

# Amicus

## Air to Water Heat Pumps

Installation, commissioning, user  
and maintenance instructions

### Models:

LAHP1002LT LAHP2504LT  
LAHP1202LT LAHP-3004LT  
LAHP1402LT LAHP-3204LT  
LAHP1602LT LAHP3504LT  
LAHP1802LT LAHP-4004LT  
LAHP2002LT LAHP4504LT  
LAHP2302LT LAHP5004LT  
LAHP2502LT



**READ AND UNDERSTAND THE INSTRUCTIONS**

Read and fully understand all instructions before attempting to operate maintain or install the unit.





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# 1 INTRODUCTION

## Preliminary information

Reproduction, storage or transmission of any part of this publication in any form, without the prior written consent of Lochinvar, is prohibited. The unit to which these instructions refer, is designed to be used for the purposes described and to be operated in accordance with these instructions.

Lochinvar will not be liable for claims for damage caused to persons, animals, material goods or property caused by improper installation, adjustment and maintenance or improper use. Any use not specified in this manual is prohibited.

This document is intended to provide information only and does not form a contract with third parties.

Lochinvar pursues a policy of constant improvement and development of its products and therefore reserves the right to change the specifications and the documentation at any time, without notice and without obligation to update existing equipment.

## Aim and content of the manual

These instructions are intended to provide the information required for the selection, installation, use and maintenance of the unit. They have been prepared in accordance with the European Union laws and with the technical standards in force at the date of issue of the instructions. The instructions contain all the necessary information to prevent any reasonably foreseeable misuse.

## How to store this manual

The manual must be kept in a suitable place with easy access for users and operators, protected from dust and damp.

The manual must always accompany the unit during the entire life cycle of the same and therefore must be transferred to any subsequent user.

## Manual Update

It is recommended that the manual is updated to the latest revision available. If updates are sent to the customer they must be added to this manual.

The latest information regarding the use of its products is available by contacting Lochinvar.

## How to use this manual



The manual is an integral part of the unit.

Users or operators must consult the manual before performing any operation and especially so when transporting, handling, installation, maintaining, or dismantling the unit in order to eliminate uncertainty and reduce risk.

In these instructions symbols have been used (described in the following paragraphs) to draw the attention of operators and users to the operations that have a higher risk and which must be performed safely.

## Potential Risks

Whilst the unit has been designed to minimize any risk posed to the safety of people who will interact with it, it has not been technically possible to eliminate completely the causes of risk. It is therefore necessary to refer to the requirements and symbolism below:

LOCATION OF RISK	POTENTIAL RISK	METHOD OF INJURY	PRECAUTIONS
Thermal heat exchangers	Small stab wounds	Contact	Avoid any contact use protective gloves
Fan and fan grilles.	Cuts, eye damage, broken bones.	Insertion of sharp objects through the grid while the fans are operating.	Never put objects through the protection grilles.
Internal components compressors and grills	Burns	Contact	Avoid any contact use protective gloves
Internal component: electric cables and metallic parts	Electrocution, severe burns.	Defect in the supply cable insulation, live metallic parts.	Adequate protection of power cables, ensure correct earthing of all metal parts.
External to unit, enclosure	Poisoning and severe burns	Fire due to short circuit or overheating of the supply cable to the unit	Size cables and main protection systems in accordance with IEE regulations
Low pressure safety valve.	Poisoning,	Severe burns.	High evaporating pressure causing a refrigerant discharge during maintenance. Carefully check the evaporating pressure during the maintenance operations.
High pressure safety valve	Poisoning and severe burns, hearing loss	Activation of the high pressure safety valve with the refrigerant circuit open	If possible do not open the refrigerant circuit valve, carefully check the condensing circuit pressure, use all protective equipment as required by law
Entire unit	External fire	Fire due to natural disasters or combustions of elements nearby unit	Provide the necessary fire-fighting equipment
Entire unit	Explosions, injuries burns	Breakages due to natural disasters or earthquake	Take all necessary precautions as required by law applicable to the installation site

## General Description of Symbols Used

Safety symbols combined in accordance with ISO 3864-2:



### **BANNED**

A black symbol inside a red circle with a red diagonal indicates an action that should not be performed.



### **WARNING**

A black graphic symbol added to a yellow triangle with black edges indicates **danger**.



### **ACTION REQUIRED**

A white symbol inserted in a blue circle indicates an action that must be done to avoid a risk.

Safety symbols combined in accordance with ISO 3864-2:



The graphic symbol “warning” is qualified with additional safety information (text or other symbols).

## Safety symbols used



### GENERAL RISK

Observe all signs placed next to the pictogram. The failure to follow directions may create a risk situation that may be injurious to the user.



### ELECTRICAL HAZARD

Observe all signs placed next to the pictogram.

The symbol indicates components of the unit and actions described in this manual that could create an electrical hazard.



### MOVING PARTS

The symbol indicates those moving parts of the unit that could create risk.



### HOT SURFACES

The symbol indicates those components with high surface temperature that could create risks.



### SHARP SURFACES

The symbol indicates components or parts that could cause stab wounds.



### EARTH CONNECTION

The symbol identifies Earthing connection points in the unit.



### READ AND UNDERSTAND THE INSTRUCTIONS

Read and understand the instructions of the machine before any operations.



### RECOVER OR RECYCLE MATERIAL

## Limitations and prohibited use

The machine is designed and built exclusively for the uses described in "Limitations of use" of the technical manual. Any other use is prohibited because it may pose a potential risk to the health of operators and users.



The unit is not suitable for operations in environments:


- excessively dusty or potentially explosive atmospheres;
- where there are vibrations;
- where there are electromagnetic fields;
- where there are aggressive atmospheres



## Unit identification

Each unit has a rating plate that provides key information regarding the machine. The rating plate may differ from the one shown below as the example is for a standard unit without accessories. For all electrical information not provided on the label, refer to the wiring diagram.

A facsimile of the label is shown below:

Via E. Mattei, 20 35028 Piove di Sacco PD - Italy +39 049 9731022 info@hidros.it www.hidros.eu		Manufacturer: PD822111	
<b>1LHA.0452.SE.LS.RV.2S.X</b> Modello Model		<b>123456</b> Matricola Serial number	
<b>2</b> Categoria PED PED Category		<b>16/2018</b> Data di fabbricazione Manufacture date	
<b>R410A</b> Tipo refrigerante Refrigerant type	<b>2</b> Gruppo fluido Fluid group	<b>2088</b> GWP	
<b>C1 9,5 Kg</b> Carica refrigerante Refrigerant charge	<b>C2</b> <b>C3</b> <b>C4</b>	<b>19,84 ton</b> CO <sub>2</sub> Equivalente CO <sub>2</sub> Equivalente	
<b>400V-3ph-50Hz</b> Tensione-Fasi-Frequenza Voltage-Phases-Frequency		<b>43,20 A</b> F.L.A. (A)	<b>20,20 kW</b> F.L.L. (kW)
LATO BASSA PRESSIONE LOW PRESSURE SIDE		LATO ALTA PRESSIONE HIGH PRESSURE SIDE	
<b>29,5 bar</b> PS		<b>45 bar</b> PS	
Min <b>-30 °C</b> Temperatura di progetto Design temperature	Max <b>+130 °C</b> Temperatura di progetto Design temperature	Min <b>-30 °C</b> Temperatura di progetto Design temperature	Max <b>+130 °C</b> Temperatura di progetto Design temperature
Peso a vuoto Weight			
Contiene gas fluorurati ad effetto serra disciplinati dal protocollo di Kyoto Contains fluorinated greenhouse gasses covered by the Kyoto protocol			



The product label should never be removed from the unit.

## 2. SAFETY

Warningrepotentiallyhazardoustoxicsubstances

Identification of the Type of Refrigerant Fluid Used: R410A

- Difluoromethane (HFC-32) 50% by weight CAS No.: 000075-10-5
- Pentafluoroethane (HFC-125) 50% by weight CAS No.: 000354-33-6

Identification of the Type of Oil Used.

The lubricant used is polyester oil. Please refer to the information provided on the compressor data plate.



**For further information regarding the characteristics of the refrigerant and oil used, refer to the safety data sheets available from the refrigerant and oil manufacturers.**

Main Ecological Information Regarding the Types of refrigerants Fluids used.



**ENVIRONMENTAL PROTECTION: Read the ecological information and the following instructions carefully.**

Persistence and degradation

The refrigerants used decompose in the lower atmosphere (troposphere) relatively quickly. The decomposed products are highly dispersible and therefore have a very low concentration. They do not influence the photochemical smog which is not among the VOC volatile organic compounds (as stipulated in the guidelines to the UNECE). The constituent refrigerants of R407C (R32, R125 and R134a), do not damage the ozone layer. These substances are regulated under the Montreal Protocol (revised 1992) and regulations EC no. 2037/200 of 29 June 2000.

Effects of discharges

Discharges into the atmosphere of this product does not cause a long-term contamination.

Exposure controls and personal protection

Wear protective clothing and gloves, protect your eyes and face

Professional exposure limits

R410A

HFC-32	TWA1000ppm
HFC-125	TWA1000ppm

**REFRIGERANT HANDLING**



**Users and maintenance personnel must be adequately informed about the possible risks of handling potentially toxic substances. Failure to follow such instructions can cause damage to personnel or to the unit.**

## PREVENT INHALATION OF HIGH VAPOURCONCENTRATION

Atmospheric concentrations of refrigerant must be minimized and kept to a level that is below the occupational exposure limit. Vapour is heavier than air and can form dangerous concentrations near the ground where the ventilation rate is lower. Always ensure adequate ventilation. Avoid contact with open flames and hot surfaces as this can cause toxic and irritating decomposition products to form. Avoid contact between liquid refrigerant and the eyes or skin.

## PROCEDURES TO BE ADOPTED IN THE EVENT OF ACCIDENTAL RELEASE OF REFRIGERANT

Ensure suitable personal protection (especially respiratory protection) during cleaning operations. If deemed safe, isolate the source of the leak. If the leakage is small and if adequate ventilation is provided, allow the refrigerant to evaporate. If the loss is substantial ensure that measures are taken to adequately ventilate the area. Contain spilled material with sand, earth or other suitable absorbent material. Do not allow the refrigerant to enter drains, sewers or basements, as pockets of vapour can form.

## MAIN TOXICOLOGICAL INFORMATION REGARDING THE TYPE OF REFRIGERANT USED

### Inhalation

A high atmospheric concentration can cause anaesthetic effects with possible loss of consciousness. Prolonged exposure may lead to irregular heartbeat and cause sudden death. Higher concentrations may cause asphyxia due to the reduced oxygen content in the atmosphere.

### Contact with skin

Splashes of nebulusliquid can produce frostbite. Probably not hazardous if absorbed through the skin. Repeated or prolonged contact may remove the skin's natural oils, with consequent dryness, cracking and dermatitis.

### Contact with eyes

Splashes of liquid may cause frostbite.

### Ingestion

While highly improbable, may produce frostbite.

## FIRST AID MEASURES



**Adhere scrupulously to the warnings and first aid procedures indicated below.**

### Inhalation

Move the person away from the source of exposure, keep him/her warm and let him/her rest. Administer oxygen if necessary. Attempt artificial respiration if breathing has stopped or shows signs of stopping. If the heart stops, perform external heart massage. Seek medical assistance.

### Contact with skin

In case of contact with skin, wash immediately with luke warm water. Thaw tissue using water. Remove contaminated clothing. Clothing may stick to the skin in case of frostbite. If irritation, swelling or blisters appear, seek medical assistance.

### Contact with eyes

Rinse immediately using an eyewash or clean water, keeping eyelids open, for at least ten minutes. Seek medical assistance.

### Ingestion

Do not induce vomiting. If the injured person is conscious, rinse his/her mouth with water and make him/her drink 200-300ml of water. Seek immediate medical assistance.

### Further medical treatment

Treat symptoms and carry out support therapy as indicated. Do not administer adrenaline or similar sympathomimetic drugs following exposure, due to the risk of cardiac arrhythmia.

### 3. TECHNICAL CHARACTERISTICS

#### Unit description

The Amus series of high efficiency heat pumps has been specifically designed for use with radiant floor heating systems or those applications where it is necessary to have maximum efficiency when heating.

They have been optimized on heating mode, are able to produce water up to 60°C and can operate down to -20°C ambient temperature.

All versions are supplied with reverse cycle valve used for winter defrost; the HH version is suitable for use in those countries that have support schemes for use of heat pump technology for heating. The HH heating only version is factory set and locked to operate only in heating mode whilst the noise is extremely low thanks to the use of a special floating vibration damping system which allows a noise reduction of about 10-12 dB(A) (Optional).

#### Frame

All units are made from hot-galvanised sheet steel, painted with polyurethane powder enamel and stoved at 180°C to provide maximum protection against corrosion. The frame is self-supporting with removable panels. All screws and rivets used are made from stainless steel. The standard colour of the units is RAL9018.

#### Refrigerant circuit

The refrigerant utilised is R410A. The refrigerant circuit is assembled using internationally recognised brand name components with all brazing and welding being performed in accordance with ISO 97/23. The refrigerant circuit includes: sight glass, filter drier, two thermal expansion valves (one for cooling mode, one for heating mode) with external equalizer, 4 way reversing valve, check valves, liquid receiver, Schrader valves for maintenance and control, pressure safety device (for compliance with PED regulations).

#### Compressors

The compressors used are a high performance scroll type that incorporates a special scroll design which enhances the efficiency of the refrigerant cycle when the source temperature is low. In all units the compressors are connected in tandem. The compressors are all supplied with a crankcase heater and thermal overload protection by a klixon embedded in the motor winding. They are mounted in a separate enclosure in order to be separated from the air stream thus enabling them to be maintained even if the unit is operating. Access to this enclosure is by the front panel of the unit. The crankcase heater is always powered when the compressor is in stand-by.

#### Source heat exchanger

The source heat exchanger is made from 3/8" copper pipes and 0,1mm thick aluminium fins with the tubes being mechanically expanded into the aluminium fins in order to maximise heat transfer. Furthermore, the design guarantees a low air side pressure drop thus enabling the use of low rotation speed (and hence low noise) fans. All heat exchangers are supplied standard with fins hydrophilic coating.

#### User heat exchangers

The user heat exchanger is a braze welded, plate type heat exchanger, manufactured from AISI 316 stainless steel. The use of this type of exchanger results in a massive reduction of the refrigerant charge of the unit compared to a traditional shell-in-tube type. A further advantage is a reduction in the overall dimensions of the unit. The exchangers are factory insulated with flexible close cell material and can be fitted with an antifreeze heater (accessory). Each exchanger is fitted with a temperature sensor on the discharge water side for antifreeze protection.

#### Fans

The fans are direct drive axial type with aluminium aerofoil blades, are statically and dynamically balanced and are supplied complete with a safety fan guard complying with the requirements of EN 60335. They are fixed to the unit frame via rubber anti-vibration mountings. The electric motors, in LS versions are 6 poles type rotating at approximately 900 rpm. In the XL versions the fans are 8 poles type (approx. 600 rpm). As standard, all units are fitted with a pressure operated fan speed controller. The motors are fitted with integrated thermal overload protection and have a moisture protection rating of IP 54.

#### Microprocessors

All units are supplied as standard with microprocessor controls. The microprocessor controls the following functions: control of the water temperature, antifreeze protection, compressor timing, compressor automatic starting sequence (For multiple compressors), alarm reset. The control panel is supplied with display showing all operational icons. The microprocessor is set for automatic defrost (when operating in severe ambient conditions) and for summer/ winter change over (only for RV versions). The control also manages the anti-legionella program, the integration with other heating sources (electric heaters, boilers, solar panels etc.), the operation of a three port modulating valve (for diverting to DHW or heating) and both the heating circuit pump and the domestic hot water circuit pump.

## Electric enclosure

The enclosure is manufactured in order to comply with the requirements of the electromagnetic compatibility standards CEE EN60204. Access to the enclosure is achieved by removing the front panel of the unit. The following components are supplied as standard on all units: main switch, a sequence relay that disables the power supply in the event that the phase sequence is incorrect (scroll compressors can be damaged if they rotate in the wrong direction), thermal overloads (protection of pumps and fans), compressor fuses, control circuit automatic breakers, compressor contactors, fan contactors and pump contactors. The terminal board has volt free contacts for remote ON-OFF, summer/ winter change over (heat pumps only) and general alarm.

## Control and protection devices

All units are supplied with the following controls and protections: user water return temperature sensor, antifreeze protection temperature sensor installed on users water output, domestic hot water supply and return temperature sensors (only versions P2S), high pressure manual reset, low pressure automatic reset, compressor thermal protection, air fan, thermal protection, pressure transducer (used to optimize the defrost cycle and to adjust the fan speed depending on ambient conditions), flow switch. All units in HA and HE versions are also fitted with a temperature probe sensor with "Energy Saving" function, supplied in a separate plastic box, which can be used to stop the pump use during periods of stand-by, when the water temperature reaches the set point. Doing this the power consumption of the unit is strongly reduced. The probe sensor must be positioned in the hydraulic compensator present at the screening technique. The domestic hot water circuit (only versions P2S) is already equipped with this probe, but it must be installed in the user circuit.

## User flow switch

The flow utility is installed as standard on all units and disables the operation of the unit in case of abnormal water flow in the system. The flow switch is made of a blade system fitted in the flow of the water; it is combined with two permanent magnets that assess the amount of water in transit and, in function of the measured parameter, enable or not the operation of the unit.

## ACCESSORIES DESCRIPTION

### Condensate discharge drip tray with antifreeze heater (BRCA)

Installed under the finned heat exchanger, this is used to collect the condensate generated during the heating mode operation. It is fitted with trace heating to prevent ice formation in low ambient conditions. This accessory may only be factory fitted.

### User water strainer

The water strainer is the first filtration indispensable for the protection of plate heat exchangers and piping. The device has a filtration degree of 400 µm and replaceable filter cartridge. The particular conformation to Y, allows the deposit of impurities on the bottom of the seat the filter-holder and therefore an easy maintenance of the filter itself.

### Antifreeze kit (RAEV2, RAEV4)

This kit, used on units fitted with a hydraulic kit, comprises a "self-heating" electric cable that is wrapped around the user and domestic hot water exchanger (P4 Units only), the water circuit pipework. This device is controlled by the microprocessor.

### Rubber vibration dampers (KAVG)

To be installed beneath the unit base and the ground to avoid the transmission of vibrations (and the noise) to the building.

### RS485 serial interface card modbus protocol (INSE)

This controller card enables the controller to communicate with other devices on a BMS using Modbus protocol.

### High efficiency E.C. axial fans (VECE)

High efficiency E.C. axial fans, supplied with Brushless DC electric motors electronically commutated (E.C. motors) able to grant the highest energy efficiency class (EFF1), according to the latest EU specifications, with the result of substantial energy consumption reduction for ventilation and noise reduction thanks to the new ultra efficient blade profiling. The fans are statically and dynamically balanced and supplied complete with a safety fan guard complying with the requirements of EN 60335. The fans are installed using a special steel profiled beam who minimize all vibrations and noise emitted. The nominal rotation speed is 700 rpm. All units are fitted with a pressure transducer for the control of the evaporation/condensation pressure. All electric motors are fitted with integrated thermal overload protection rating IP54.

### E.C. ductable fans (VECC)

Axial fans with high available Static Pressure, supplied with Brushless DC electric motor electronically commutated (E.C. motors), directly coupled to the electric motor. The fan wheel and the scroll are made from hot galvanized thick sheet metal, painted with polyurethane

powders, to ensure the best resistance against aggressive environments. The electric motor is a high efficiency DC brushless type with external rotor, to guarantee an ideal cooling of the windings and the absence of power lost due to pulleys and belt transmission. The fan is statically and dynamically balanced class 6.3 according to ISO1940. The electric motor has a separate electronic commutator (driver) and a speed modulation 0-10V, integrated PFC, "burn out" thermal protection (in case of considerable reduction of the power supply), protection degree IP54, serial interface card with Modbus protocol RTU. The maximum available static pressure is 150 Pa at nominal airflow.

#### Electronic expansion valve (VTEE)

The electronic expansion valve enables the maximum possible efficiency to be achieved by maximising the evaporator heat exchange, minimising the reaction time to load variations and optimising the superheat. It is strongly recommended for use in systems that will experience large load variations.

#### Electronic soft starter (DSSE)

All units are supplied, standard with the soft starter device which minimize the peak starting current of the compressor reducing down to the same value of the nominal maximum input current.

#### Remote control panel (PCRL)

All units are supplied with microprocessor control panel with high definition display, mounted on board of the unit and it is removable up to 50 mt. distance.

#### Hydraulic circuit antifreeze kit (KP)

This kit, used on units fitted with a hydraulic kit, comprises a "self-heating" electric cable that is wrapped around the user and domestic hot water exchanger (P4 Units only), the water circuit pipework and includes an armoured electric heater that is fitted inside the water tank. This device is controlled by the microprocessor and it is used in the unit equipped with hydraulic kit.

#### Hydraulic kit with one pump without tank - user circuit (A1NTU)

It includes: 1 water pump, expansion vessel, and pressure relief valve (if required by PED norms).

#### Cascade control system (SGRS)

Cascade control system for the management of units. The system is made of a separate plastic box, to be installed in the technical room. It is connected to the units via RS485.

