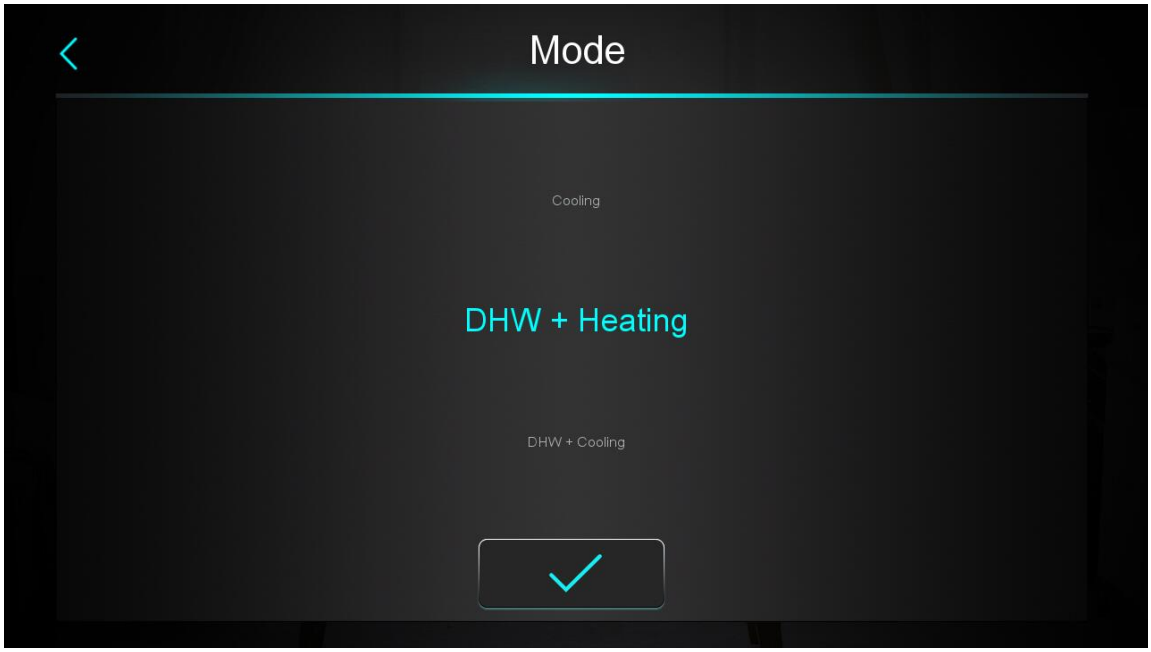


Figure 17 MODE Menu Screen

The required MODE can be selected by swiping up or down to the desired mode. Details of each MODE are below. After selection, confirm with the enter button  to save the new mode. This will return to the Home Screen with the appropriate symbols for the selected MODE enabled.

Modes

No.	Mode	Description
1	Hot Water	This enables Hot Water only.
2	Heating	This enables Heating only.
3	Hot Water & Heating	This enables both Heating & Hot Water with Hot Water taking priority.

3.1.2 Target Button.

Press this button to set the desired temperatures. Pressing the button will bring up the following menu screen where the required temperatures can then be set.

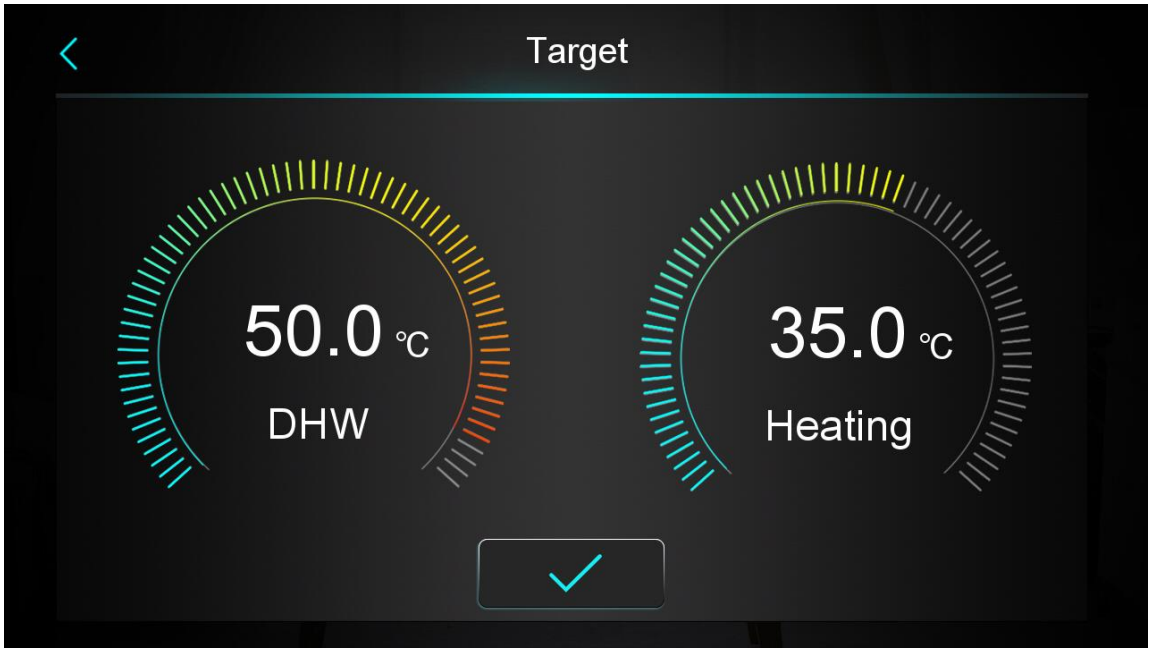


Figure 18 Target Temperature Menu Screen

Depending on the current mode of the appliance, the Target Temperature Menu Screen will display the relevant temperatures available to be modified. For example, the image of the display above means that Hot Water & Heating Mode is enabled. The Temperatures can be adjusted by swiping around the curves

3.1.3 State Display

The State display screen is accessed by swiping right from the Main Screen. The State display brings up the following display screen which displays the current status of the appliance, the current mode the appliance is running in and live data for a number of parameters. These parameters include Inlet Water (Heating Return) Temperature, Outlet Water (Heating Flow) Temperature, Water Tank Coil (evaporator) Temperature, Exhaust (Compressor disharge) Temperature, Water flow rate and Low (suction) pressure.

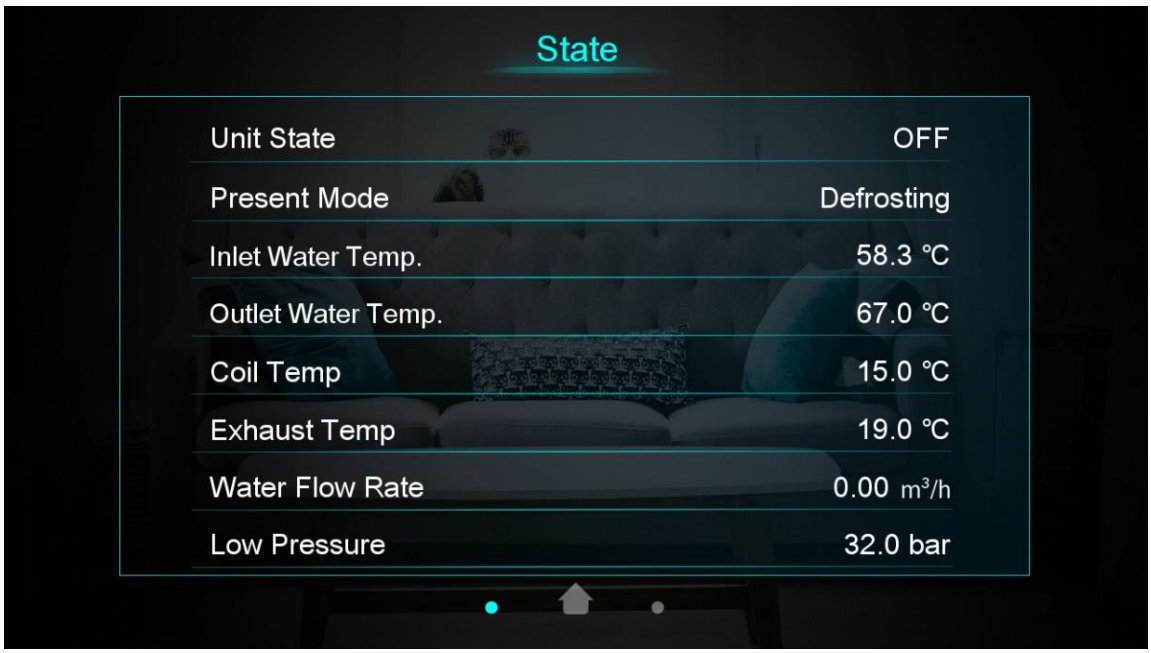


Figure 19 State Display

3.1.4 Settings Menu

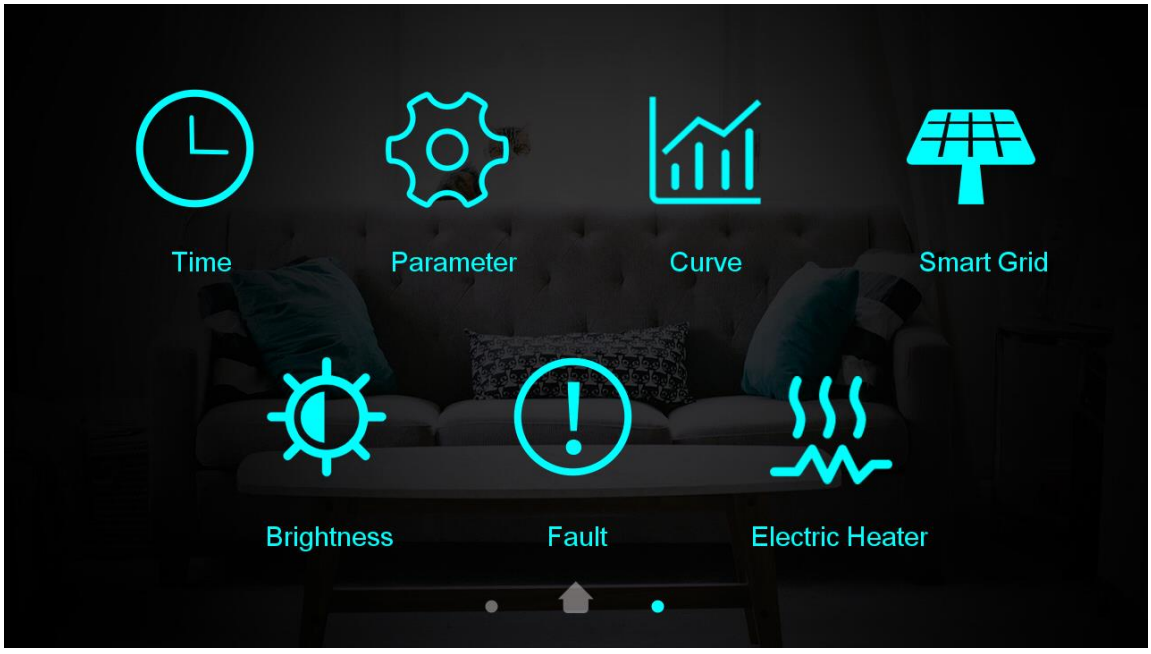


Figure 20 Settings Menu Screen

The Settings Menu Screen is accessed by swiping left from the Main Screen. The Settings Menu Screen features 7 further Setting Sub-Menus. These include Time, Parameter, Curve, Brightness, Fault, Electric heating & Smart Grid as shown above and detailed below. These Sub-Menus are detailed in the following pages.

3.1.4.1 Time Menu

Press this button to enter the Time Sub-Menu. Pressing the button brings up the following display screen which displays 3 sub menus as detailed below.

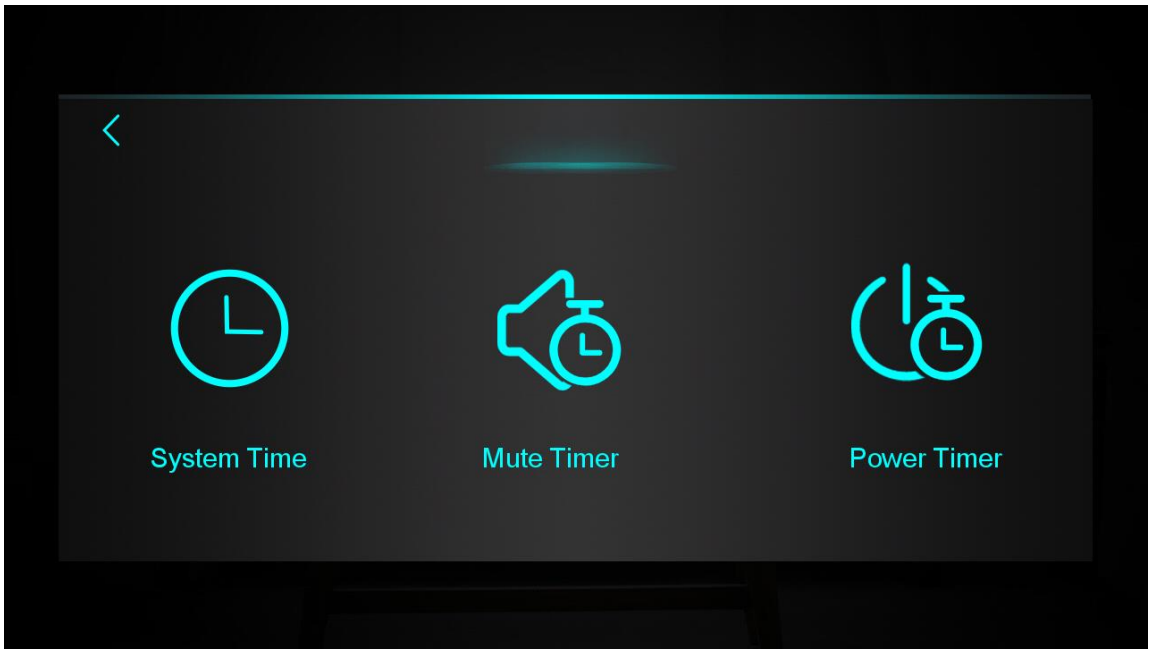


Figure 21 Status Display Screen

System Time – Press this button to set the System Time and Date. This sub-menu allows the clock to be set to the current time and date. This must be accurately set to enable the timeclock functionality and monitoring system to operate correctly. The System Time sub-menu is shown below.

