

Control Manual

CM

Group: Chiller
Part number: CM CLIM LC
Date: 6 June 2023

CLIM LC Series Water Cooling Unit

Model

7.5 to 62.5 TR

Refrigerant HFC-410A

50/60 Hz



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Manufactured in an ISO 9001 certified facility



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SAFETY WARNINGS

This manual provides information on the control data of the Clima Flex CLIM LC series.

NOTE: Installation and maintenance should be performed only by qualified personnel who are familiar with local codes and regulations and who have experience with this type of equipment.

⚠ DANGER ⚠

LOCKOUT/TAKOUT all power sources before turning on, pressurizing, depressurizing or shutting down the chiller. Disconnect electrical power before servicing equipment. More than one deenergization may be required to deenergize the unit. Failure to follow this warning to the letter can result in serious injury or death. Be sure to read and understand the installation, operating and service instructions in this manual.

⚠ WARNING ⚠

Electric shock hazard. Improper handling of this equipment can cause personal injury or damage to the equipment. This equipment must be properly grounded. Control panel connections and maintenance should be performed only by personnel knowledgeable in the operation of the equipment being controlled. Disconnect electrical power before servicing equipment.

⚠ CAUTION ⚠

Static sensitive components. Static discharge during handling of the electronic circuit board can cause damage to components. Use a static strap before performing any service work. Never unplug any cables, circuit board terminal blocks or power plugs while power is applied to the panel.

⚠ CAUTION ⚠

When moving coolant to/from the cooler using an auxiliary tank, a grounding strap should be used. An electrical charge builds up when halocarbon refrigerant travels in a rubber hose. A grounding strap should be used between the auxiliary coolant tank and the cooler end sheet (ground to ground), which will safely carry the charge to ground. Failure to follow this procedure may result in damage to sensitive

⚠ WARNING ⚠

If refrigerant leaks from the unit, there is a potential choking hazard as the refrigerant will displace air in the immediate area. Be sure to follow all applicable published industry-related standards and local, state, and federal statutes, regulations, and codes if refrigerant is produced. Avoid exposing refrigerant to an open flame or other ignition source.

⚠ WARNING ⚠

Polyolester oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems and may be present in this Clima Flex product. POE oil, if it ever comes in contact with PCV/CPVC, will coat the inside wall of the PVC/CPVC pipe and cause environmental stress fractures. Although there is no PCV/CPVC pipe in this product, keep this in mind when selecting piping materials for your application, as system failure and property damage could occur. Consult the pipe manufacturer's recommendations to determine appropriate pipe applications.

HAZARD IDENTIFICATION INFORMATION

⚠ DANGER ⚠

Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING ⚠

Warning indicates a potentially hazardous situation which may result in property damage, personal injury or death if not avoided.

⚠ CAUTION ⚠

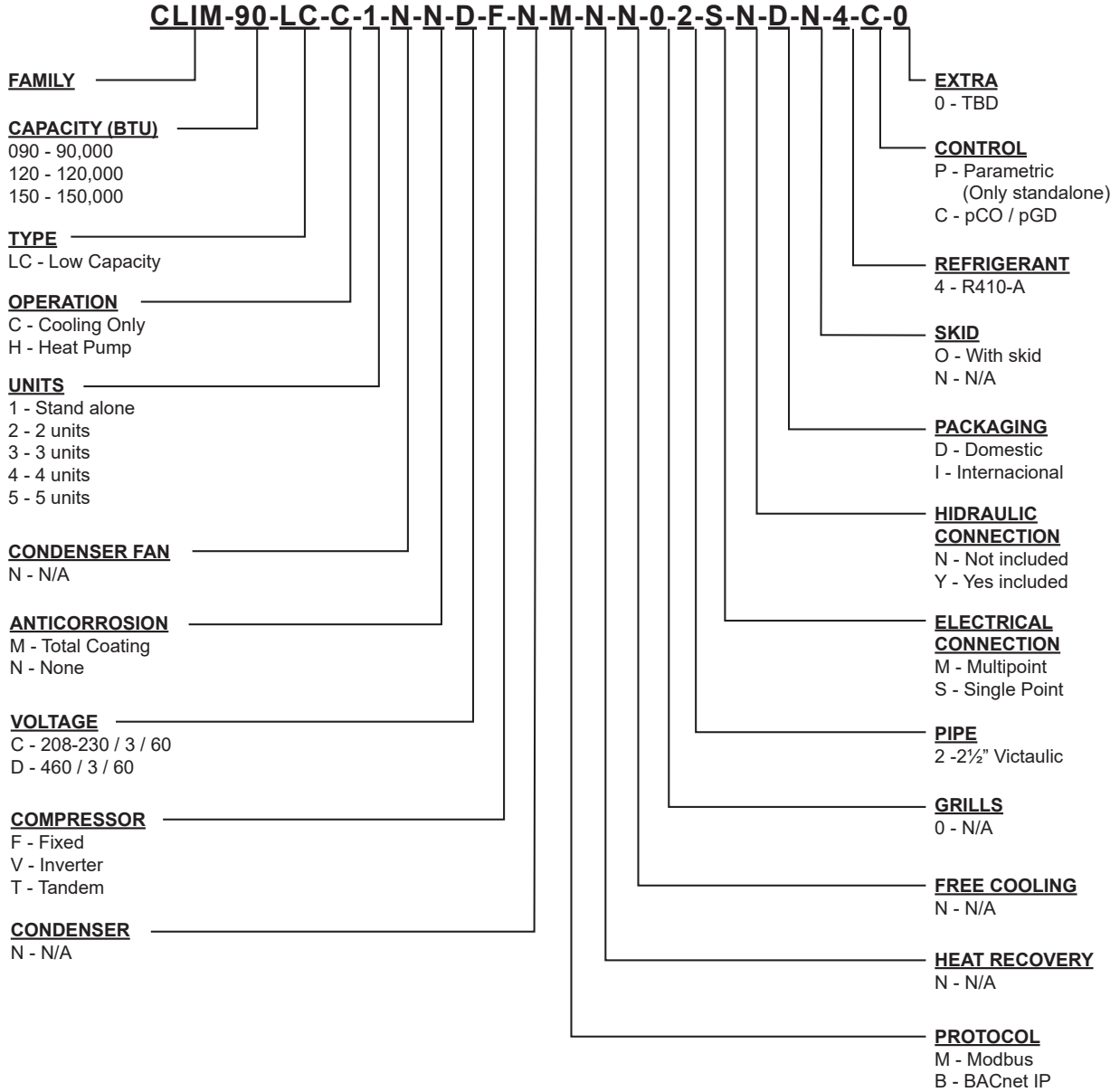
Caution indicates a potentially hazardous situation which may result in minor injury or equipment damage if not avoided.

NOTES: Indicate important details or clarifying statements for the information presented.

Our units are designed to effectively meet the HVAC needs of any project. Our units feature controls, logic routines and digital sensors that continuously monitor the system to adapt its operation

to the level necessary to maintain optimal system conditions at all times, thus achieving maximum performance and energy savings in a system that is simple to operate and maintain.

NOMENCLATURE



FEATURES / BENEFITS

EFFICIENCY

Our units are designed to meet the needs of any project. Our intelligent process controllers and smart temperature sensors provide maximum performance and energy savings.

The system automatically modifies the operating mode to maintain optimum system conditions, making it very easy to operate.

All temperature sensors are calibrated and adjusted at the factory prior to shipment. Start-up should be performed by a qualified technician, during initial start-up the unit will be adjusted to local conditions and all operating points will be checked.

Once the unit has been set up, operation is a matter of pressing the start/stop button until it is certain that the unit is operating properly. After this the unit will operate automatically, turning itself on according to the demand of the refrigeration system and local conditions.

FLEXIBILITY

The units feature intelligent processors and sensors that automatically control the temperature at optimum operating conditions.

The units were designed to be coupled with each other and combined to meet different load variations (Tandem Installation). Up to 5 modules can be combined; these combinations can be made with Water Chiller Units of different capacities ranging from 7.5 to 62.5 tons. Capacities vary depending on the number and type of units.