## 4. TECHNICAL DATA

Heating only version (HH)

HE/LS/HH - P2S/P2U	252	302	402	452	502	602	702	802	902	1002	1202	1402
Heating capacity (EN14511) <sup>1)</sup>	22.2	29.6	37.3	47.1	50.8	61.2	67.3	74.9	93.2	104.9	114.9	137.1
Total input power (EN14511) <sup>1)</sup>	5.3	7.1	8.8	11.5	11.8	13.3	15.1	17.2	21.2	24.5	27.8	30.9
COP (EN14511) <sup>1)</sup>	4.11	4.16	4.23	4.11	4.32	4.61	4.46	4.36	4.40	4.29	4.13	4.44
Energy Class <sup>2)</sup>	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++
SCOP <sup>3)</sup>	3.83	3.86	3.85	3.85	3.92	4.13	4.04	3.97	3.87	3.85	3.83	3.85
vs. h <sup>4)</sup>	150.1	151.4	150.9	151.1	153.6	162.0	158.4	155.8	151.7	150.8	150.2	151.0
Sound power level <sup>4)</sup>	73	74	74	75	76	76	77	78	82	83	85	86
Sound pressure level <sup>4)</sup>	41	42	42	43	44	44	45	46	50	51	53	54
Power supply	V/Ph/Hz											
Compressors / Circuits	n°/n°	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1
Fans	n°	2	2	2	2	2	2	2	2	2	2	3
Refrigerant	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
Refrigerant charge	7.7	7.7	10.6	10.9	11.1	14.8	14.9	15.2	22.5	22.5	22.5	34.4
Global warming potential (GWP)	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
Equivalent CO charge	16.1	16.1	22.1	22.7	23.2	30.9	31.1	31.7	47.0	47.0	47.0	71.8
HE/LS/HH - P2S/P2U	1602	1802	2002	2302	2502	2504	3004	3204	3504	4004	4504	5004
Heating capacity (EN14511) <sup>1)</sup>	151	167.9	182.8	210.6	241.3	229.4	271.4	296.7	339.0	364.9	407	463.7
Total input power (EN14511) <sup>1)</sup>	34.4	40.2	45.5	49.4	54.8	55.8	63.9	71.5	83.7	88.8	104.1	115.1
COP (EN14511) <sup>1)</sup>	4.39	4.18	4.02	4.26	4.40	4.11	4.25	4.15	4.05	4.11	3.91	4.03
Energy Class <sup>2)</sup>	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++	A++
SCOP <sup>3)</sup>	3.86	3.85	3.84	3.92	3.97	3.83	3.85	3.83	3.91	3.89	3.87	3.86
vs. h <sup>4)</sup>	151.3	150.9	150.4	153.6	155.6	150.2	151.1	150.3	153.5	152.4	151.9	151.5
Sound power level <sup>4)</sup>	87	87	87	89	91	88	89	90	90	90	92	92
Sound pressure level <sup>4)</sup>	55	55	55	57	59	56	57	58	58	58	60	60
Power supply	V/Ph/Hz											
Compressors / Circuits	n°/n°	2/1	2/1	2/1	2/1	4/2	4/2	4/2	4/2	4/2	4/2	4/2
Fans	n°	3	3	3	3	4	6	6	6	6	8	8
Refrigerant	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
Refrigerant charge	34.8	35.3	35.3	49.4	57.3	56.7	66.5	67.1	68.0	79.9	81.1	97.7
Global warming potential (GWP)	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
Equivalent CO charge	72.7	73.7	73.7	103.1	119.6	118.4	138.9	140.1	142.0	166.8	169.3	204

Performances are referred to the following conditions:

(1) Heating: Ambient temperature 7°C DB, 6°C WB, water temperature 30/35°C.

(2) Average conditions, low temperature, variable - Reg EU 811/2013

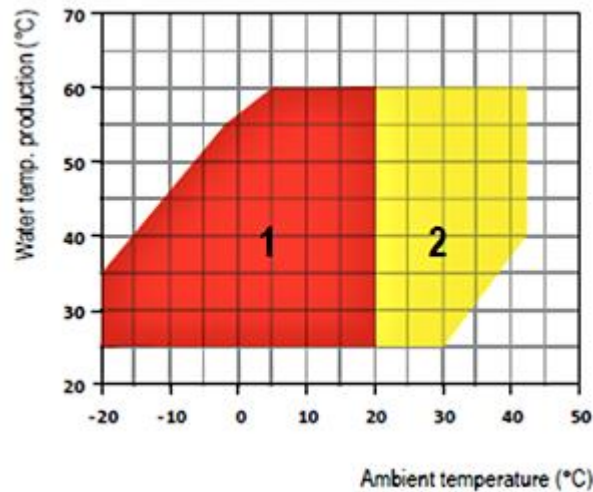
(3) Sound power level in accordance with ISO 3744.

(4) Sound pressure level at 10 mt from the unit in free field conditions in accordance with ISO 3744.



The refrigerant data may change without notice. It is therefore necessary to refer always to the silver label placed on the unit.

## OPERATIONAL LIMITS



### User heat exchanger water flow rate

The nominal water flow rate given is referred to a  $\Delta t$  of 5°C. Maximum flow rate allowed is the one that presents a  $\Delta t$  of 3°C: higher values may cause too high pressure drop.

The minimum water flow rate allowed is the one presenting a  $\Delta t$  of 8°C.

Insufficient values cause too low evaporating temperatures with the action of safety devices which would stop the unit.

Use the nominal flow rate given in the appliance TPS for pipework sizing etc.

### User hot water temperature (winter operation)

Once the system is on temperature, the minimum user water temperature should not be less than 30°C. Lower values could cause incorrect working operation of the compressor and compressor failure may occur.

The maximum user outlet water temperature cannot exceed 55°C for SA/SE versions and 60°C for HA/HE versions. High values may call the action of safety devices which would stop the unit.

### Ambient air temperature

The units are designed and manufactured to operate, in winter operation (heating mode) from -20°C to 43°C. In cooling mode the units can operate with ambient air temperatures from -10 to 43°C.





If the unit is installed in particularly windy areas, it will be necessary to provide some windbreaker barriers to avoid any malfunction. We suggest to install the barriers only if the wind exceeds 2,5m/s.



The units, in their standard configuration, are not suitable for installation in saline environments.



In WINTER mode, the unit can be started with external air of -20°C and cold inlet water (about 20°C). Such a configuration is allowed only for a short time and only to bring the plant to the right temperature. To reduce this setting time, we suggest to install a 3-way valve which allows to by-pass water from the user to the plant till the standard conditions are reached.



Units are designed and manufactured to European safety and technical standards. The units have been designed exclusively for heating, cooling and domestic hot water production (DHW.). The units must be used for this specific purpose only. Lochinvar will not be liable for claims for damage caused to persons, animals or material goods or property caused by improper installation, adjustment and maintenance or improper use. Any use not specified in this manual is prohibited.



If it's required heating operation at outdoor temperatures above 20°C or cooling operation at outdoor temperatures below 20°C, is required an evaporating/condensing pressure control (DCCF). The device monitors the evaporating/condensing pressure and maintains it at a constant level by modulating the airflow. It can also be used to reduce noise emission when ambient temperatures are lower (e.g. at night). This accessory is supply as standard.



In case of operations outside of these values, please contact Lochinvar before switching on the unit.

## DOMESTIC HOT WATER PRODUCTION

Amicus Low temperature units can produce domestic hot water by Pre-heating a gas fired water heater or as part of our Hybrid heat pump system.

**With a heat pump it is not possible to achieve the supply temperature or work at the large  $\Delta T$ 's associated with fossil fuel boilers hence the output of a standard indirect coil would be substantially less than that calculated above. Special, enhanced surface area coils for use with smaller heat pumps (<20kW) and plate heat exchanger/buffer tank combinations for larger units should be used.**

Both options are available from Lochinvar Limited.

### Compressor capacity steps

NUMBER OF COMPRESSORS				
Model	1	2	3	4
252	50%	50%	...	...
302	50%	50%	...	...
402	50%	50%	...	...
452	50%	50%	...	...
502	50%	50%	...	...
602	50%	50%	...	...
702	50%	50%	...	...
802	50%	50%	...	...
902	50%	50%	...	...
1002	43%	57%	...	...
1202	50%	50%	...	...
1402	45%	55%	...	...
1602	50%	50%	...	...
1802	45%	55%	...	...
2002	50%	50%	...	...
2302	43%	57%	...	...
2502	50%	50%	...	...
2504	25%	25%	25%	25%
3004	22%	28%	22%	28%
3204	25%	25%	25%	25%
3504	22%	28%	22%	28%
4004	25%	25%	25%	25%
4504	22%	28%	22%	28%
5004	25%	25%	25%	25%

## CORRECTION TABLES

### Operation with glycol

Glycol percentage	Freezing point (°C)	CCF	IPCF	WFCF	PDCF
10	-3.2	0.985	1	1.02	1.08
20	-7.8	0.98	0.99	1.05	1.12
30	-14.1	0.97	0.98	1.09	1.22
40	-22.3	0.965	0.97	1.14	1.25
50	-33.8	0.955	0.965	1.2	1.33

**CCF: Capacity correction factor**

**IPCF: Input power correction factor**

**WFCF: Water flow correction factor**

**PDCF: Pressure drops correction factor**

The water flow rate and pressure drop correction factors are to be applied directly to the values given for operation without glycol. The water flow rate correction factor is calculated in order to maintain the same temperature difference as that which would be obtained without glycol. The pressure drop correction factor takes into account the different flow rate obtained from the application of the flow rate correction factor.

### Correction tables different Ot

Water temperature diff.(°C)	3	5	8
CCCP	0.99	1	1.02
IPCF	0.99	1	1.01

**CCCP = Cooling capacity correction factor** **IPCF = Input power correction factor**

### Correction tables different Fouling factors

Fouling factor	0.00005	0.0001	0.0002
CCCP	1	0.98	0.94
IPCF	1	0.98	0.95

**CCCP= Cooling capacity correction factor**

**IPCF = Input power correction factor**

SOUND DATA

HA / LS										
Mod.	Octave bands (Hz)								Lw	
	63	125	250	500	1K	2K	4K	8K	dB	dB(A)
	dB	dB	dB	dB	dB	dB	dB	dB		
252/HA/LS	88,1	79,3	73,2	71,7	70,6	65,2	61,8	52,7	88,9	75
302/HA/LS	88,1	79,3	73,2	71,7	70,6	65,2	61,8	52,7	88,9	75
402/HA/LS	88,1	79,3	73,2	71,7	70,6	65,2	61,8	52,7	88,9	75
452/HA/LS	88,1	79,3	73,2	71,7	70,6	65,2	61,8	52,7	88,9	75
502/HA/LS	89,1	80,3	74,2	72,7	71,6	66,2	62,8	53,7	89,9	76
602/HA/LS	89,1	80,3	74,2	72,7	71,6	66,2	62,8	53,7	89,9	76
702/HA/LS	90,1	81,3	75,2	73,7	72,6	67,2	63,8	54,7	90,9	77
802/HA/LS	91,1	82,3	76,2	74,7	73,6	68,2	64,8	55,7	91,9	78
902/HA/LS	95,1	86,3	80,2	78,7	77,6	72,2	68,8	59,7	95,9	82
1002/HA/LS	96,1	87,3	81,2	79,7	78,6	73,2	69,8	60,7	96,9	83
1202/HA/LS	98,1	89,3	83,2	81,7	80,6	75,2	71,8	62,7	98,9	85
1402/HA/LS	99,1	90,3	84,2	82,7	81,6	76,2	72,8	63,7	99,9	86
1602/HA/LS	100,1	91,3	85,2	83,7	82,6	77,2	73,8	64,7	100,9	87
1802/HA/LS	100,1	91,3	85,2	83,7	82,6	77,2	73,8	64,7	100,9	87
2002/HA/LS	100,1	91,3	85,2	83,7	82,6	77,2	73,8	64,7	100,9	87
2302/HA/LS	102,1	93,3	87,2	85,7	84,6	79,2	75,8	66,7	102,9	89
2502/HA/LS	104,1	95,3	89,2	87,7	86,6	81,2	77,8	68,7	104,9	91
2504/HA/LS	101,1	92,3	86,2	84,7	83,6	78,2	74,8	65,7	101,9	88
3004/HA/LS	102,1	93,3	87,2	85,7	84,6	79,2	75,8	66,7	102,9	89
3204/HA/LS	103,1	94,3	88,2	86,7	85,6	80,2	76,8	67,7	103,9	90
3504/HA/LS	103,1	94,3	88,2	86,7	85,6	80,2	76,8	67,7	103,9	90
4004/HA/LS	103,1	94,3	88,2	86,7	85,6	80,2	76,8	67,7	103,9	90
4504/HA/LS	105,1	96,3	90,2	88,7	87,6	82,2	78,8	69,7	105,9	92
5004/HA/LS	105,1	96,3	90,2	88,7	87,6	82,2	78,8	69,7	105,9	92

Lw: Sound power level according to ISO 3744.

Lp: Sound pressure level measured at 10 mt from the unit in free field conditions direction factor Q=2 according to ISO 3744.

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## 5. INSTALLATION

### GENERAL SAFETY GUIDELINES AND USE OF SYMBOLS



Before undertaking any task the operator must be fully trained in the operation of the machines to be used and their controls. They must also have read and be fully conversant with all operating instructions.



All maintenance must be performed by TRAINED personnel and be in accordance with all national and local regulations.



The installation and maintenance of the unit must comply with the local regulations in force at the time of the installation.



Avoid contact and do not insert any objects into moving parts.

### Health and safety Considerations



The workplace must be kept clean, tidy and free from objects that may prevent free movement. Appropriate lighting of the work place shall be provided to allow the operator to perform the required operations safely. Poor or too strong lighting can cause risks.



Ensure that workplaces are always adequately ventilated and that respirators are working, in good condition and comply fully with the requirements of the current regulations.

### PERSONAL PROTECTIVE EQUIPMENT



When operating and maintaining the unit, use the following personal protective equipment listed below as required by law.



Protective footwear.



Eye protection.



Protective gloves.



Respiratory protection.



Hearing protection.

## INSPECTION

When installing or servicing the unit, it is necessary to strictly follow the rules reported on this manual, to conform to all the specifications of the labels on the unit, and to take any possible precautions of the case. Not observing the rules reported on this manual can create dangerous situations. After receiving the unit, immediately check its integrity. The unit left the factory in perfect conditions; any eventual damage must be questioned to the carrier and recorded on the delivery note before it is signed. Lochinvar must be informed, within 8 days, of the extent of the damage. The customer should prepare a written statement of any severe damage.

Before accepting the unit check:

- The unit did not suffer any damage during transport;
- The delivered goods are conforming to what shown in the delivery note.

## In Case of Damage

- List the damage on the delivery note
- Inform Lochinvar of the extent of the damage within 8 days of receipt of the goods. After this time any claim will not be considered.
- A full written report is required for cases of severe damage.

## STORAGE

Units should be stored under cover and ideally, should remain in their packaging. The tools that are supplied for opening the electric box should be formally transferred to the person responsible for the plant.

## UNPACKING



**Packaging could be dangerous for the operators.**

It is advisable to leave packaged units during handling and remove it before the installation.  
The packaging must be removed carefully to prevent any possible damage to the machine.  
The materials constituting the packaging may be different in nature (wood, cardboard, nylon, etc.).



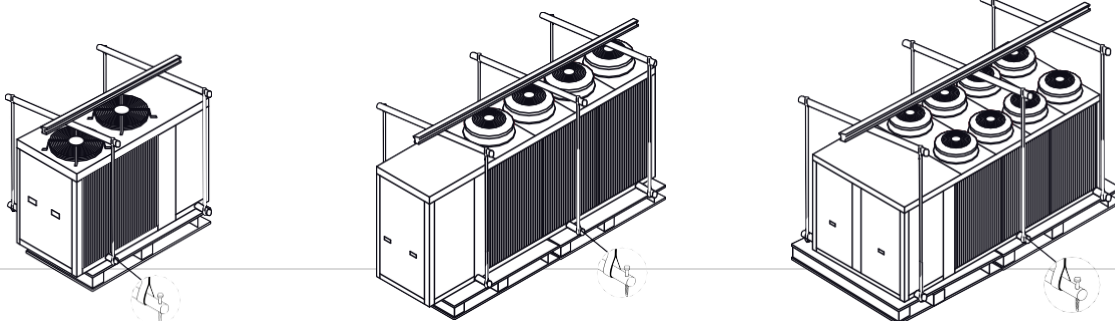
**The packaging materials should be separated and sent for disposal or possible recycling to specialist waste companies.**

## LIFTING AND HANDLING

When unloading the unit, it is strongly recommended that sudden movements are avoided in order to protect the refrigerant circuit, copper tubes or any other unit component. Units can be lifted by using a forklift or, alternatively, using belts. Take care that the method of lifting does not damage the side panels or the cover. It is important to keep the unit horizontal at all time to avoid damage to the internal components.



**The Source heat exchangers fins are sharp. Use protection gloves.**



## LOCATION AND MINIMUM TECHNICAL CLEARANCES

All units are designed for external installation: any overhang above the unit and location near trees, if they partially cover the unit, must be avoided in order to prevent air by-pass. It is advisable to create a proper mounting plinth, with a size similar to the unit foot-print. Unit vibration level is very low: it is advisable however, to install vibration dampers (spring or rubber) between the plinth and the unit base-frame to keep vibrations at a very low level. It is vital to ensure adequate air volume to the source fan. Re-circulation of discharge air must be avoided; failure to observe this point will result in poor performance or activation of safety controls. For these reasons it is necessary to observe the following clearances:



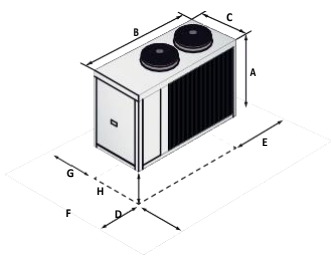
The unit has to be installed such that maintenance and repair is possible. The warranty does not cover costs for the provision of lifting apparatus, platforms or other lifting systems required to perform repairs during warranty period.



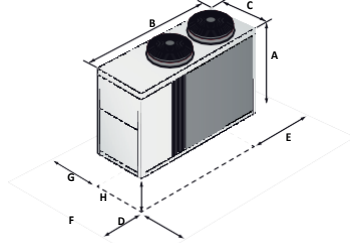
The installation site should be chosen in accordance with EN 378-1 and 378-3 standards. When choosing the installation site, all risks caused by accidental refrigerant leakage should be taken into consideration.



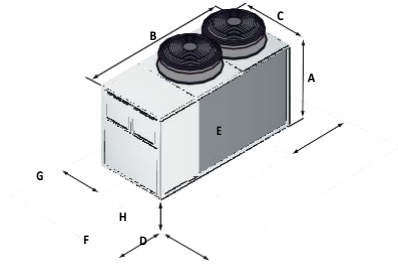
All air to water heat pumps, during defrost mode, and produce condensate at the base of the source heat exchanger. If the ambient temperature is below 0°C the water may freeze, creating a thick layer of ice within the unit. This layer of ice, in specific conditions, may damage the heat exchanger and therefore, to guarantee correct operation of the units it is highly recommended to raise the unit of a minimum amount (H). This recommendation becomes more important if the unit is to be installed in a location that is subject to heavy snowfall.



HA/HE 252 - 302



HA/HE 402-452-502-602



HA/HE 702 - 802 - 902 - 1002 - 1202

		252	302	402	452	502	602	702	802
A (mm)	HA-HE/XL	1470	1470	1670	1670	1670	1820	1820	1820
B (mm)	HA-HE/XL	1910	1910	2200	2200	2200	2905	2905	2905
C (mm)	HA-HE/XL	900	900	900	900	900	1150	1150	1150
D (mm)	HA-HE/XL	1000	1000	1500	1500	1500	2000	2000	2000
E (mm)	HA-HE/XL	800	800	1000	1000	1000	1000	1000	1000
F (mm)	HA-HE/XL	800	800	1000	1000	1000	1000	1000	1000
G (mm)	HA-HE/XL	800	800	1000	1000	1000	1000	1000	1000
H (mm)	HA-HE/XL	350	350	350	350	350	350	350	350



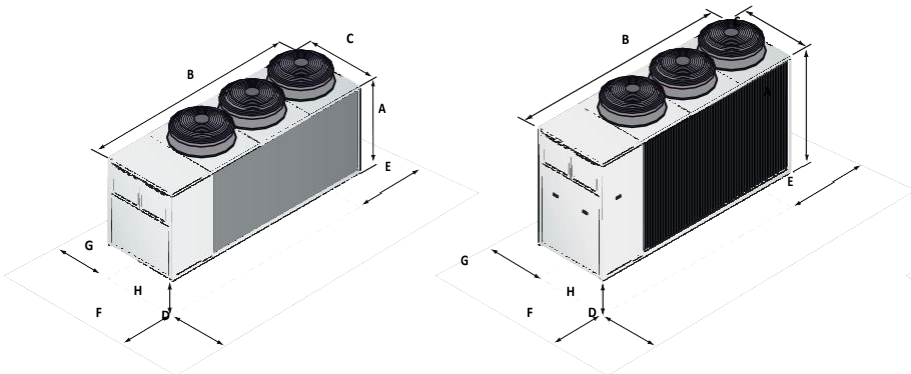
The unit has to be installed such that maintenance and repair is possible. The warranty does not cover costs for the provision of lifting apparatus, platforms or other lifting systems required to perform repairs during warranty period.



The installation site should be chosen in accordance with EN 378-1 and 378-3 standards. When choosing the installation site, all risks caused by accidental refrigerant leakage should be taken into consideration.



All air to water heat pumps, during defrost mode, and produce condensate at the base of the source heat exchanger. If the ambient temperature is below 0°C the water may freeze, creating a thick layer of ice within the unit. This layer of ice, in specific conditions, may damage the heat exchanger and therefore, to guarantee correct operation of the units it is highly recommended to raise the unit a minimum amount (H). This recommendation becomes more important if the unit is to be installed in a location that is subject to heavy snowfall.



HA/HE 1402-1602-1802-2002

HA/HE 2302-2502

		902	1002	1202	1402	1602	1802	2002	2302
A (mm)	HA-HE/XL	1820	1820	1820	1820	1820	1820	1820	2220
B (mm)	HA-HE/XL	2905	2905	2905	3965	3965	3965	3965	3965
C (mm)	HA-HE/XL	1150	1150	1150	1150	1150	1150	1150	1150
D (mm)	HA-HE/XL	2000	2000	2000	2000	2000	2000	2000	2000
E (mm)	HA-HE/XL	1000	1000	1000	1000	1000	1000	1000	1000
F (mm)	HA-HE/XL	1000	1000	1000	1000	1000	1500	1500	1500
G (mm)	HA-HE/XL	2000	2000	2000	2000	2000	2000	2000	2000
H (mm)	HA-HE/XL	350	350	350	350	350	350	350	350





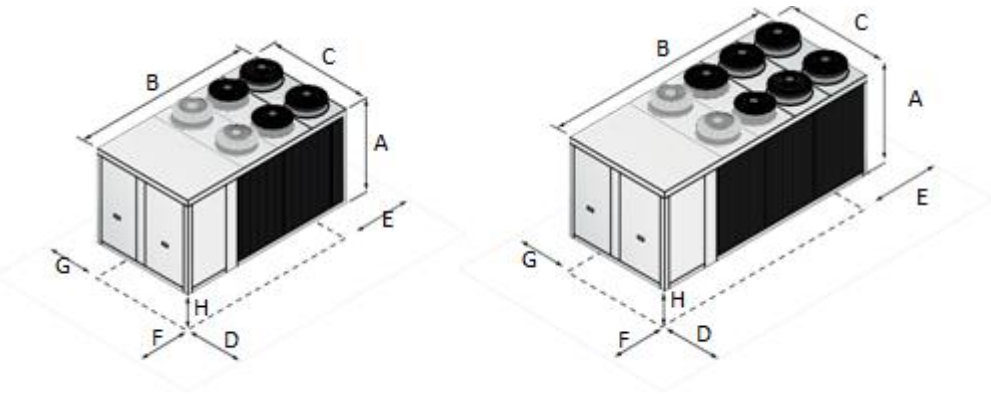
The unit has to be installed such that maintenance and repair is possible. The warranty does not cover costs for the provision of lifting apparatus, platforms or other lifting systems required to perform repairs during warranty period.



The installation site should be chosen in accordance with EN 378-1 and 378-3 standards. When choosing the installation site, all risks caused by accidental refrigerant leakage should be taken into consideration.



All air to water heat pumps, during defrost mode, and produce condensate at the base of the source heat exchanger. If the ambient temperature is below 0°C the water may freeze, creating a thick layer of ice within the unit. This layer of ice, in specific conditions, may damage the heat exchanger and therefore, to guarantee correct operation of the units it is highly recommended to raise the unit of a minimum amount (H). This recommendation becomes more important if the unit is to be installed in a location that is subject to heavy snowfall.