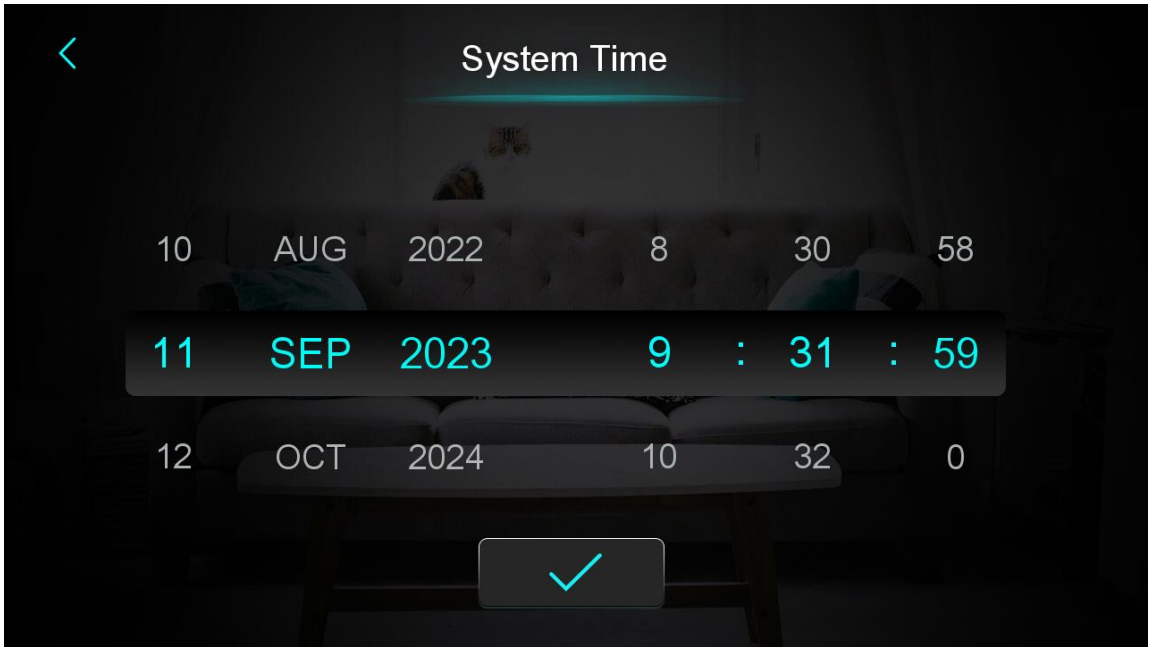


Figure 22 Clock Sub-Menu Screen

The date and time can be set by swiping up and down on the day, month, year, hour, minute and second values shown in the display above. Confirm with the enter button ✓ to save the new time. Return to the Setting Menu Screen with the return button at the top left side of the screen.

Power Timer – Press this button to set the Power Timer.
The Power Timer Setup Screen allows the times for the appliance to be powered on to be set. The functionality can be enabled or disabled by moving the slider on each timer. When the slider is blue, it indicates that the timeclock function is active. If the timeclock function is not active, the slider will be white. Pressing the ON-OFF time allows the ON time and OFF time to be set. Checking the day of the week boxes sets the days when the timer is repeated. Up to 6 timers can be set.

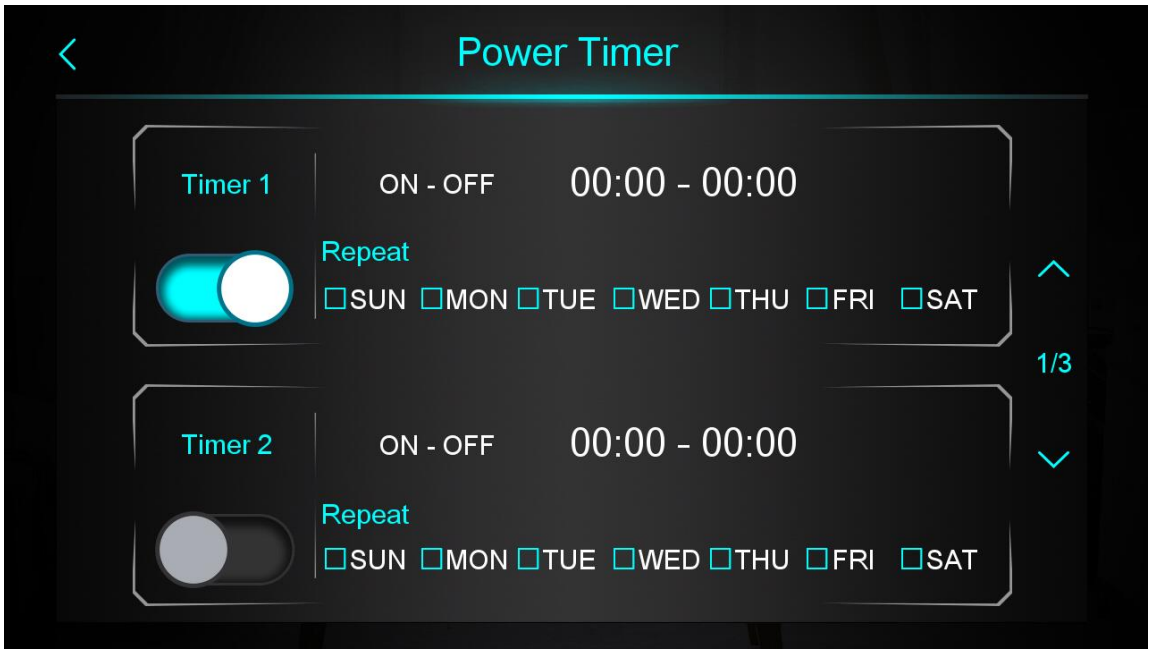


Figure 23 Power timer

Mute – Press this button to set the Mute timer. This sub-menu allows the appliance to be switched into or out of Quiet Mode at certain times of the day/night. In Quiet Mode, the appliance will run at a slower speed with the fan speed also reduced to provide quiet operation. As such the maximum heat output available will be reduced when Quiet Mode is enabled. The Mute Sub-Menu Screen is shown below.

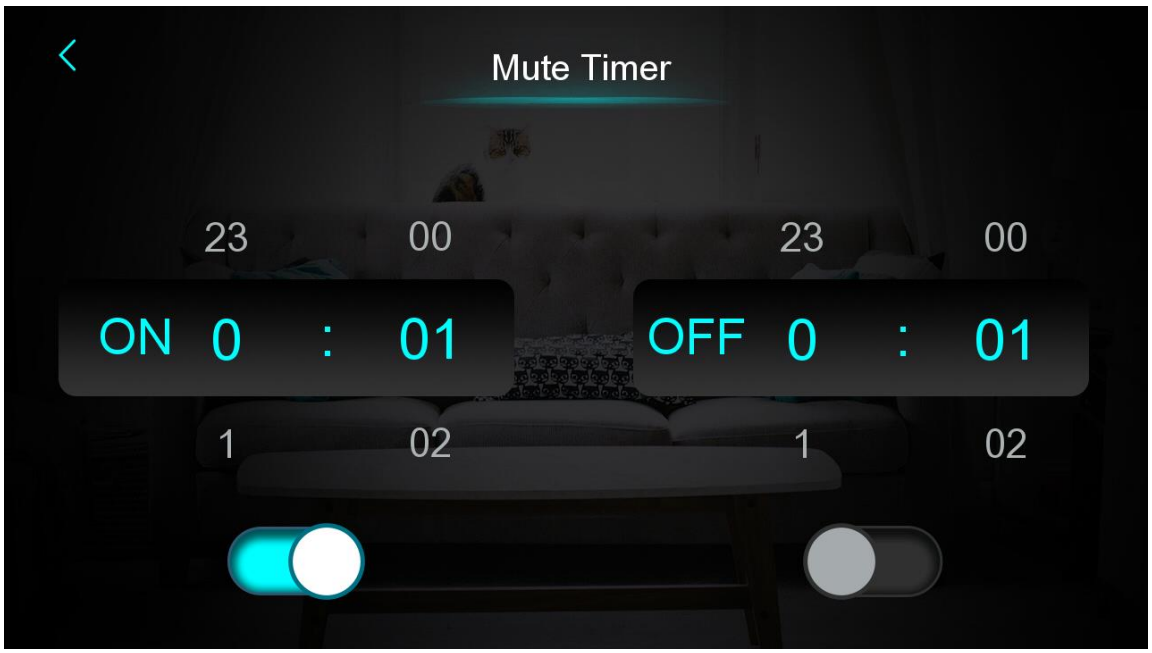


Figure 24 Mute Timer Screen

The functionality can be enabled or disabled by swiping the ON slider, on the left as shown above, to the right. Moving the ON button will turn it blue, indicating it is active and the ON time is set using the Hour and Minute settings above. The OFF time is set using the right side Hour and Minute settings. The OFF slider on the right side should be grey as shown above.

3.1.4.2 Parameter Menu

Press this button to enter the Parameter Settings Password Screen. The Password Screen is shown below. These parameters are detailed in section 3.2.

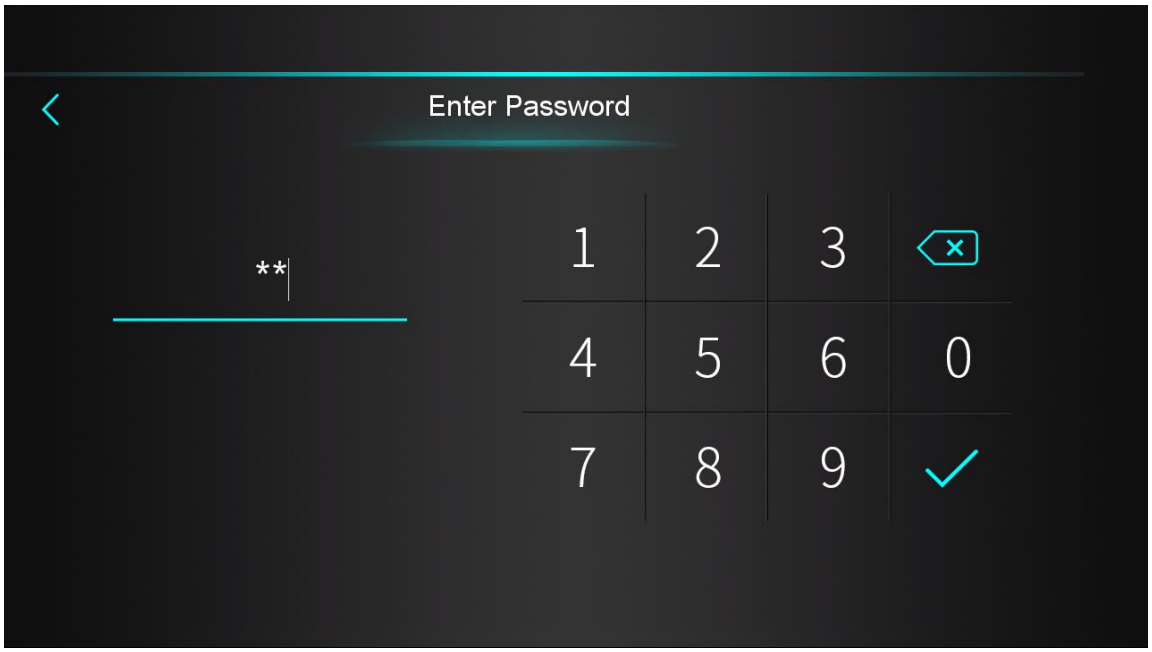


Figure 25 Parameter Settings Password Screen

Enter Password ‘0022’ to enter the Engineer Parameter (Factory Setting) Sub-Menu. This will display the screen shown in Figure 26 with 6 sub menus as detailed below.

NOTE: This Sub-Menu should only be accessed by a suitably trained engineer. Modifying parameters can cause operating errors and malfunction of the appliance.