SAFETY

All structures are made of galvanized sheet steel, coated with electrostatic baked-on paint to ensure long durability and freedom from corrosion under all weather conditions, such as direct sunlight, rain and wind.

All units are designed to fit into a small installation space, thus eliminating large installation areas. We use only high quality components to ensure durability and safety even in harsh environmental conditions.

NOTE: For applications in tropical climates our units are coated inside and out with corrosion protection (on request).

Our products have AHRI efficiency certifications and ETL safety certifications, in addition to meeting all industry safety standards. We are members of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). To show our commitment to our customers and stakeholders; our equipment comes with a 1 year major warranty after start-up.

Our units use R410A refrigerant, which is harmless to the ozone layer and is non-toxic and non-flammable, even in case of leakage. Finally, the efficiency of the heat exchanger and its modular design allow for quick and easy installation.

DESING

Research conducted by the Engineering Department has resulted in units with high design efficiency and optimum performance. The selection of the main components, our quality and control system guarantee high performance and safety.

All major components are rigorously tested and qualified before installation. Each designed unit has undergone long hours of rigorous testing to ensure the safety, durability and quality of the entire system.

COMUNNICATION

The units can be controlled in tandem mode and/or can be connected to a central control unit. Operation and user access will be through a 7" color touch screen.

Our units can be managed through different communication protocols; such as Modbus and BACnet, the most commonly used protocols in the Air Conditioning industry.

Our units keep track of all programmable variables in real time, such as performance monitoring, specific alarms of the refrigeration cycle and the electrical system; as well as detection of external factors such as fire or flood (optional sensors).

The control and monitoring system ensures the correct operation of the unit by monitoring in real time the condition of the major components (high or low refrigerant pressure, compressor and fan motor conditions, etc.).

In case of failure, the event will be recorded for later analysis, facilitating the localization of a possible failure and its solution.

INSTALLATION

The units have been designed for easy installation. The screw connections provide easy installation of the water piping, which are located on both sides of the unit, so that the piping can be connected to either side of the unit.

The individual assembly of the units reduces installation cost, the units have a rigid base that balances the weight of the unit and allows for easy installation.

MAINTENANCE

The simplicity in the design of each unit allows for maximum ease of maintenance. All major components are available to maintenance personnel by simply opening the service panel.

If an emergency shutdown occurs, the control section will indicate in detail the cause of the failure, helping to facilitate and accelerate troubleshooting.

TEST

Each unit is pressure and vacuum tested and then charged with the refrigerant required for proper operation based on the customer's installation conditions.

The units are evaluated at full load operation with water flow, heat load and line voltage placed at actual operating conditions.

NOTE: The warranty policy requires that commissioning be performed by qualified personnel authorized by the company.

INSITUM® CORROSION PROTECTION

SPRAY FOR COATING HVAC/R PRODUCTS

Coating is a flexible, water-based, water-reducible, synthetic polymer corrosion coating designed specifically for the protection of HVAC/R coils and components. Insitu® Spray Applied Coating contains ES2 (embedded stainless steel pigment) technology, an anti-corrosion coating specifically designed for the protection of coils mounted in corrosive areas.

HVAC/R coils, components and cabinets will have a permanent water-based synthetic coating with ES2 pigment applied to all areas of the coating surface with no bridging of material between the fins. Therefore, ES2 pigments are suitable for even the most corrosive environments and will maintain their appearance after many years of exposure. UV degradation ES2 pigments form a multilayer structure throughout the paint film.

This creates a barrier layer that reflects sunlight away from the paint film preventing UV rays from penetrating. As a result, UV degradation of individual polymer molecules is eliminated, film integrity is maintained and the pigment particles remain well anchored to the substrate.

The resulting smooth, hard finish prevents dirt build-up. The multilayer structure of ES2 pigments delays the passage of water molecules into the film and acts as an effective moisture barrier.

Ideal applications for Insitu® spray-applied coatings.

- Mini-splits
- Packaged enclosures
- Condensing units
- Modular air handlers
- Indoor and outdoor HVAC cabinets and copper tubing
- Heat exchange coils (water, condenser, evaporator, DX)



CONTROL

PCO SYSTEM

The system is designed to handle one unit with capacity control by means of a drive or a typical unloading valve on a Digital fixed compressor, this is a unit called "Mother" and up to 9 additional units without capacity control called "Sons" can be added.

Function

The "Mother" unit is managed directly by the main control, the pCO. Each "Child" unit is controlled by a pCOE expansion module. If the units are water-cooled, they require one expansion module per "Child". Each "Mother" unit is equipped with a 7" pGD touchscreen terminal.



PCO (CONTROL)

The pCOEM+ is an electronically programmable microprocessor-based controller that is fully compatible (software and hardware) with the pCO family of products and systems that include programmable controllers, user terminals, gateways, communication devices and remote device management.

These devices represent a powerful control system that can be easily linked with the vast majority of Building Management Systems (BSM) available on the market.

Figure 1. Pco(Control) Optional Equipment

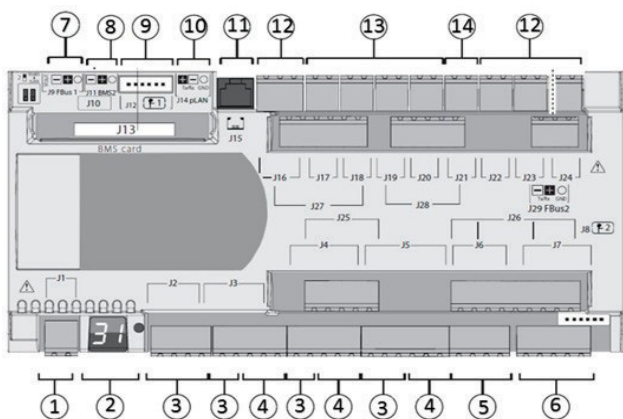


Table 1. Description of PCO Control Equipment

REF	DESCRIPTION
1	Power Connector [G(+), G0(-)].
2	pLAN address setting button and secondary display, LEDs
3	Universal inputs/outputs
4	+Vdc: Energy for active probes +5 VR Energy for radio metric probes
5	Analog Outputs
6	DI: Voltage-free digital inputs
7	Fieldbus connector 1
8	BMS connector 2
9	Single-pole valve connectors
10	pLAN plug in connector
11	Connector for pLAN phone terminal / Download application for programming
12	Digital Relay Outputs
13	Digital Relay Outputs for Power On
14	Alternating power supply for "Switching of digital relay outputs".

PGD TOUCH (HMI)

The pDG 7" touch screen graphic terminal belongs to the family of touch screens designed to make the interaction with the pCO system controls easier and more intuitive. The electronic technology used and the new 64,000 color display allow for high image quality and high aesthetic quality.

The touch screen panel also facilitates user-machine interaction by making it easier to navigate between the different screens.

Figure 2. Pco(Control) Optional Equipment

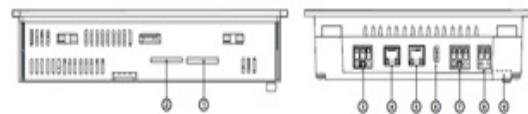


Table 2. Descripción de Pantalla Táctil PGD

REF	DESCRIPTION
1	SD card connector
2	Membrane keypad programming
3	Optically Isolated RS485 port
4	Ethernet port 1 (Internal switch)
5	Ethernet Port 2 (Internal switch)
6	USB Host Port
7	RS485 port without optical isolation
8	Power Supply
9	Dockable connector (on the back)

EXPANSION TABLE

Figure 3. Expansion Table or Module

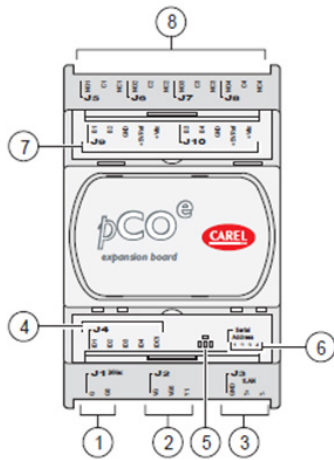


Table 3. Expansion Table Description

REF	DESCRIPTION
1	SD card connector
2	Membrane keypad programming
3	Optically Isolated RS485 port
4	Ethernet port 1 (Internal switch)
5	Ethernet Port 2 (Internal switch)
6	USB Host Port
7	RS485 port without optical isolation
8	Energy Source

MOTOR SAVER

It is designed so that 3-phase loads are not damaged by power supply conditions.

