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USER INSTRUCTION

Air Conditioning System

Air Conditioning Modular Unit

607NT-608NT INVERTER DC chiller-heat pump

INDEX

1.0	Introduction	page 3
2.0	Equipment inspection	page 3
3.0	Installation and maintenance	page 4
3.1	Electrical requirements and wiring	page 4
3.2	Mounting	page 7
3.3	Remote control (dry contact)	page 7
3.4	Hydraulic connections	page 7
3.5	Maintenance	page 9
3.6	Fan coil safety rules	page 9
4.0	Operating	page 10
4.1	Electronic control	page 10
4.2	Digital display control panel	page 13
4.3	Alarm table	page 15
5.0	Working limits	page 15
6.0	Warranty	page 14

1.0 INTRODUCTION

The unit you have purchased has been designed and manufactured following high quality standards, in order to achieve the best performances over the time. Parts and materials have been selected to give the highest reliability. Every single unit has been checked and tested after production, verifying performances in heating and cooling mode, acoustic levels and electrical safety, EN 60204-1.

2.0 EQUIPMENT INSPECTION

Inspect all cartons and packages for damages during transport. Remove shipping cartons and boxes and check for concealed damages.

IMPORTANT! *the unit must be always kept upright.*

Inspect refrigerant circuits for fractures or breaks. The presence of refrigerant oil usually indicates a rupture in the refrigerant circuit.

WARNING! *The chiller heat pump unit is factory charged with refrigerant fluid R410A, having ODP=0 and GWP=1890 kg. The circuit is completely sealed by soldering therefore a gas leakage is very unlikely to happen. However the R410A hazard identification is the following: Colourless, volatile liquid with ethereal and faint sweet odour. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels CNS depression and cardiac arrhythmia may result from exposure. Vapour displaces air and can cause asphyxiation in confined spaces. At higher temperatures (>250°C) decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.*

Units that have been turned upside down or on their sides may have concealed damage to the compressor, other parts or to the refrigerant system. If the unit is not upright when you receive it, immediately file a claim with the freight carrier for concealed damages and follow these steps:

Set unit upright and allow to stand 24h on rest.

Attempt to start the unit after 24h.

If the unit does not start or makes excessive noise, return it to the freight carrier.

WARNING! *If the information in these instructions are not followed exactly, a fire, carbon monoxide poisoning or explosion may result causing property damage, personal injury or loss of life. Read all the instruction carefully prior to beginning the installation. Do not begin installation if you do not understand any of the instructions. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a qualified installer, service agency in accordance with these instructions and in compliance with all codes and requirements of authorities having jurisdiction.*

3.0 INSTALLATION AND MAINTENANCE

ATTENTION! Do not stress hydraulic connections. To lift or move the unit use the wooden base.

3.1 Electrical requirements and wiring

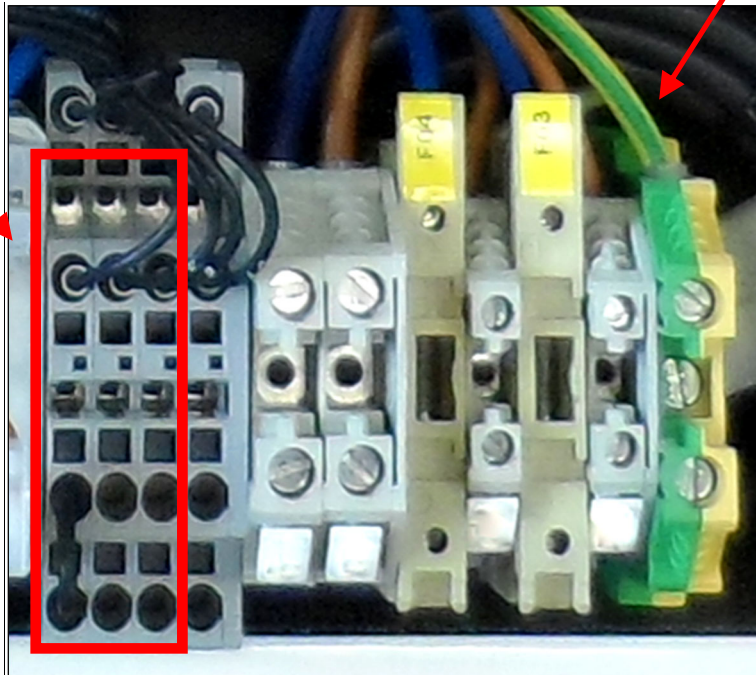
- **WARNING!** Failure to follow safety warnings exactly could result in serious injury, death and property damage. Turn off electrical power at fuse box or service panel before making any electrical connections and ensure a proper ground connection is made before connecting line voltage.
- **WARNING!** All electrical work can be performed only by qualified personnel, in conformity with law and regulations of the country where the system is being mounted. The electrical connections must be done following the wiring diagrams, supplied with the unit.
- **WARNING!** Wires must be sized for the maximum input power following indications on wiring diagrams.
- **WARNING!** Use only copper conductors having sufficient size to carry the required amount of current.
- **WARNING!** A properly sized circuit breaker must be used, taking into account the water pumps and chillers.
- **WARNING!** Power supply must be within allowable range of $\pm 6\%$ of rated voltage, with proper phase and frequency.
- **WARNING!** The unit must be properly grounded to reduce the risk of shock or electrocution.
- **WARNING!** The electrical connections must be made to the switchboard located inside the unit and proper external electrical circuit breaker must be used.