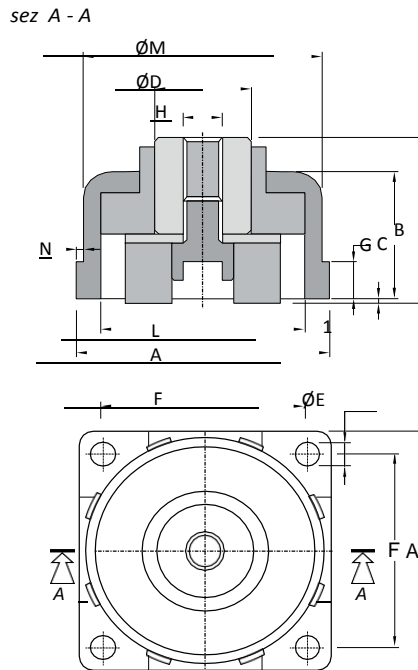
HA/HE2504-3004-3204-3504

HA/HE 4004 - 4504 - 5004

		2502	2504	3004	3204	3504	4004	4504	5004
A (mm)	HA-HE/XL	2220	2350	2350	2350	2350	2350	2350	2350
B (mm)	HA-HE/XL	3965	4265	4265	4265	4265	4805	4805	4805
C (mm)	HA-HE/XL	1150	2210	2210	2210	2210	2210	2210	2210
D (mm)	HA-HE/XL	2000	2000	2000	2000	2000	2000	2000	2000
E (mm)	HA-HE/XL	1000	1000	1000	1000	1000	1000	1000	1000
F (mm)	HA-HE/XL	1500	1500	1500	1500	1500	1500	1500	1500
G (mm)	HA-HE/XL	2000	2000	2000	2000	2000	2000	2000	2000
H (mm)	HA-HE/XL	350	350	350	350	350	350	350	350

## INSTALLATION OF RUBBER VIBRATION DAMPERS (KAVG)

All units should be installed on vibration dampers in order to prevent the transmission of vibration to the supporting surface and reduce the noise level. Rubber vibration dampers are available as an option in the catalogue. The vibration dampers (optional) are supplied by the factory in separate packaging.



Mod.	A	B	C	D	E	F	G	H	L	M	N
<b>252÷302</b>	88 mm	52 mm	41 mm	25 mm	11 mm	67 mm	10 mm	M12	65 mm	74,5 mm	5,5 mm
<b>452÷602</b>	88 mm	52 mm	41 mm	25 mm	11 mm	67 mm	10 mm	M12	65 mm	74,5 mm	5,5 mm
<b>702÷2002</b>	88 mm	52 mm	41 mm	25 mm	11 mm	67 mm	10 mm	M12	65 mm	74,5 mm	5,5 mm
<b>2504÷5004</b>	145 mm	79 mm	65 mm	35 mm	12,5 mm	110 mm	12 mm	M16	118 mm	129 mm	8 mm

## SERIAL INTERFACE CARD RS485(INSE)

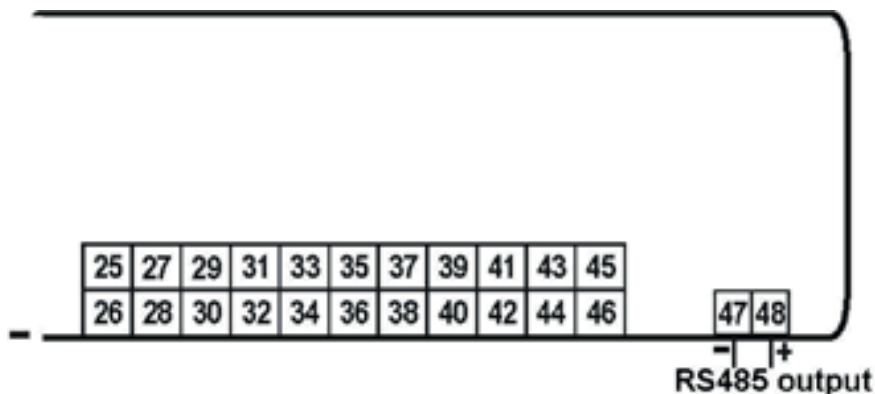
Supervision system interface (MODBUS RS485 available only)

This system allows you to remotely monitor all parameters of the unit and change their values.

It is necessary to respect the polarity of the wiring as shown in the diagram. Any reversal of polarity will result in the non-functioning unit.

The supervision connectivity cable must be telephone one type 2x0,25 mm<sup>2</sup>.

The unit is configured at the factory with serial address 1. In case of using the MODBUS system, you can request the list of variables by contacting the assistance.



## INSTALLATION OF CONDENSATE DRIP TRAY(BRCA)

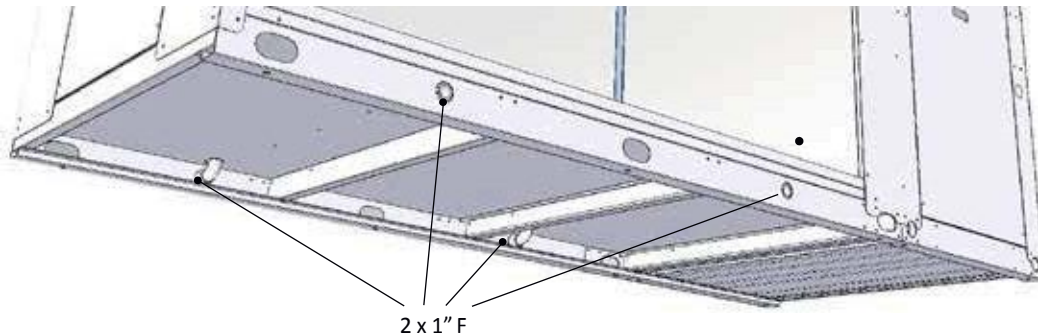


In heating and domestic hot water mode, the unit can produce a quantity of condensate, depending upon the ambient conditions and the working hours. This condensate may freeze in severe ambient conditions. The unit must therefore be installed in such a way as to prevent a slipping hazard to the user or third parties due to the presence of ice around the heatpump.

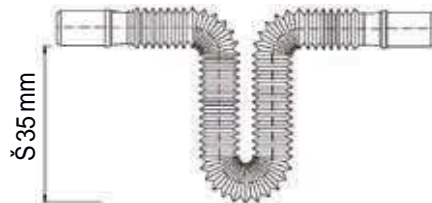


Installing the condensate drip tray on site may be difficult. We recommend that you request the BRCA accessory when ordering the unit so that it can be installed at the factory.

All units have a drip tray that is positioned underneath the source heat exchanger (finned coil) and above the base frame, this recovers all water generated by the unit when in heating and domestic hot water working mode. The drip tray is supplied with a self-heating antifreeze kit that melts any ice present in the drip tray. The drip tray is supplied with a discharge connection that must be connected to a discharge pipe.



The condensate drain line should have a water trap which may have minimum flying height equal to the suction of the fan, in any case never less than 35 mm.



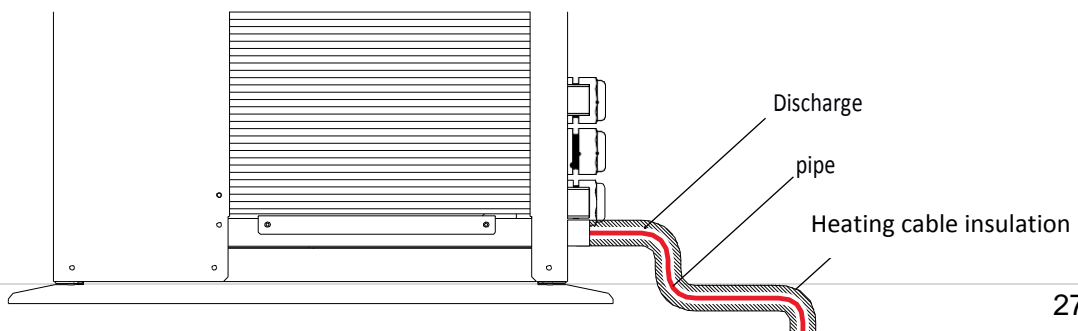
### Installation of the heating cable



It is recommended that a heating cable be installed in the condensate drip discharge pipe to prevent freezing of the water inside the pipe itself, as this can lead to a malfunction of the unit.



The heating cable that is to be inserted in the discharge pipe must have a protection degree IP67 with a specific heating capacity of a minimum of 35W per linear metre. It is also recommended that the discharge pipe be insulated with closed cell type insulation having a minimum thickness of 15 mm.



## HYDRAULIC CONNECTIONS

The water pipe-work must be installed in accordance with national and local regulation and can be made from copper, steel, galvanized steel or PVC. The Pipework must be designed to cater for the nominal water flow and the hydraulic pressure drops of the system, a maximum pressure drop of 300 Pa/m run being typical. All pipes must be insulated with closed-cell material of adequate thickness. The hydraulic piping should include:

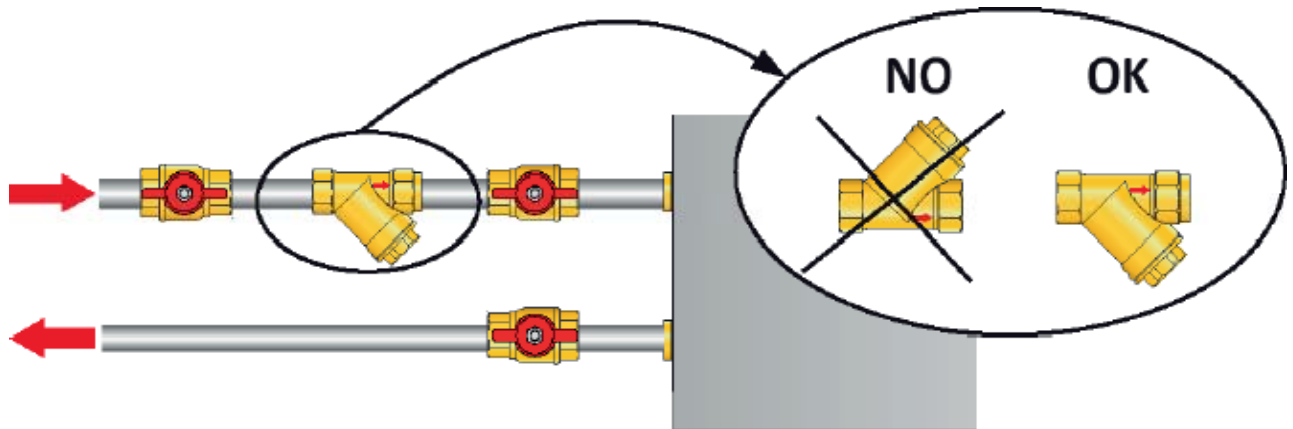
- Pockets for temperature sensor to measure the temperature in the system.
- Flexible joints, to isolate the unit from the rest of the system.
- Temperature and pressure gauges for maintenance and servicing operations.
- Shut-off manual valves to isolate the unit from the hydraulic circuit.
- Metallic filters to be mounted on the inlet pipe with a mesh not larger than 1 mm (supplied as standard).
- Vent valves, expansion tank with water filling, discharge valve.



System return water must be fitted to the connection labelled: "USER WATER IN" as incorrect connection can damage the heat exchanger by freezing.



It is compulsory to install on the USER WATER IN connection, a water strainer with a mesh not larger than 1 mm. Fitting this filter is **COMPULSORY** and the warranty will be invalidated if it is removed. The filter must be kept clean and checked periodically.



All units are factory supplied with a flow switch; the flow switch **MUST BE FITTED** in the pipework connection labelled "USER WATER OUT". If the flow switch is altered, removed, or the water filter omitted on the unit, the warranty will be invalidated.



The water flow through the heat exchangers of the unit should not be fall below At 8°C measured at the following conditions:

Heating mode: 7°C Dry bulb ambient temperature, 35°C water outlet temperature;  
Cooling mode: 35°C dry bulb ambient temperature, 7°C water outlet temperature.

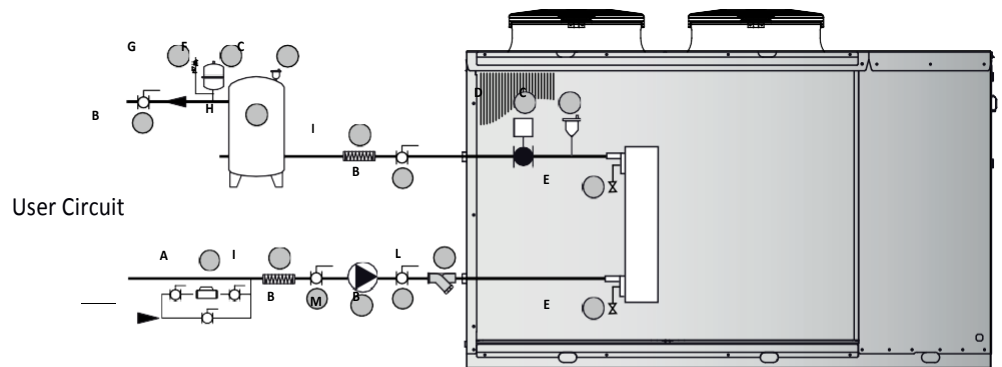
## CHEMICAL CHARACTERISTICS OF THE WATER

The system is to be filled with clean water and vented after a full flushing operation has been performed; the water should have the following characteristics:

<b>PH</b>	6-8	<b>Total Hardness</b>	Lower Than 50 ppm
<b>Electric conductivity</b>	Lower Than 200 mV/ cm (25°C)	<b>Sulphur ion</b>	None
<b>Chlorine ions</b>	Lower Than 50 ppm	<b>Ammonia ion</b>	None
<b>Sulphuric acid ions</b>	Lower Than 50 ppm	<b>Silicon ion</b>	Lower Than 30 ppm
<b>Total Iron</b>	Lower Than 0,3 ppm		

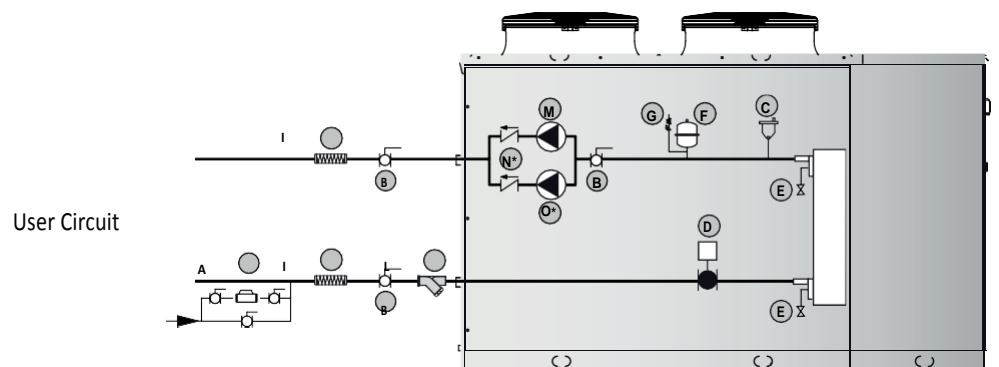
## HYDRAULIC COMPONENTS

Standard Versions (no Hydraulic kit fitted)



The water pump must be installed with the supply side toward the water inlet connection of the unit.

A1NTU (with Hydraulic kit fitted)



A	System Filling Group	H	User water tank
B	Shut-off Valve	I	Flexible Connection
C	Vent Valve	L	Water Strainer
D	Flow Switch	M	Water Pump
E	Drainage valve	N*	One way valve
F	Expansion Vessel	O*	Not available
G	Safety Valve		

Legend:



Components shown inside the units are factory fitted. Components shown outside of the units must be present in the system to guarantee the correct operation. The installation of those components is charged to the installer.

## USER CIRCUIT MINIMUM WATERCONTENT



Heat pump units need a minimum water content inside the user circuit in order to guarantee the correct functioning of the unit. A correct water content reduces the n° of starts-and-stops of the compressors and this extends the operating life of the unit and allows a reduced reduction of the hot water temperature during the defrosting cycle. For these reason it's necessary to guarantee to the unit the following minimum water contents in the user circuit:

Recommended water content: 15l/kW

Recommended minimum water content: 20 lt. x Thermal power (kW) / Number of compressors.

Model	252	302	402	452	502	602	702	802	902	1002	1202	1402
Minimum water content winter mode (l)	240	340	400	480	560	650	750	820	1000	1120	1240	1440

Model	1602	1802	2002	2302	2502	2504	3004	3204	3504	4004	4504	5004
Minimum water content winter mode (l)	1600	1800	1920	2000	2200	1230	1400	1530	1700	1970	2240	2420

## MINIMUM DOMESTIC HOT WATER CIRCUITCONTENT

The minimum domestic hot water circuit content required is:

Model	252	302	402	452	502	602	702	802	902	1002	1202	1402
Minimum water content hydraulic circuit (l)	240	340	400	480	560	650	750	820	1000	1120	1240	1440

Model	1602	1802	2002	2302	2502	2504	3004	3204	3504	4004	4504	5004
Minimum water content hydraulic circuit (l)	1600	1800	1920	2000	2200	1230	1400	1530	1700	1970	2240	2420



The minimum domestic hot water circuit content shown in the above table shows the minimum water content required by the system to guarantee the correct operation of the unit in terms of the acceptable number of starts of the compressors and the minimum allowed working time per cycle. The above values do not guarantee the availability and temperature of domestic hot water; the correct volume MUST be calculated based upon the domestic hot water system type and on the user requirements. Please contact Lochinvar for information regarding this.

## FILLING THE HYDRAULIC CIRCUIT

- Before filling, check that the installation drain valve is closed.
- Open all pipework, heat pump and terminal unit air vents.
- Open the shut off valves.
- Begin filling, slowly opening the water valve in the filling group outside the unit.
- When water begins to leak out of the terminal air vent valves, close them and continue filling until the pressure gauge indicates a pressure of 1.5 bars.

The installation should be filled to a pressure of between 1 and 2 bars. It is recommended that this operation be repeated after the unit has been operating for a number of hours (due to the presence of air bubbles in the system). The pressure of the installation should be checked regularly and if it drops below 1 bar, the water content should be topped-up. If frequent top-ups are required, check all connections for leaks.

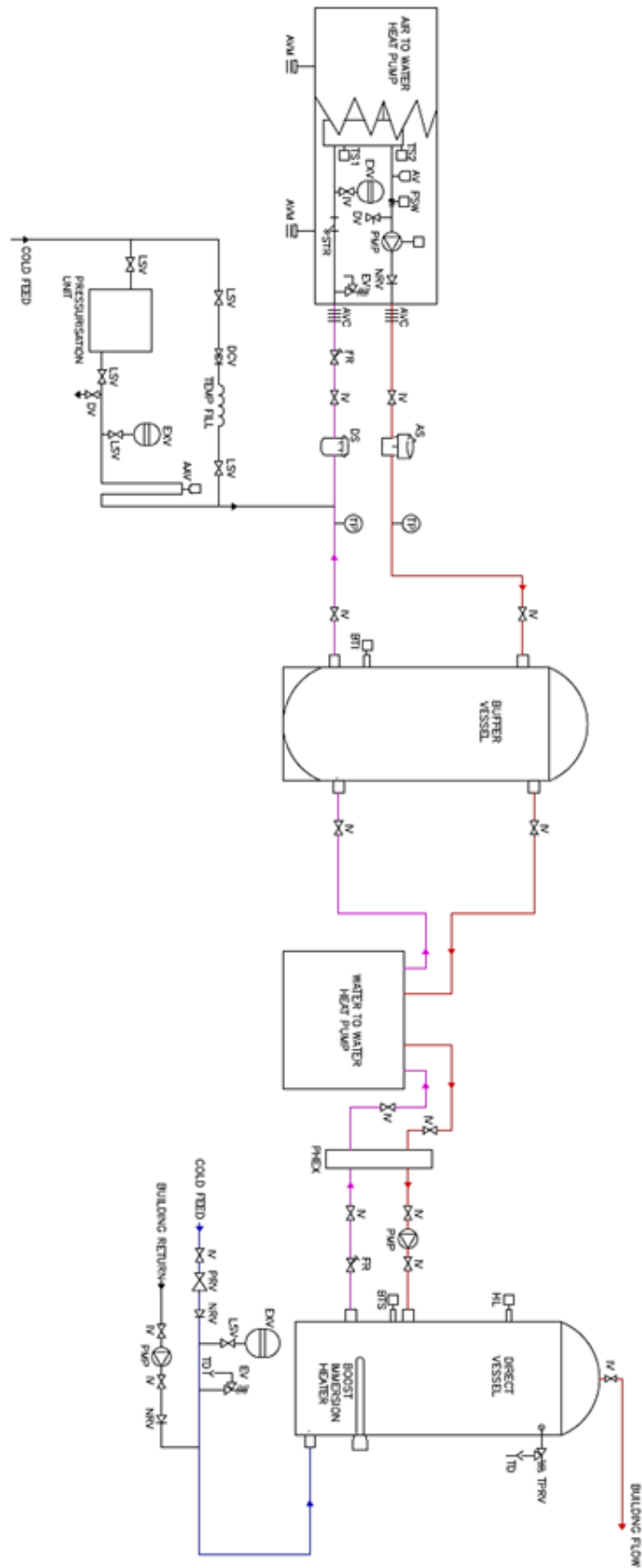
## EMPTYING THE INSTALLATION

- Before emptying, place the mains switch in the "Off" position.
- Make sure the filling group valve is closed.
- Open the drainage valve outside the unit and all the installation and terminal air vent valves.