- Loss of any of the phases
- Low voltage
- High voltage
- Voltage spikes
- Phase reversal
- Fast cycling

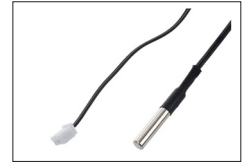


Table 4. Diagnostic Indicator Lights

Diagnostic indicator lights	
REGULAR OPERATION	STEADY GREEN
START RELAY	FLASHING GREEN
INVERSE PHASE	FLASHING RED
UNBALANCED PHASE	LAPSES RED
HIGH/LOW VOLTAGE	STEADY RED

TEMPERATURE SENSOR

The PT10K NTC Temperature Sensor is resistant to temperature changes, the relationship with the curve is the higher the temperature, the lower the resistance and vice versa.



DIGITAL INPUT (REMOTE ON/OFF, OPERATION MODE: COOLING, HEATING)



An electrical component that can interrupt the electrical circuit, interrupting the current or diverting it from one conductor to another.

VANE FLOW SENSOR

Only with parametric counter (Microchiller)

The flow switch comprises a unique paddle system, the design of which is a paddle located at the flow end that is pivoted in the center and a magnet at the opposite end.



Above this magnet is a reed switch contact, isolated outside the flow chamber. A second magnet creates the force necessary to reset the vane back to the zero flow position.

ULTRASONIC FLOW METER/SENSOR

The flow sensor is a measuring device with no moving parts. It has a low pressure drop and excellent measurement characteristics.

Components:

1. Electronics housing with cover.

The housing contains the signal conditioning circuitry. The circuitry is encapsulated in the housing to protect it against moisture and mechanical stress. The electrical connector is mounted on the housing cover.

HIGH/LOW PRESSURE CONTROL

ACB / LCB is a small disc type pressure control for use in refrigeration and air conditioning systems. As standard, it is equipped with a 6th contact system with manual or automatic reset. The control is robust and reliable in the operation of different unit types.



Thanks to its small size, light weight and high degree of protection it can be placed directly in the refrigeration system where pressure regulation is required.

The control is available with different settings and pressure connections to meet customer needs.

All these features reduce installation costs and save space.

CONTROL

INPUTS AND OUTPUTS

The configuration of the inputs and outputs depends on the initial configuration of the system.

The tables in this section show the inputs and outputs assigned to each type of configuration as well as the port used for the “Mother” unit (whose capacity is regulated by an inverter or an unloader) and the “Child” units.

Key: CO is for Cooling only and HP is for Heat Pump.

Table 5. Analog inputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
U1	Injection	Injection	Injection	Injection	NTC
U2	Return	Return	Return	Return	NTC
U3	Cooling	Cooling	Cooling	Cooling	NTC
U4	Main return	Main return	Main return	Main return	NTC
U5	Main injection	Main injection	Main injection	Main injection	NTC
U6	Cond. Temp	Cond. Temp	Cond. injection	Cond. injection	NTC
U7	-	-	-	Cond. return	NTC

Figure 4. Digital inputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
U9	-	Selector	-	Selector
ID1	High pressure	High pressure	High pressure	High pressure
ID2	Low pressure	Low pressure	Low pressure	Low pressure
ID3	Remote start	Remote start	Remote start	Remote start
ID4	Motor Saver	Motor Saver	Motor Saver	Motor Saver

Table 6. pCo analog inputs 0.5-3.5 Vdcd (Motherboard)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
U8	Evaporator flow	Evaporator flow	Evaporator flow	Evaporator flow
U8	-	-	Flujo de cond.	Flujo de cond.
NO7	Second stage	Second stage	-	-
NO8	-	Reversible valve	-	Reversible valve

Table 7. Digital outputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
NO1	Compressor	Compressor	Compressor	Compressor
NO6	Pump	Pump	Pump	Pump
NO7	Fan	Fan	-	-
NO8	-	Reversible valve	-	Reversible valve

Table 8. Analog outputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
Y1	Inverter/SSR	Inverter/SSR	Inverter/SSR	Inverter/SSR	0-10 V
Y2	Inverter Fan	Inverter Fan	Inverter Fan	Inverter Fan	0-10 V

Table 9. Analog inputs of the pCo (Expansion Module Son)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
B1	Injection	Injection	Injection	Injection	NTC
B2	Return	Return	Return	Return	NTC
B3	Cooling	Cooling	Cooling	Cooling	NTC
B4	Condenser	Condenser	Cond. injection	Cond. injection	NTC

Table 10. Analog inputs of the pCo (Auxiliary Child Expansion Module)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
B1	Evaporator flow	Evaporator flow	Evaporator flow	Evaporator flow	5-3.5 VCD
B2	Condenser flow	Condenser flow	Condenser flow	Condenser flow	5-3.5 VCD
B3	Condenser return	Condenser return	Condenser return	Condenser return	NTC
D14	Motor saver	Motor saver	-	-	

Table 11. Digital inputs of the pCo (Expansion Module Son)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
DI1	High pressure	High pressure	High pressure	High pressure
DI2	Low pressure	Low pressure	Low pressure	Low pressure
DI3	Evaporation flow	Evaporation flow	Evaporation flow	Evaporation flow
DI4	*Motor Saver	*Motor Saver	*Motor Saver	*Motor Saver

Note: Digital motor protector inputs on “Daughter” units are optional and their consideration depends on the initial configuration of the system, on the other hand motor protection input on “Mother” units is indispensable.

Table 12. Digital outputs of the pCo (Expansion Module Son)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
NO1	Compressor	Compressor	Compressor	Compressor
NO2	**Pump	**Pump	**Pump	**Pump
NO3	Fan	Fan	Fan	Fan
NO4		Reversible valve	-	Reversible valve

Note: The digital output pump in “Child” units depends on the initial configuration of the system. It is not possible to use it if the system is configured with only one “Mother” pump (pCO unit).

CONTROL

START-UP

24 V

- Place the Control switch in the on position to activate the 24 VAC control.
- After the control is turned on, it will take 2 minutes for the unit to come online.



COMPRESSOR

- Place the switch in the ON position, this allows the compressor to turn on and off according to the status.



Note: Once the pump is turned on, it will take a few seconds until a steady flow of water is detected, at the end of this delay, the flow switch will be monitored. If the switch is on, it commands the pump to turn off (5 attempts within 10 seconds). If a uniform water flow is detected, the unit will begin operation.

Under normal conditions, the unit will turn on and off the cooling circuit of the unit, according to its needs. When alarms are present in the system, they will always be indicated on the user interface.

The digital control will start compressor operation according to the logic set in the control.

ON/OFF (RESTART)

The operating sequence starts with a check of all pre-programmed safety check points, if the necessary conditions are met, the unit is ready to start operation. To start operation of the unit, turn the switch to the ON position.

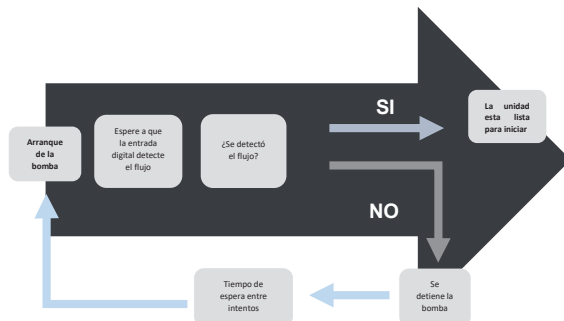


After a few seconds the computer will send power to the water pump. If the computer detects water flow it will command the start of the unit's internal control sequence.