Wiring diagrams:

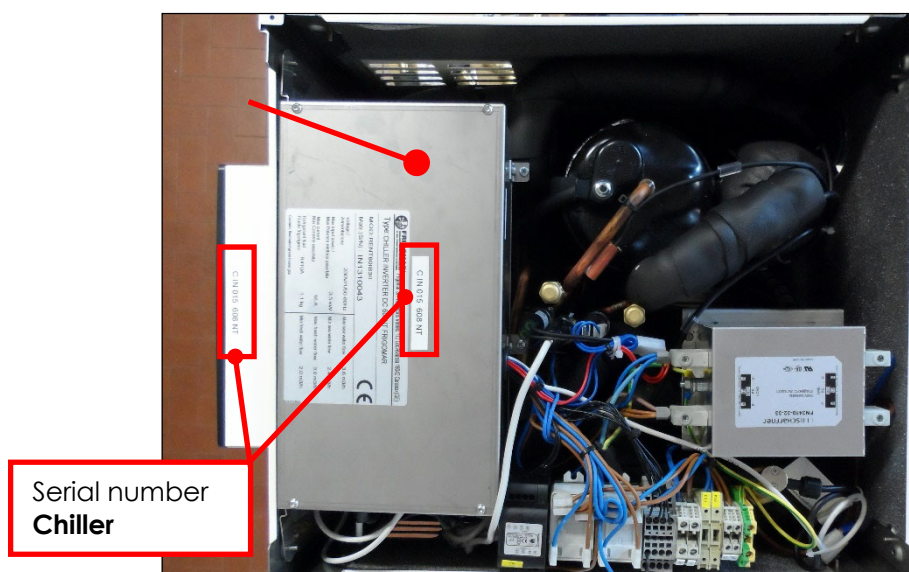


Terminal board

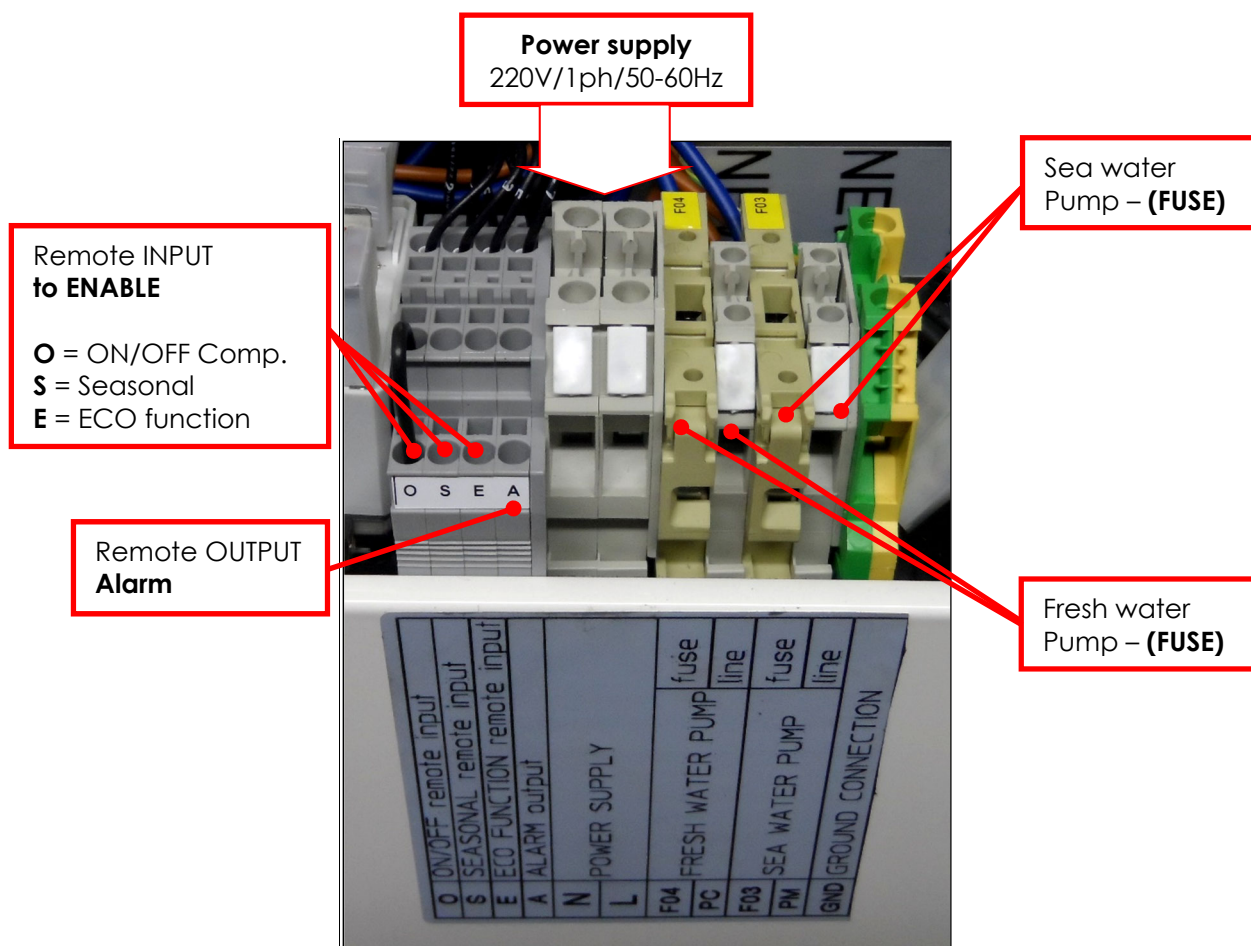
To enable



Warning! Never remove PCB cover, adversely warranty coverage will decline



Terminal board connection:



	Max. input power	Circuit pump fuse	Sea water pump fuse
607NT	2.2 kW	5 A	5 A
608NT	3.5 kW	5 A	5 A

3.2 Mounting

1. The unit shall not be installed above an electronic or electrical panel, circuit breakers or anything electrical.
2. Installation and servicing of this system can be hazardous due to system pressure and electrical components. When working on this equipment, always observe precautions described in literature, tags and attached labels.
3. Select a location for noise considerations. In some location, acoustic baffles may be required.
4. The unit must be installed in a space with sufficient clearance on all sides for proper air circulation and for services. Sufficient airflow is critical to the proper operation of the units. Air temperature shall be below 45°C with relative humidity below 90% without condensing.
5. The chilling unit is equipped with a cupronickel heat exchanger between refrigerant fluid and seawater. To prevent corrosion due to stray electrical current or voltage, all metallic parts in contact with seawater must be connected to the ship's bonding system. A zinc anode is mounted at the inlet of cupronickel heat exchanger: it must be replaced periodically depending on the degree of wearing. Failure to properly ground and bond the system will void the warranty.
6. The axial fan help the system to cool the inverter drive during operation. Be careful the air intake is not covered or obstructed during operation.