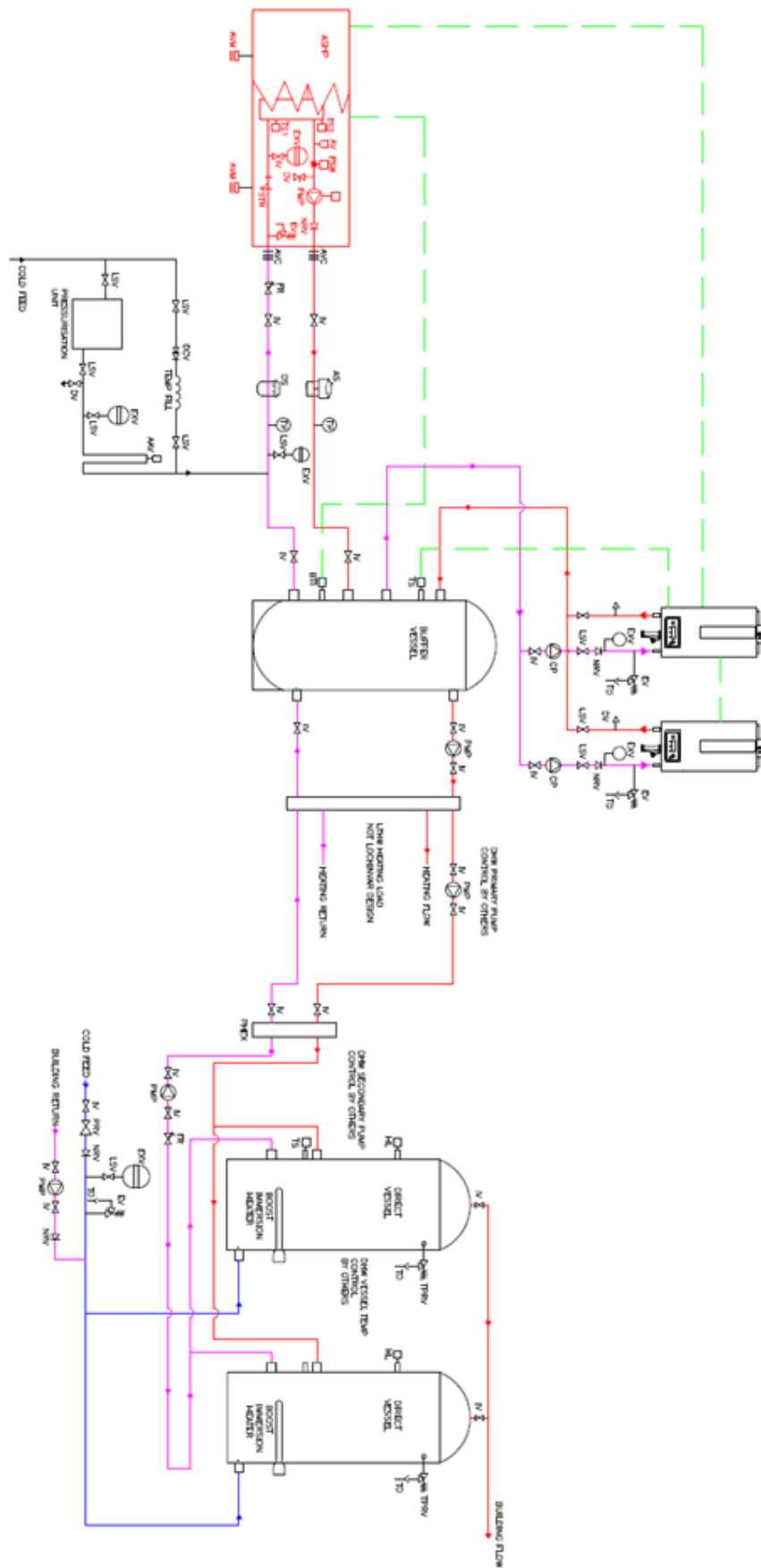


If the fluid in the circuit contains anti-freeze, it MUST not be allowed to run away to drain. It must be collected for possible re-cycling or for correct disposal.

TYPICAL INSTALLATIONS



Amicus Air source heat pump pre-heating an Amicus boost heat pump system



Amicus Air source heat pump working with support gas condensing boilers



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## ELECTRIC CONNECTIONS: PRELIMINARY SAFETY INFORMATION

The electric panel is located inside the unit at the top of the technical compartment where the various components of the refrigerant circuit are also to be found. To access the electrical board, remove the front panel of the unit:



Power connections must be made in accordance to the wiring diagram enclosed with the unit and in accordance to the norms in force.



Make sure the power supply upstream of the unit is (blocked with a switch). Check that the main switch handle is padlocked and it is applied on the handle a visible sign of warning not to operate.



It must be verified that electric supply is corresponding to the unit electric nominal data (tension, phases, and frequency) reported on the label in the front panel of the unit.



Power cable and line protection must be sized according to the specification reported on the form of the wiring diagram enclosed with the unit.



The cable section must be commensurate with the calibration of the system-side protection and must take into account all the factors that may influence (temperature, type of insulation, length, etc.).



Power supply must respect the reported tolerances and limits: If those tolerances should not be respected, the warranty will be invalidated.



Flow switches must be connected following the indication reported in the wiring diagram. Never bridge flow switches connections in the terminal board. Guarantee will be invalidated if connections are altered or not properly made.



Make all connections to ground as required by law and legislation.



Before any service operation on the unit, be sure that the electric supply is disconnected.



The power line and the unit external safety devices must be sized in order to ensure the correct voltage at the maximum operating conditions of the unit reported in the wiring diagram of the unit.



### FROST PROTECTION

If opened, the main switch cuts the power off to any electric heater and antifreeze device supplied with the unit, including the compressor crankcase heaters. The main switch should only be disconnected for cleaning, maintenance or unit repairs.

## ELECTRIC DATA



The electrical data reported below refer to the standard unit without accessories. In all other cases refer to the data reported in the attached electrical wiring diagrams.

The line voltage fluctuations cannot be more than  $\pm 10\%$  of the nominal value, while the voltage unbalance between one phase and another cannot exceed 1%, according to EN60204. If those tolerances should not be respected, please contact our Company.

Model		252	302	402	452	502	602	702	802
<b>Power supply</b>	V/~ z	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50	400/3+N/ 50
<b>Control board</b>	V/~ z	24 V	24 V	24 V	24 V	24 V	24 V	24 V	24 V
<b>Auxiliary circuit</b>	V/~ z	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50
<b>Fans power supply</b>	V/~ z	230/1/50	230/1/50	230/1/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
<b>Line section</b>	mm <sup>2</sup>	10	10	16	16	16	25	35	35
<b>PE section</b>	mm <sup>2</sup>	6	6	6	10	10	10	16	16

Model		902	1002	1202	1402	1602	1802	2002	2302
<b>Power supply</b>	V/~ z	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
<b>Control board</b>	V/~ z	24 V	24 V	24 V	24 V	24 V	24 V	24 V	24 V
<b>Auxiliary circuit</b>	V/~ z	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50
<b>Fans power supply</b>	V/~ z	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
<b>Line section</b>	mm <sup>2</sup>	50	50	70	70	70	90	120	150
<b>PE section</b>	mm <sup>2</sup>	25	25	35	35	50	50	70	70

Model		2502	2504	3004	3204	3504	4004	4504	5004
<b>Power supply</b>	V/~ z	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
<b>Control board</b>	V/~ z	24 V	24 V	24 V	24 V	24 V	24 V	24 V	24 V
<b>Auxiliary circuit</b>	V/~ z	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50
<b>Fans power supply</b>	V/~ z	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
<b>Line section</b>	mm <sup>2</sup>	150	185	185	185	240	2x120	2x150	2x240
<b>PE section</b>	mm <sup>2</sup>	70	90	90	90	120	120	150	240

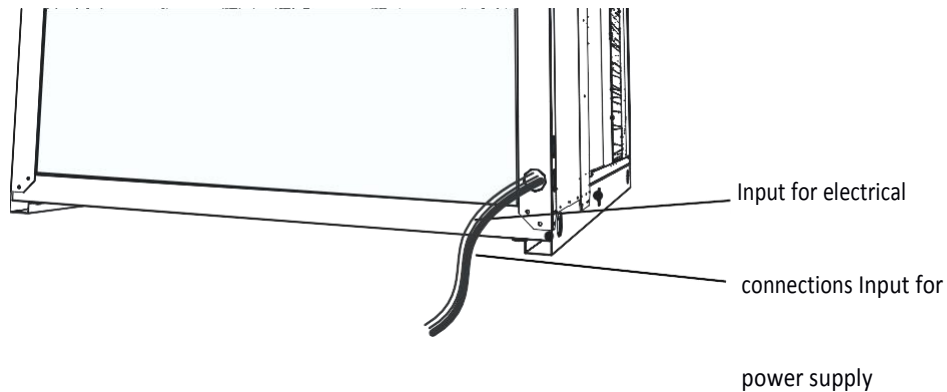


Electric data may change for updating without notice. It is therefore necessary to refer always to the wiring diagram present in the units.

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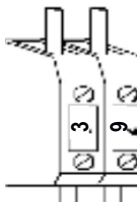
## ELECTRIC CONNECTIONS

### Power supply and electrical connections



### Remote wiring connections (compulsory)

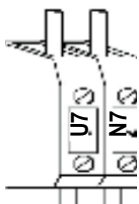
All terminals referred to in the explanations below will be found on the terminal board inside the electrical box. All electric connections mentioned below have to be made by the installer, on site.



#### USER CIRCUIT WATER INLET SENSOR (BTI)

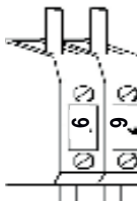
It is used to measure the return water temperature from the user circuit. The sensor is connected to terminals 7 and 02.

The standard working mode has the user pump switched off during stand-by periods (Compressors Off). The sensor must be placed in an appropriate position in order to measure the temperature of the secondary circuit. Incorrect positioning of the user water sensor can adversely affect the operation of the heat pump. The remote sensor is supplied loose with the unit (it is present inside the electric box) and it is supplied with a 3 mt. cable length. If this is too short, it is possible to increase the length by using cable of diameter 0.5 mm<sup>2</sup> up to a maximum distance of 50 meters.



#### USER CIRCUIT WATER PUMP

If the pump is factory supplied and fitted (A version) it will already be connected otherwise, connect to terminals U7 and N7; maximum input current 3A. In standard configuration, the unit microprocessor controller switches off the user water pump when the set point is reached or if the unit is in standby. This strategy is suitable if the unit is heating a buffer store from which a secondary circuit is taken and provides a substantial reduction of energy use.

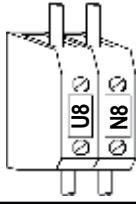


#### DOMESTIC HOT WATER SENSOR (BTS)

This is used to measure the return water temperature from the domestic hot water circuit. The sensor must be placed in the pocket provided in the DHW (Domestic hot water) cylinder, in an appropriate position, in order to measure the correct temperature of the domestic hot water. Incorrect positioning of the domestic hot water sensor can have an adverse effect on the operation of the heat pump. The sensor is supplied loose with the unit (it is placed inside the electric box) and it is supplied with a 3 mt. cable length. The sensor is connected to terminals 7 and 4. If this is too short, it is possible to increase the length by using cable of diameter 0.5 mm<sup>2</sup>, up to a maximum distance of 50 meters.



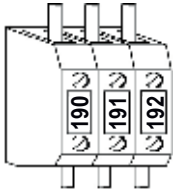
The numbering of the terminals may change without notice. Please refer to enclosed wiring diagram for final specifications



### DOMESTIC HOT WATER CIRCUIT PUMP

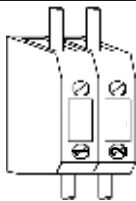
To be connected across terminals U8 and N8; maximum input current 1A. In standard configuration, the microprocessor control of the unit switches off the user water pump when the set point has reached or if the unit is in standby. This strategy provides a substantial reduction of energy use.

Remote wiring connections (optional)



### 3 WAY ON/OFF VALVE (Only required on 2 pipes systems versions); Not required on /P4 versions)

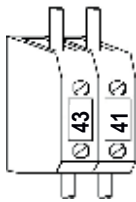
The 3 way valve is used with 2 pipe systems to produce domestic hot water; the valve is activated by the Domestic hot water sensor (BTS) and diverts the hot water either to the domestic hot water cylinder or to the user circuit. The valve is connected across terminals



### REMOTE ON / OFF

To switch the unit on or off remotely, the cable jumper connected across terminals 1 and 2 must be replaced with a switch.

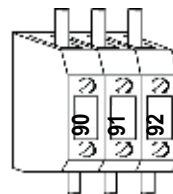
Contact closed, unit ON,  
Contact open, unit OFF.



### REMOTE SUMMER / WINTER CHANGE OVER

To remotely switch the unit from heating to cooling, the cable jumper connected across terminals 50 and 49 must be replaced with a switch.

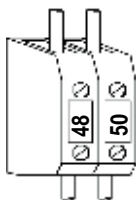
Contact closed, unit in  
Winter mode, Contact  
open, unit Summer mode.



### REMOTE GENERAL ALARM

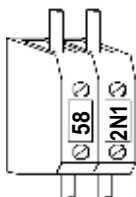
For remote display of a general alarm, connect the visual or audible device between terminals 90-91-92.

Contacts 90/91 NC (Normally  
closed) Contacts 91/92 NO  
(Normally Opened)



### DOMESTIC HOT WATER CIRCUIT FLOW SWITCH (P4 versions only)

If a flow switch is required on the domestic hot water circuit, it must be connected across terminals 48 and 50. The unit is factory fitted with a jumper that has to be removed before installing the flow switch.

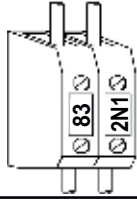


### USER CIRCUIT ELECTRIC INTEGRATION HEATERS

If user circuit integration heaters are required, the coil of the contactor that is used to switch them must be connected across terminals 78 and 2N1.

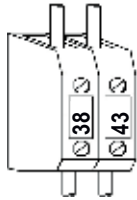


The numbering of the terminals may change without notice. For their connection is mandatory to refer to the wiring diagram supplied along with the unit.



### DOMESTIC HOT WATER ELECTRIC INTEGRATION HEATERS

If domestic hot water circuit integration heaters are required, the coil of the contactor that is used to switch them must be connected across terminals 93 and 2N1. Only P2S - P4S



### PRIORITY SELECTOR (HOT WATER)

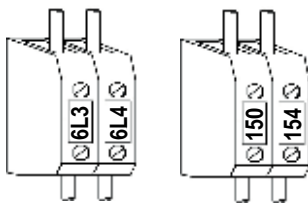
If a priority selector switch is to be fitted, a voltage free switch has to be connected to terminals 50 and 57. The selector operates as follows:

Closed contact: Domestic hot water only;

Opened contact: Domestic hot water / Heating (and / or cooling);

The unit is supplied with noting connected to terminals 50 and 57 (Open contact).

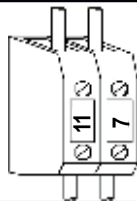
Modd 252÷402 Modd 452÷5004



### HEATING CABLE

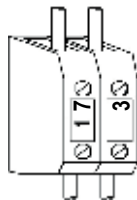
This is used to prevent freezing of the condensate produced, in the outlet of the drain tray. The maximum current must not exceed 0.5 A relating to a maximum power of 100 W. It is connected to terminals 6L3/6L4 (Modd 252÷402) and 150/154 (Modd 452÷5004) (this heating cable is operated in conjunction with the electric heater in the condensate drain tray).

Factory fitted wiring connections



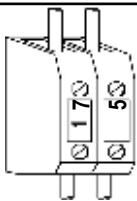
### WEATHER COMPENSATED SENSOR (BTE)

This is used to measure the ambient temperature enabling weather compensation modulation of the user setpoint with respect to the ambient conditions. It is connected to terminals 11 and 7.



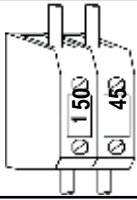
### USER CIRCUIT WATER OUTLET SENSOR (BTO)

This is used to measure the outlet user temperature; it is also used as antifreeze protection in cooling mode; it is connected to the terminals 7 and 3.



### DOMESTIC HOT WATER OUTLET SENSOR (BTU)

This is used to measure the domestic hot water outlet temperature; it is also used as maximum temperature sensor to protect the refrigerant circuit of the unit from excessive temperatures in case of low water flow rates. The sensor is connected to terminals 7 and 5.



### USER CIRCUIT FLOW SWITCH (SFW1)

This is used to protect the unit if there is a low water flow rate in the user circuit. It is factory fitted across terminals 50 and 45.



The numbering of the terminals may change without notice. For their connection is mandatory to refer to the wiring diagram supplied along with the unit.

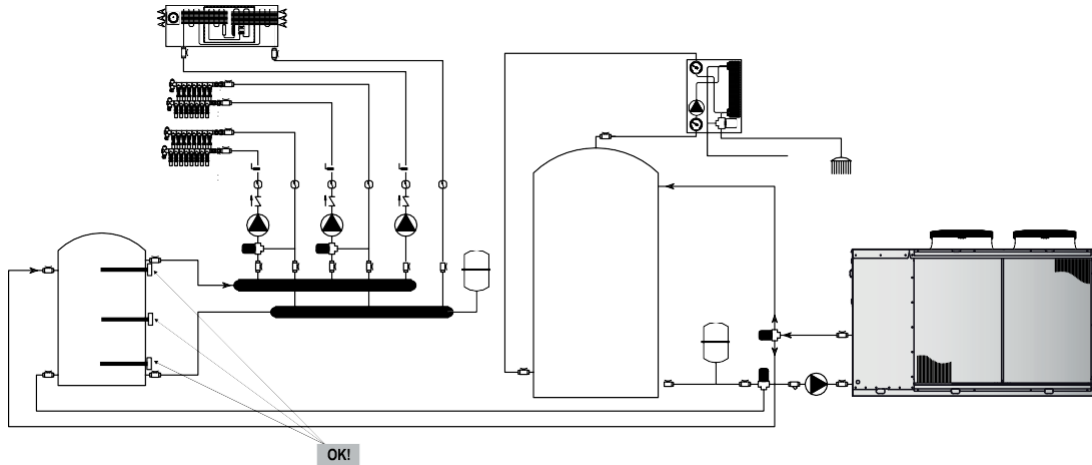
## POSITIONING OF THE USER CIRCUIT WATER INLET SENSOR (BTI)

The correct positioning of the BTI sensor is extremely important to guarantee the correct operation of the heat pump. The BTI sensor is used to cycle the unit to maintain the user water temperature at set point. The BTI sensor is also used to activate the user water pump and to stop it when the user water temperature set point is reached.

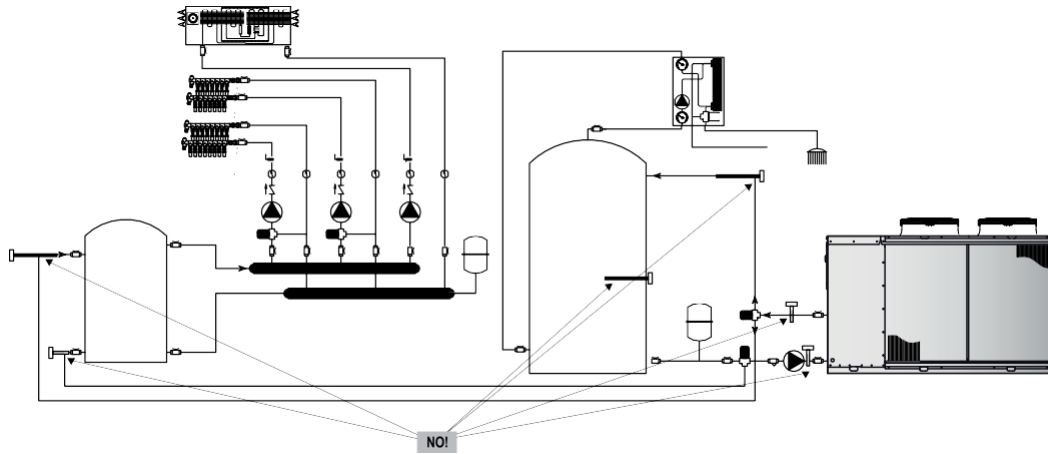


To guarantee the correct measurement of the temperature, insert the probe in the sensor pocket of the buffertank.

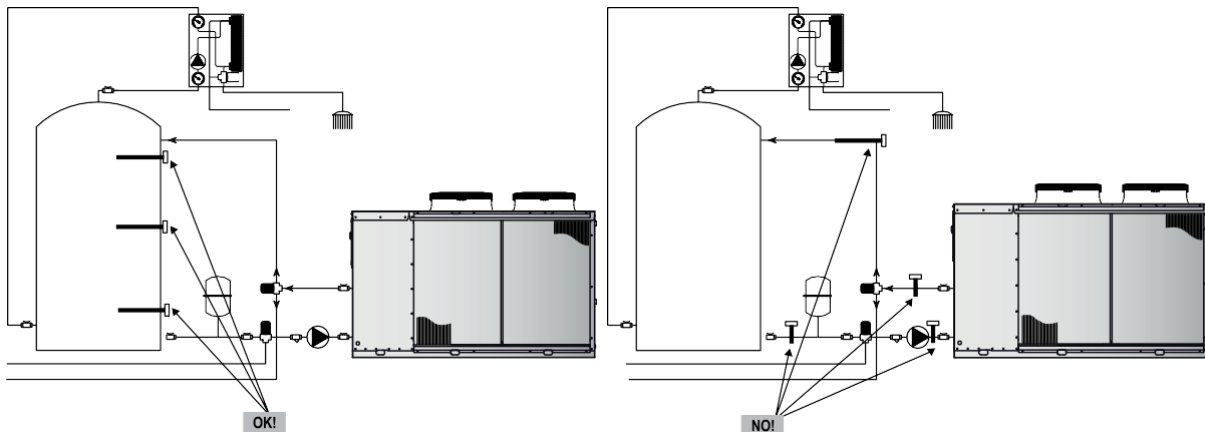
### CORRECT POSITIONING OF THE BTI SENSOR



### Incorrect positioning of the BTI sensor



## POSITIONING OF THE DOMESTIC HOT WATER CIRCUIT SENSOR (BTS)



Correct positioning of the BTS sensor

Incorrect positioning of the BTS sensor

## REFRIGERANT CIRCUIT LAYOUT

### Refrigerant circuit layout version SAISE P2U - P2S - single finned coil



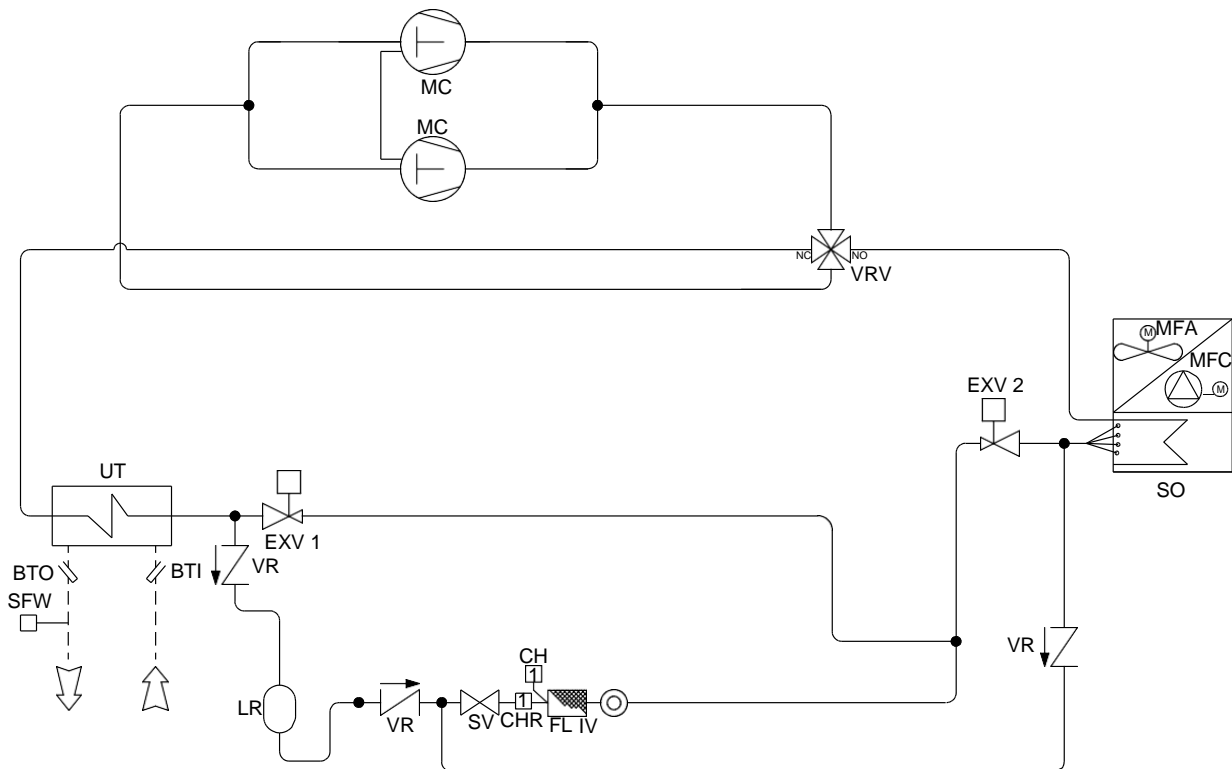
#### P2U Version

This is a two pipe version that can produce hot water for heating and cold water for cooling. The unit is used with two pipe water based change-over systems. It is not able to produce domestic hot water.