COMMISSIONING OF THE CONTROL LOGIC PUMP

When the unit is turned on, if all safety measures are correct (vacuum pressure, discharge, phase monitor), the pumps of all enabled units will start. Fig. 5 shows the pump start flow diagram.

Figure 5. Pump start-up control flow diagram (applies to any unit)

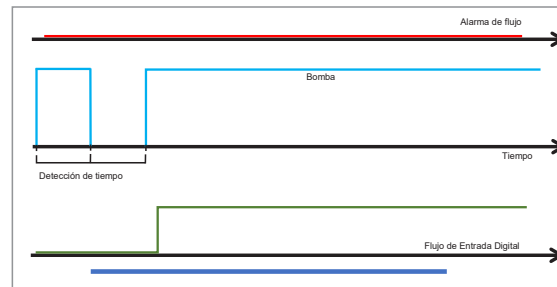


Note: If the number of pump start attempts is exceeded, the general flow alarm will be activated, this will stop all operations on that unit until the alarm is reset.

START-UP - PUMP (OPTIONAL)

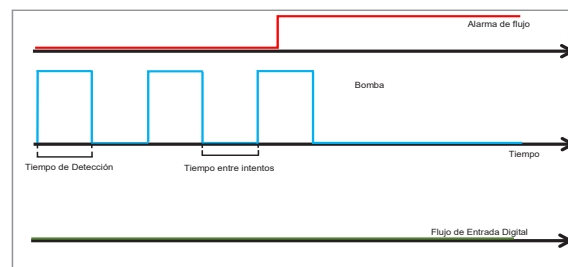
The pumps in the units are always working independently of the thermal demand, the flow detection is also constantly monitored. If after a pause in the flow detection a change in the status of the digital outputs is detected, the on-demand start is activated in the unit in question. Fig. 6 shows an example of this case.

Figure 6. Example of the pump start-up cycle, where the flow was detected on the second attempt.



If the flow detection fails after the period allotted for digital input detection, it is necessary to turn off the pump and restart it to make an attempt after the waiting time between lapses has elapsed. If after a certain number of attempts the flow is still not detected, the "no constant flow" alarm will be activated and the unit in question will be suspended, as illustrated in Fig.7 on the next page.

Figure 7. Example of the pump start-up cycle where the flow has not been detected, after 3 attempts the flow alarm has been activated.



Note: The system can have a paddle flow sensor with digital signal of "1" or "0"; or ultrasonic sensor with analog signal showing the flow on the display.

REGULATION

Temperature control can be implemented in different ways, always taking into account the system configuration. If there are “Child” units, the temperature can be set in “Tandem” mode (all units are coordinated by the “Mother” unit, which calculates the total demand) or each unit can work in “Independent” mode, where each unit calculates the local demand from its respective temperature injection sensor (in case the main injection sensor fails).

In “Tandem” mode, the temperature control is the reading received from the main head sensor. With this reading the total demand is calculated. Fig. 8 shows an example of the calculated demand when the control is set to “Proportional”.

If the units are in “Independent” mode, each unit calculates its local demand based on its temperature injection sensor. The local demand for the “Mother” unit is generated by the same PID control equations, while the demand for the “Child” units is a constant reset cycle, as shown in Fig. 9.

The choice between cooling and heating (when the system was configured with a heat pump), can be placed by the digital input “Selector” or can be done by the user. All units in a “Tandem” mode will always work under the same mode.

Figure 8. Example of the proportional control cycle, for cases of total demand or demand for the “Mother” unit.

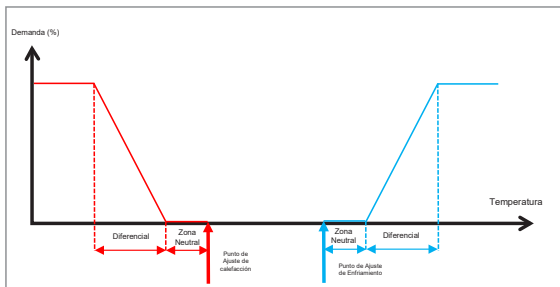


Figure 9. Example of proportional control cycle for local demand in each “Son” unit.

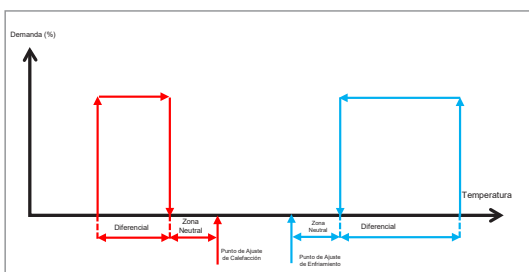
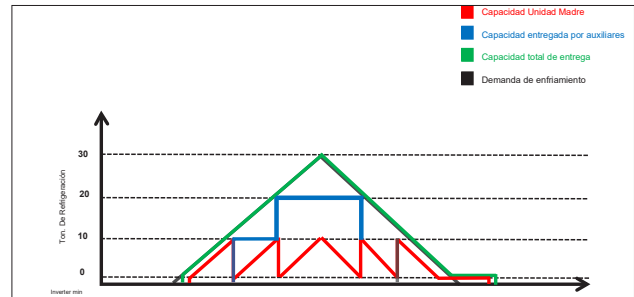


Figure 10. Example of capacity delivered according to demand, for a “Mother” unit and 2 “Child” units of 10TR cooling each.



UNIT ROTATION

When the system is operating in “Tandem” mode, the total demand is calculated as mentioned in the previous section, depending on how many units are operating, the system will request the activation or suspension of the same in order to meet the demand.

In any configuration, the “Mother” compressor (whose capacity is controlled by a drive or a flow valve) is the first to start and the last to stop. An example of global demand management by starting and stopping units is shown in Fig. 10.

When demand requests the start or stop of units, and the system is working in “Tandem” mode, it can rotate the units to ensure equal wear between all units.

The types of rotation that can be performed are:

- FIFO: The first unit to be turned on will be the first to be turned off/suspended.
- LIFO: The first unit to be turned on will be the last to be turned off/suspended.
- Cumulative Operating Time: The unit with the lowest cumulative working time is always turned on first, and the first unit to be shut down/suspended will be the one with the highest cumulative time.
- Custom: You assign startup and shutdown/suspend priorities for each unit.

Note: Regardless of the type of unit rotation set, the drive or unloaded unit will be the first to start and the last to shut down/suspend.

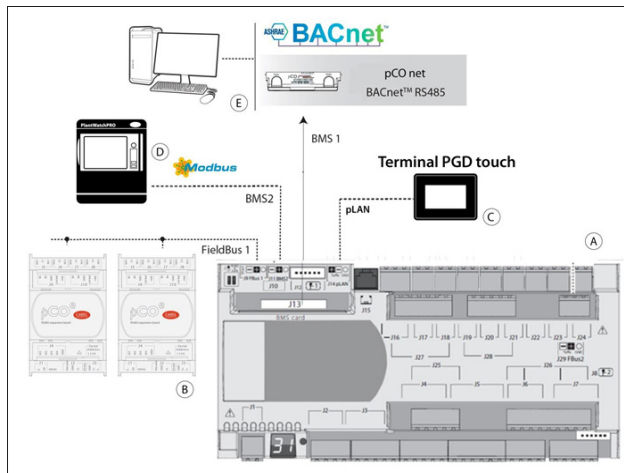
Note: If a unit is active and working and stops for some situation (such as an alarm), it will be replaced by the next available unit according to the rotation algorithm.

CONTROL

COMMUNICATION PROTOCOL

The pCO has 4 independent communication ports configured as follows:

- **pLAN:** Communicates with the pGD touch terminal using the Modbus RTU protocol Son.
- **Fieldbus 1:** Communicates with the Expansion Modules (located in the “Child” units) through the Modbus “Mother” protocol.
- **BMS1:** It communicates with a supervisory system using the BACnet* protocol.
- **BMS2:** It communicates with an external monitoring system such as PlanWatch Pro using the Modbus RTU “Son” protocol.