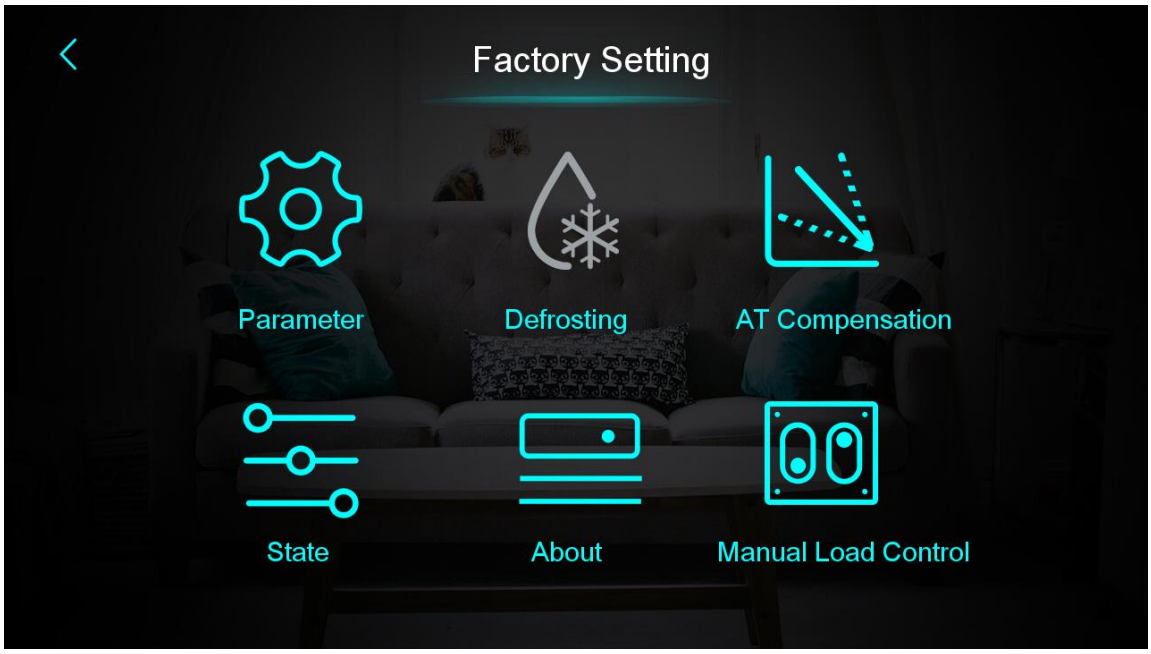


Figure 26 Parameters (Factory Setting) Sub-Menu Screen

Parameters – Press this button to enter the Parameters Sub-Menu. Pressing the button brings up the following configurable display screen which features a large number of editable parameters spread across a number of pages.

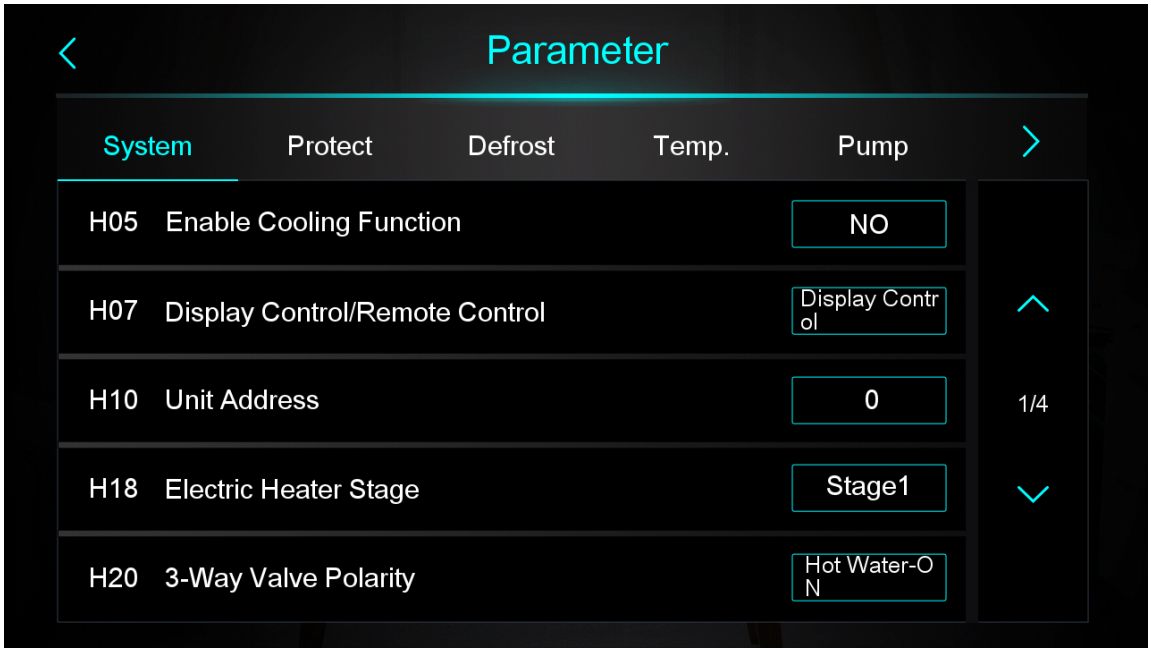


Figure 27 Parameters Screen

Defrosting – Press this button to activate or deactivate manual Defrost mode (when conditions allow i.e. Inlet Temp >23ºC Coil Temperature <13ºC). The icon is bright (blue) when manual Defrost mode is active and grey when inactive.

AT (Ambient Temp) Compensation / Weather Compensation – Press this button to enter the Ambient Temperature Compensation (otherwise known as Weather Compensation) Sub-Menu. Pressing the button brings up the following display screen. Ambient Temp / Weather Compensation can be enabled/disabled using the On/Off slider at the top right of the screen. The compensated target temperatures displayed at several ambient temperatures along the slope which are calculated based on the adjustable Slope (right) and Offset (left) sliders. The slope and offset parameters can be changed to modify the weather compensation curves to suit the property. Weather compensation is enabled as standard. Disabling weather compensation will invalidate the SAP assessment (EPC). A commissioning record and label must be provided that confirm this disablement.

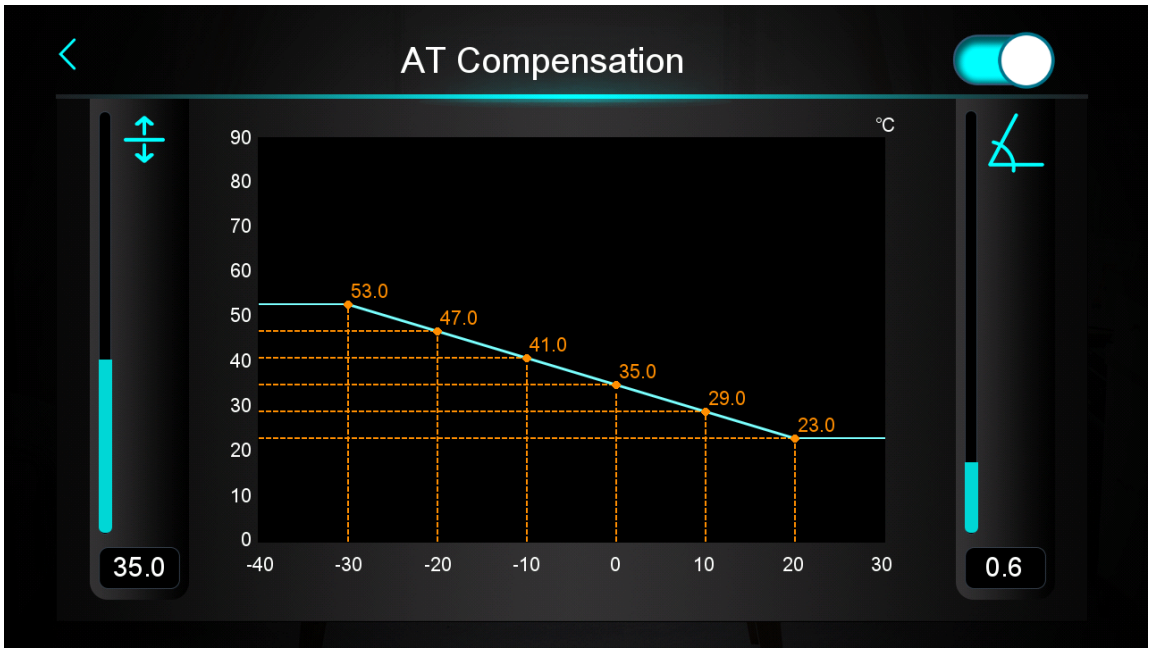


Figure 28 Ambient Temperature Compensation Screen

State – Press this button to enter the appliance Status Sub-Menu. Pressing the button brings up the following display screen which displays the current status of a number of outputs spread across a number of tabs. These outputs and their functionality are detailed at the end of this chapter:

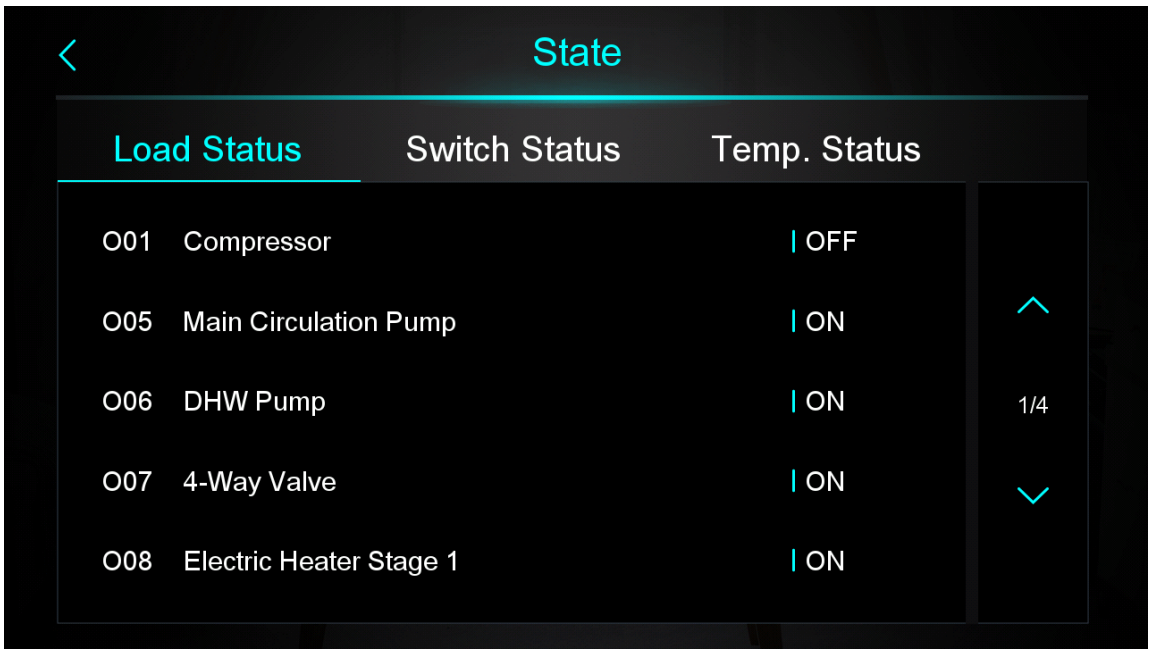


Figure 29 State Sub-Menu Screen

About – Press this button to enter the About screen. Pressing the button brings up the following display screen which displays the codes and software versions for the control mainboard and display. The DTU Barcode is also displayed. This information may be requested by Warmflow technical support.

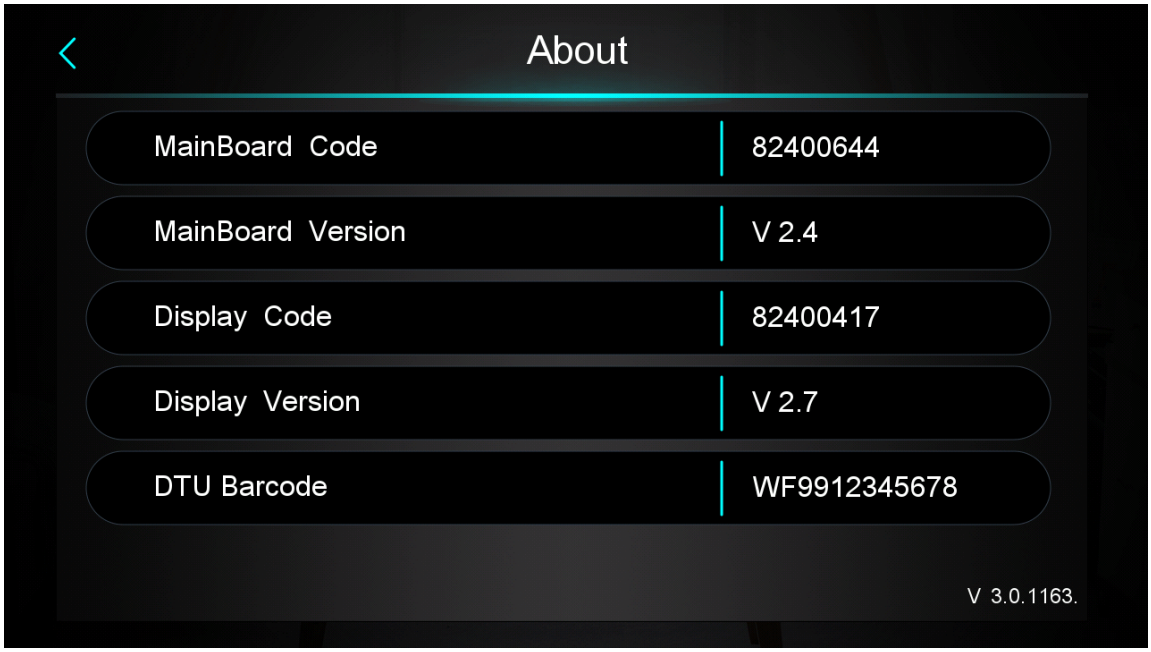


Figure 30 About Screen

Manual Load Control – Press this button to enter the Manual Load Control screen. Pressing the button brings up the following display screen which displays the digital outputs available on the appliance. Pressing the buttons on the right will activate the digital output described on the left of

the button. The appliance must be in Display Control mode (Parameter H07 = Display Control (0)) and the appliance must be switched off using the ON/OFF button on the main screen.
Activating the digital outputs using the manual load controls can assist with commissioning and diagnostics. Not all the digital outputs shown in the manual control section will be available depending on the system configuration. Please contact Warmflow for further details.