#### P2S Version

This is a two pipe version that can, in addition to producing hot water for heating and cold water for cooling, also generate domestic hot water. The controller has dual heating set points (heating and DHW) and can also control a three port diverting valve that directs the DHW to the cylinder. DHW production has priority irrespective of the mode of operation of the unit. The unit is normally used with two pipe water based change-over systems.



Models LHA 2504-3004-3204-3504, 4004-4504-5004, in all versions, use two independent refrigerant circuits identical to the one shown above.

BTI	User water input probe	MFC	Centrifugal fan
BTO	User water output probe	SFW	User flow switch
CH	Charging plug	SO	Source side
CHR	Charging plug	SV	Shut off valve
ECO	Economizer	UT	User side
EXV	Thermostatic valve	VR	Check valve
FL	Liquid line filter	VRV	Reverse cycle valve
IV	Moisture indicator sight glass	YEC	By-pass solenoid valve
LR	Liquid receiver		Refrigeration connections
MC	Compressor	-	Hydraulic connections
MFA	Source fan		

Refrigerant circuit layout version HAIHE P2U - P2S - double finned coils



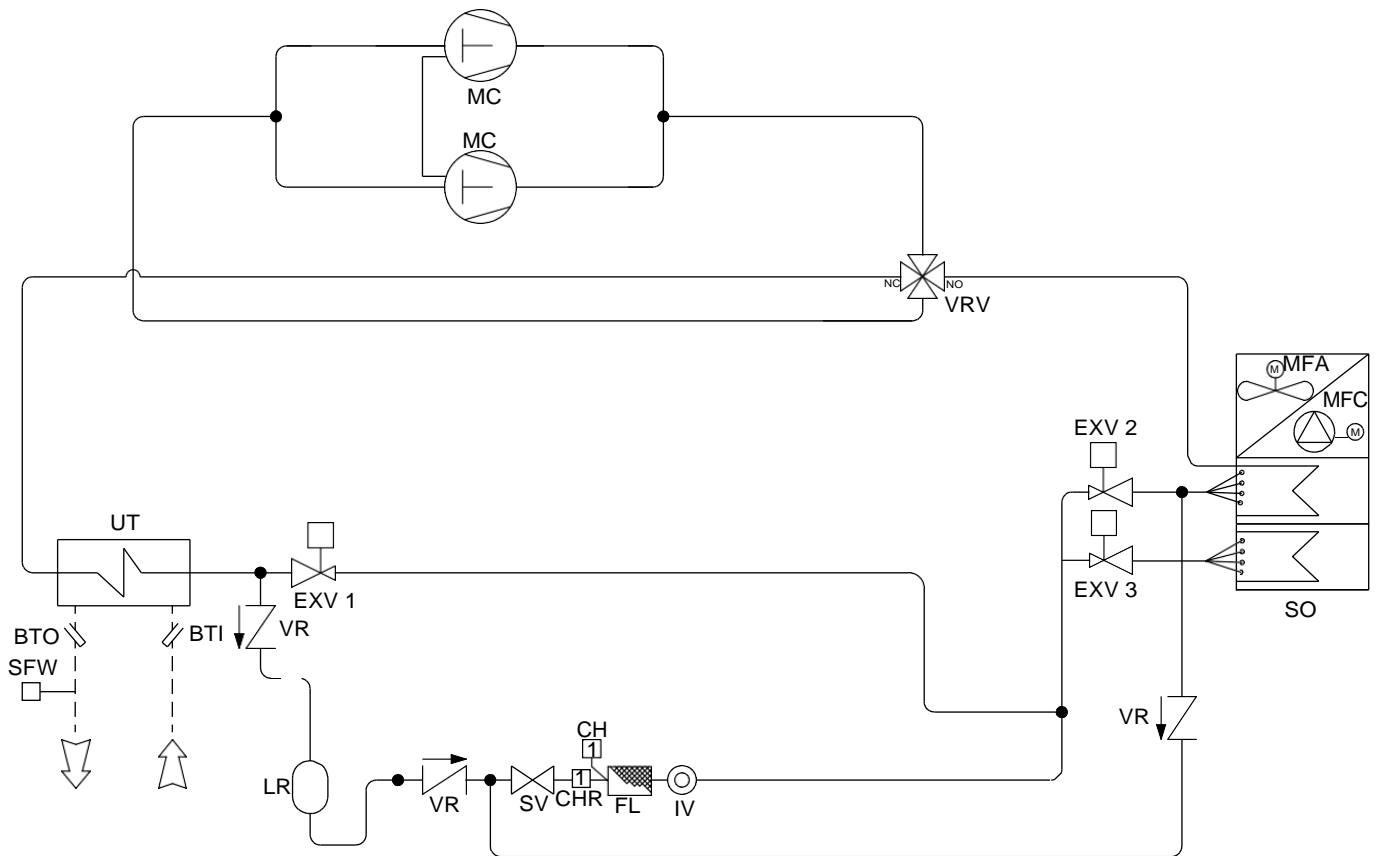
**P2U Version**

This is a two pipe version that can produce hot water for heating and cold water for cooling. The unit is used with two pipe water based change-over systems. It is not able to produce domestic hot water.



**P2S Version**

This is a two pipe version that can, in addition to producing hot water for heating and cold water for cooling, also generate domestic hot water. The controller has dual heating set points (heating and DHW) and can also control a three port diverting valve that directs the DHW to the cylinder. DHW production has priority irrespective of the mode of operation of the unit. The unit is normally used with two pipe water based change-over systems.



<b>BTI</b>	User water input probe	<b>MFC</b>	Centrifugal fan
<b>BTO</b>	User water output probe	<b>SFW</b>	User flow switch
<b>CH</b>	Charging plug	<b>SO</b>	Source side
<b>CHR</b>	Charging plug	<b>SV</b>	Shut off valve
<b>ECO</b>	Economizer	<b>UT</b>	User side
<b>EXV</b>	Thermostatic valve	<b>VR</b>	Check valve
<b>FL</b>	Liquid line filter	<b>VRV</b>	Reverse cycle valve
<b>IV</b>	Moisture indicator sight glass	<b>YEC</b>	By-pass solenoid valve
<b>LR</b>	Liquid receiver	<b>-</b>	Refrigeration connections
<b>MC</b>	Compressor	<b>-</b>	Hidraulic connections
<b>MFA</b>	Source fan		



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## 6. UNIT START UP

### PRELIMINARY CHECKS

Before starting the unit the checks detailed in this manual of the electric supply and connections (par. 4.20), the hydraulic system (par. 4.11) and the refrigerant circuit (par. 5.1.4), should be performed.



Start-up operations must be performed in accordance with the instructions detailed in the previous paragraphs.



If it is required to switch the unit on and off, never do this using the main isolator: this should only be used to disconnect the unit from the power supply when the unit is to be permanently off. Isolation will result in no supply for the crankcase heater and on start up the compressor could be seriously damaged.

### BEFORE START-UP



Damage can occur during shipment or installation. It is recommended that a detailed check is made, before the installation of the unit, for possible refrigerant leakages caused by breakage of capillaries, pressure switch connections, tampering of the refrigerant pipework, vibration during transport or general abuse suffered by the unit.

- Verify that the unit is installed in a workmanlike manner and in accordance with the guidelines in this manual.
- Check that all power cables are properly connected and all terminals are correctly fixed.
- The operating voltage between phases R S T is the one shown on the unit labels.
- Check that the unit is connected to the system earth.
- Check that there is no refrigerant leakage.
- Check for oil stains, sign of a possible leak.
- Check that the refrigerant circuit shows the correct standing pressure on the pressure gauges (if present) otherwise use external ones.
- Check that the Schrader port caps are the correct type and are tightly closed.
- Check that crankcase heaters are powered correctly (if present).
- Check that all water connections are properly installed and all indications on unit labels are observed.
- The system must be flushed, filled and vented in order to eliminate any air.
- Check that the water temperatures are within the operation limits reported in the manual.
- Before start up check that all panels are replaced in the proper position and locked with fastening screws.



Do not modify internal wiring of the unit, as this will immediately invalidate the warranty.



Crankcase heaters must be powered at least 12 hours before start up (pre-heating period) To do this, isolate the compressor(s), fans and pump(s) in the electric box and then switch on the main isolator (heaters are automatically supplied when the main switch is closed). The crankcase heaters are working properly if, after several minutes, the compressor crankcase temperature is about  $10\div 15^{\circ}\text{C}$  higher than ambient temperature.



During the 12 hours pre-heating period it is also important to check that the label OFF is shown on the display or that the unit is on stand-by mode. If there is an accidental start-up before the 12 hours pre-heating period has elapsed, the compressors could be seriously damaged and therefore the warranty will immediately terminate.

## DEVICE SET-POINT DIFFERENTIAL RESET

Device		Set-point	Differential	Reset
Heating mode	°C	35	2	----
Domestic hot water mode	°C	50	2	----
Anti-freeze thermostat	°C	4.5	4	MANUAL
High pressure switch	Bar	45	7	Automatic for 3 times (then manual)
Low pressure switch	Bar	5.7	1.3	
Water safety valve (Present in A versions only)	Bar	6		Automatic

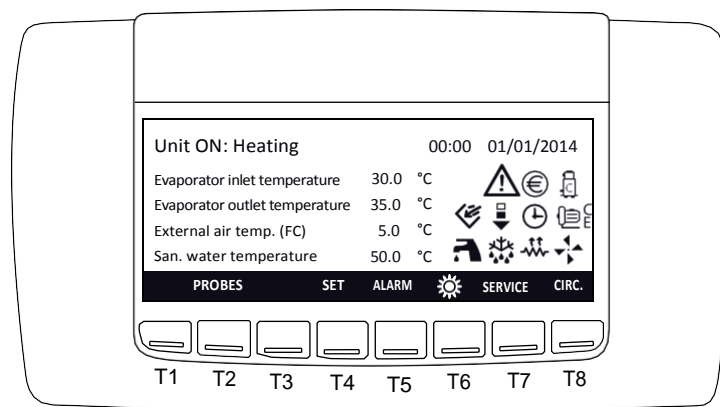


If the unit is required for heating only (without domestic hot water production) the internal parameter of the microprocessor FS1 has to be modified from 2 to 1 in order to avoid configuration alarms. Please contact Lochinvar for support.

## CONTROLS DURING UNIT OPERATION

- Check the rotation of the compressors and fans. If the rotation is incorrect, disconnect the main switch and change over any two phases of the incoming main supply to reverse motor rotation (only for units with three-phase fan motors).
- After several hours of operation, check that the sight glass has a green colour core: if the core is yellow moisture is present in the circuit. In this event it is necessary for dehydration of the circuit to take place. This must be performed by qualified people only. Check that there are no continuous vapour bubbles present at the sight glass. This would indicate a shortage of refrigerant. A few vapour bubbles are acceptable.
- Few minutes after start up, check that the equivalent temperature of the refrigerant gas, measured at the pressure inside the finned coil with fans running at full speed, differs from the outside air temperature of about 7-10°C; also verify that the equivalent temperature of the refrigerant gas, measured at the pressure in the plate heat exchanger, differs from the temperature of the water outlet from the exchanger of about 3-5°C.

## POSITION OF THE CONTROLPANEL





## Display icons

Icon	Meaning	Icon	Meaning
	Number of compressors in operation.		Indicates that the electric heaters are active.
	Water pump		Economy or ON/OFF by timetable.
	Indicates that the fans are working.		Free cooling is active (not available).
	Indicates that an alarm is active.		Domestic hot water.
	Economy function		Indicates that the defrost is active.
	Unloading function (not available).		

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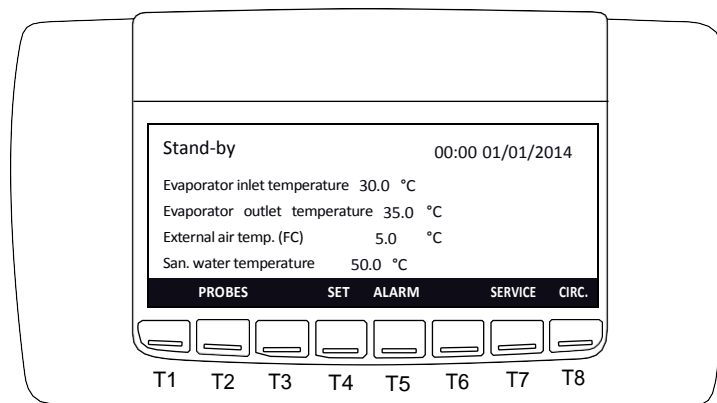
## Key function

---

T2:	<b>PROBES</b>	Allows to read the value of the probes configured
T3:		Allows to switch on the unit in cooling mode
T4:	<b>SET</b>	Allows to read and modify the set point
T5:	<b>ALARM</b>	Allows to read and reset the alarms
T6:		Allows to switch on the unit in heating mode
T7:	<b>SERVICE</b>	Allows to enter the SERVICE menù
T8:	<b>CIRC</b>	Allows to read the main information of the circuits (compressor status, water pump status, pressure probe value,)

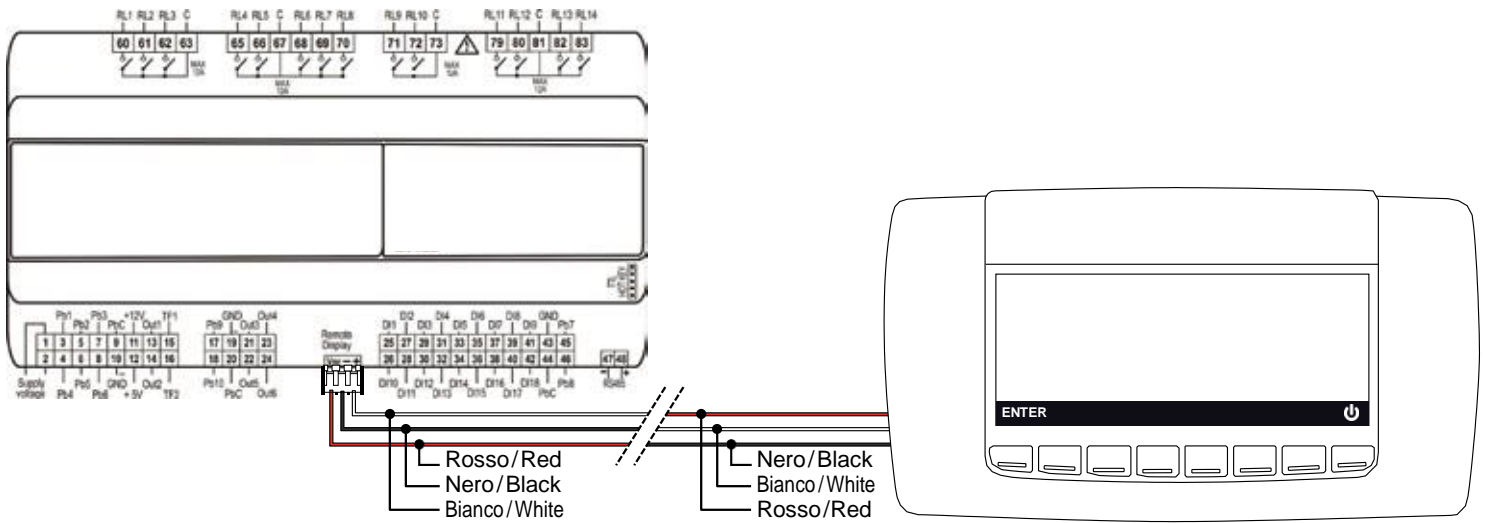
---

When the unit is turned on, the display will be as follows:



## TO REMOTE THE CONTROL

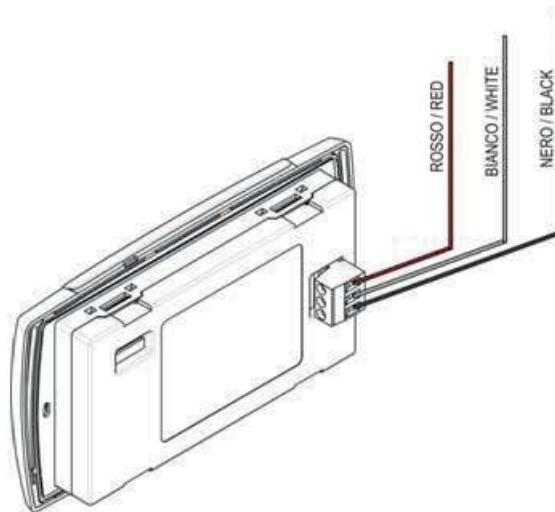
### Remote keyboard connection (VGI890)



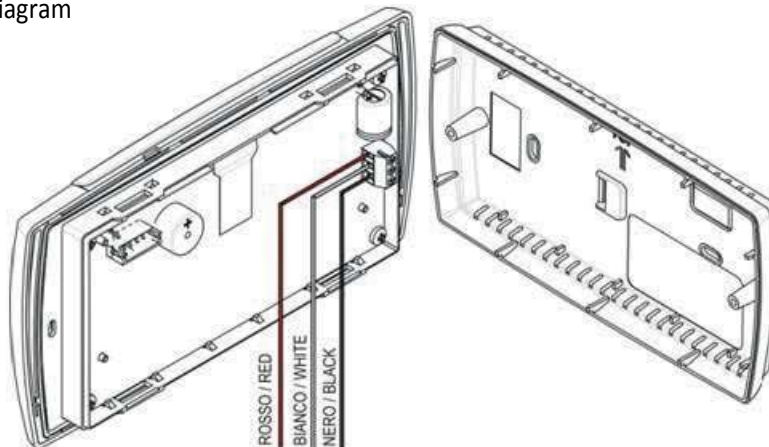
**Special care must be taken when connecting the keyboard to the chill200D, to avoid irreparable damage to the controller or/and keyboard**

- In case of power supply failure (wire black or red), the keyboard doesn't work.
- In case of communication problems, the display shows "noL" message.

### Panel mounting connection diagram



### Wall mounting connection diagram



---

## SWITCH THE UNIT ON

Unit switch-on and switch-off can take place:

- From the keyboard
- From digital input configured as remote ON/OFF

Switch the unit on from the keyboard

### Heating mode

To start the unit in heating mode, press the  key. The icon  appears on the display.

If requested, the compressor safety delay countdown starts and the compressor icon flashes. The water pump will be activated after few seconds and then, once the compressor countdown has finished, the compressor starts and the icon remains on. The display shows the user water inlet temperature and Domestic hot water inlet temperature.

### Domestic hot water mode

At the first start up, the unit microprocessor control checks the domestic hot water inlet temperature measured by the sensor BTS (this has priority over the other parameters) and, if the measured temperature is lower than the domestic hot water set point, it will activate the domestic hot water mode automatically. If the unit is required to operate in heating and the domestic hot water temperature is higher than the set point (there is no requirement for domestic hot water) the microprocessor control will activate the unit in heating mode. If the unit is required to operate in cooling and domestic hot water mode the microprocessor control will activate both functions at the same time. If domestic hot water is not required, the microprocessor control will activate cooling mode only.

In stand-by mode, the controller gives the possibility to:

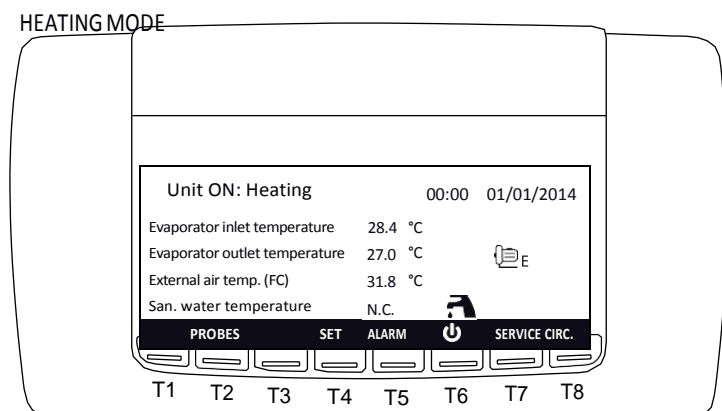
- display the set values
- manage alarms, their display and reports.