3.3 Remote control (DIGITAL INPUTS)

Digital inputs available:

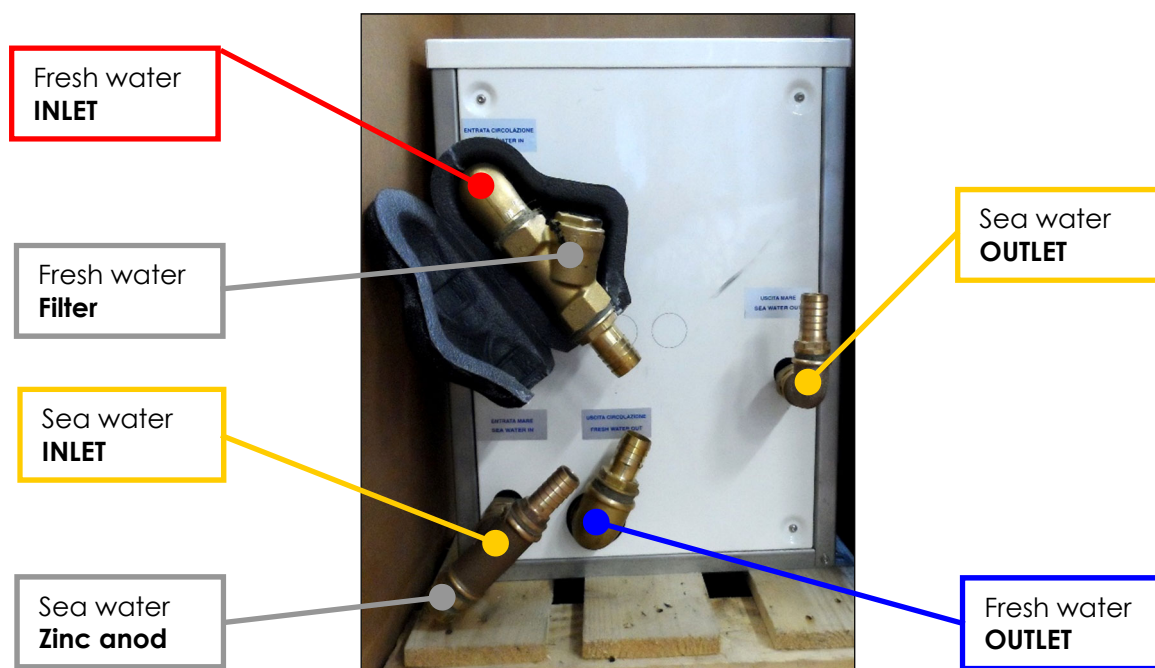
- O** = ON/OFF remote input (open contact = **Compressor OFF**)
S = Seasonal remote input (open contact = **HEATING** / close contact = **COOLING**)
E = ECO function (close contact = **ECO** function activated)
A = Alarm output (open contact = General **ALARM**)

Important: in case of connecting two or more units in parallel the digital inputs of each unit must be kept separated

3.4 Hydraulic connections

Recommended water pipe sizes (circulation and seawater):

FLOW RATE m3/h	PUMP INLET PIPE	PUMP DISCHARGE PIPE
0.9 – 1.5	3/4"	5/8"
1.5 – 2.5	1"	3/4"
2.5 – 3.4	1"	1"



If two or more units are connected in parallel a manifold with balancing valves is required. It is mandatory when using a manifold to assure the correct water flow to each unit, as follows:

Chiller / Heat	Fresh water flow (m3/h)		Pipe inner	Sea water flow (m3/h)		Pipe inner
Pump unit	min	MAX	Ø mm	min	MAX	Ø mm
607NT	1.5	2.5	25	1.2	1.8	20
608NT	2.0	3.0	25	2.4	3.6	25

Chiller / Heat	Fresh water flow	Pressure drop	Sea water flow	Pressure drop
	(m3/h)	Fresh water (kPa)	(m³/h)	Sea water (kPa)
607NT	1.5	30	1.3	60
608NT	2.0	38	2.5	50

1. **Sea water circulation.** Before starting the unit check that the water flow is correct, without any air bubble inside the circuit; pumps shall be located below the water line at all times, as they are not self-priming. Operation with poor water circulation can damage the compressor due to abnormal working pressure. Check weekly the sea water flow, considering the flow requirements indicated in the above table.
2. Clean your strainer weekly or more, depending on the region, due to the presence of jellyfish, seaweed, sand, and anything else that can clog strainers very quickly. Pump is not self-priming and it has to be installed below the water line with the outlet pointed upward so that if air enters the system it can pass through the pump. Damage incurred due to a pump running dry is not covered under warranty.
3. Sea water pump must be sized so that medium water velocity inside the coil is between 2 m/s and 3 m/s. Higher velocity may cause metal erosion while lower velocity may cause coil clogging.