Note: The BMS1 port requires a communication card (pCOnet to BACnet MS/TP or pCOWeb for BACnet IP). The programming of the logic packet in the switching protocol is also required. An FLG-Modbus can also be connected to connect a BACnet MS/TP.

ALARMS

The alarms that may occur, depending on the initial configuration are:

- **Sensor Failure Alarms:** If a sensor is detected as disconnected or broken, the algorithm used will be disabled. If it is the head injection sensor that was detected, the units will work in “Independent” mode automatically.
- **Phase Fault Alarm:** Activated by a digital input. Motor protection is a high priority alarm and stops all machine functions. It is reset manually.
- **No Flow” Alarm:** This alarm is a high priority alarm and stops all machine functions. It is manually reset.
- **Freeze Alarm:** If the sensor temperature is below the programmed threshold, this alarm will be activated. This condition stops all functions of the equipment in question. This alarm automatically resets once the temperature exceeds the reset value and will keep the unit in reset mode (No power for operation for the programmed time).
- **Water Freeze Alarm:** Same case as the freeze alarm, but in this alarm, the injection sensor reading is considered.
- **High Pressure Alarm:** It is triggered by a Digital input. This alarm is a high priority event and stops the compressor operation, however it does not disable the pump. It is a manual reset alarm.

To restart, keep the unit on high performance, the compressor will not start until the programmed time has elapsed.

- **Low Pressure Alarm:** This is triggered by a digital input. This alarm stops the compressor of the unit in question. It resets automatically, however it keeps the unit in a low performance mode.
- **Disconnect Alarm:** If the system contains any “Son” units and any of these units are disconnected, this alarm will be activated.
- **Condenser Flow Alarm:** This alarm functions like the main Flow alarm; it is activated only when the cooling system is water-cooled.
- **Lack of Refrigerant Alarm:** This alarm is activated when a start command is sent due to cooling demand, and the injection temperature sensor detects a change in temperature for a period of time. This alarm does not take Control actions and can be deactivated by the user.

USER INTERFACE

When the equipment is factory reset or in case the default parameters are needed, the controller will start the configuration from 0, which has the purpose of selecting the most suitable parameters for the equipment as shown in Fig.11.

When the equipment is restored from the factory or a factory set-up is needed, the first screen that will start will be the language selection. Two languages are available in this section, in case an additional language is required it is recommended to contact the manufacturer for additional language options.



Figure 11. Factory installed screen.

To perform this procedure, simply press the screen to select the menus, since it has a 7” touch screen.

Once the language is selected, click on the image with the arrow to the right as shown in Fig. 12.

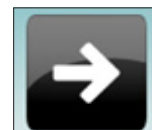


Figure 12. Next screen button.

After pressing the key to the right the menu will change to the machine type selection as shown in the following image.



For the selection of this machine, select in the menu “**Type of machine**”. In this menu the water-water selection will be applied; obviously this selection has to be according to the machine type.

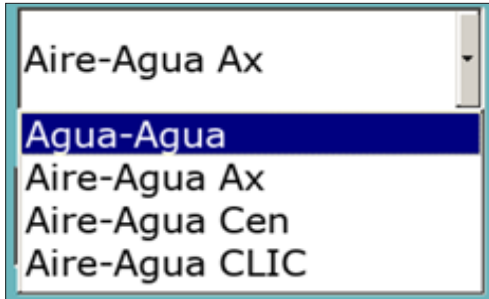
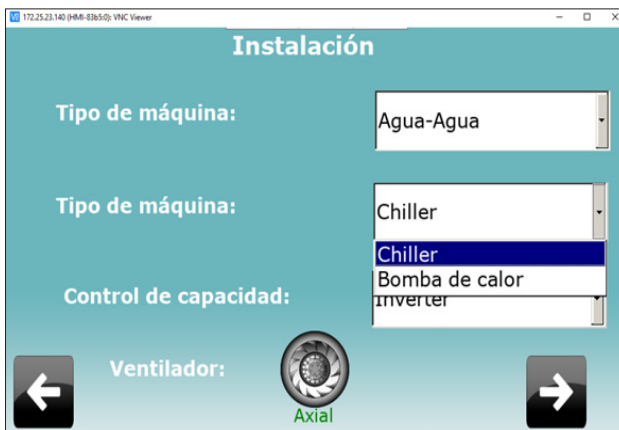


Figure 13. Machine type selection.

Once the machine type has been selected, we will proceed to select the type of work of the equipment, the CLIM equipment can work in two ways: either in cooling mode only or having both options available, cooling mode and heating mode. To be able to make this selection in the second line and the second selection with the description “**Type of machine**” select the desired option depending on the requirement of the equipment as shown below.



After selecting the type of work of the machine will proceed to select the capacity control of the equipment. This option allows us to select how the equipment will divide the thermal load for the work of each compressor, in this case for the selection of each of these options will have to be selected by a professional, depending on the installation of the equipment and the needs required by the equipment for this case the inverter option will be used.



Once the configuration has been completed on this screen, you will see at the bottom of the screen that there are two icons with the description of an arrow, one to the right and the other to the left, these icons, when pressed, allow you to scroll between screens. In this case, it is possible to scroll through the installation screens, so care must be taken when selecting the equipment configuration to avoid skipping important configurations.



Once the configuration of the unit's type of work has been completed, the selection of how many slaves will be available for the unit will be made. In this case, the CLIM unit has the capacity to manage up to 7 units, depending on the commercial selection of the unit, the number of slaves can be selected as shown in the following image.



After the selection of the number of slaves of the equipment, the date and time of the equipment will be configured. This is important because the display has the ability to store certain records and events, to which the locking is also linked in order to schedule system start-up events.

CONTROL



Once the previous configurations have been made, a screen will appear in which the current information of the equipment will be available as shown in the following image, values will not be shown, so you will have to select first the type of units in which you want to show the value of the temperatures, for this you will press the centigrade or fahrenheit icon depending on the desired selection.



MAIN SCREEN

The configured devices will display this screen by default as the main system screen with the following information:

1. Working System Mode icon, either in "Tandem" or "Standalone" mode.
2. Main Unit Injection and Return Temperature, if the system is in "Tandem" mode or "Mother" Unit Injection and Return Temperature, if in "Stand-alone" mode.
- 3.
4. Control Status, can be Enabled, Disabled by a digital input or disabled by the terminal (pGDTouch).
5. Selection of Temperature Measurement Units (Fahrenheit or Celsius).
6. Date.



DISPLAY ICONS

The Navigation bar is found on every screen of the system. It appears and disappears automatically by pressing the tab at the bottom, as shown in Fig. 14.

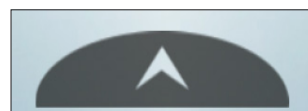


Figure 14. Navigation bar on screen.

When the tab is pressed the navigation menu will be displayed, as in Fig. 15.



Figure 15. Example of navigation bar on the main screen.

The navigation menu changes the access icons depending on the context where the user is within the system. Potential navigation buttons are shown below.

ICONO	DESCRIPTION
	From this icon you can access the equipment trends option. These graphs will show the behavior of the temperatures in the equipment throughout the course of its operation.
	This icon has the purpose of showing the alarms that occur in the equipment; in case an alarm occurs, this icon will change from opaque to red with an indicator on the main screen indicating that an alarm is present.
	Displays the summary of the equipment in functional status together with the information of the functional slaves.
	The purpose of this icon is to enter the equipment sub configuration menu where you can change the time, language, equipment temperature setpoint and access to equipment maintenance.

Pressing the icon at the end of the table will bring up a new submenu as shown in Fig.16.



Figure 16. Sub-settings menu.

Pressing the **working hours** icon will give access to the equipment operation information which will show the number of compressor start-ups, their working hours, how many low and high pressure alarms the equipment has suffered.









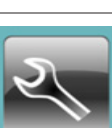
By pressing the **scheduler** icon you can access the scheduler menu as shown in the image below, which has the purpose of configuring timers in the equipment to be able to turn it on and off whenever you want.