**If it is required to switch the unit on and off, never do this using the main isolator: this should only be used to disconnect the unit from the power supply when the unit is to be permanently off. Isolation will result in no supply for the crankcase heater and on start up the compressor could be seriously damaged.**

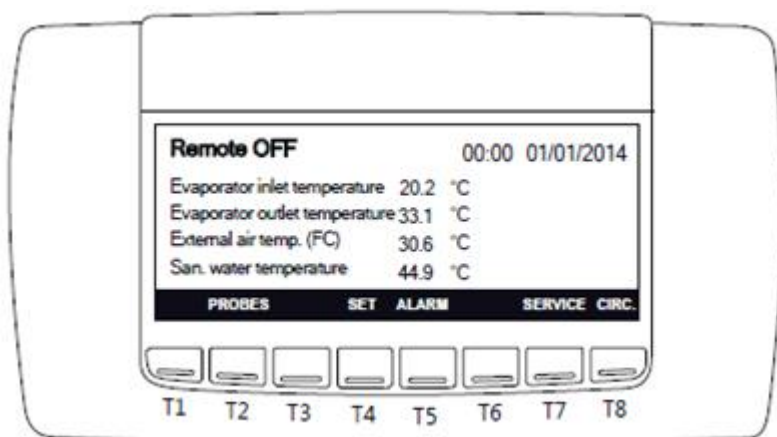
## Heating and cooling mode

The display shows the typical visualization during the unit working in:



## SWITCH THE UNIT ON FROM DIGITAL INPUT


If the unit is switch off by remote digital input, the display shows:

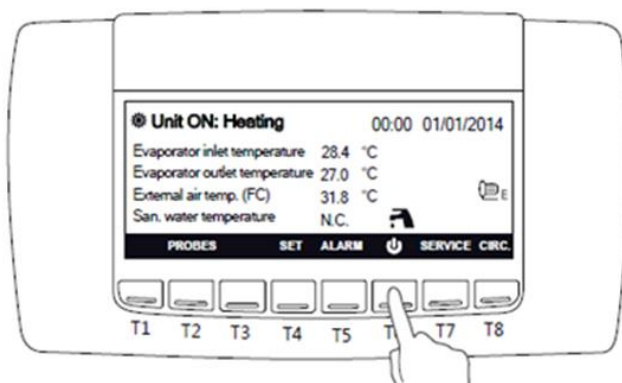


When the digital input is not active, the unit is in OFF mode

- The remote input has the priority with respect to the keyboard
- The unit can only be switched-on and off if the remote input is activated

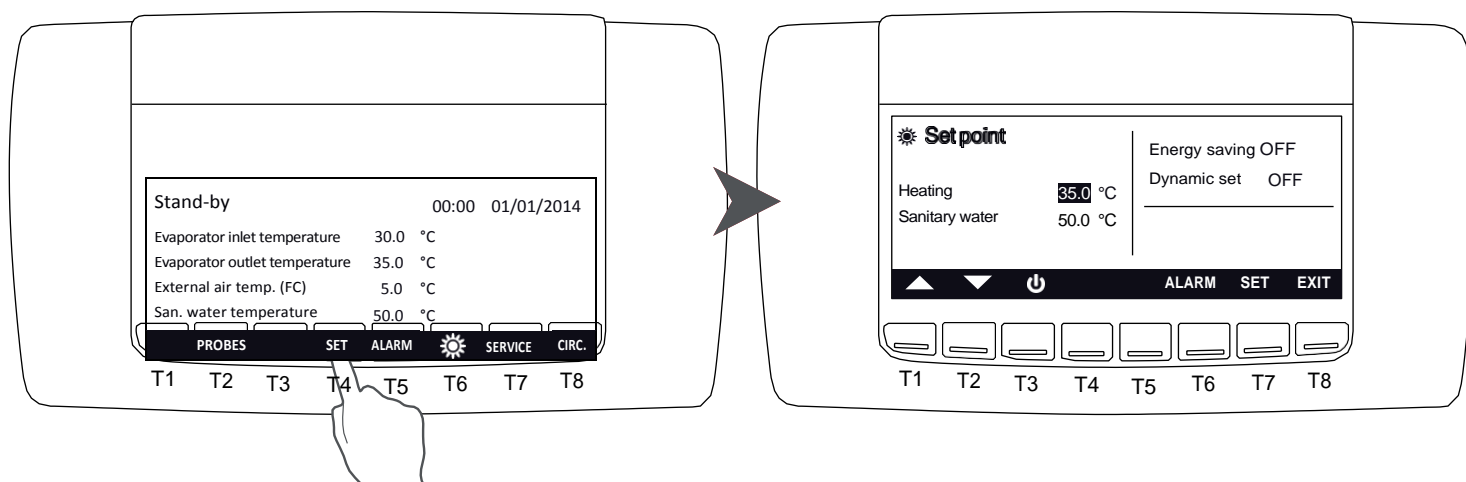
## STOP

To switch the unit off press the key 



## SET POINT

To change the set-point from the main screen, press **SET**.



To modify the values, move the cursor with ; press **SET** to select, the value starts blinking, change the data pressing and . Once the required value is reached, press again **SET** to confirm.

The cursor will automatically position itself on the next value, to modify it, repeat the operation just described.

In this screen it is also possible to verify (but not modify) whether the energy saving mode and dynamic set are active.

Press **EXIT** to go back to the main menu.



All set points refer to the return temperature from the plant. In case hot water at 45°C is requested and the dt is 5°C, then the set point must be set at 40°C. In case the dt is 8°C, then the set point must be set at 37°C. In case cold water is requested, for example at 15°C and the dt is 5°C, then the set point must be set at 20°C. If the dt is 8°C, then the set point must be set at 23°C.

## Adjustable parameters

The adjustable set point that can be modified by the end user are:

Function	Adjustment limit	Default value
Heating set-point	10÷55°C	35°C
Domestic hot water set-point	20÷55°C	50°C
Cooling set-point	10÷25°C	23°C
Set point compensation	0÷15°C	10°C
Password	(Contact Lochinvar)	

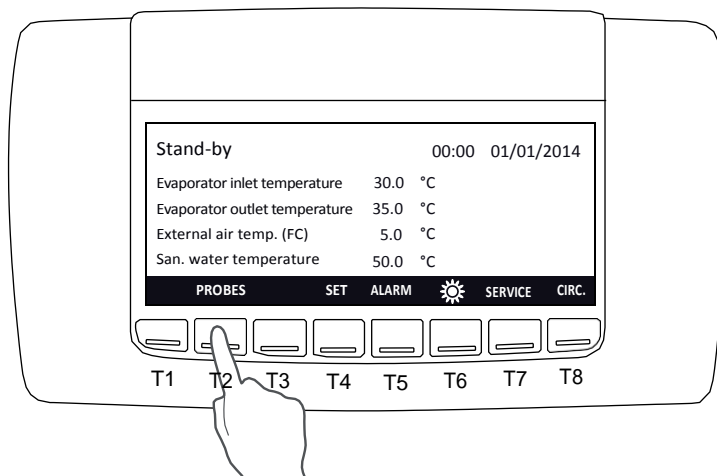


The units are supplied with a very sophisticated control system with many other parameters that are not adjustable by the end user; these parameters are protected by a manufacturer password.

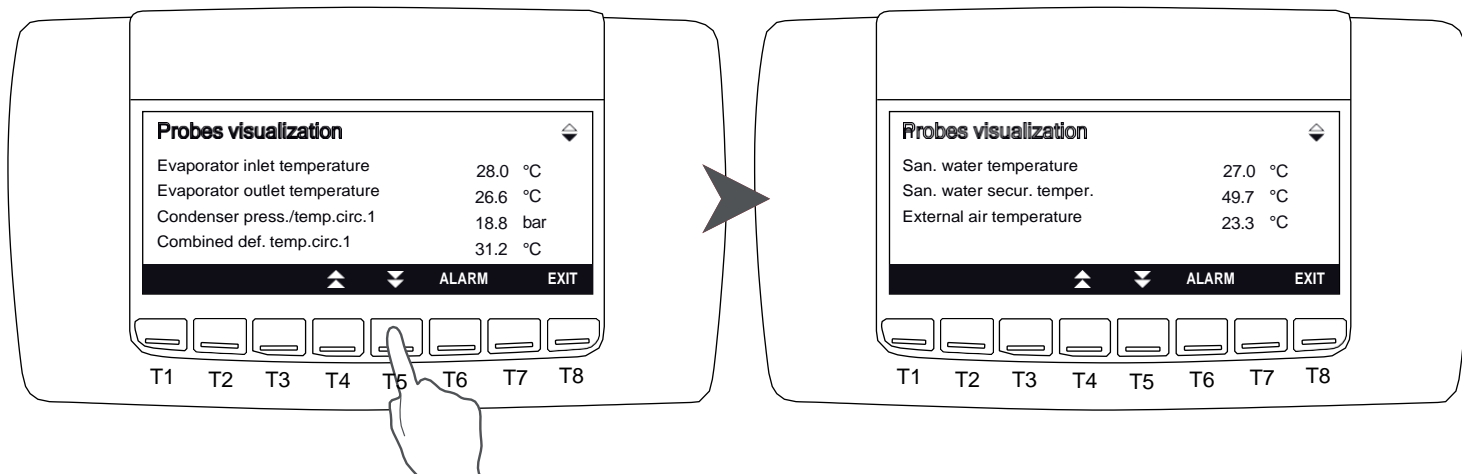


## PROBES KEY

To view all the parameters measured by the sensors of the unit press **PROBES**;



By pressing the **▼** key, all relevant values of the circuit will be displayed



Press **EXIT** to go back to the main menu.

## ALARM KEY

When the alarm occurs, the display shows the icon  blinking.

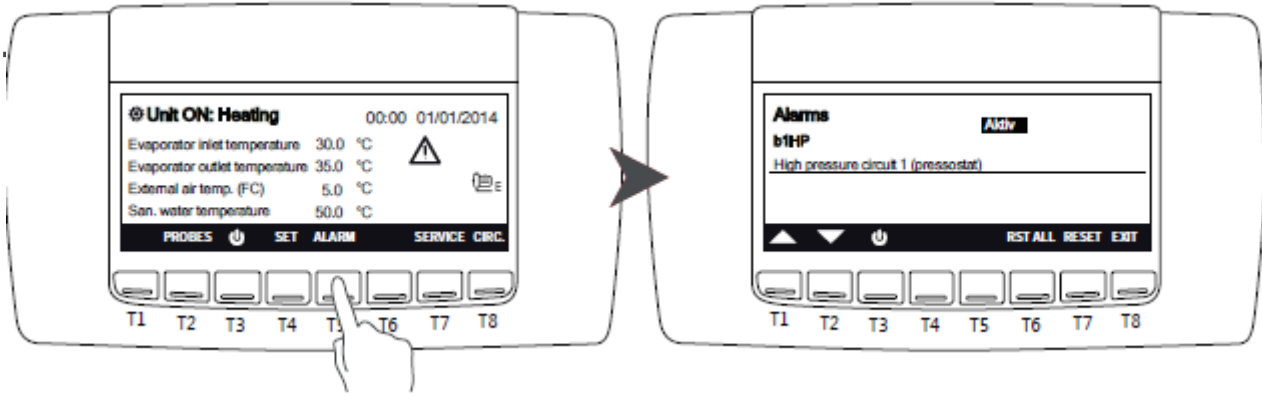
Press **ALARM** key to read the alarm status:

The alarm status can be:

- **Reset:** the alarm is not active and it is possible to reset it. Press **▲** and **▼** keys to select the alarm to select it and press **RESET** key to reset the alarm.
- **Password:** in this case the alarm is no longer active, but you need a password to reset it (please contact Lochinvar).
- **Active:** the alarm is still active and it is not possible to reset it.

In case more resettable alarms are present, it's possible to reset all of them at once pressing **RSTALL** key.

In any case, even if all the alarms are reset, they remain present in the alarm history (par. 6.7.7).



**CIRC KEY**

Pressing **CIRC** can view the different parameters of the unit:

Pressing **▲** and **▼** you move from one screen to another while with **▲** and **▼** you scroll through the menu items. Press **ENTER** key to view the values.

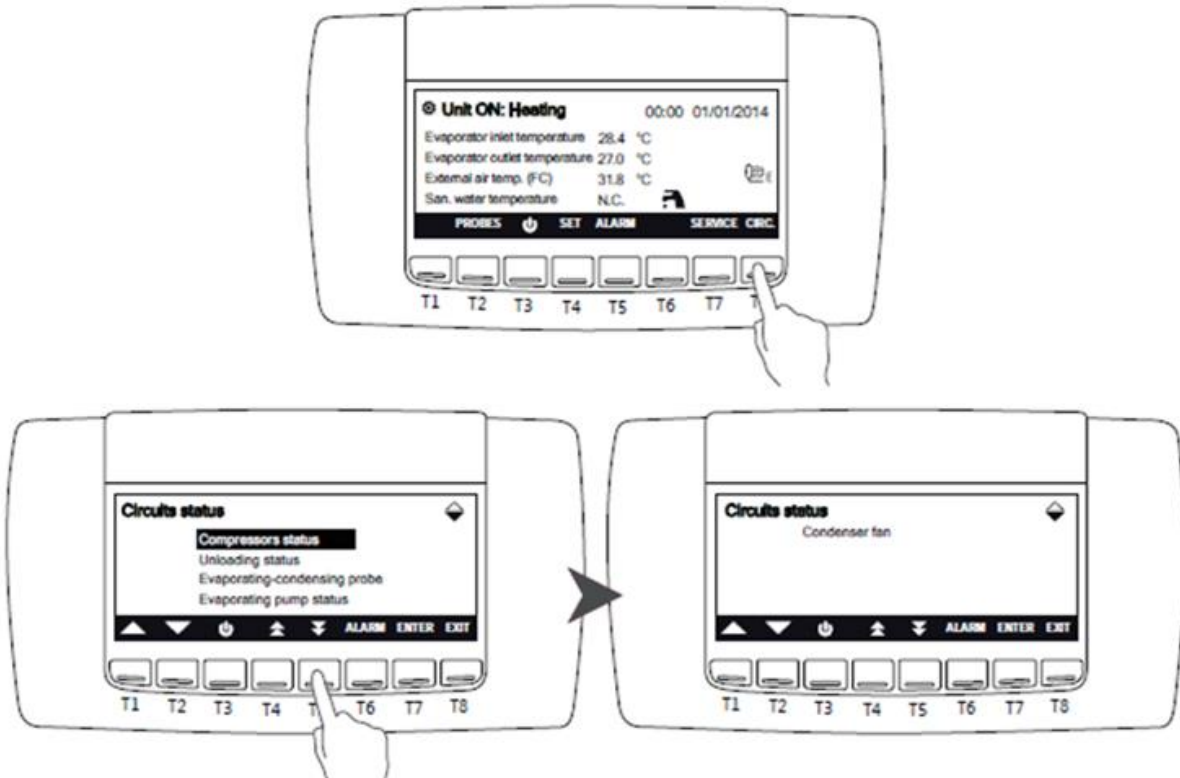
**State of the compressors;** the display shows compressors present in each circuit and the activation status of each one.

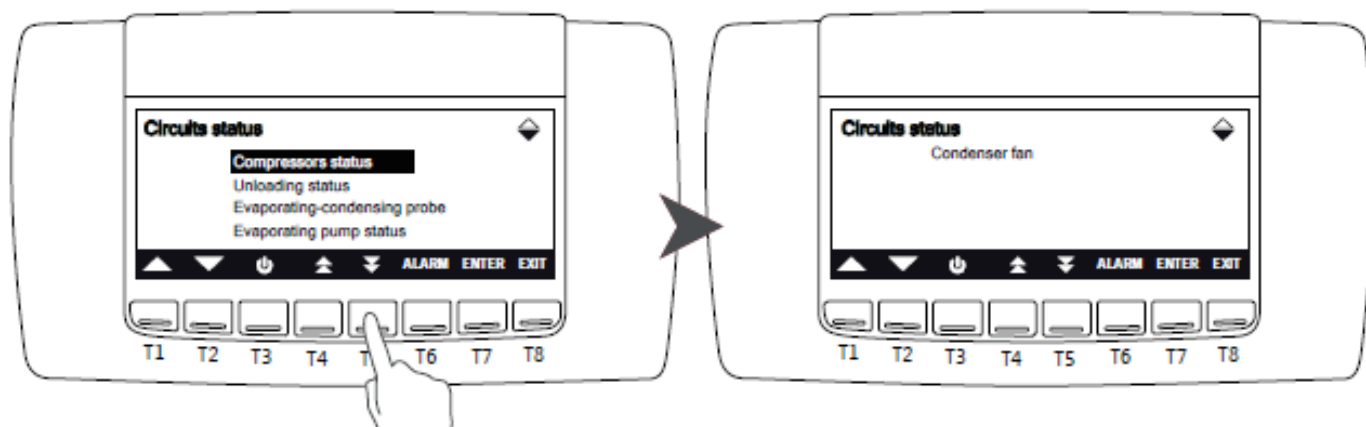
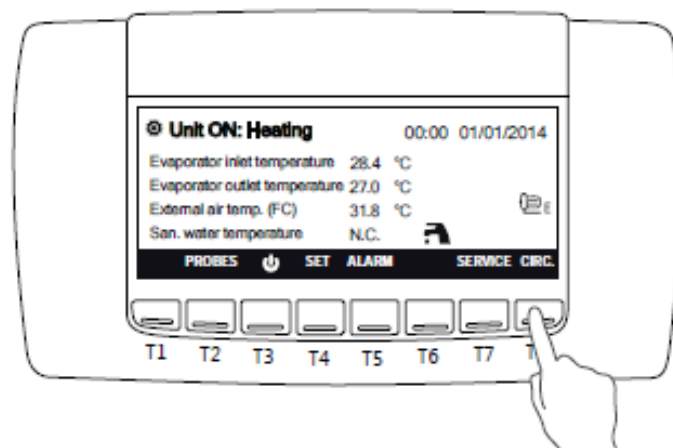
**Colour black:** compressor running

**Colour white:** compressor on standby

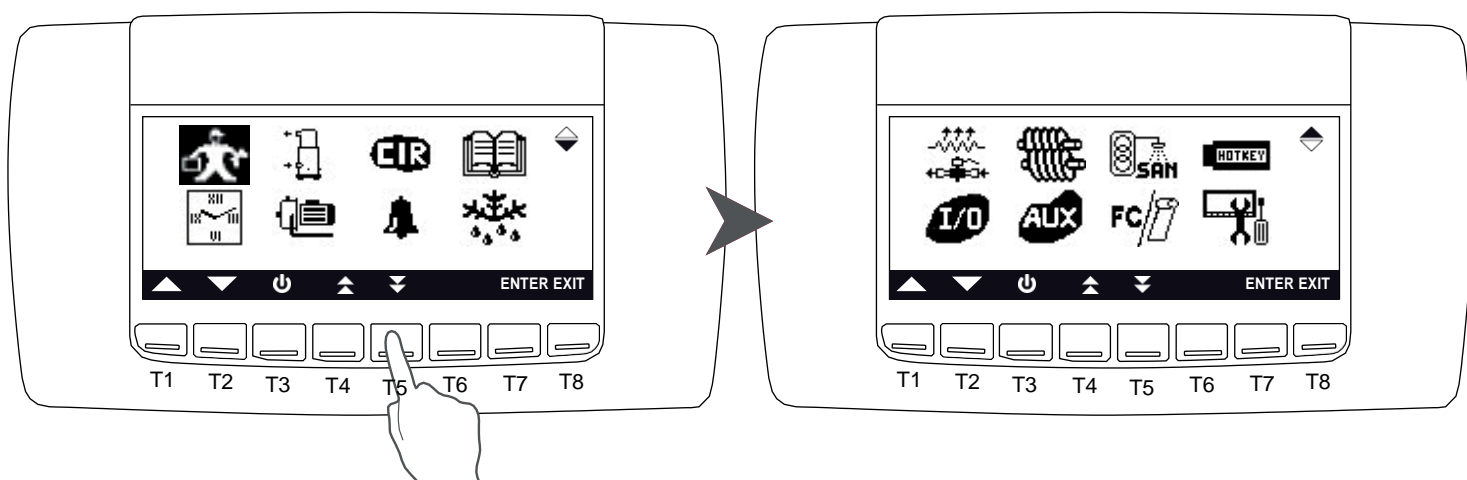
In case of use of compressors in part-loading (typically screw compressors) an icon appears to the right of the compressor showing the level of step control.

In case of use of On/Off compressors (Scroll) no icon appear to the right of the compressor.























## SERVICE KEY



Press the **SERVICE** key to access the following menus:

	Setting parameters (for service only)		Electrical heater and pump down valve status
	Time and date setting		I/O status (Inputs and Outputs)
	Compressors status		Screw compressor information (Not configured)
	Pumps		Auxiliary outputs
	Circuit maintenance		Domestic hot water (if available)
	Display of alarms		Free cooling and Solar panel visualization (if available)
	Alarm history		Upload and download parameter map with Hot Key
	Defrost (if available)		Control panel




Press  key to display all the menu available.

To modify and set the parameters move the cursor using the  and , press **ENTER**, to select the required menu, and then **SET** to select the desired value.

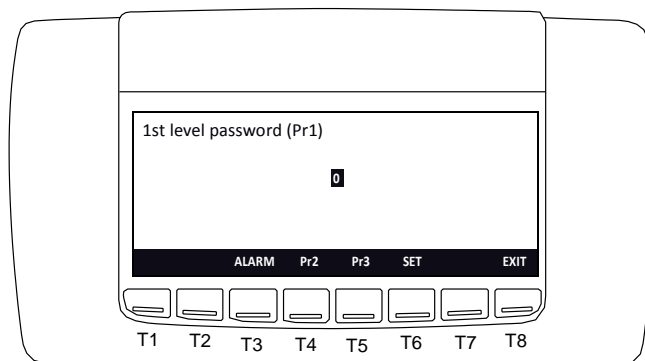
Change the parameters by pressing the  and , and then press **SET** again to confirm.


Press the **EXIT** key to return to the main menu.

## Service parameters setting

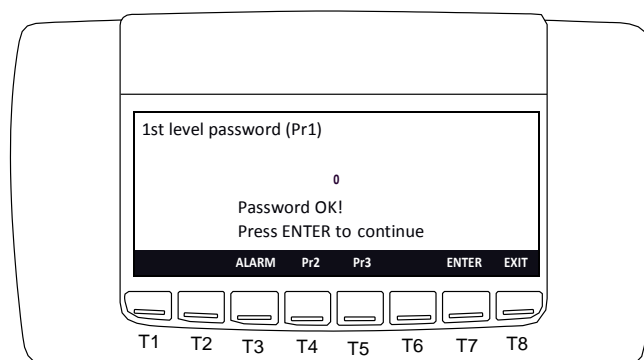
To enter service menu select  moving between the icons with  and  keys and press **ENTER**.



The system prompts you to enter the password to access to different levels of security.



The first level allow to modify some parameters as for example heating and cooling set points and dynamic set points. Press **SET** key, with  modify the password to 1 then press **SET** again to confirm.

The display show:



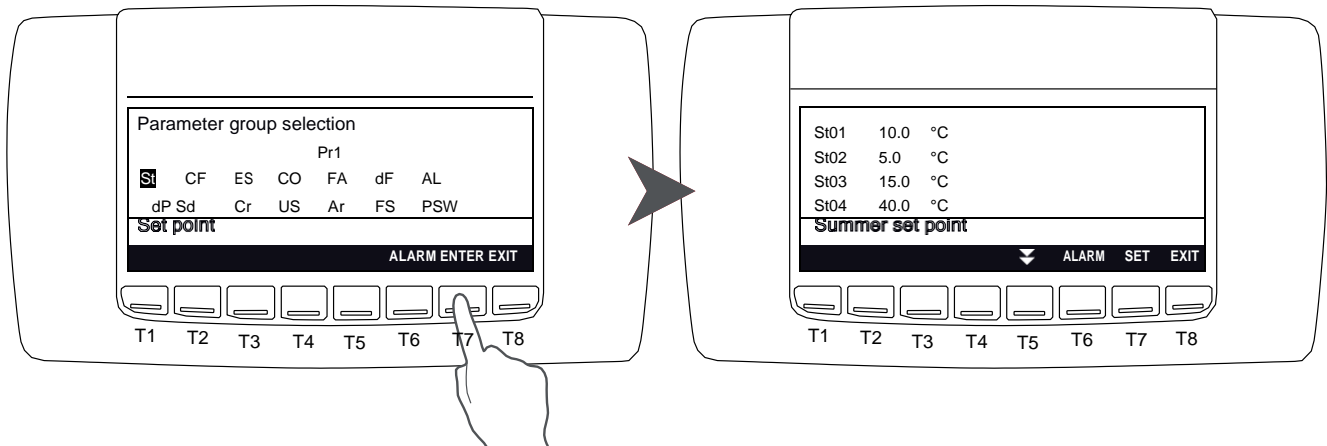
Press  and  to scroll through different groups of parameters. With password level 1 you could only change the Set Point (**St**), dynamic Set point (**Sd**), and parameters of sanitary circuit (**FS**); the unit must be switched on. Press **ENTER** to enter in the group of parameters. Other parameters can only be modified by service with a dedicated password. Other parameters could be modified by service people only with a dedicated password.