WARNING! Air conditioning unit must be overseen (also through suitable protection devices) as any eventual breaking of fittings or pipes carrying seawater may have disastrous effects on the boat (from room engine flooding to boat sinking, considering the seawater flow through the unit ranges from 2 to 4 m³/h).

1. **Fresh water to fan coils.** Filling the system for the 1st time, a 10-20% percentage of glycol must be added to the fresh water, and then this proportion must be maintained along the system's life. Assure the fresh water circuit is clean before filling it. Should water contain parts bigger than 0.8 mm a 16-20 mesh filter must be installed upstream the exchanger inlet, before the fresh water inlet. Check regularly that the filter is not clogged.
2. Before starting the unit check that water circulation is correct. After a shut-down you are advised before starting the pumps to rotate manually the pump shaft (2-3 rounds).
3. Air-conditioning system shall not be used during navigation as long as seawater conditions or boat high speed could unprime the pump.
4. All the hydraulic lines, including the unit, must be kept free from water following system shut-down, whenever the ambient temperature could go below 0°C

3.5 Maintenance *(Only qualified technicians can perform maintenance)*

1. Check at least once a year, after shutting off the main breaker, the state of all the electrical connections and circuit breakers of the air conditioning system, cleaning and repairing as necessary. These devices are exposed to salty air and suffer over time from corrosion and general wear. High resistance caused by corroded, bent or worn connectors results in high resistance which causes overheating, which further amplifies the power drop. This is not only creates conditions for a potential fire, but causes electrical equipment to work harder, resulting in reduced life span of equipments. We recommend that you buy only the highest quality power cord and connectors.
2. If applied to the Cupronickel condenser check the zinc anode condition at least every three months or more frequently depending on its rate of wear. It shall be replaced as wearing is more than 50%. If the anode metal surface is shining that means the wearing is very fast maybe due to electrolysis problem.
3. Check seasonally that the flow switch is working properly. In every chilling unit there is a flow switch at the fresh water inlet. As water volume decreases below 1- 0.8 m³/h the compressor must stop within 10 s. This test has to be carried out in every chilling unit, checking that without water flow the compressor does not start and the relevant alarm code is displayed. Should compressor start working in this situation, stop it immediately and contact the closest authorized Innova Service.
4. Clean at least once a season the Cupronickel heat exchanger on seawater side. Do not use any chemicals that might corrode the inner pipes.

3.6 Fan coil: safety rules

1. Do not install fan coil (air suction) in engine room or any other place where vapour from fuel, battery, bilge and any other toxic or harmful substance could be introduced in occupied areas.
2. Do not install fan coil in rooms where there are flammable fluids.
3. The condensate drain pipe must end in an environment free from any toxic or harmful substance.
4. Keep the condensate drain pipe end at least 3 m away from the engines exhausts.
5. Do not install the fan coil above any electrical and electronic equipment or device, as water could accidentally drop to it.
6. Check and clean monthly the draining system efficiency, as well as condensate pan and pipe.
7. Check and clean monthly the air suction filters. If they are clogged also the finned heat exchanger must be cleaned with a vacuum cleaner.
8. Make sure air flows correctly through the fan coil; fan coil's suction and discharge shall be free from any obstructions. Any eventual obstructions may cause fan motor overheating.

4.0 OPERATING

CAUTION! Under both heating and cooling modes of operation, certain components will run at fairly high temperatures. Exercise care in working around operating equipment. Do not touch operating machinery without the aid of qualified personnel.

4.1 Electronic control

The unit you have purchased has been factory tested and it has overcome the safety electrical tests EN60204-1. Electronic control of the unit has been developed in order to obtain a product complying with the best quality standards.