From the **regulation** icon you can access the machine's working setpoint selection menu.

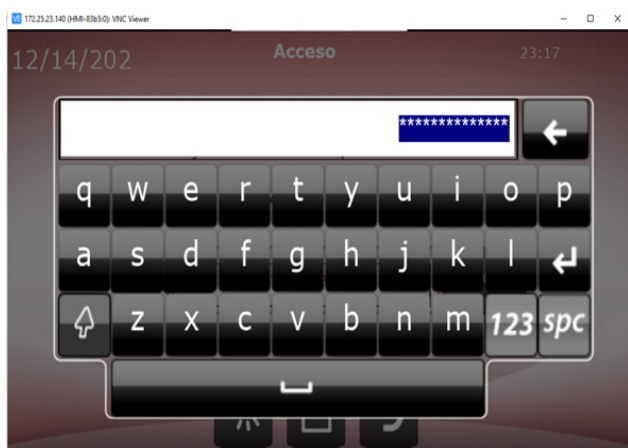
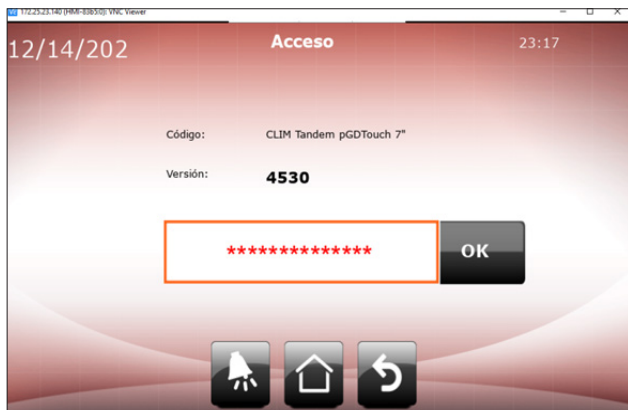
In this case, we have the example of the machine that is working in cold mode so the regulation of heat mode does not appear, however when the selection of heat mode is made when the initial start of the equipment is made, this menu will change and the regulation of heat mode will be shown.



	From this icon you can access the language configuration screen for this specific unit, you can select between Spanish or English.
	From this icon you can change the date and time settings.
	From this icon you can access the working hours of each compressor and the alarm history of the unit.
	From this icon you can access the current status of the equipment in which you can observe the water temperatures, amount of water gallognage and operation of components in general.
	From this icon it is possible to access the equipment's scheduling or candelarizarían to program times or dates at which the equipment needs to be activated.
	By means of this icon you can access the setpoint selection of the equipment, from here you can select the operating point in cold mode or hot mode depending on the configuration that has been selected from the start of operation of the equipment.
	From this icon you can access the maintenance mode parameters of the equipment. In order to access this menu, a password will be required, which at the moment of accessing will show a submenu that should only be manipulated by qualified personnel.

CONTROL

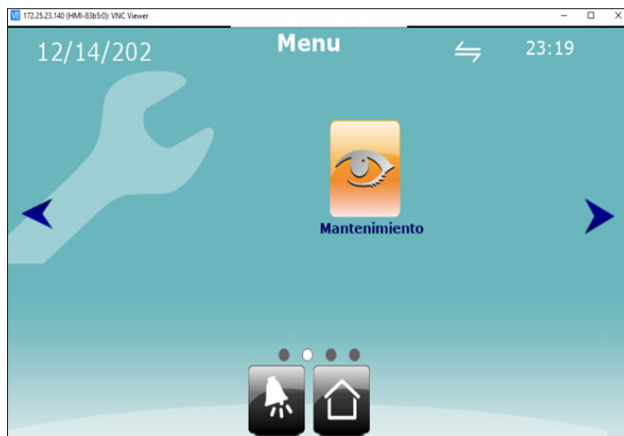
By pressing access you will be able to access the maintenance parameters submenu as shown in the following images. In order to access this menu, a password will be required so that only qualified personnel can manipulate the internal parameters of the equipment. If you need to manipulate these parameters without qualified personnel, ask for technical assistance by phone in order to attend to parameterization requirements.



When the equipment maintenance submenu is accessed, a blue arrow will appear to the right, which can be used to move the necessary parameters in order to access their parameterization.






The following is a description of each of the maintenance submenus and the parameters they contain in order to be able to parameterize the machine to the operation needs.




Pressing this menu will give access to the display of the inputs and outputs of the machine.

The following screen shows a menu where you can find the configuration, parameter settings and calibration of the machine, each of the menus contained in this page will be described below.



ICON	DESCRIPTION
	From the settings menu you can configure the behavior of the equipment with the thermal load of the work and the ranges at which the setpoint can start working.
	From the calibration menu you can modify the reading values of the analog sensors and, if necessary, adjust the analog outputs.
	From the export menu you can download the alarms of the events that occur in the equipment.



From the delete logs menu you can delete the saved events that have occurred in the equipment, it is worth mentioning that if these logs are deleted, the events that have occurred in the equipment will be definitively lost.

Once the necessary settings have been made on the previous page to continue with the necessary configuration of the equipment, press the key to the right of the screen, this will change the page and an extra menu will appear as shown below.







From this screen you can monitor the inputs and outputs of the machine.



When entering the summary menu you can see the current status of the system and operation in general as shown in the following image, this page will show the icons of the equipment that will be in operation. For this example, only one unit is selected, so if more units are selected in the initial configuration, they will be shown in this screen.



ICON	DESCRIPTION
	From the configuration menu you can modify the equipment startup and the setpoint limits of the equipment, you can also activate the vnc of the screen; this will allow a remote connection with the equipment, it is worth mentioning that in the new version of the screen this option is no longer available since in the version of the new screens this configuration comes by default. To activate it is a different procedure. Consult with the screen version which the machine has from the beginning.
	From the restore menu you can reset the equipment parameters by default, it should be taken into account that this procedure requires trained personnel. Consult with the manufacturer.
	From the devices menu you can configure the alarms and alarm times of the machine, also consider to move these parameters consult with trained personnel.
	The auxiliary menu contains extra options that the equipment can have. In order to configure these options, consult with qualified personnel to confirm if the equipment has these extra options.

In order to enter the description it is necessary to press the compressor icon.

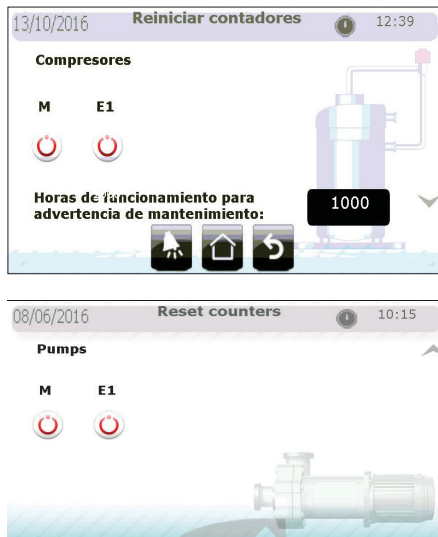
Pressing the above icon will take you to the general description of the unit's operation, from here you can see the status of the main operating inputs of the unit, as well as the system temperatures and the water flow measurement in the system.



CONTROL

RESETTING THE WORK HOURS COUNTER

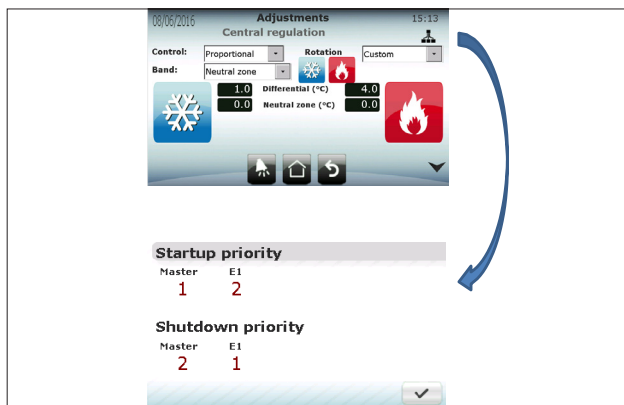
In this section, accessible with level 1 password, the user is given the option to reset the counters via buttons for each section. The counter reset button resets the count of the number of times the compressor was started, the number of hours worked and the number of times the pressure suction and discharge digital inputs were activated. The pump reset button resets the number of times the pump has been started and the number of hours worked by the pump.