Parameters list:

Code	Meaning	Code	Meaning
<b>St</b>	Set point	<b>US</b>	Auxiliary output
<b>dP</b>	Main visualization	<b>FA</b>	Fan
<b>CF</b>	Configuration	<b>Ar</b>	Antifreeze
<b>Sd</b>	Dynamic set	<b>dF</b>	Defrost
<b>ES</b>	Energy saving	<b>FS</b>	Sanitary water
<b>Cr</b>	Compressor racks	<b>AL</b>	Alarms
<b>CO</b>	Compressor		

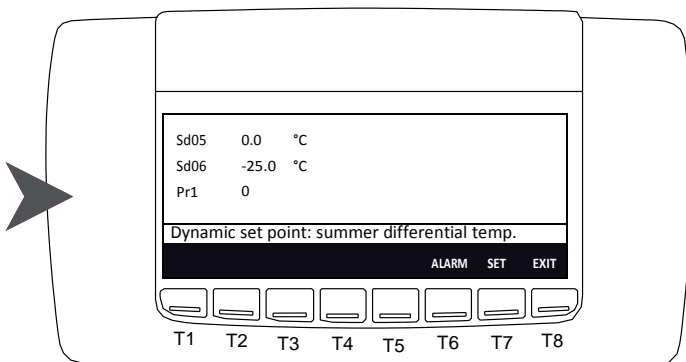
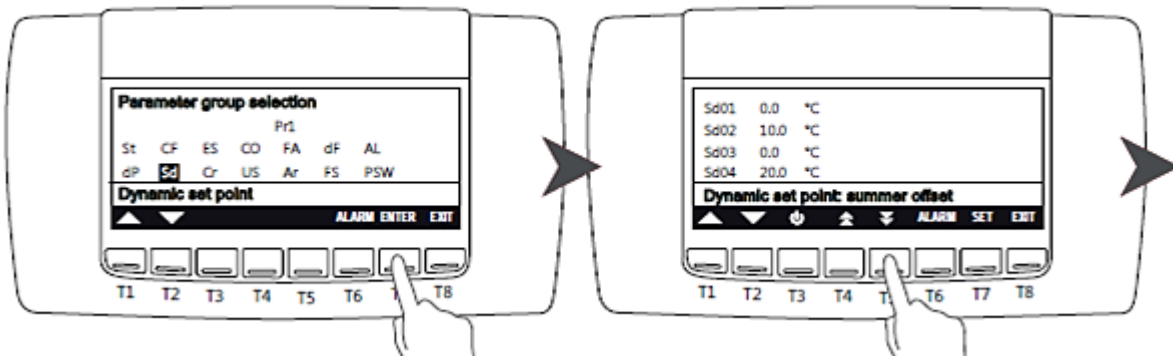
To modify the value of the parameter: press ▲ or ▼ to select the parameter to modify then press **SET** the value start to blinking, press ▲ and ▼ to modify, than press **SET** again to confirm.

The values available in the group of parameters "Set point" (St) are: summer set point (St01), winter set point (St04), summer regulation band (St07) and winter regulation band (St08).



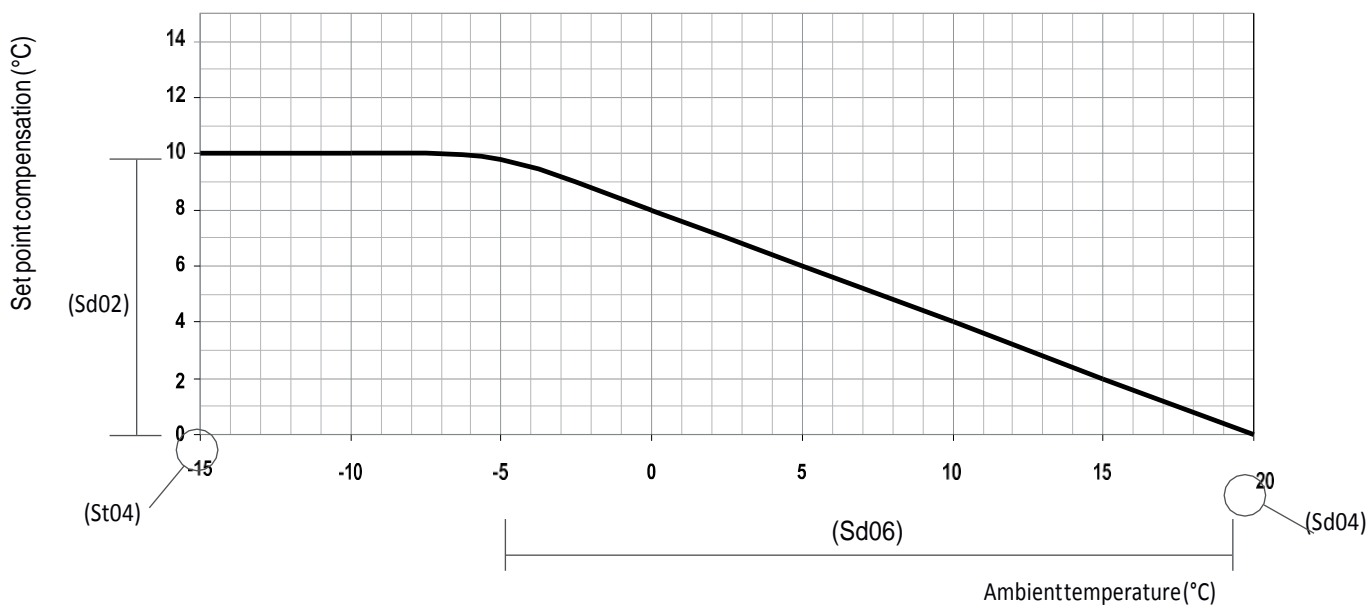
The values available in the group of parameters "Dynamic set point" (Sd) are: dynamic set point: summer offset (Sd01), dynamic set point: winter offset (Sd02), dynamic set point: summer outside temp. (Sd03), dynamic set point: winter outside temp. (Sd04), dynamic set point: summer differential temp. (Sd05) and dynamic set point: winter differential temp. (Sd06).

For more information about the parameters see par. 6.3.1 and 6.3.2.



## WEATHER COMPENSATED FUNCTION

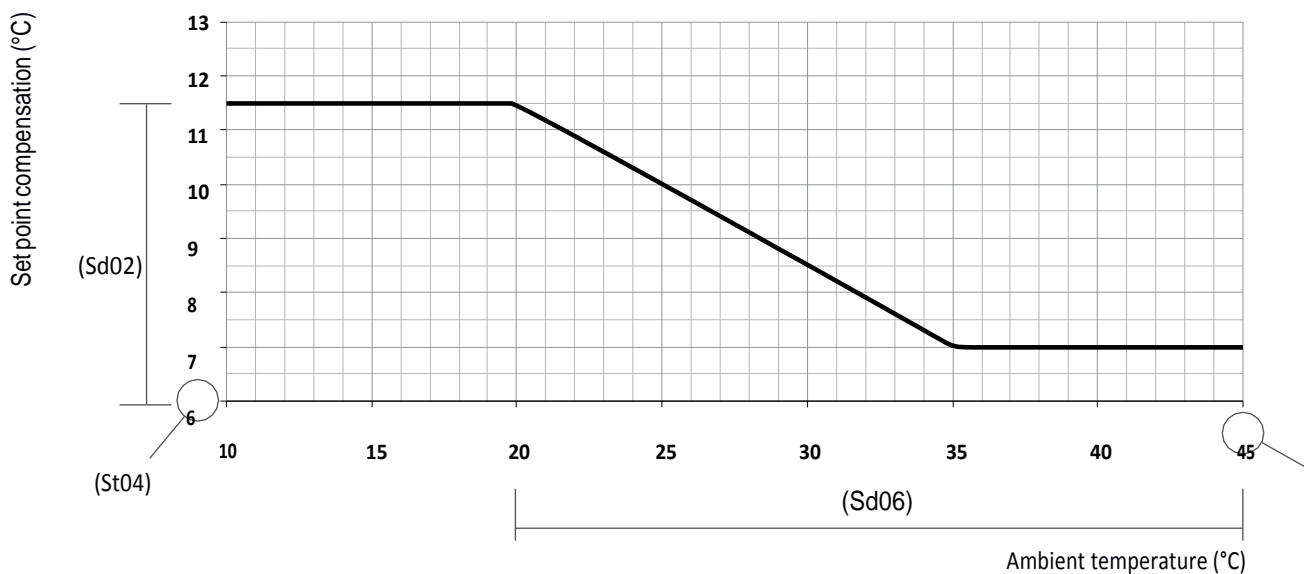
This function makes it possible to activate the weather compensation sensor in order to optimize the efficiency of the unit. Automatically it modifies the set-point value with respect to external air temperature: a calculation is performed on the set-point to provide a revised value of set point for higher ambient conditions (see example given below). This function makes it possible to save energy and to operate the unit in severe ambient conditions. This function is only active in heating mode.



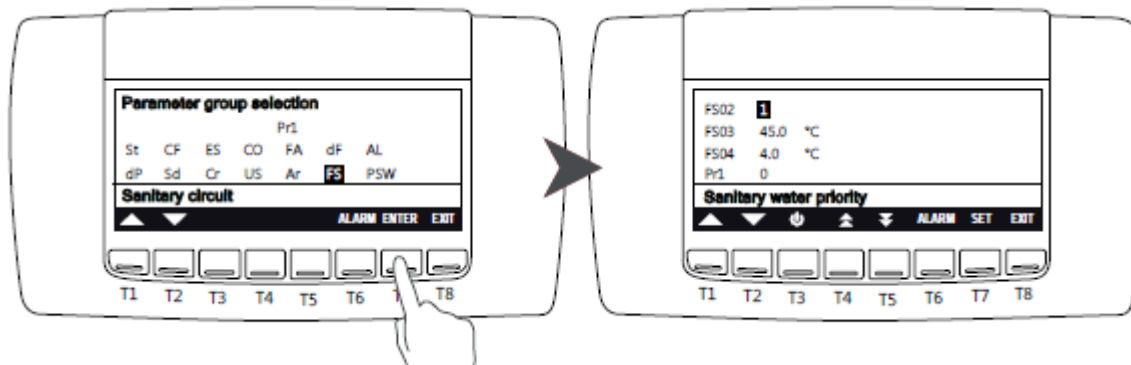
All units are factory set with the weather compensated function activated. The slope starts at +20°C with a differential of 10°C.






With the energy saving mode activated, if the SET key is pressed twice the bottom of the display shows the SETTR (weather compensated set point) label that is the specific set point calculated by the microprocessor control for the measured ambient temperature condition.





The values available in the group of parameters "Sanitary circuit" (FS) are: Sanitary water priority (FS02), Sanitary water set point (FS03), Sanitary water proportional band (FS04).

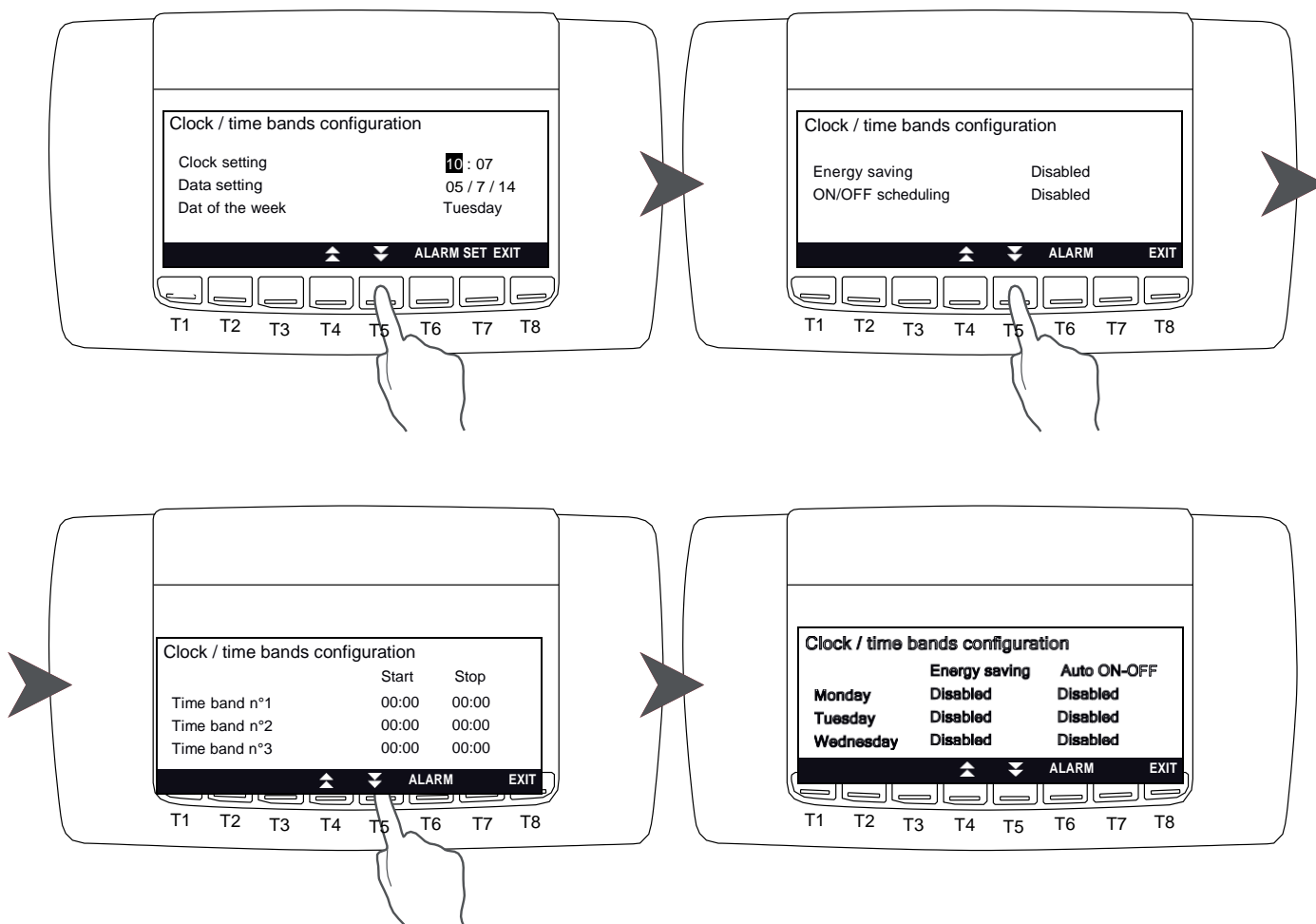


### SETTING DATE AND TIME

To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.






Press  and  to select the value you want to edit than press **SET**. The selected parameter will start blinking, press  and  to set the value and than press **SET** to confirm.

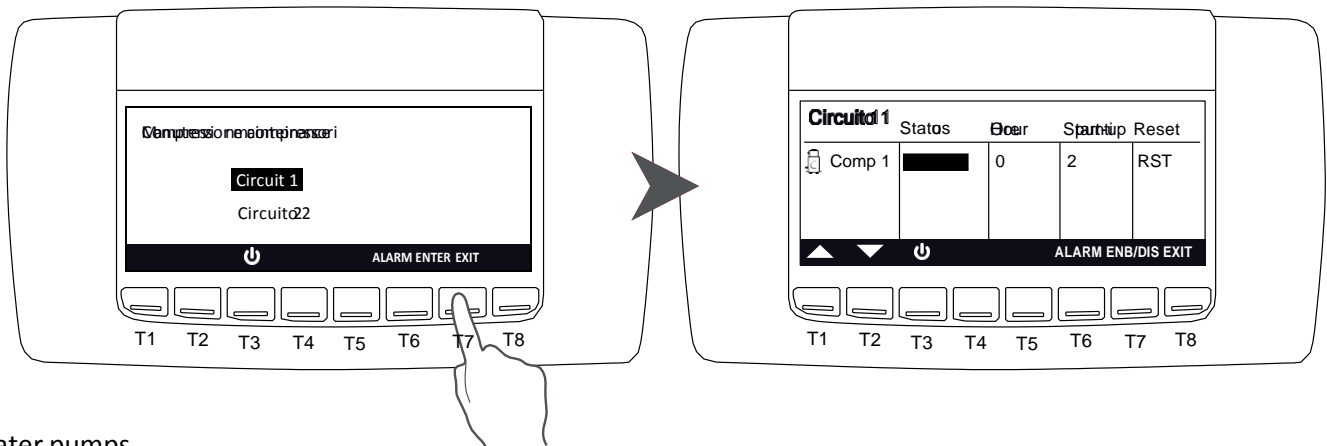
Pressing  it is possible to read the information about the Energy saving, ON/OFF scheduling and time bands. To modify the hour of the time band and to enable the function is necessary to insert the password, in case you do not have a password, you can only view the different parameters..








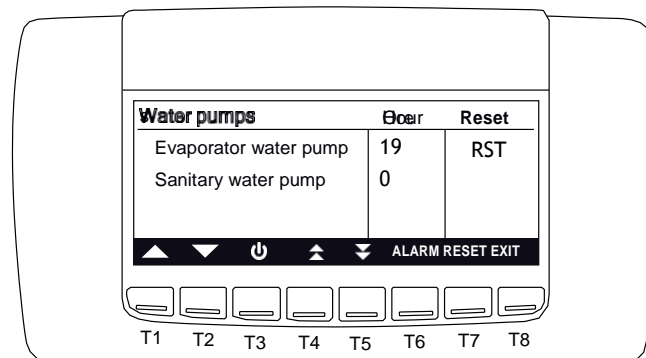
## COMPRESSOR MAINTENANCE

To enter this menu  moving between the icons with the keys  and  and press **ENTER**.  
 It is possible to display the compressors working hour and the number of activations. Select the circuit with the keys  and  than press **ENTER** to display the parameters. The disabling function of the compressors **ENB/DIS** is only possible by service people.






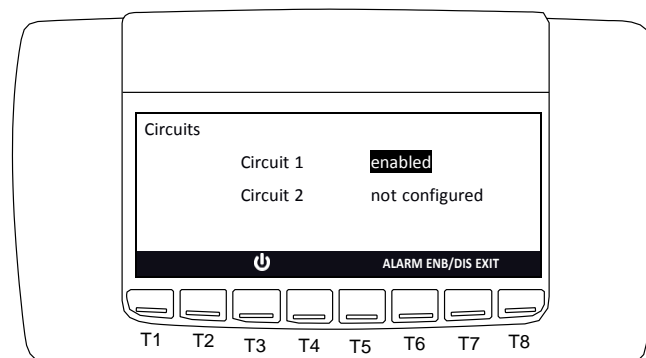
## Water pumps

To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.  
 It is possible to display the working hours of water pumps. The function **RESET** is only possible by service people.






## CIRCUIT MAINTENANCE

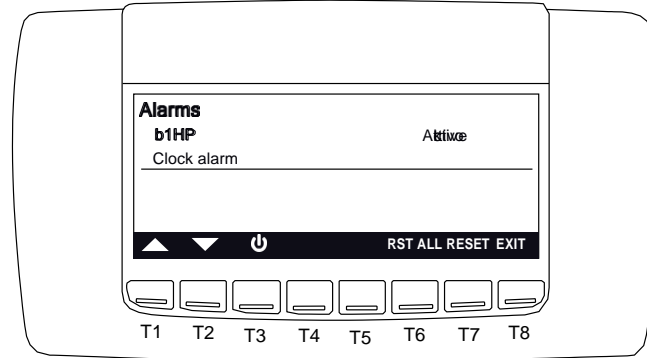
To enter this menu  moving between the icons with the keys  and  and press **ENTER**.  
 It is possible to display the status of the circuits. The function **ENB/DIS** is only possible by service people.






## ALARMS



To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.

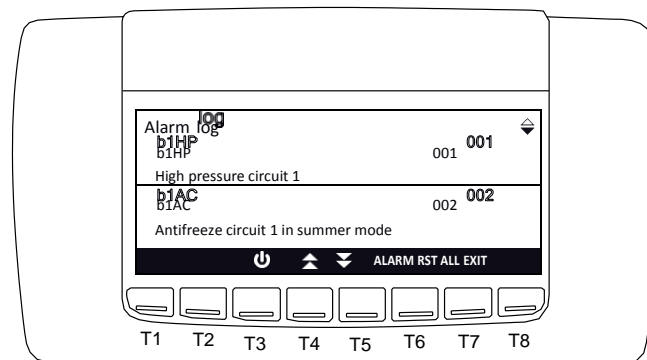
For the management of alarms see par. 6.5.






## Alarm log

To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.

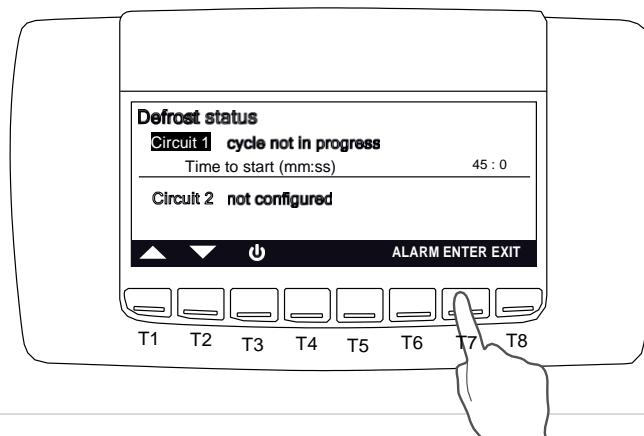
Pressing  and  it is possible to read the last 99 alarms. The function of reset of all alarms **RST ALL** is only possible by service people.



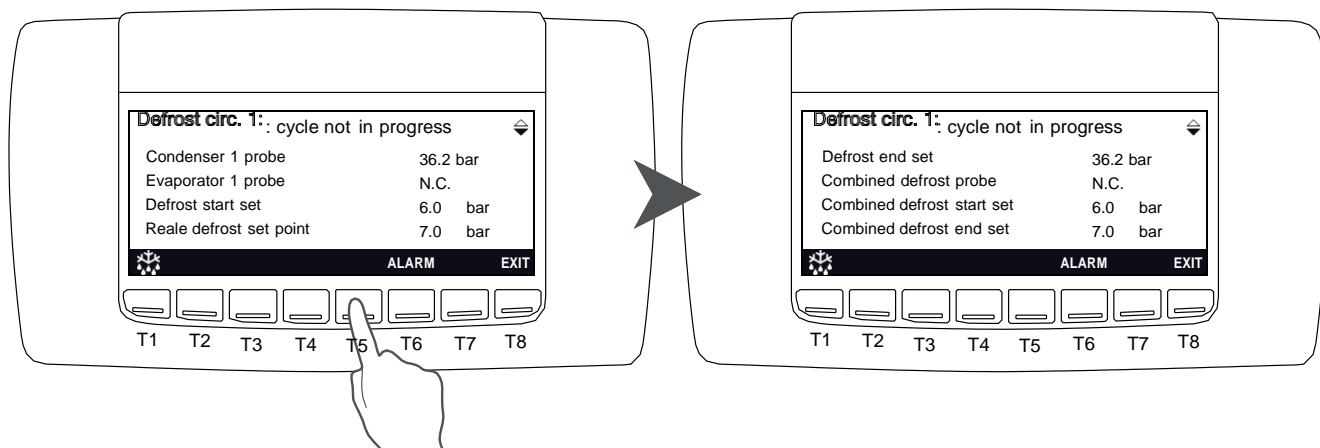
## DEFROST

To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.