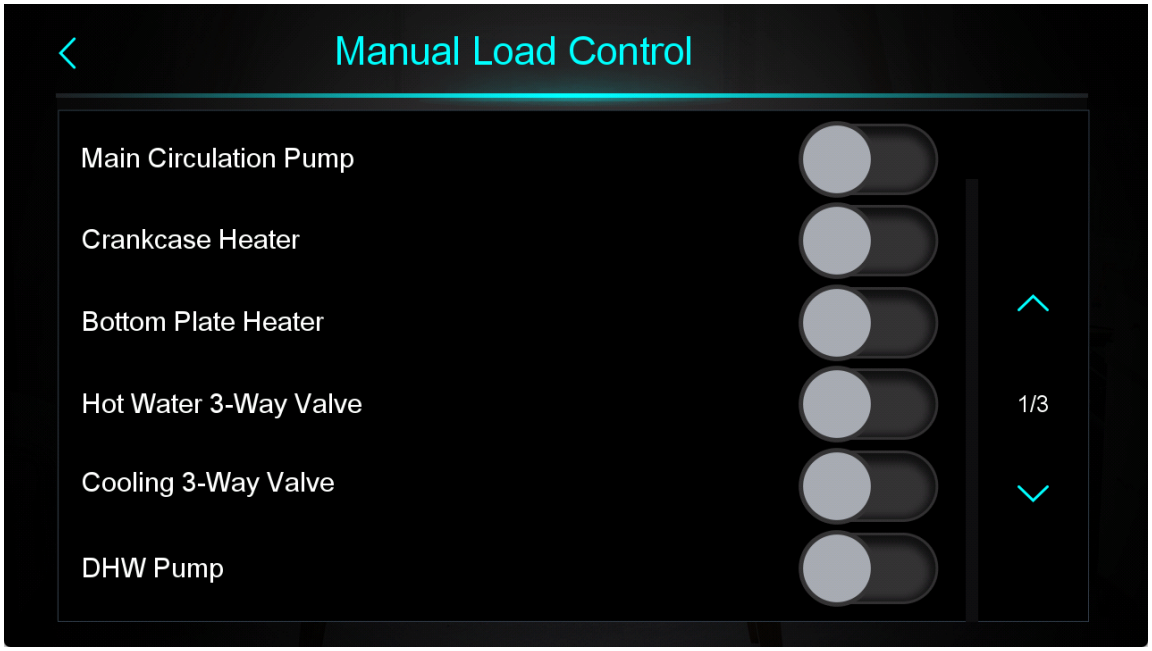


Figure 31 Manual Load Control

3.1.4.3 Curve Menu

Press this button to enter the Curve Sub-Menu. This sub-menu displays a graph showing the Heating Flow, Heating Return and Ambient temperatures when the appliance is running (data will not be recorded if the appliance is not running). The data is recorded every 5 minutes and displayed in either °C or °F dependent on the user setting. The most recent recording is shown on the right side of the graph. A typical graph is shown below:

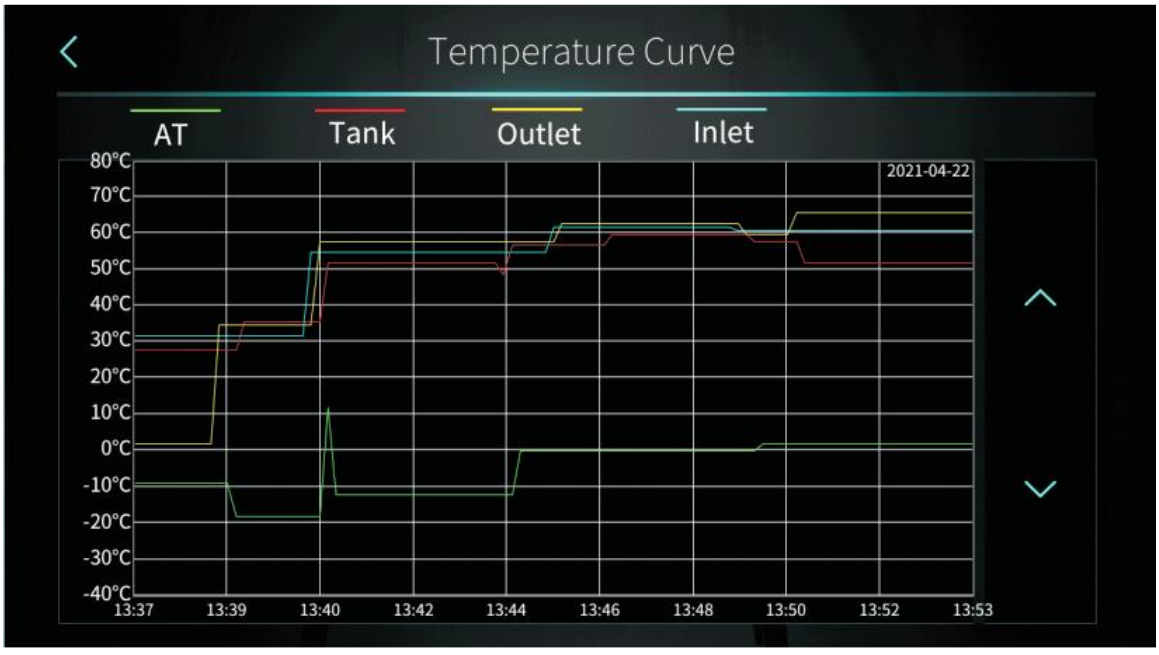


Figure 32 Temperature Curve Display

3.1.4.4 Brightness Menu

Press this button to enter the Brightness Setting. Pressing the button brings up the following display screen which allows the display brightness to be increased or decreased using the slider. The Brightness Setting Screen is shown below:

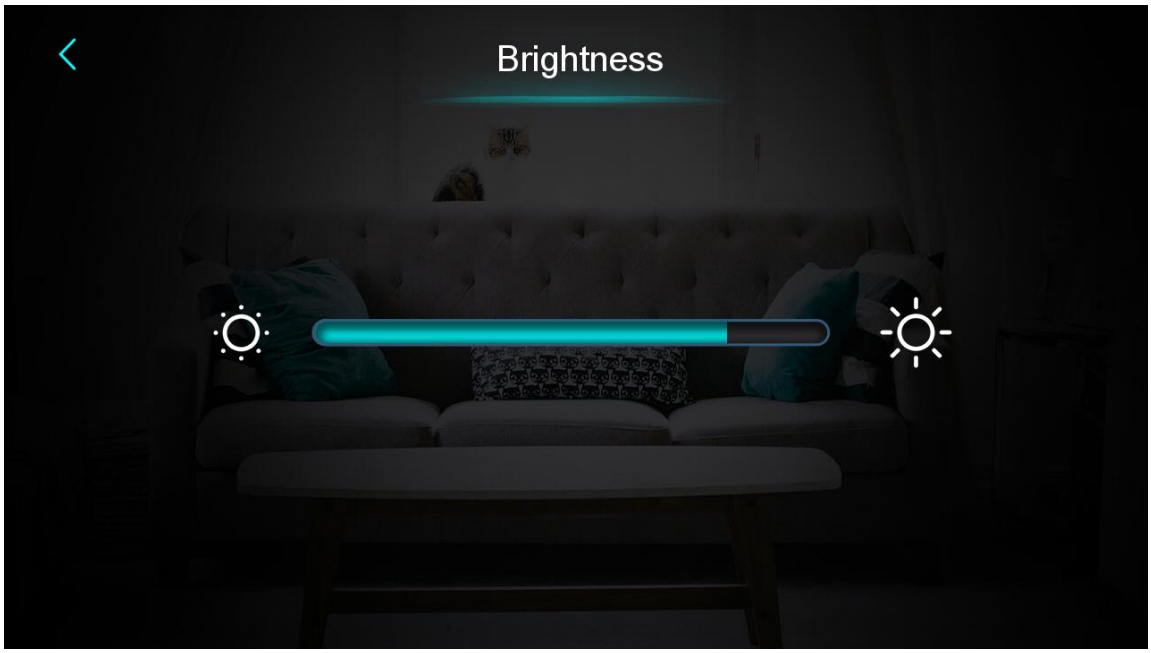


Figure 33 Brightness Control

3.1.4.5 Fault Menu

Press this button to enter the Fault Log. Pressing the button brings up a list of the stored fault codes (most recent first) as shown below. The date and time are displayed as follows: YEAR-MONTH-DAY HOUR:MINUTE:SECOND in order to record the exact time when the fault occurred. A list of error codes, a description and possible resolution can be found in section 5.2 of this manual.

NOTE: It is essential that these error codes are not cleared in order to allow an engineer to fully diagnose the problem and prevent further failures.

Figure 34 Fault Record

3.1.4.6 Electric Heating

Press this button to activate or deactivate Electric Heating (when available). If electric heating is not enabled this icon will not be visible. Electric Heating is only available when an auxiliary electric heater such as an immersion heater in the hot water cylinder has been fitted. The icon is bright (blue) when Electric Heating is active and grey when deactivated.

3.1.4.7 Smart Grid

The Smart Grid function is for future development. Do not try to use or make any changes to the Smart Grid settings.

This appliance must be serviced annually. Contact Warmflow for further details.

In the event of a breakdown please refer to section 5.2 - Alarms and Troubleshooting. Alternatively, contact your commissioning engineer who should then contact our service department whilst at your home, to report the fault.

Table 7 Monitored Parameters

Ref.	Text	Description	Expected Value(s)
T01	Inlet Water (Return) Temp.	This is the temperature at which the heating water returning from either the heating circuit or to the hot water storage cylinder is entering the heat pump.	Ambient temperature if the appliance has been off for a time. The value should be approximately 5.0 degrees Celsius below the heating Outlet (flow) temperature in heating mode.
T02	Outlet Water (Flow) Temp.	This is the temperature at which the heating water leaving to either the heating circuit or to the hot water storage cylinder is returning to the heat pump.	Ambient temperature if the appliance has been off for a time. No greater than 75°C in normal operation.
T03	Coil (Evaporator) Temp.	This is the temperature of the evaporator coil.	Ambient temperature if the appliance has been off for a time. Varies between negative and positive temperature depending on the mode.
T04	Ambient Temp.	This is the temperature of the outside air.	Dependent on local climate condition, typically between -10°C and 30°C.
T05	Suction Temp.	This is the temperature of the suction line (the gas entering the compressor from the evaporator).	Ambient temperature if the appliance has been off for a time. Varies between negative and positive temperature depending on the mode.
T08	DHW Tank Temp.	This is the temperature of the water in the domestic hot water (DHW) storage tank.	Not greater than 70°C in normal operation.
T09	Room Temp.	This is the temperature at the room temperature sensor location (if fitted)	Dependent on local climate condition, typically between 10°C and 30°C.
T10	Inlet Temp. (EVI)	Not Applicable	Not Applicable
T11	Outlet Temp. (EVI)	Not Applicable	Not Applicable
T12	Exhaust (Discharge) Temp.	This is the temperature of the disharge line (the gas leaving the compressor travelling to the condenser).	Ambient temperature if the appliance has been off for a time. Not greater than 110°C in normal operation.
T14	Distributor Tube Temp.	This is the temperature of the Coil Distributor Tube temperature.	Ambient temperature if the appliance has been off for a time. Varies between negative and positive temperature depending on the mode
T15	Low Pressure	This is the pressure of the suction line (the gas entering the compressor from the evaporator).	This should read between 3.0 and 8.0 bar if the appliance is off and between 1.5 and 6.0 bar in normal operation..
T27	Speed of Fan1 Motor	This is the current speed of the fan motor.	Between 0r and 2000r.
T28	Speed of Fan2 Motor	This is the current speed of the second fan motor (only applies to AS03 models).	Between 0r and 2000r.
T29	Target Speed of Fan Motor	This is the requested speed of the fan motor/s.	Between 0r and 2000r.
T30	Actual Frequency	This is the requested speed of the compressor.	Between 30Hz and 90Hz when the appliance is running, 0Hz when the appliance is off.