SETTINGS

In the settings section, protected by level 2 password, the parameters for the control and management of the cooling demand (and heating for systems configured as heat pump) are displayed.

The parameters for Central Control ("Tandem" mode) are completely independent of the type of regulation in "Stand-alone" mode, with the exception of the cooling and heating set points, as well as the option to clear the accumulated integral errors when the set point is reached.



Note: Even if a custom rotation mode was selected, the drive with the inverter or unloader ("Mother" drive) will always be the first to be turned on and the last to be turned off, regardless of the assigned priority.

TANDEM OR CENTRAL CONTROL

The control parameters in the central or "Tandem" regulation mode using the control temperature as the main unit temperature are:

- **Central Control or Tandem mode parameters:**
- Control type (P, PI or PID).
- Remove integral control when set point is reached to avoid fluctuations inherent to integral control.
- Rotation Type
- Differential (Water Chiller Unit and heat pump)
- Neutral Zones (Water Chiller Unit and heat pump)
- Integral Time
- Derivative time

Note: To configure PD control, select PID and set the integral time to 0.

INDEPENDIENT CONTROL

The "Independent Control" calculates all the parameters that regulate the demand control in each unit independently using the injection temperature as the main parameter.

As the "Mother" unit can regulate its capacity, it has a unique proportional control algorithm, P+I or PID with parameters independent of the central control. If PD control is desired, the user must select PID and set the integral time to 0 sec.

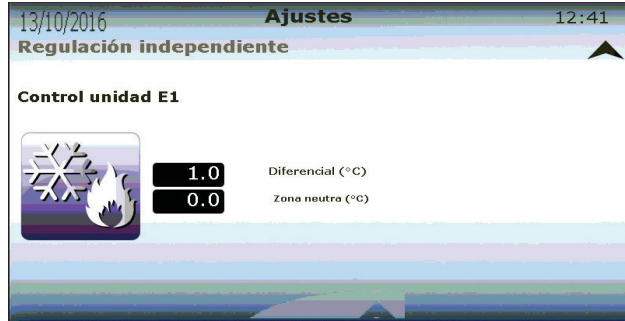
Parameter mode o Independent central control for the "Mother" unit

- Control type (P, PI or PID)
- Remove integral error when set point is reached to avoid fluctuations inherent in integral control.
- Differential (Water Chiller Unit and Heat Pump)
- Neutral Zone (Water Chiller Unit and Heat Pump)
- Integral Time
- Derivative Time

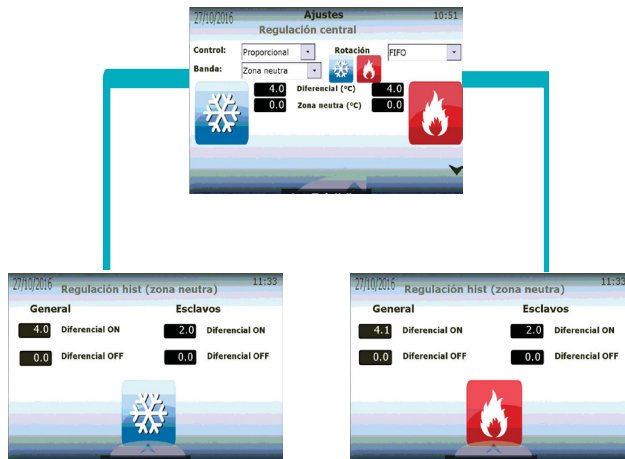


Individual control in “Son” units only requires the following parameters:

- Differential (The same process for cooling and heating)
- Neutral Zone (Same process for cooling and heating)



HYSTERESIS CONTROL



The unit has the option to configure the respective ON and OFF from the set point, both for cooling and heating mode, in “General” the ON differential will have the value of ON and the OFF differential the value of OFF, always with respect to the set point of the unit.

Example

Differential ON = 5
Differential OFF = 0
Set point = 50

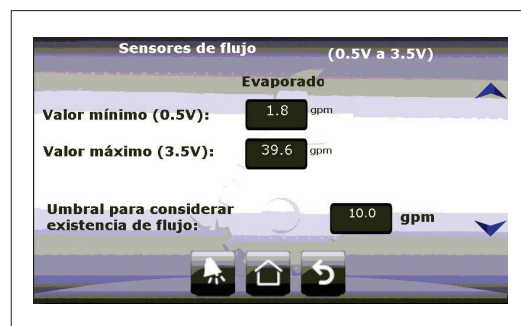
The unit will turn on at set point +5 (55) and turn off at set point -0 (55).

In addition, in the “Son” section it is possible to configure the switching on and off of the same, this configuration is a prevention to avoid the alarm of freezing or cold water in the “Tandem” mode, this function is the same as in “General” and respective to the set point.

Note: The ON differential in both “General” and “Child” units must always be >0, otherwise the unit will never be activated.

CALIBRATION

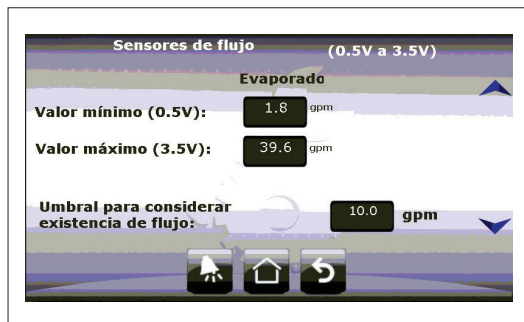
In the “Calibration” section, which is password protected to Level 2, the user can adjust the readings of the sensors connected to the units to match the readings on a measurement standard. Additionally, it is possible to set the logical operation of the digital inputs; these can be “Regularly Open” (NO) or “Regularly Closed” (NC).



In addition it is possible to calibrate the minimum flow rate allowed to turn on the system, the unit system needs 2.4 gallons/min per Ton. If you have a 10 Ton unit you will need 24 gallons/min. If the hydraulic installation cannot provide this flow, it is possible to operate the unit at 80% of the required flow to avoid flow alarms, be cautious if you decrease to less than 80% as this can cause serious problems in your system such as inefficiency and lack of rated capacity.

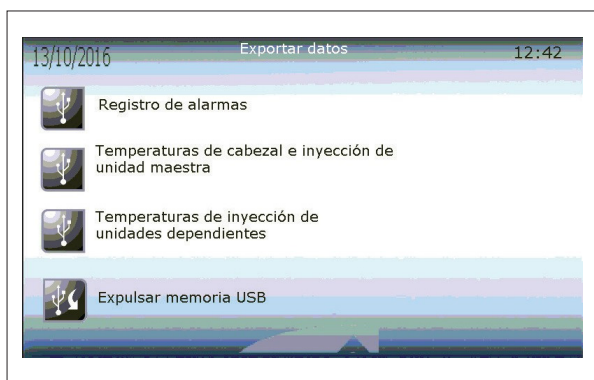
CONTROL

For water heat pumps you will see the condenser sensor, do not change the maximum and minimum values, these must be configured in the installation.



This type of sensor cannot measure more than 39.6 gal/min, in case you get a value higher than this, the display will show 295.6 approx. Check your hydraulic system to regulate the flow. The value considered acceptable will be the same for the evaporator sensor.

EXPORT OF RECORDS



The user can export to a USB Flash Drive all the information stored in the unit by means of a comma separated file (CSV). The user can export 3 different files with different information:

- The Alarm Log
- The injection temperature of the “Mother” unit and if available, the temperatures of the Mother unit.
- The injection temperature of the “Child” units (if any are present in the system).

DELETION OF RECORDS

In the last part of Level 2 of the Navigation Menu, the user can delete the historical graphs and alarm records from the internal memory of the pGD Touch terminal.