The unit is equipped with an inverter drive card SSPM and control card MAIN MCU with its display MAIN DSP, as shown in the following wiring diagrams. Seawater and circulation water pumps are also managed through the control card. Operation control and system configuration can be achieved from a display panel as shown in the following diagrams.

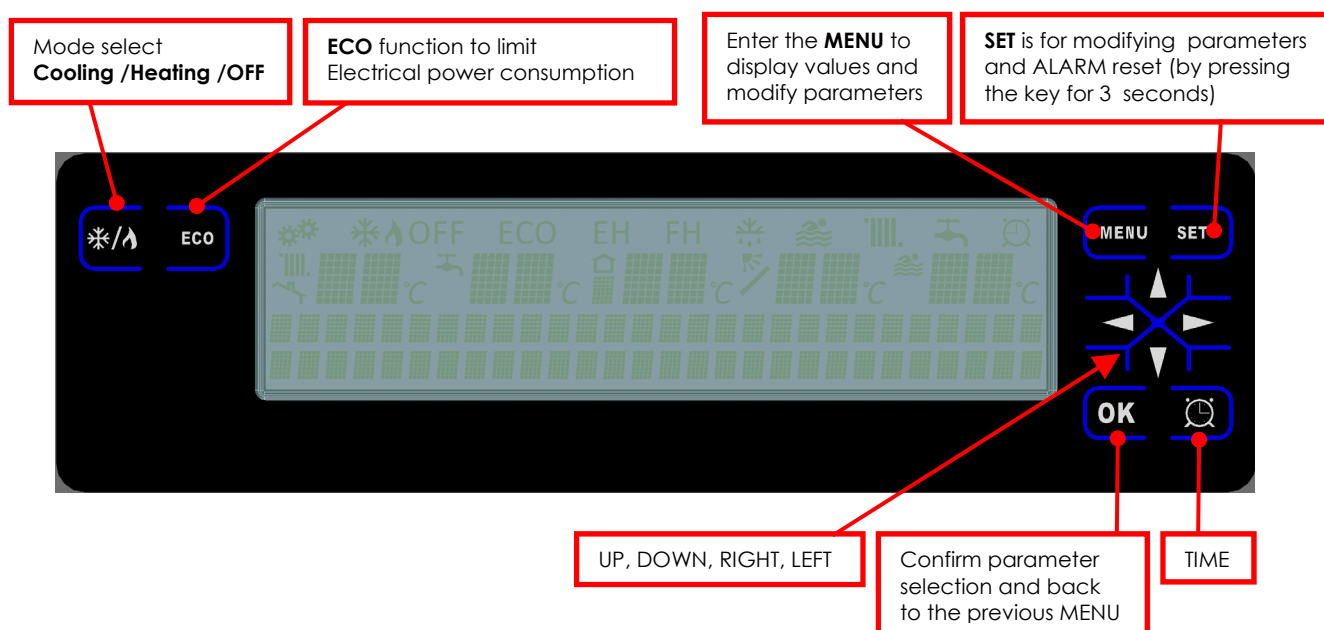
All the following operation parameters are continuously checked:

- Discharge compressor gas temperature (*analogical input TM2*).
- Compressor head temperature (*analogical input TM4*).
- Suction compressor gas temperature (*analogical input TM6*).
- Circulation water inlet temperature (*analogical input TI21*).
- Circulation water outlet temperature (*analogical input TI20*).
- Seawater condenser inlet (*analogical input TI23*).
- Seawater condenser outlet (*analogical input TI22*).
- Suction compressor gas pressure (*analogical input PR1*).
- Circulation fan coils water flow (*digital input DI1*).
- Gas discharge pressure (*digital input DM1*).
- Gas suction pressure (*digital input DM2*).
- Driver SSPM temperature (*analogical input SSPM*).




Through the parameters analysis and by algorithms the controller manages the operation in cooling and heating mode.

Abnormal operations (values out from the defined ranges) are immediately detected and displayed, and the unit modifies the operation or stops working under defined conditions. It is possible to verify and reset the alarm from the display panel.