Ref.	Text	Description	Expected Value(s)
T31	Operation Freq. of Compressor	This is the current speed of the compressor.	Between 30Hz and 90Hz when the appliance is running, 0Hz when the appliance is off.
T32	Max Frequency Allowed for Driver	This is the maximum adjusted speed of the compressor.	Varies between 0 Hz and 120 Hz depending on the operating condition. 0 Hz = no adjustment
T33	IPM Shutdown Protection Temp.	This is the temperature on board the Inverter board IPM module above which the appliance will shut down.	Calculated value based on current conditions.
T34	AC Input Voltage	This is the current incoming AC voltage measurement.	Typically between 210Vac and 240Vac.
T35	AC Input Current	This is the current incoming AC current measurement.	Typically between 1Amp and 33Amps.
T36	Phase Current of Compressor	This is the compressor current measurement.	Typically between 1Amp and 33Amps.
T37	DC Bus Voltage	This is the current voltage measurement for the communication bus.	Up to 450V.
T38	IPM Temp.	This is the temperature on board the IPM module.	Ambient temperature if the appliance has been off for a time.
T39	Water Flow	This is the flow rate of water through the appliance from the system.	This should read 0.0m^3/hr when the appliance is off and between 0.3 m^3/hr and 5.0 m^3/hr when the appliance is running.
T40	Heating Returning Water Temp.	Not Applicable	Not Applicable
T41	Heating Leaving Water Temp.	Not Applicable	Not Applicable
T42	Mix Tube Outlet Water Temp.	Not Applicable	Not Applicable
T43	DHW Returning Water Temp.	Not Applicable	Not Applicable
T44	DHW Leaving Water Temp.	Not Applicable	Not Applicable
T45	High Pressure	Not Applicable	Not Applicable
T46	External Fan Motor Driver IPM Temp.	This is the temperature on board the Fan board IPM module above which the appliance will shut down.	Calculated value based on current conditions.
T47	External Fan Motor Driver Power	Not Applicable	Not Applicable
T48	External Fan Motor Driver Current	Not Applicable	Not Applicable
T49	Evaporation Temp.	This is the temperature of the gas in the evaporator.	Ambient temperature if the appliance has been off for a time. Varies between negative and positive temperature depending on the mode.

Ref.	Text	Description	Expected Value(s)
T50	Exhaust Superheat	This is the superheat temperature of the disharge line (the gas leaving the compressor travelling to the condenser).	Not greater than 20°C in normal operation.
T51	Suction Superheat	This is the superheat temperature of the suction line (the gas entering the compressor from the evaporator).	Not greater than 5°C in normal operation.
T52	Transformer Current 1	This is the Inverter board transformer current measurement.	Typically between 1Amp and 33Amps.
T53	Transformer Current 2	Not Applicable	Not Applicable
T54	Transformer Current 3	Not Applicable	Not Applicable
T55	Outlet Temp. after Electric Heater (for IDU)	Not Applicable	Not Applicable
T56	Water Pressure (for IDU)	Not Applicable	Not Applicable

3.2 Parameter List

Table 8 Installer Parameters List

System Tab				
Parameter	Name	Range	Default	Description
H05	Enable Cooling Function	0/1	0	Enables or Disables Cooling Mode (0 for Disabled, 1 for Enabled)
H07	Display Control/Remote Control	0/1	0	Sets the appliance as display controlled (previously Master) (0) or remote controlled (previously Slave) (1)
H10	Unit Address	*	1	Software Address of the Appliance
H18	Electric Heater Stage	1/2/3	3	Sets the Electric Heating Stage (1 for Stage 1 only, 2 for Stage 2 only, 3 for Stage 3 (Stage 1 & 2)
H20	3-Way Valve Polarity	0/1	0	0 for ON with Hot Water (DHW), 1 for OFF with Hot Water (DHW)
H21	Temperature Units	0/1	0	O for °C, 1 for °F
H25	Temp. Control Selection	0/1/2/3	0	Temperature Setpoint Target: 0-Outlet Water Temp. 1-Room Temp. 2-Buffer Tank Temp. 3-Inlet Water Temp.
H28	Heating/Cooling and Hot Water Function Enabled	0/1	1	Enables or Disables Heating\Cooling & DHW Mode (0 for Disabled, 1 for Enabled, 2 for DHW Only)
H30	Indoor Unit Type	0/1/2/3	0	Indoor Unit Type (0 for None, 1 for 1st Type, 2 for 2nd Type, 3 for 3rd Type)
H32	Force Switch Mode Time	1-300 min	120	Maximum time appliance can be in DHW mode
H36	Enable Positive Weather Compensation	0/1	0	Enables or Disables Weather Compensation (0 for Disabled, 1 for Enabled)
H37	DHW Temp. Sourcing	0/1	0	DHW Tank Temperature source. (0 for DHW Tank sensor, 1 for External bus sensor)
H38	Language	1-12	0	Display language (0- English)
H40	External Pump Selection	0/1/2	0	System pump connected to terminals 18 & 19. 0-DHW tank pump. 1-DHW circulation pump (secondary return). 2-OFF signal when defrosting.
H43	Normal/Eco	0/1	0	Normal or Eco mode (eco mode = reduced fan & compressor speed) 0-Normal 1- Eco

Protect Tab				
Parameter	Name	Range	Default	Description
A04	Antifreeze Temperature	*	4°C	Temperature below which Antifreeze Protection is enabled.
A23	Min. Outlet Water Temp. Protect	*	5°C	Minimum Outlet Temp below which the appliance will shut down.
A27	Temp. Diff. of Limiting Frequency	*	7°C	Differential between Inlet & Outlet temperatures above which compressor speed will be limited.
A28	Temp. Diff. Between Outlet and DHW Temp.	*	7°C	Differential between Outlet & DHW Tank temperatures below which compressor speed will be limited.
A31	Electric Heater On AT	*	0°C	Ambient temperature below which Electric heating is enabled.
A32	Electric Heater Delays Comp. On Time	10 -999 mins	90 mins	Minimum compressor running time before Electric heating is enabled.
A33	Electric Heater Opening Temp. Diff	*	2°C	Differential between Outlet & Setpoint temperatures above which Electric heating is enabled.
A34	Crank Preheating Time	0 -360 mins	0 mins	Crankcase heater on time before compressor start.
A35	Electric Heater Off Temp. Diff	*	0°C	Differential between Outlet & Setpoint temperatures below which Electric heating is disabled.

Defrost Tab				
Parameter	Name	Range	Default	Description
D17	Coil Temp. of Exit Defrosting	*	13°C	Coil Temperature when appliance exits defrost mode.
D19	Max. Defrosting Time	*	8mins	Maximum time allowed to complete defrosting
D24	Defrosting Heating Source in Heating / DHW Mode	0/1/2	0	System source to use for defrosting: 0-Stay on Current Circuit 1-DHW Circuit 2-Heating Circuit
D26	Enable Defrosting Communication in Cascade	0/1	0	Enable Communication of Defrosting between appliances in Cascade (0 for No, 1 for Yes).

Temperature Tab				
Parameter	Name	Range	Default	Description
R01	DHW Target Temp.	15~70°C	50°C	Hot water target setpoint
R02	Heating Target Temp.	15~75°C	35°C	Heating target setpoint
R03	Cooling Target Temp.	7~28°C	7°C	Cooling target setpoint
R04	Temp. Diff. for Power-on in Heating	0~10°C	2°C	Hysteresis differential for Heating to reactivate Heating Mode
R05	Temp. Diff. for Standby in Heating	0~10°C	1°C	Temperature difference above the setpoint to return to standby mode
R06	Temp. Diff. for Power-on in Cooling	0~10°C	5°C	Hysteresis differential for Cooling to reactivate Cooling Mode
R07	Temp. Diff. for Standby in Cooling	0~10°C	1°C	Temperature difference below the setpoint to return to standby mode
R16	Temp. Diff. for Power-on in DHW	0~10°C	5°C	Hysteresis differential for DHW to reactivate DHW Mode
R17	Temp. Diff. for Standby in DHW	0~10°C	0°C	Temperature difference above the setpoint to return to standby mode
R70	Target Room Temp.	5~27°C	20°C	Room temperature target setpoint
R71	Room Temp. Diff. for Power-on in Heating	0.1~3°C	0.5°C	Hysteresis differential for Room temperature to reactivate Heating Mode
R15	Room Temp. Diff. for Standby in Heating	0.1~3°C	0.5°C	Temperature difference above the setpoint to return to standby mode
R16	Room Temp. Diff. for Power-on in Cooling	0.1~3°C	0.5°C	Hysteresis differential for Room temperature to reactivate Cooling Mode
R17	Room Temp. Diff. for Standby in Cooling	0.1~3°C	0.5°C	Temperature difference above the setpoint to return to standby mode

Pump Tab				
Parameter	Name	Range	Default	Description
P01	Main Circulation Pump Operation Mode	0/1/2	1	Selects the operating mode of the pump, 0 for Always ON, 1 for Eco, 2 for interval.
P06	Main Circulation Pump Manual Control	0/1	0	Manually activate the Main Circulation Pump. 0 for No (OFF), 1 for Yes (ON).
P09	Circulation Pump Protection Period	0~30 days	30	Main Circulation Pump will be started if no starts for this number of days.

Disinfection Tab				
Parameter	Name	Range	Default	Description
G01	Disinfection Water Temp.	60~70°C	63°C	Hot water thermal disinfection target temperature
G02	Time of Duration of Disinfection	0~60min	10min	Duration of disinfection cycle. Time DHW tank temperature is held at or above the setpoint (G01) (0 is off)
G03	Disinfection Start Time	0~23h	1h	Hour of day when thermal disinfection is on
G04	Interval Period of Disinfection	1~30days	30days	Thermal disinfection cycle schedule.
G05	Enable Disinfection	0-1	1	Thermal disinfection enabling or disabling (0 is disabled, 1 is enabled)

Zone Tab				
Parameter	Name	Range	Default	Description
Z01	Enable Multi-Zone Control	*	0	For future use

*** Indicates that this parameter is not adjustable**

4 Commissioning

The following tasks must be completed to commission the air source heat pump:

4.1 Recorded Details

The following details must be recorded at commissioning, this may be completed online by scanning the QR code found in Section 8 of this manual.

- Householder's Name and Address
- Installation Date
- Installing Engineer
- Commissioning Date
- Commissioning Engineer (Name and registered company)
- Appliance Type (AS01-R290, AS02-R290 or AS03-R290)
- Serial Number

The time and date must be set on the appliance.

4.2 Testing Flow Rate

The heating circuit must be fully installed, filled, purged and pressure tested. The pressure should be set at around 1 bar. It is essential that all air has been expelled from the circuit and that adequate flowrates are achievable. Loosen the cap of the air purge valve located on heat exchanger outlet pipe to purge air from the water circuit. If air remains in the system the system will not operate correctly. To assist with removing air from the system the main circulating pump can be activated using the Manual Load Control (see sect 3.1.4.2 & Figure 31).

Move the slider on Main Circulation Pump to the ON position to activate the pump manually. Make sure to move the slider to the OFF position when the commissioning process is completed.

To prevent excessive refrigerant temperatures the appliances are fitted with flow protection by means of a flow switch.

When the pump is activated the flow switch must close within a short period of time. If the flow switch does not close the appliance will not start and the pump will stop. The system retries to start 3 times before displaying an alarm.

Check flow switch status (Settings/Parameter/22/State/Switch Status/S03) the installer can verify if the water fill operation is completed (when water is flowing, parameter S03 = Closed)

S03	**Flow Switch**	**Closed**

4.3 3-Port Motorised Valve

The operation of the 3-Port Motorised Valve can also be checked by using the Manual Load Control (see sect 3.1.4.2 & Figure 31). With the slider on Hot Water 3-Way Valve in the OFF position, check the valve is in the correct position for Heating operation. Move the slider on Hot Water 3-Way Valve to the ON position to activate the valve manually. Wait for any movement of the valve actuator to complete. Check the valve is in the correct position for Hot Water operation. Make sure to move the slider to the OFF position when the commissioning process is completed.

4.4 Setpoints

The Heating and Hot Water setpoints are available in the parameters list (Table 8) in addition to the Target button on the main screen. (Settings/Parameter/22/Parameters/Temp).

The Heating setpoint R02 is based on the Outlet (Flow) water temperature (T02).

The Turn Off Condition for the Hot Water setpoint is 0.0°C above the setpoint.

The Turn Off Condition for the Heating setpoint is +2.0°C above the setpoint.

The maximum recommended value for the Hot Water setpoint is 60.0°C

The maximum recommended value for the Heating setpoint is 53.0°C

4.5 Remote Operation

If the appliance is to operate in 'Remote Control' mode (Parameter H07 (Display Control/Remote Control) = "Remote Control") the operation of the remote switches can be checked by operating the remote switches and checking the switch status.

To check for remote call for heating: Check Heat/Cool On/Off switch status (Settings/Parameter/22/State/Switch Status/S10). S10 = closed - Heating activated.