NOTE: If records are deleted, it is NOT possible to recover them later.

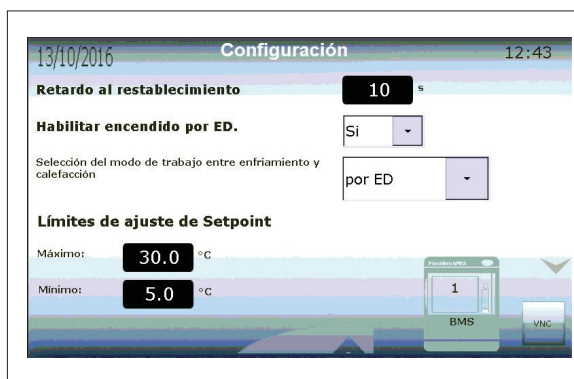


SETTING

The Global system configuration is protected with the Level 3 password.

In the “Configuration” section you will find the global parameters of the system. These are separated into 3 categories.

- Restart Delay: If the control is Off, when it is restarted the controller will wait this time before starting the regulation process.
- Enable unit start-up via Digital input.
- Select operation mode.
- Set point safety limits.



NETWORK COMMUNICATION

The BMS2 control port can be used to monitor the entire system remotely with an external supervisor via Modbus RTU protocol.

In this screen the user sets the parameters of the communication protocol to be connected to an external device. These parameters are:

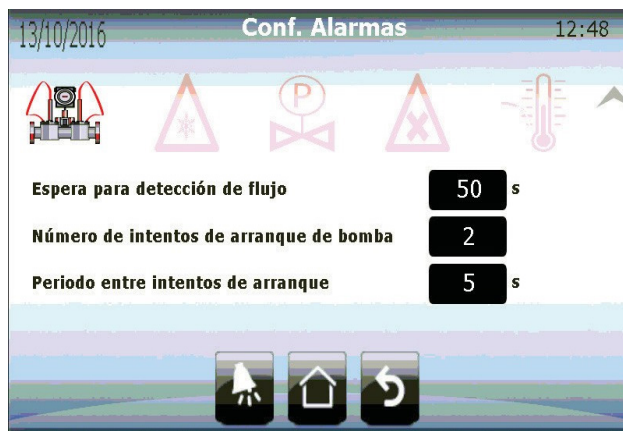
- Address
- Speed (Baud per second)
- Stop bits
- Parity



FLOW ALARM

The detection processes for water flow are explained in the "Pump Startup" section. The parameters to be assigned by the user are:

- Waiting time for digital input detection once the pump has been turned on.
- Number of attempts to start the pump in case of digital input flow detection failure.
- Waiting time between attempts to start the pump.

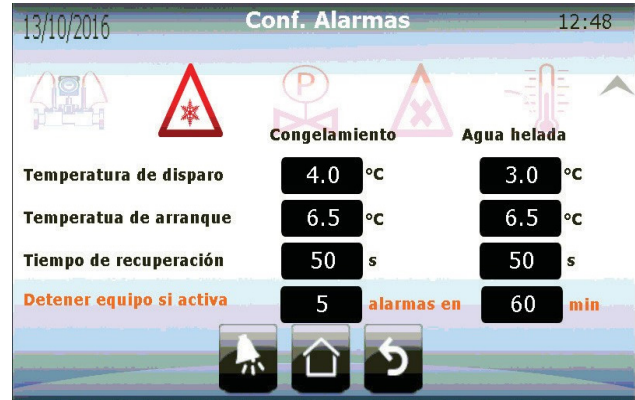


FREEZING AND COLD WATER ALARM

The freezing and cold water logic is the same, except that one considers the freezing sensor and the other the injection sensor as the main source of information.

For each of the alarms, an activation value, a reset and recovery time (where the unit with an active alarm will not be reset) must be set.

Each unit has an internal counter that keeps track of how many times a freeze or cold water alarm has been activated. If the unit exceeds a certain number of alarms in a certain amount of time, the continuous freeze alarm will be activated, which will disable the unit until the user resets it.



HIGH AND LOW PRESSURE ALARM

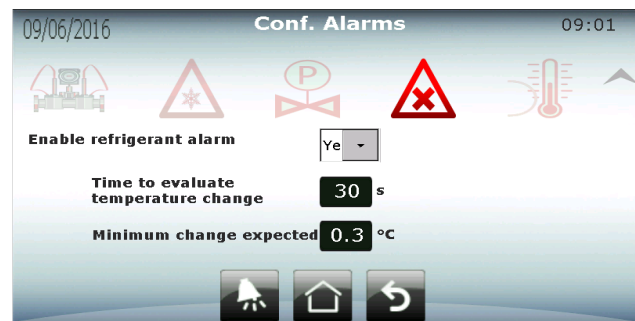
The high and low pressure alarms are activated immediately after a change in the digital input is detected. Both alarms stop compressor operation immediately.

The high pressure alarm is not automatically reset, the user must perform this operation manually. The low pressure alarm is automatically reset once a change in the corresponding digital input is detected. When the alarm is reset, the compressor will be disabled for the recovery time set by the user in this section.



REFRIGERANT ALARM

The refrigerant alarm is a user-enabled warning that evaluates the change in the injection temperature sensor when the compressor starts running. If it detects any change in the set time, the alarm is activated. This alarm will not stop any control process. In this section the user can enable and disable the alarm, and if applicable, set the minimum detection range and the maximum time in which this change must occur to not activate the alarm.



CONTROL

RESTAURATION

In the last section that can be accessed with the Level 3 password, there is the option to reset the unit to factory settings. Restore System allows the user to reconfigure the system as a completely new installation and reset the initial settings. The reset resets the parameters of the initial system configuration, but does not change any of the other values stored in the controller's memory (setpoints, differential, alarms, etc.).

It is the user's responsibility to properly configure the system with the new settings for proper operation of the units.



Nota : Cuando el sistema es reestablecido, el usuario debe reiniciar tanto el controlador (pCO) como la terminal (pGD Touch).

APPENDIX

SERIAL ADDRESS OF EXPANSION MODULES

Each "Child" unit uses an expansion module that communicates via Modbus with the parent (pCO) controller through the Fieldbus1 port of the controller. Consequently, the units need to be configured with the correct serial address. To avoid errors, the address is set and fixed when the controller is programmed and cannot be changed. The only task to be performed by the user is to set the physical address of the expansion modules by combining 4 "switches" on each expansion module. The address on the "switches" is set by the 4-bit binary number they represent. The lower position of the "switches" has a value of "1" and the opposite is "0".

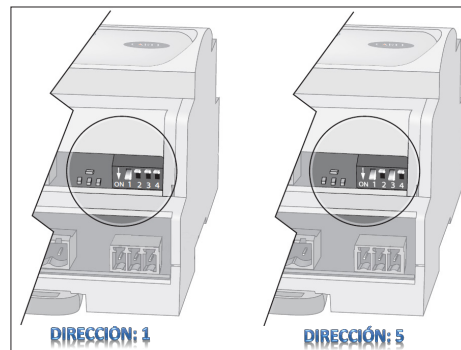
The addresses to assign are:

PCOE EXPANSION MODULE	SERIAL ADDRESS	SWITCHES IN PCOE
CHILD UNIT 1	1	ON 1 2 3 4
CHILD UNIT 2	2	ON 1 2 3 4
CHILD UNIT 3	3	ON 1 2 3 4
CHILD UNIT 4	4	ON 1 2 3 4

PCOE EXPAN-SION MODULE	SERIAL ADDRESS	SWITCHES IN PCOE
CHILD UNIT 1	9	ON 1 2 3 4
CHILD UNIT 2	10	ON 1 2 3 4
CHILD UNIT 3	11	ON 1 2 3 4
CHILD UNIT 4	12	ON 1 2 3 4

No other serial address will be recognized, the "expansion module disconnected" alarm will be triggered if a wrong address is used.

EXAMPLE :



Note: It is important that the addresses are not repeated, or the entire instrument network on that port could collapse.