4.2 Digital display control panel



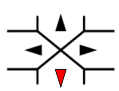
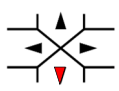
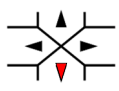
ECO function can be selected to reduce power consumption whenever other electrical appliances are being used simultaneously.

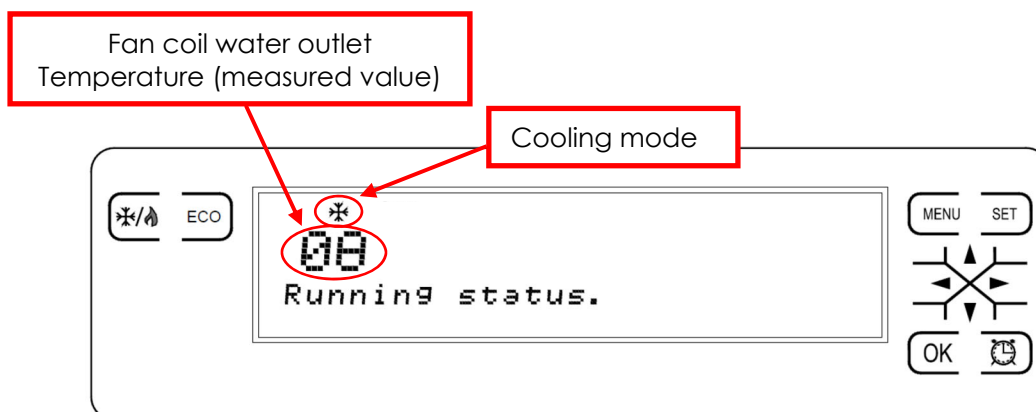
-  Cooling mode (summer operation)
-  Heating mode (winter operation)
-  Compressor activation either in cooling or heating mode

Starting:

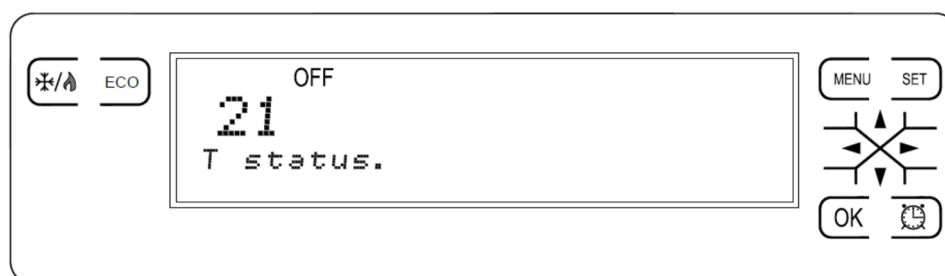
-  Select operating mode: cooling/heating/OFF

Parameter reading sequences:

Normal set Menu	MENU		
Press DOWN			
Running status	Press OK	(EEV step, Plant temp need, Sanit temp need, Comp in press, ...)	
Press DOWN			
T status	Press OK	HPump1 (TI20)	
		Press DOWN	
		HPump1 (TI21)	



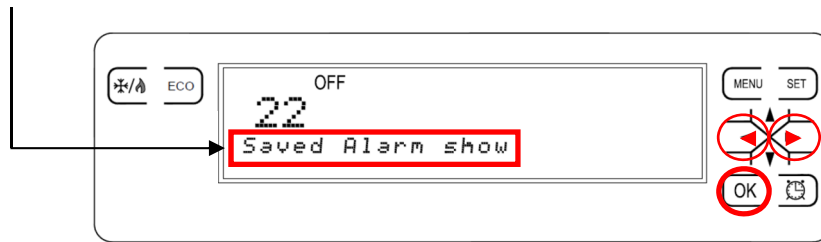
From page “**T status**” all the following parameters can be displayed by pressing “OK” and “DOWN” step by step:



- Circulation water outlet temperature (analogical input TI20).
- Circulation water inlet temperature (analogical input TI21).
- Seawater condenser outlet (analogical input TI22).
- Seawater condenser inlet (analogical input TI23).
- Discharge compressor gas temperature (analogical input TM2).
- Suction compressor gas temperature (analogical input TM6).
- Suction compressor gas pressure (analogical input PR1).
- Gas discharge pressure (digital input DM1).
- Gas suction pressure (digital input DM2).
- Circulation fan coils water flow (digital input DI1).