S10	**Air Conditioning Switch**	**Closed**

To check for remote call for DHW: Check DHW On/Off switch status (Settings/Parameter/22/State/Switch Status/S07). S07 = closed – DHW mode activated.

S07	**Hot Water Switch**	**Closed**

4.6 AT (Ambient Temp) Compensation / Weather Compensation Mode

AT (Ambient Temperature) / Weather compensation works by adjusting the heat output of the heat pump to match the current heat loss of the building. This is achieved by adjusting the heating flow temperature according to the outdoor temperature. As the outdoor temperature drops, the heating flow temperature is increased and vice versa. The outdoor temperature is monitored by an external temperature sensor installed on the back of the appliance.

To activate AT compensation, press the AT Compensation button in the Parameters sub-menu (Settings/Parameter/22/AT Compensation). Use the slider in the top right of the screen to toggle AT compensation on/off as shown in Figure 35 below. If a fixed flow temperature is required, the weather compensation can be turned off. If weather compensation is disabled, the SAP assessment (EPC) is invalid. A commissioning record and label must be provided that confirm this disablement.

Sample settings for weather compensation curves for underfloor heating and radiators are shown below. The flow temperature setpoint should be adjusted to match the calculated flow temperature requirement at the design day temperature. The default flow temperature setting is 50°C.

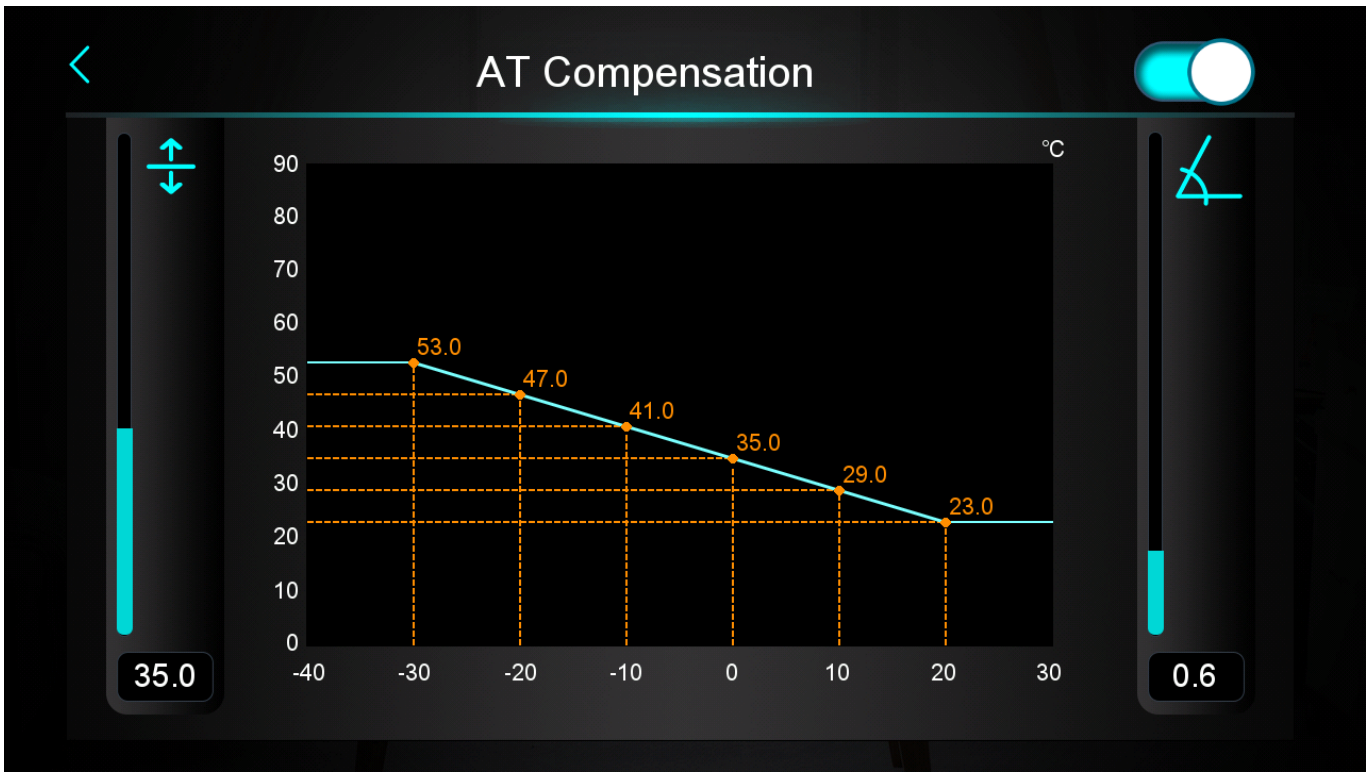


Figure 35 Weather Compensation Activation & Setting

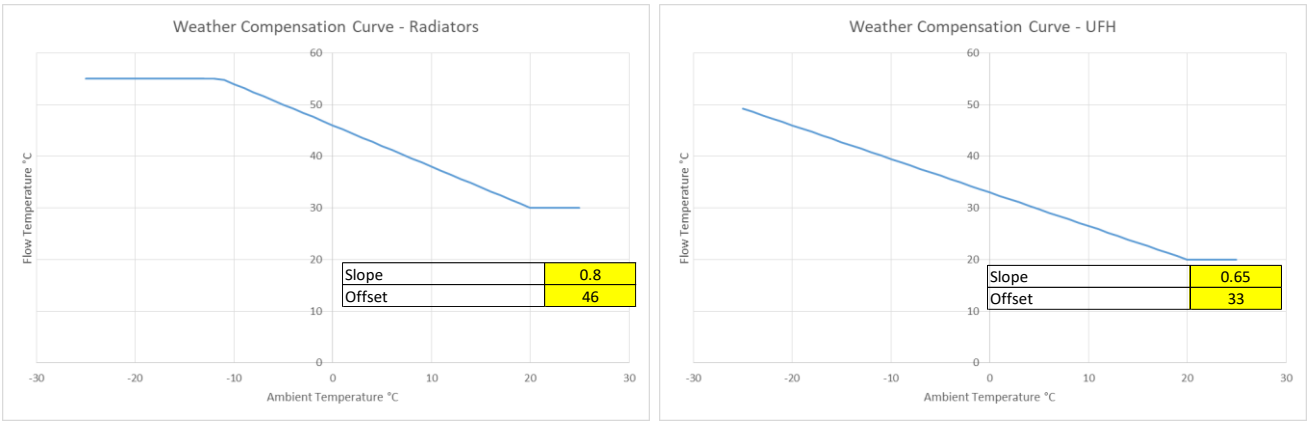


Figure 36 Sample Weather Compensation settings for Radiators & UFH

4.7 DHW Cylinder Heat Up Test

A DHW cylinder heat up test must be completed for appliances in a system providing both heating and DHW. The cylinder storage temperature should be set to maximum and the appliance switched to DHW 'ON'. The appliance will now start up and begin heating the DHW cylinder. The appliance will continue heating the tank until it reached the setpoint or it can no longer transfer the heat it is producing. If the appliance shuts down before the DHW storage cylinder reaches the desired setpoint, the heat exchanger area in the DHW cylinder is too small or the flow rate is not high enough. The maximum temperature that the DHW storage cylinder reaches should be recorded in the commissioning records and the DHW cylinder setpoint should be set to 3 degrees below this value. The thermal disinfection program will then need to be enabled to boost the DHW cylinder temperature above 60°C on a weekly basis.

4.8 Thermal Disinfection

The appliance can activate the immersion heater in the DHW cylinder to sanitise the cylinder and prevent legionella formation. The immersion heater contactor should be connected to the DHW Electric Heater output on the installer terminals (see 2.10.4).

The recommended parameter settings for activating the immersion heater every 7 days for a 10-minute cycle at 1am to 63°C are shown below.

G01	**Setpoint**	**63.0 °C**
G02	**Time of Duration**	**10 min**
G03	**Start Time**	**01 h**
G04	**Work Cycle**	**7 Days**
G05	**Thermal Disinfect Enable**	**Yes**

4.9 Parameter Backup

When commissioning has been completed the parameter settings in the appliance must be backed up to the user interface. From the 'Settings' menu press the 'Parameters' button on the settings screen. Enter Password '855' to enter the Backup and Reset menu as shown in Figure 37.

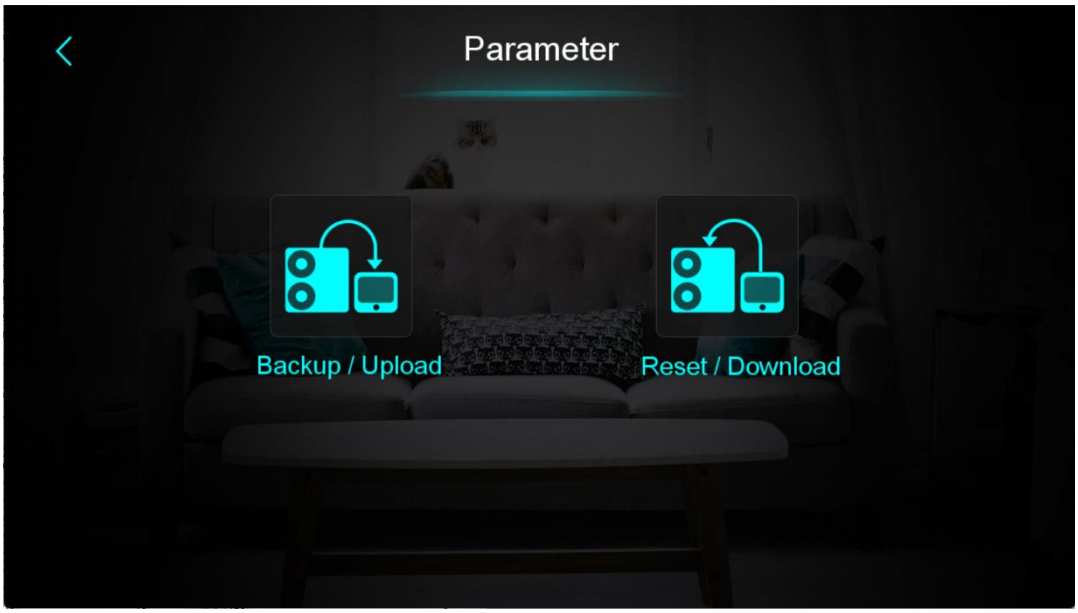


Figure 37 Backup and Reset Menu

Press the 'Backup / Upload' button to upload the parameter settings from the main board to the user interface. Confirm the 'Backup / Upload' with the enter button when requested. When the backup process is completed the user interface will show 

. Press the back button to return to the Settings menu.

4.10 Sign Off

The commissioning must be signed off by the commissioning engineer, who's details must also be included during registration of the appliance.

All product warranties will be invalidated if the appliance is not commissioned by a Warmflow engineer or other trained and competent engineer and the appliance registered with Warmflow within 30 days from the date of installation, and 90 days from the date code stamped on the appliance. Registration may be completed online by scanning the QR code found in Section 8 of this manual.

4.11 System Hand Over

After installation and commissioning has been completed, a handover package should be completed by the installer and delivered to the house holder. This handover package will include the following:

- Instructions explaining the operation of the complete system (including this user manual and the instructions for any additional controls fitted).
- Final plans of the system layout to include; heating circuit design together with all equipment and piping used.
- Electrical Schematic of sensor and input/output connections outside of the heat pump appliance.
- The results of commissioning tests.
- Contact details of the installer.

The installer should explain the components of the handover package to the householder.

5 Servicing

5.1 Servicing Schedule

The appliance must be serviced at least annually by a Warmflow Engineer or other competent Engineer. This is necessary in order to optimise performance of the appliance and to ensure its efficiency and safety for the user.

The below table is a typical list of service operations, however it is not exhaustive.

Item	Inspect	Clean	Test
Electrical Connections	✓		
Heating Circuit Filter	✓	✓	
Inhibitor Concentration of Heating Medium	✓		✓
Glycol Concentration of Heating Medium	✓		✓
Heating Circuit Pressure	✓		✓
Heating Manifold	✓		
Heating Pipework & Sealing	✓		
Heating Circuit Safety Devices	✓		✓
Heating Flow Rate	✓		✓
Insulation Inside Appliance	✓		
Evaporator	✓	✓	
Refrigeration circuit	✓		✓

Replace any defective components if necessary.

Electrical Connections - Inspection of the electrical connections should only be undertaken with power isolated to the appliance. The condition of wiring together with the security of electrical connections should be inspected and repaired as required.

Heating Circuit Filter - The heating filter/strainer should be inspected and cleaned to remove any debris and ensure optimal flow rates. The filter should first be isolated on both sides using the isolating valves. The strainer element can then be removed for cleaning.

Inhibitor Concentration of Heating Medium - The system corrosion inhibitor level must be checked (instant on-site test kits are available from inhibitor manufacturers) and additional inhibitor must be added if the system is found to be under-dosed. Refer to the inhibitor manufacturer for further guidance. If the inhibitor concentration has dropped significantly since the last service/commissioning, this may suggest someone has been topping up the heating system with water. Further investigation for a leak may be necessary.