For each circuit it is possible to read the status of the defrost and, after selecting the circuit, pressing the **ENTER** key it is possible to display some parameters relating to the defrosting of the circuit (values related to the probes and to the set points).





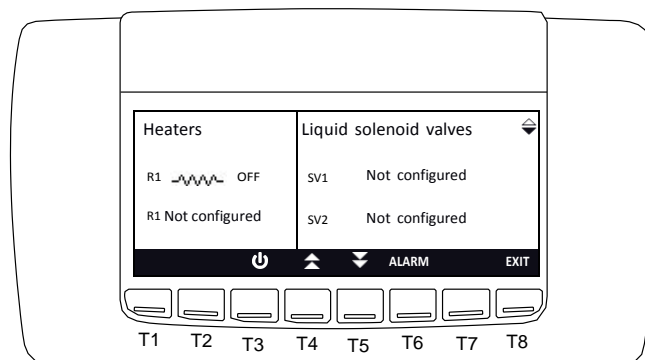
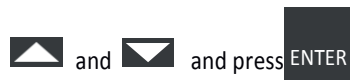
Press  and  to display all the available parameters.






### ELECTRICAL HEATER

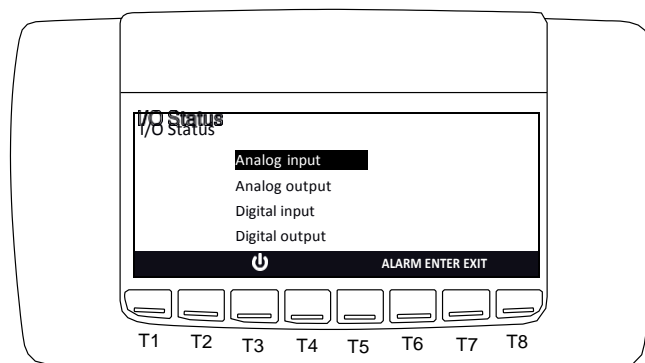
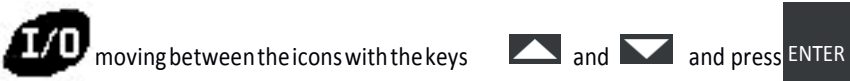


To enter this menu moving between the icons with the keys  and  and press **ENTER**.  
It is possible to read the status of the electrical heaters.




### I/O STATUS (INPUT/OUTPUT)



To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.  
It is possible to display: probes status, analogue input and output, digital input and output.

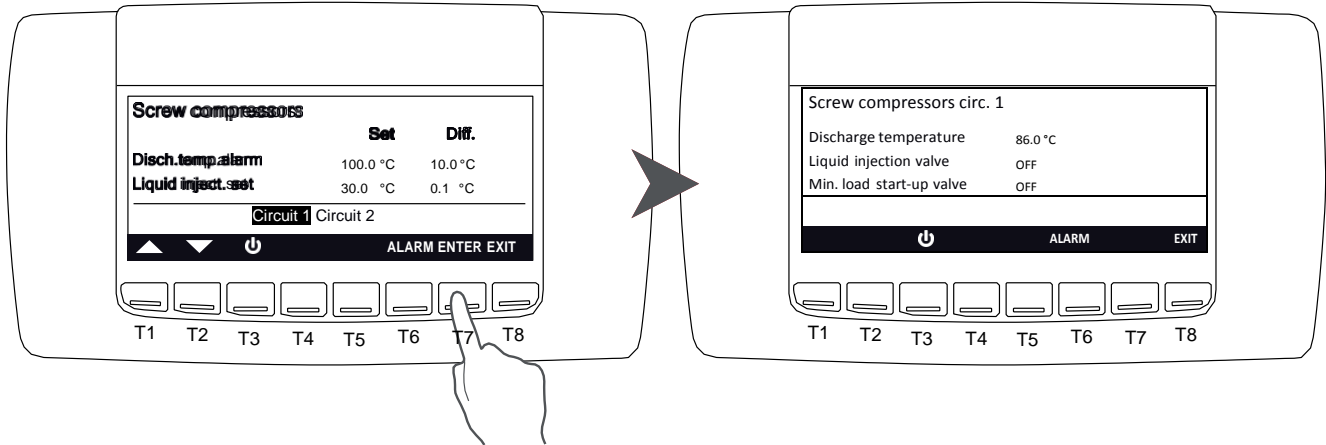


## SCREW COMPRESSOR (IF AVAILABLE)






To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.

In the main screen it is possible to display the discharge temperature and the liquid injection set point. Press  and  keys to select the required circuit than press **ENTER** key to read the discharge temperature and the status of the valves.

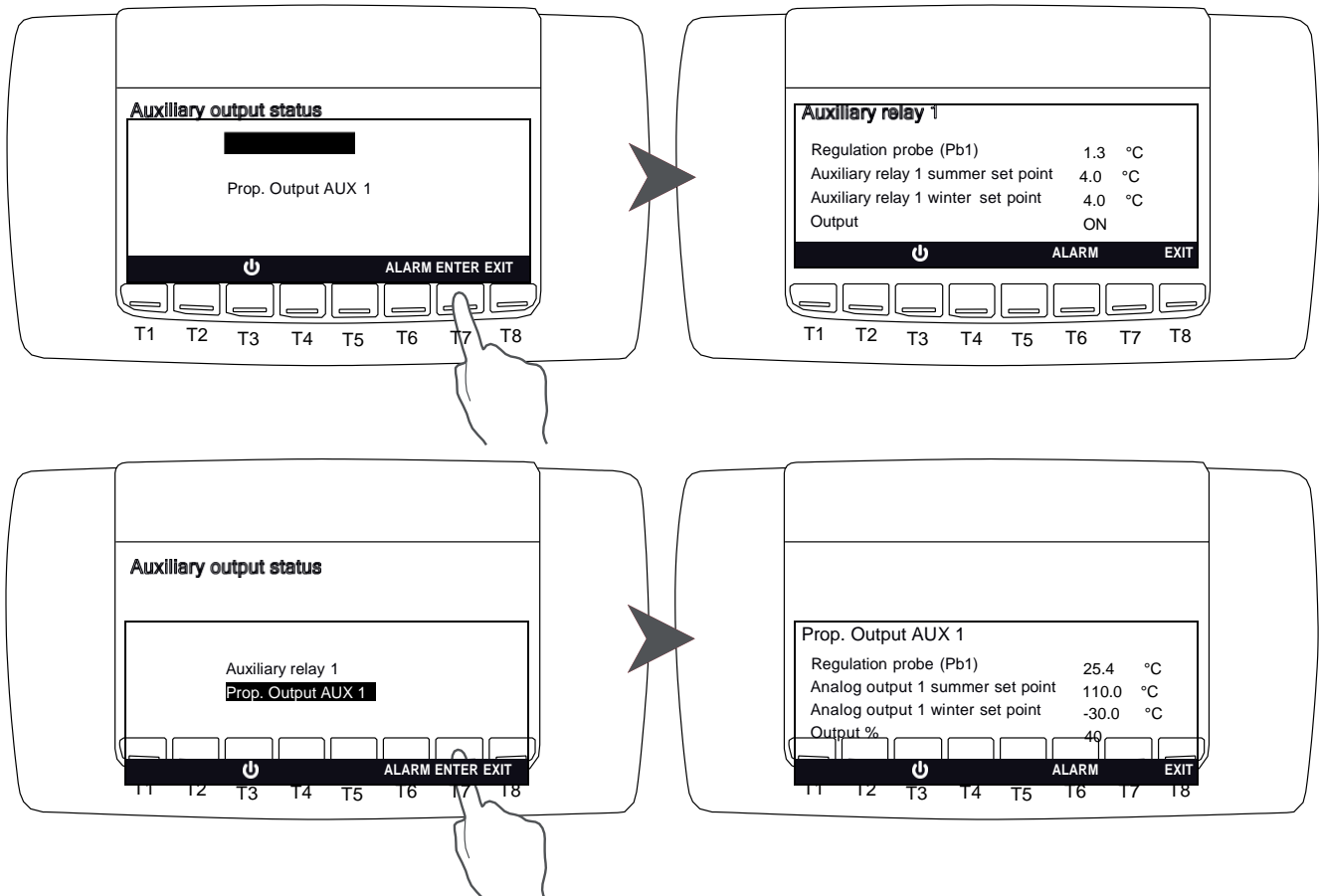


## AUXILIARY OUTPUT



To enter this menu select  moving between the icons with the keys  and  and press **ENTER**.

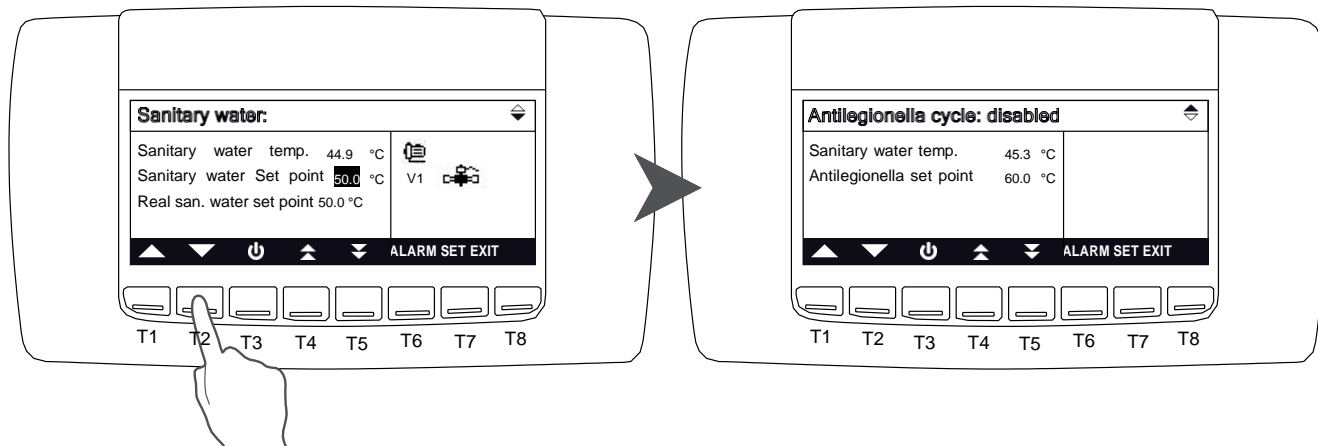
It is possible to read information about auxiliary outputs.



## SANITARY WATER

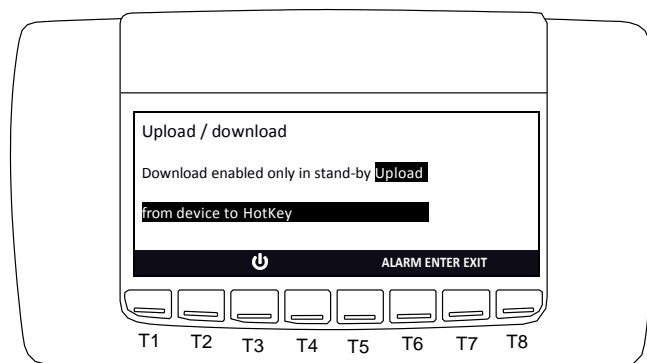


To enter this menu select **SAW** moving between the icons with the keys and and press **ENTER**.  
It is possible to read information of the sanitary water regulation. Press **SET** key to modify the values.



## UPLOAD / DOWNLOAD

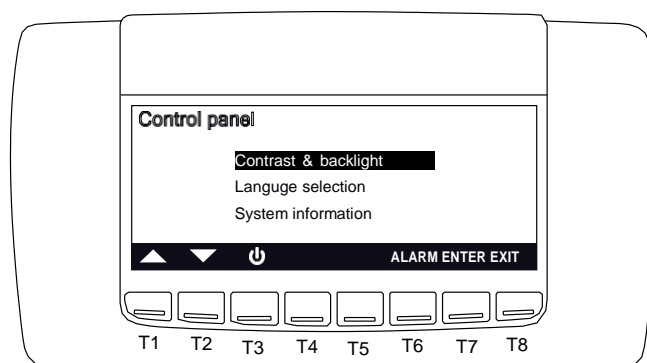
To enter this menu select **HOTKEY** moving between the icons with the keys and and press **ENTER**.  
This function is allowed only to the service.



## CONTROL PANEL



To enter this menu select **SAW** moving between the icons with the keys and and press **ENTER**.



## 6.8 ACOUSTIC SIGNAL SILENCING

Pressing and releasing one of the keys; the buzzer is switched off, even if the alarm condition remains in place.

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## 7. MAINTENANCE OF THE UNIT

### General warnings



Starting from 01/01/2016 the new European Regulation 517\_2014, "Obligations concerning the containment, use, recovery and destruction of fluorinated greenhouse gases used in stationary refrigeration, air conditioning and heat pumps", became effective. This unit is subject to the following regulatory obligations, which have to be fulfilled by all operators:

- (a) Keeping the equipment records
- (b) Correct installation, maintenance and repair of equipment
- (c) Leakage control
- (d) Refrigerant recovery and disposal management
- (e) Presentation to the Ministry of the Environment of the annual declaration concerning the atmospheric emissions of fluorinated greenhouse gases.

### Maintenance can:

- Keep the equipment operating efficiently
- Prevent failures
- Increase the equipment life



It is advisable to maintain a record book for the unit which details all operations performed on the unit as this will facilitate troubleshooting.



Maintenance must be performed in compliance with all requirements of the previous paragraphs.



Use personal protective equipment required by regulations as compressor casings and discharge pipes are at high temperatures. Coil fins are sharp and present a cutting hazard.



If the unit is not to be used during the winter period, the water contained in the pipes may freeze and cause serious damage. In this event, fully drain the water from the pipes, checking that all parts of the circuit are empty including any internal or external traps and siphons.

### Drive access

Access to the unit once installed, should only be possible to authorized operators and technicians. The owner of the equipment is the company legal representative, entity or person owns the property where the machine is installed. They are fully responsible for all safety rules given in this manual and regulations. If it is not possible to prevent access to the machine by outsiders, a fenced area around the machine at least 1.5 meters away from external surfaces in which operators and technicians only can operate, must be provided.

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## PERIODICAL CHECKS



The start-up operations should be performed in compliance with all requirements of the previous paragraphs.



All of the operations described in this chapter **MUST BE PERFORMED BY TRAINED PERSONNEL ONLY**. Before commencing service work on the unit ensure that the electric supply is disconnected. The top case and discharge line of compressor are usually at high temperature. Care must be taken when working in their surroundings. Aluminium coil fins are very sharp and can cause serious wounds. Care must be taken when working in their surroundings. After servicing, replace the cover panels, fixing them with locking screws.

### Every 6 months:

It is advisable to perform periodic checks in order to verify the correct working of the unit.

- Check that safety and control devices work correctly as previously described.
- Check all the terminals on the electric board and on the compressor are properly fixed.
- Check and clean the sliding terminals of the contactors.
- Check for water leaks in the hydraulic system.
- Check correct operation of the flow switch and clean the strainers on the pipework.
- Check the compressor crankcase heater has the proper supply and is functioning correctly.
- Check the state of the finned coil, removing any debris or leaves. If possible, use compressed air to blow through in the opposite direction to the airflow. If the coil is heavily clogged, clean it with a low pressure washer, taking care to avoid damaging the aluminium fins.
- Check the state of the finned coils metallic filters (Optional), removing any debris or leaves. If possible, use compressed air to blow through in the opposite direction to the airflow. If the coil is heavily clogged, clean it with a low pressure washer, taking care to avoid damaging the aluminium fins.
- Check mounting of fan blades and their balancing.
- Check the colour of the sight glass core, if it has a yellow colour, check the oil acidity and make any replacement operations gas filter, oil etc.
- Check the oil level in the compressor using the appropriate sight glass.

### End of seasons or unit switched off:

If the unit is to be left out of commission for a long period, the hydraulic circuit should be drained down. This operation is compulsory if the ambient temperature is expected to drop below the freezing point of the fluid in the circuit (water or Glycol mix).

### Refrigerant circuit repair



If the refrigerant circuit is to be emptied, all the refrigerant must be recovered using the correct equipment.

For leak detection, the system should be charged with nitrogen using a gas bottle with a pressure reducing valve, until 15 bar pressure is reached. Any leakage is detected using a bubble leak finder. If bubbles appear discharge the nitrogen from the circuit before brazing using the proper alloys.



Never use oxygen instead of nitrogen: explosions may occur.

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Site assembled refrigerant circuits must be assembled and maintained carefully, in order to prevent malfunctions.

Therefore:

- Avoid oil replenishment with products that are different from that specified and that are pre-loaded into the compressor.
- In the event of a gas leakage on machines using refrigerant R407C, even if it is only a partial leak, do not top up. The entire charge must be recovered, the leak repaired and a new refrigerant charge weighed in to the circuit.
- When replacing any part of the refrigerant circuit, do not leave it exposed for more than 15 minutes.
- It is important when replacing a compressor that the task be completed within the time specified above after removing the rubber sealing caps.
- When replacing the compressor following a burn out, it is advisable to wash the cooling system with appropriate products including a filter for acid.
- When under vacuum do not switch on the compressor.

## 8. DECOMMISSIONING

### DISCONNECT THE UNIT



All decommissioning operations must be performed by authorized personnel in accordance with the national legislation in force in the country where the unit is located.

- Avoid spills or leaks into the environment.
- Before disconnecting the machine please recover:
  - the refrigerant gas;
  - Glycol mixture in the hydraulic circuit; (if used)
  - The compressor lubricating oil.

Before decommissioning the machine can be stored outdoors, providing that it has the electrical box, refrigerant circuit and hydraulic circuit intact and closed.

### DISPOSAL, RECOVERY AND RECYCLING

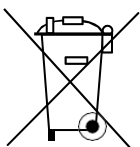
The frame and components, if unusable, should be taken apart and sorted by type, especially copper and aluminium that are present in large quantities in the machine.

All materials must be recovered or disposed in accordance with national regulations.



The refrigerant circuit of the unit contains lubricant oil that binds the disposal mode of components.

### RAEE DIRECTIVE (EU ONLY)



- The RAEE Directive requires that the disposal and recycling of electrical and electronic equipment must be handled through a special collection, in appropriate centres, separate from that used for the disposal of mixed urban waste.
- The user has the obligation not to dispose of the equipment at the end of the useful life as municipal waste, but to send it to a special collection centre.
- The units covered by the RAEE Directive are marked with the symbol shown above.
- The potential effects on the environment and human health are detailed in this manual.
- Additional information can be obtained from Lochinvar Limited.



## 9. DIAGNOSIS AND TROUBLESHOOTING

### FAULT FINDING

All units are checked and tested at the factory before shipment, however, during operation an anomaly or failure can occur.



**Be sure to reset an alarm only after you have removed the cause of the fault; repeated reset may result in irrevocable damage to the unit.**

Code	Alarm Description	Cause	Solution
ACF1	Configuration alarm	Wrong configuration of microprocessor control system.	Contact Lochinvar.
ACF2	Configuration alarm		
ACF3	Configuration alarm		
ACF4	Configuration alarm		
ACF5	Configuration alarm		
ACF6	Configuration alarm		
ACF7	Configuration alarm		
ACF8	Configuration alarm		
ACF9	Configuration alarm		
AEE	Eeprom alarm	Severe hardware damage in the microprocessor control system.	Switch OFF the unit and, after few second switch ON the unit; if the alarm appears again contact the service.
AEFL	User water flow switch alarm	Presence of air or dirtiness in the user hydraulic system.	Bleed carefully the user hydraulic system or check and clean the water strainer.
AEUn	Compressor unloading alarm (only units with 2 compressors)	User water temperature is too high.	Wait until the user water temperature is lower.
AHFL	Domestic hot water flow switch alarm	Presence of air or dirtiness in the user hydraulic system.	Bleed carefully the user hydraulic system or check and clean the water strainer.
AP1	Alarm user inlet water temperature sensor	Wrong electrical connection, Sensor defect.	Check the electrical connection of the sensor to the terminal board, if correct call the service to replace the sensor.
AP10	Alarm safety domestic hot water sensor		
AP2	Alarm user outlet water temperature sensor		
AP3	Alarm pressure transducer		
AP4	Alarm finned coil sensor / defrost sensor		
AP5	Alarm domestic hot water inlet temperature sensor		
AP6	Alarm domestic hot water outlet temperature sensor		

Code	Alarm Description	Cause	Solution
AP7	Alarm ambient sensor	Wrong electrical connection, Sensor defect.	Check the electrical connection of the sensor to the terminal board, if correct call the service to replace the sensor.
AP8	Not used		
AP9	Not used		
AtE1	Evaporator water pump 1 overload		
AtE2	Evaporator water pump 2 overload		
B1 HP	High pressure switch circuit 1	<p>In heating mode: Insufficient user circuit water flow; Insufficient domestic hot water circuit water flow.</p> <p>In cooling mode: Insufficient air flow at the source fan; Insufficient domestic hot water circuit water flow.</p>	<p>Restore the correct user circuit water flow. Restore the correct domestic hot water circuit water flow.</p> <p>Restore the correct air flow to source fan. Restore the correct domestic hot water circuit water flow.</p>
b1AC	Anti-freeze alarm circuit 1 (cooling mode)	Too low water temperature	Check user temperature set point; Check user water flow.
b1AH	Anti-freeze alarm circuit 1 (heating mode)	Too low water temperature	Check user temperature set point.
b1dF	Wrong defrost circuit 1 (maximum time admitted)	Defrost time too long; Outside temperature outside the working limits; Refrigerant charge leakage.	Check defrost set point; Restore normal working conditions; Find leakage and repair.
b1hP	High pressure transducer alarm circuit 1	Transducer defect	Replace the faulty transducer.
B1LP	Low pressure switch circuit 1	Refrigerant charge leakage.	Find leakage and repair.
b1lP	Low pressure transducer alarm circuit 1	Transducer defect	Replace the faulty transducer.
b1tF	Overload source fan alarm	Fan input current outside operation limits.	Check the proper operation of the source fan and, in case replace it.
C1tr	Compressor 1 overload	Compressor 1 input current outside operation limits.	Replace the compressor.
C2tr	Compressor 2 overload	Compressor 1 input current outside operation limits.	Replace the compressor.





## IMPORTANT INFORMATION

These instructions must be read and understood before installing, commissioning, operating or maintaining the equipment.