4.3 Alarm table

From page “**Saved Alarm show**” all the following alarms can be displayed by pressing “OK” and “RIGHT/LEFT” step by step:



ALARM	DESCRIPTION	TROUBLESHOOTING
AL 1	TXX (description) probe disconnected or broken	Sensor to be replaced - call authorized service
AL 2	Refrigerant low pressure	Check if seawater flow and fresh water flow are correct Check for refrigerant leakage
AL 3	Refrigerant high pressure	Check if seawater flow and fresh water flow are correct
AL 4	Compressor Driver high temperature	Check cooling fan and heat sink cleanliness
AL 5	Compressor shell high temperature	Check if seawater flow and fresh water flow are correct Check for refrigerant leakage
AL 6	SSPM driver alarm	Call authorized service
AL 7	Compressor low temperature	Check if seawater flow and fresh water flow are correct
AL 8	High compressor discharge temperature	Check if seawater flow and fresh water flow are correct Check for refrigerant leakage
AL 17	Fresh water flow switch	Check if fresh water flow is correct/air bubbles presence
AL 24	Seawater water exchanger low temperature	Check if sea water flow is correct
AL 25	Fresh exchanger low temperature	Check if fresh water flow is correct

5.0 WORKING LIMITS

The unit operates correctly within the following ranges:

- Summer cooling mode: 15°C < sea water temperature < 40°C
- Winter heating mode: 5°C < sea water temperature < 20°C

Should working conditions be out of these ranges, in your particular application, please contact Innova before installation in order to find a suitable solution.

- **Localized situations:** in some regions, it is common to experience a tremendous presence of jellyfish or seaweed concentrated in back bay marinas for some periods of time. This can clog strainers, water pumps and heat exchangers in a little while, causing shut-down faults and sometimes equipment damage. In such particular conditions, please seek the advice of a local Innova service representative. Any possible modification to the overall system (chiller, pumps, strainers, etc) that could overtake the problem must be approved by Innova, otherwise warranty coverage will decline.
- **The pump is not self-priming:** any damage incurred due to a pump running dry is not covered under warranty. Air conditioning system must be switched off, as well as pumps, whenever there is a risk of pump unpriming, due to particular seawater conditions related to the boat type and its speed. The compressor could be damaged if the seawater flow through the heat exchanger is considerably reduced.
- **This air conditioning system is designed to work under normal operation conditions.** Where failure or malfunctions could lead to an abnormal operating condition that could cause injury or damage to any equipment or other property, additional precautions must be designed into the control system. Other devices (limit or safety control) or systems intended to warn of, or protect against failure or malfunction, must be incorporated into and maintained as part of the system.

6.0 WARRANTY

If any part of the Innova air conditioning unit fails due to a manufacturing defect within 24 month from the date of original shipment by Innova, or within 12 months from the date of original start-up, whichever is the earlier date, Innova will supply without charge the required replacement part. The owner of the product may ship the allegedly defective or malfunctioning product or part to Innova at his charge: Innova will analyse the defect and, provided it is covered under warranty, will repair or replace it without charge. All costs for shipment and risk of loss or damage during shipment of the product or parts to Innova and back to the owner shall be the responsibility and liability of the owner.

The service labour outside Innova factory, if needed in the warranty period, will be at the owner charge.

The responsibility of the owner of the equipment includes the following:

1. To operate the equipment according to the manufacturer's instructions.
2. To provide easy accessibility for service.
3. To check and reset circuit breakers and disconnect before calling for service.
4. To keep the unit clean and free of dirt.
5. To keep the condenser coil free of sediment and scale.
6. To keep clean the fresh water circuit, and the evaporator brazed plates exchanger.
7. To pay the charges incurred when any of the above has not been done.
8. To pay for repair or replacement of any material or part other than those within the Innova unit.
9. To check any fuses on the circuit board and replace as required.

This warranty does not cover damages caused by improper installation and use, misuse of equipment, negligent servicing, natural disasters, flooding, fire, wrong electrical and hydraulic connections, power supply not in according to manufacturer's specifications.

NOTE

This image shows a full page of blank white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing or drawing. There are no margins, text, or other markings on the page.

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