Heating Circuit Pressure - The system pressure of the heating circuit should be inspected on the installed pressure gauge. The pressure should be between 1 and 2 bar. The pressure should be adjusted accordingly. If the pressure has dropped significantly since the last service/commissioning, this may suggest a drop in expansion vessel pre-charge or a leak somewhere in the system. The expansion vessel pre-charge should be checked using a suitable pressure gauge. The system should be cold and the pressure relieved in order to obtain an accurate reading. The system must be repressurized and corrosion inhibitor and glycol levels restored

Glycol (Antifreeze) Concentration of Heating Medium - The system Glycol level must be checked (if applicable). This can be checked with a refractometer in accordance with the Glycol manufacturer's instructions. Additional Glycol must be added if the system is found to be under-dosed. Refer to the Glycol manufacturer for further guidance. If the Glycol concentration has dropped significantly since the last service/commissioning, this may suggest someone has been topping up the heating system with water. Further investigation for a leak may be necessary.

Heating Manifold - The condition of the manifold, together with the operating of any motorised valves and the flow rates in each circuit should be inspected.

Heating Pipework & Sealing - The condition of the heating pipework including joints and insulation should be inspected and repaired as necessary.

Heating Circuit Safety Devices - Safety devices such as pressure and temperature relief valves should be manually activated to confirm their operation. Defective devices should be replaced immediately.

Heating Flow Rate - The maximum heating flow rate achievable must be checked. The heating flow rate must be checked against the maximum flow rate recorded on the commissioning records. If the flow rate is found to have dropped significantly, this may indicate a blockage in the system or a problem with the pump. Further investigation is required.

Insulation Inside Appliance - The condition of pipe insulation and sound proofing in the appliance casing should be inspected for damage. If either is found to be damaged or defective, it should be replaced.

Evaporator - The condition of the evaporator coil should be inspected for damage and debris. If the fins are found to be damaged or blocked due to debris that could cause reduced air flow through the fins these should be repaired and cleaned if required.

Refrigeration circuit - The pipework and insulation of the refrigeration circuit and the part of the base pan below should be examined for signs of oil. Refrigerant oil in these locations is a sign of a leak in the refrigerant circuit.

Note: All product warranties will be invalidated if the appliance is not serviced at least annually by a Warmflow engineer or other trained and competent engineer, details must be recorded and service records retained.

In the event of a breakdown please contact your commissioning engineer who should then contact our service department whilst at your home, to report the fault.

5.2 Faults and Troubleshooting

5.2.1 Faults

The control system built into the appliance includes a fault utility. The fault utility shuts the appliance down and displays fault codes if a fault or abnormality develops in the appliance.

The fault conditions listed in the following pages suggest possible causes for the activation of each fault code. Suggested actions for each fault condition are also included.

The suggested actions are attributed to the user (typically the homeowner) or a Warmflow engineer or other trained and competent engineer and should be conducted in the order suggested. The possible causes and suggested actions are not exhaustive.

Fault Code	Fault	Possible Cause(s)	Suggested Action(s)	Action By	
				User	Engineer
P01	Heating Return Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the heating return temperature sensor and re-connect/replace if necessary.		✓
P02	Heating Flow Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the heating flow temperature sensor and re-connect/replace if necessary.		✓
P03	DHW Cylinder Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the DHW cylinder temperature sensor and re-connect/replace if necessary.		✓
P04	Ambient Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
P17	Suction Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the refrigerant suction line temperature sensor and re-connect/replace if necessary.		✓
P013	Heating Return Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
P018	DHW Return Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
P023	Heating Flow Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
P028	DHW Flow Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
P42	Room Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the room temperature sensor (if fitted) and re-connect/replace if necessary.		✓
P152	Distributor Tube Temp. Sensor Fault	The temperature sensor is faulty or disconnected.	Test the operation of the evap. temperature sensor and re-connect/replace if necessary.		✓
P153	Evaporator Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the evap. temperature sensor and re-connect/replace if necessary.		✓

Fault Code	Fault	Possible Cause(s)	Suggested Action(s)	Action By	
				User	Engineer
P181	Discharge Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the refrigerant discharge line temperature sensor and re-connect/replace if necessary.		✓
P182	Discharge Overheat Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the discharge line overheat temperature sensor and re-connect/replace if necessary.		✓
P191	Anti-freezing Temp. Sensor Fault	The temperature sensor is faulty or disconnected.	Test the operation of the discharge line overheat temperature sensor and re-connect/replace if necessary.		✓
P02a	Mix Tube Outlet Water Temp. Sensor Fault	The temperature sensor is faulty or disconnected.	Test the operation of the heating flow temperature sensor and re-connect/replace if necessary.		✓
P03a	Buffer Tank Temp. Sensor	The temperature sensor is faulty or disconnected.	Test the operation of the heating flow temperature sensor and re-connect/replace if necessary.		✓
PP11	Pressure Sensor Error	The pressure sensor is faulty or disconnected.	Test the operation of the suction line pressure sensor and re-connect/replace if necessary.		✓
TP	Low Ambient Temperature Warning	The ambient temperature is too low.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
TC	No Cooling at Low AT Protection	The temperature sensor is faulty or disconnected. or the Ambient temp is lower than the set value for parameter A30	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
E04	Electric Overheat Protection	The electric heater protection switch is open	Check the status of the link wire or operation of the electric heater if overheat protection is configured.		✓
E06	Excess Temp. Diff. Between Inlet & outlet	There is not enough flow in the heating circuit.	Check the plumbing circuit for blockages or air, valves are open and the operation of the circulating pump.		✓
E08	Communication Error	There is a communication error between the controller and the appliance.	Check the wiring and connections between the controller and the appliance.		✓
E11	High Pressure Protection	The high pressure switch in the refrigeration circuit has been tripped.	Check the operation of the high pressure switch and refrigeration circuit in terms of gas pressure.		✓

Fault Code	Fault	Possible Cause(s)	Suggested Action(s)	Action By	
				User	Engineer
E12	Low Pressure Protection	The low pressure switch in the refrigeration circuit has been tripped.	Check the operation of the low pressure switch and refrigeration circuit in terms of gas pressure.		✓
E19	Primary Anti-freezing Protection	The ambient temperature is low.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
E29	Secondary Anti-freezing Protection	The ambient temperature is low.	Test the operation of the ambient temperature sensor and re-connect/replace if necessary.		✓
E030	Insufficient Defrosting Water Flow Alarm	There is not enough flow in the heating circuit.	Check the plumbing circuit for blockages or air, valves are open and the operation of the circulating pump.		✓
E032	Low Flow Error	There is not enough flow in the heating circuit.	Check the plumbing circuit for blockages or air, valves are open and the operation of the circulating pump.		✓
E051	Compressor Overload	The compressor is overloaded.	Check the operation of the refrigeration circuit in terms of gas pressure and charge.		✓
E065	Outlet Water Temp. Overtemp.	The temperature of the outlet water is too high.	Check there is enough water in the system and there are no air locks/lack of flow.		✓
E071	Outlet Water Temp. Lowtemp.	The temperature of the outlet water is too low.	Check there is enough water in the system and there are no air locks/lack of flow.		✓
E081	DC Fan Motor 1 & PCB Communication Error	There is a communication error between the fan speed control module and the main board.	Check the wiring and connection between the fan speed control module and the main board.		✓
E082	DC Fan Motor 2 & PCB Communication Error	There is a communication error between the fan speed control module and the main board.	Check the wiring and connection between the fan speed control module and the main board.		✓
E084	Display and Main Controller Not Compatible	The software on the Display is not compatible with the main control board.	Replace the Display with a compatible version.		✓
E101	Compressor Overcurrent	The compressor is overloaded.	Check the operation of the refrigeration circuit in terms of gas pressure and charge.		✓

Fault Code	Fault	Possible Cause(s)	Suggested Action(s)	Action By	
				User	Engineer
E171	Anti-freezing Protection	The temperature of the heating circuit water is too low.	Check the plumbing circuit, valves and operation of the circulating pump. Check the inlet & outlet water temperatures and sensors		✓
F00	Inverter IPM Overcurrent Shutdown	Inverter IPM input current is too high.	Check the current measurement and adjust/replace if necessary.		✓
F01	Compressor Start-up Failure	Voltage too low. Damage to inverter.	Check the voltage measurement. Check the inverter for damage.		✓
F03	Power Factor Correction (PFC) Error	There is an error with the power factor correction circuit.	Check the power correction wiring for a break or short circuit.		✓
F05	DC Bus Overload	The DC bus voltage is higher than the overload protection limit.	Check the input voltage measurement.		✓
F06	DC Bus Underload	The DC bus voltage is lower than the underload protection limit.	Check the input voltage measurement.		✓
F07	AC Input Underload	The AC input voltage is low causing the input current to be low.	Check the input voltage measurement.		✓
F08	AC Input Overload	The AC input voltage is high causing the input current to be high.	Check the input voltage measurement.		✓
F09	Input Voltage Read Error	The input voltage reading is incorrect/out of range.	Check the input voltage measurement.		✓
F12	DSP and PFC Communication Error	There is a communication error between the DSP and the PFC.	Check the wiring and connection between the DSP and the PFC.		✓
F11	DSP Communication Error	There is a communication error between the DSP and the inverter.	Check the wiring and connection between the DSP and the inverter.		✓
F151	Comp. Driver and PCB Communication Fault	There is a communication error between the DSP and the main board.	Check the wiring and connection between the inverter and the main board.		✓
F13	IPM Over Temperature Protection	There IPM module temperature is too high.	Check the current measurement and adjust/replace if necessary.		✓
F14	Compressor Lacking Phase	The compressor has lost a phase.	Check the wiring and connection between the inverter and the compressor.		✓
F15	Input Voltage Lacking Phase	The input voltage has lost a phase.	Check the input voltage measurement.		✓
F16	Weak Magnetism Error	The magnetic force of the compressor motor is too low.	Check the operation of the refrigeration circuit in terms of gas pressure and charge.		✓
F17	Module/Radiator Sensor Error	A transducer has overheated.	Check the current measurement.		✓
F18	IPM Current Read Error	The IPM current reading is incorrect/out of range.	Check the IPM current measurement.		✓

Fault Code	Fault	Possible Cause(s)	Suggested Action(s)	Action By	
				User	Engineer
F20	IGBT Power Device Error	A transducer has overheated.	Check the current measurement.		✓
F21	Overspeed Error	The compressor is running abnormally.	Check the operation of the refrigeration circuit in terms of gas pressure and charge.		✓
F22	AC Input Over Current Error	The AC input current is too high.	Check the current measurement and adjust/replace if necessary.		✓
F23	EEPROM Alarm	MCU Error.	Replace board.		✓
F24	EEPROM Alarm	MCU Error.	Replace board.		✓
F25	LP 15V Error	The V15V is out of range.	Check the V15V input voltage is between 13.5V and 16.5V.		✓
F26	IGBT Power Device Over Temperature	The IGBT transducer temperature is too high.	Check the current measurement and adjust/replace if necessary.		✓
F29	EEPROM Alarm	Failure to read the inverter EEPROM	Replace inverter board.		
F33	Compressor Current Frequency Reduction Error	The Compressor current reading is incorrect/out of range.	Check the Compressor current measurement.		✓
F10	AC Power Overvoltage Error	The input voltage reading is incorrect/out of range.	Check the input voltage measurement is above 265V		✓
F101	Fan Driver Power input Phase Error	The fan has lost phase.	Check the connection between the fan module and fan motor. Replace the fan board.		✓
F102	Fan Start Error	The fan failed to start.	Check if the fan is blocked. Replace the fan board.		✓
F105	Fan external Overcurrent Error	The fan IPM hardware current reading is too high.	Check if the fan is blocked. Replace the fan board.		✓
F106	Fan IPM Overheat Error	The fan IPM hardware has poor heat dissipation.	Check if the fan is blocked. Check ventilation & temperature Replace the fan board.		✓
F109	Fan Driver Overspeed Error	The fan speed is too high.	Check the the fan module and fan motor. Replace the fan board.		✓
F112	Fan Current sampling Error	The fan electrical supply is faulty.	Check the fan board. Replace the fan board.		✓
F113	Fan internal Overcurrent Error	The fan software current reading is too high.	Check if the fan is blocked. Replace the fan board.		✓
F120	Fan Driver Temperature Sensor Error	The temperature sensor is faulty or disconnected.	Test the operation of the fan module temperature sensor and re-connect/replace if necessary.		✓

5.3 Troubleshooting

Other faults or problems with the appliance that may not trigger a fault are listed below

Symptom	Possible Cause(s)	Suggested Action(s)	Action By	
			User	Engineer
No heat supplied to the property or hot water storage cylinder.	Timer mode not enabled.	Ensure timer mode is enabled in 'Timer' menu.	✓	
	Time clocks not set.	Ensure time clocks are set correctly in 'Timer' menu.	✓	
	No demand signal from remote digital inputs. (Remote Control mode)	Check feeds from room thermostats, underfloor manifolds and remote time clocks are functioning correctly.		✓
	Incorrect control configuration (Display Control/Remote Control)	Check parameter H07 is set correctly for the type of control.		✓
Timeclock and controls are switched on, and appliance is in standby.	Heat demand for the property has been satisfied	If the property temperature is too low, increase the flow temperature in the 'Temperature' sub-menu.	✓	
		Check if weather compensation has been activated and the settings for the curve.	✓	
The appliance has been producing heat for some time, but the property heat demand has still not been satisfied.	Flow temperature set too low.	Increase flow temperature in the 'Temperature' sub-menu.	✓	
	Airlocks in heating system.	Bleed heating system to remove airlocks.		✓
	3-port diverting valve fault.	Ensure valve is operating correctly.		✓
	Heating circulating pump fault.	Ensure pump is operating correctly.		✓
Appliance is cycling on and off very frequently.	Poor quality room thermostats, or location close to draughts from opening doors etc.	Consider upgrading controls and utilise alternative locations.		✓
	Hysteresis temperature is too low.	Increase hysteresis parameter.		✓
	External temperature located in position where temperature is changing rapidly.	Ensure external temperature sensor is on a north facing wall out of direct sunlight and away from opening such as vents, doors and windows.		✓

6 Your Guarantees, Terms & Conditions

6.1 Period of Guarantee

Your Air Source Heat Pump is guaranteed against defective parts and workmanship for a period of five (5) years from the date of registration, provided that your Appliance is installed and commissioned in accordance with any instructions and recommendations of the manufacturer in force at the time of installation, and any other conditions of this warranty are met.

Please note that this period of guarantee will not be extended under any circumstances.

6.2 Warmflow's Obligations

Where components are found to be defective in materials or workmanship within the periods set out above, Warmflow will arrange for repair or replacement as required.

In the event that components are not capable of repair, Warmflow will provide replacement parts for any such components.

Warmflow reserves the right to repair or replace components within the period of guarantee at a time and location that is most convenient to the company.

All removed parts and components of your Appliance shall become the property of Warmflow. All replaced and/or repaired parts shall assume the status of the original part for the purposes of this warranty and this warranty shall not be extended by the replacement of such parts.

This guarantee applies to Warmflow appliances installed in GB (including Scottish Isles), Isle of Man, Channel Islands, Northern Ireland and Republic of Ireland only. Provision of warranty cover elsewhere is subject to the agreement in writing of Warmflow.

6.3 Your Obligations

Your Appliance must be installed, commissioned and serviced in accordance with any instructions and recommendations of the manufacturer from time to time in force as may be communicated to you.

In addition:

- Your Appliance must be registered with Warmflow within thirty (30) days of installation. Please note if your Appliance has not been installed within three (3) months of the date of dispatch from Warmflow, then this guarantee will be deemed to have commenced upon such date of dispatch. Please also note that failure to register the appliance will invalidate all guarantees. See Section 8 of this manual.

- Your Appliance must be installed and commissioned by an appropriately qualified person with suitable training* and experience, with commissioning completed immediately following installation.

- Your Appliance must be serviced by an appropriately qualified person with suitable training* and experience twelve (12) months after the date of installation and thereafter at twelve (12) monthly intervals in accordance with the manufacturer's instructions and all

regulations and codes of practice in force at the time. Warmflow reserves the right to determine at its absolute discretion whether an engineer has suitable experience.

- Servicing records must be completed with proof of servicing retained and made available to Warmflow in respect of any claim.

- If you choose to have someone other than an appropriately qualified person with suitable training* and experience carry out works to your Appliance, this warranty will automatically become null and void.

- All product warranties will be invalidated if the appliance is not commissioned and serviced as per the above and proof of commissioning and servicing retained and made available to Warmflow in respect of any claim.

* i.e. Warmflow product training course

In the event of a breakdown please contact your commissioning engineer who should then contact our Customer care Department whilst at your home to report the fault.

PLEASE NOTE THAT FAILURE TO REGISTER AND ANNUALLY SERVICE THIS PRODUCT WILL INVALIDATE ALL GUARANTEES IN THEIR ENTIRETY

6.4 Exclusions of Guarantee

The guarantee is not transferable.

6.4.1 Repairs

All repairs and/or replacements must be authorised in writing by Warmflow prior to any works being carried out. Warmflow will have no responsibility or liability for repairs or works performed by a person who has not been authorised by Warmflow.
Warmflow will accept no liability for the cost of repairs resulting from incorrect installation, inadequate commissioning, lack of annual servicing, misuse, tampering or repair by persons who have not been authorised by Warmflow. Invoices for call out and/or repair by any third party or parts supplied by a third party will not be accepted unless previously authorised by Warmflow in writing. If you choose to have someone other than an authorised service provider carry out works to your appliance, this warranty will automatically become null and void.

6.4.2 Other property

In no event shall Warmflow have any liability or responsibility whatsoever for damage to surrounding property and other structures or objects around your Appliance.

6.4.3 General

This warranty excludes all defects or damage that are not the direct fault of Warmflow, including without limitation, loss or damage caused by any one or more of the following:

(a) use of the Appliance in anything other than its normal and intended use;
(b) Any repair that is needed as a result of anything other than a fault in the appliance or failure of the appliance itself;
(c) Any damage, whether accidental, negligent, malicious or otherwise;
(d) Any fault or failure in the heating system to which the appliance is connected;
(e) Any other costs or expenses caused by, or arising as a result of, a repair;

(f) any fault or failure in the appliance caused by a fault, failure or defect in the heating system to which the appliance is connected
(g) any party's wilful misconduct, negligence, misuse, abuse, accidents, improper operation, failure to maintain, improper or negligent installation, tampering, failure to follow operating instructions, mishandling, unauthorized service;
(h) adjustment, alteration or modification of the Appliance of any kind;
(i) ordinary wear and tear; and
(j) any external forces and factors, including without limitation, lightning strikes, fire, floods, rain, freezing, excessive moisture or extended exposure to humidity, power surges, and acts of God.
(k) Any defects that appear after the customer makes any modification or alteration to the appliance;
(l) Defects caused by the improper use or storage of the appliance and in particular (but without limitation) Warmflow shall not be liable in the case of defects arising from normal deterioration or improper or faulty handling or processing of the appliance by the customer;
(m) Any problems caused by inadequate supply of services such as electricity or water to the property;

Claims for consequential loss or damage however caused are not covered by this guarantee.

Please note that your statutory rights are not affected by this guarantee.

7 End-Of-Life Information

Warmflow High Efficiency Air Source Heat Pumps must be disposed of according to local regulations by using a public or private waste collection service.

7.1 Safety Risks

This product contains the refrigerant R290. Any action requiring the product to be unpackaged or access gained to the internal parts must only be taken by personnel with knowledge of the properties of and risks associated with the refrigerant R290.
Work on the refrigeration circuit and involving equipment for use with flammable refrigerants requires special training in addition to standard repair procedures for refrigerant equipment.
Obey instructions in relevant regulations and applicable laws.
Prior to disassembly, the appliance should be electrically isolated and disconnected.
Refrigeration gas (R290) should be recovered and disposed of by an F-Gas registered engineer.
Any fluids within the appliance must be drained and disposed of in-line with local regulations.
Care should be taken when handling the appliance due to weight, use appropriate PPE and lifting aids.

7.2 Disassembly of the Product

The main materials of the components are:

- Mild Steel
- Stainless Steel
- Copper
- Brass
- Neoprene Foam
- Plastic Components
- Electronic Components

These may be recycled – depending on the local recycling facilities available.

The appliance is assembled by using mechanical fasteners and can be disassembled with standard tools.

8 APPLIANCE REGISTRATION

Instructions.

- **Complete the Installation/Commissioning.**

- **Register the Appliance.**

  - Registration may be completed online by scanning the QR code below and following the instructions provided.

Scan QR for Registration, ErP and Manuals

  - Alternatively register online at the below web address:

    https://www.warmflow.co.uk/support/product-registration

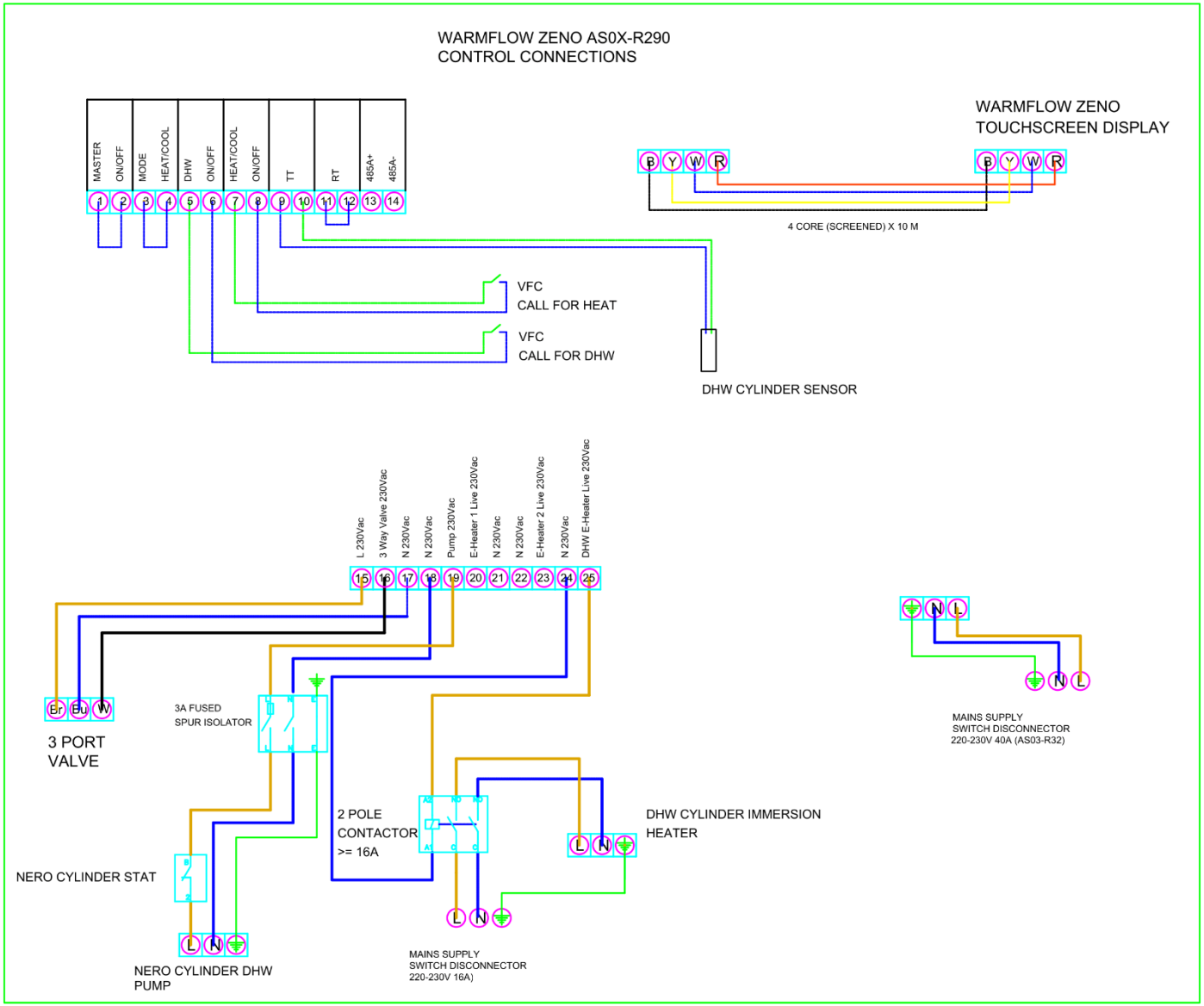
If the appliance is not registered, warranty may be invalidated.

9 Appendix A: Tables For Minimum Circulating Volume Calculation.

Typical Pipe Volumes			
Pipe Type	**O.D. (mm)**	**I.D. (mm)**	**Volume per meter (L)**
Copper (Table X)	15	13.6	0.145
	22	20.2	0.320
	28	26.2	0.539
	35	32.6	0.835
PEX	10	7.4	0.043
	12	8	0.050
	16	12	0.113
Plastic (push fit)	15	12	0.113
	22	18	0.254
	28	22.8	0.408

Typical Radiator (Emitter) Volumes			
Radiator Height (mm)	**Volume per meter (L)**		
	Single Panel	**Double Panel**	**Triple Panel**
300	1.89	3.7	5.4
450	2.57	5.15	-
500	-	-	8.33
600	3.25	6.6	9.8
700	3.77	7.63	11.37

10 Appendix B: Wiring Diagrams



Notes:
FOR REMOTE OPERATION
BY VFC SET PARAMETER
H07 TO "SLAVE"

FOR IMMERSION HEATER
CONTROL (SANITIZATION).
CONNECT EXTERNAL
RELAY COIL TO TERMINALS
24 (N) & 25 (L).

SET SANITIZATION
PARAMETERS AS BELOW:
G01 (SETPOINT = 63.0
G02 (DURATION) = 10
G03 (START TIME) = 01 (OR
30 MINS AFTER SCHEDULED
DHW CYCLE)
G04 (WORK CYCLE) = 7
G05 (THERMAL DISENFECT
ENABLE) = 1 (YES)

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This manual is accurate at the date of printing (E&OE) but will be superseded and should be disregarded if specifications and/or appearances are changed in the interests of continued product improvement. Refer to www.warmflow.co.uk for current edition of Warmflow product manuals.

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