
Ecogreen®

ECCLAHP/R 2-PIPE/4-PIPE
RECIPROCATING/SCREW
AIR-SOURCE HEAT PUMP

Replaces: V2.4.1

Version: V2.4.2

INSTALLATION, OPERATION AND MAINTENANCE MANUAL



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2.4.2	Add c.pCO controller, valves three way	01/04/2024	VR		

IMPORTANT!

READ BEFORE YOU CONTINUE!

GENERAL SAFETY RULES

During assembly, installation, operation, maintenance, or service, individuals may be exposed to specific components or conditions including, but not limited to, heavy objects, coolants, materials under pressure, rotating components, and high and low voltage. Each of these items has the potential, if misused or mishandled, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operation/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in severe damage to the equipment and property on which you are located, as well as serious personal injury or death to them and the people on site.

This document is intended for use by owner-authorized installation, operation, and maintenance personnel. These individuals are expected to possess independent training that enables them to perform their assigned tasks properly and safely. Before performing any task on this computer, this person must have read and understood the product labels, this document, and any reference materials. This person will also need to be familiar with and comply with all applicable government and industry rules and regulations related to the task at hand.

Security symbols

The following symbols used in this document are to alert the reader to specific situations:

DANGER

It indicates a possible dangerous situation that will lead to death or serious injury if proper precautions are not taken.

CAUTION

Identifies a hazard that could damage the machine, other equipment, and environmental contamination if proper care is not taken or instructions are not followed.

WARNING

It indicates a potentially dangerous situation that will result in injury or equipment damage if proper care is not taken.

NOTE

It highlights additional information that is useful to the technician in completing the job successfully.

WARNING

External cabling should not be connected inside the control cabinet unless specified as an optional connection in the manufacturer's product line. Devices such as relays, switches, transducers, controls, and any external wiring should not be installed inside the control board. All wiring must be by the published specifications of Ecochillers Inc. and must be performed only by a qualified electrician. Ecochillers Inc. It will NOT be liable for damage/problems resulting from incorrect connections to controls or the application of incorrect control signals. Failure to comply with this warning will void the manufacturer's warranty and result in severe property damage or personal injury.

IMPORTANT SAFETY INSTRUCTIONS

This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge unless they have been given supervision or instruction concerning the use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

Cet appareil n'est pas destiné à être utilisé par des personnes (y compris des enfants) ayant des capacités physiques, sensorielles ou mentales réduites, ou un manque d'expérience et de connaissance, à moins qu'elles n'aient été supervisées ou instruites sur l'utilisation de l'appareil par une personne responsable de leur sécurité.

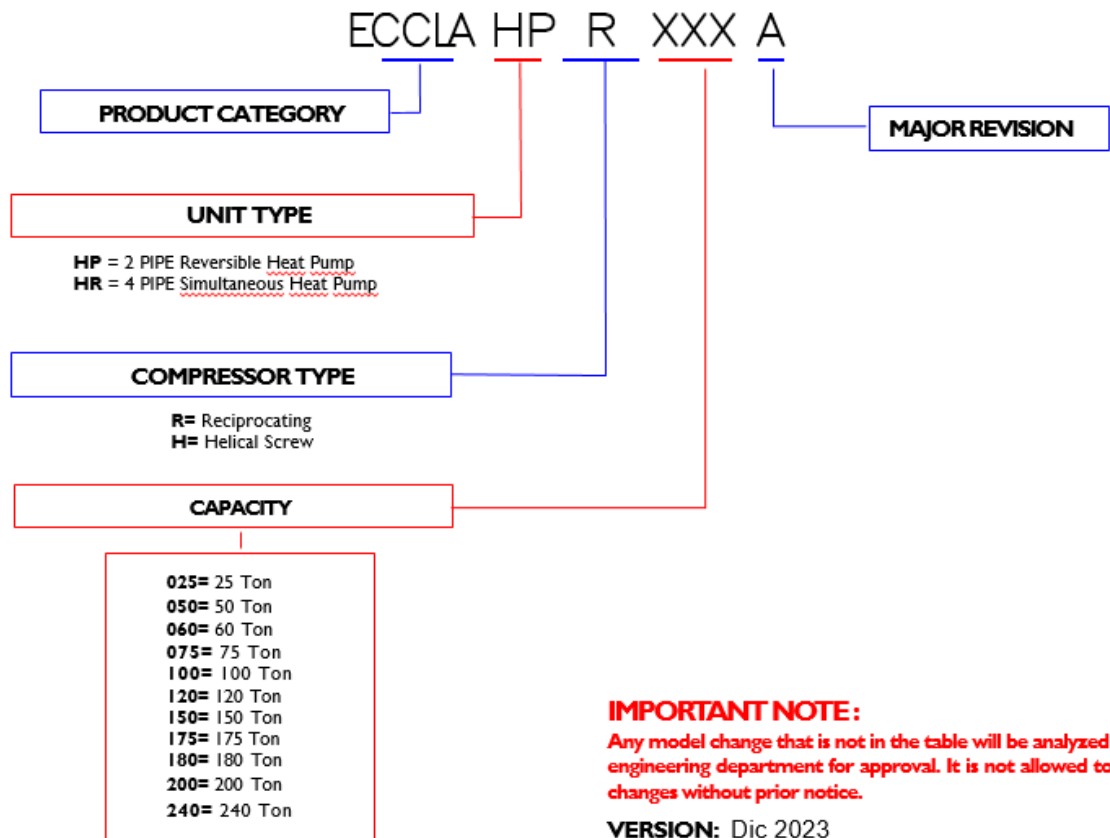
Les enfants doivent être surveillés pour s'assurer qu'ils ne jouent pas avec l'appareil.

MODIFICATION OF THIS DOCUMENT



To comply with the policy of Ecochillers Inc. For continuous product improvement, the information contained here is subject to change without notice. Ecochillers Inc. makes no commitment to automatically update or provide updated information to the owner of the manual or product. Updated manuals, if applicable, can be obtained by contacting the nearest Ecochillers Inc. service office or by accessing the Ecochillers Inc. website in ecochillers.com.

It is the responsibility of assembly, lifting, and operation/service personnel to verify the applicability of these documents to the equipment. If there are any questions regarding the applicability of these documents, assembly, lifting and operation/service personnel should check whether the equipment has been modified and whether the equipment owner has up-to-date literature before performing any work on the cooler.

HEAT PUMP NOMENCLATURE



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1 GENERAL INFORMATION

1.1 INTRODUCTION

The ECOGREEN air-cooled full DC inverter modular chiller and heat pump provides chilled and hot water for all air conditioning applications using an air handling or terminal unit. The unit is completely self-contained and designed for outdoor installation at roof or ground level. Each packaged unit includes Reciprocating compressors, liquid heat exchanger, air-cooled condensers, R-513B refrigerant, and a weather-resistant microprocessor control center, all mounted in a sheet metal frame. Up to four modules can be provided as a factory package with single point electrical connection. The unit is available as either a two-pipe reversible heat pump or four-pipe simultaneous heating and cooling machine, with load balancing capability enabled by the air-source heat exchanger.

1.2 Control Principles

1.2.1 Air-to-water heat pump unit modes of operation

The ECOGREEN two-pipe heat pump has two operation modes:

cooling only or **heating only**. A reversing valve changes the function of the heat exchangers to provide either heated or cooled liquid as required. A third operating mode, defrost cycle, is enabled automatically as necessary to remove ice build-up when the unit is in heating operation.

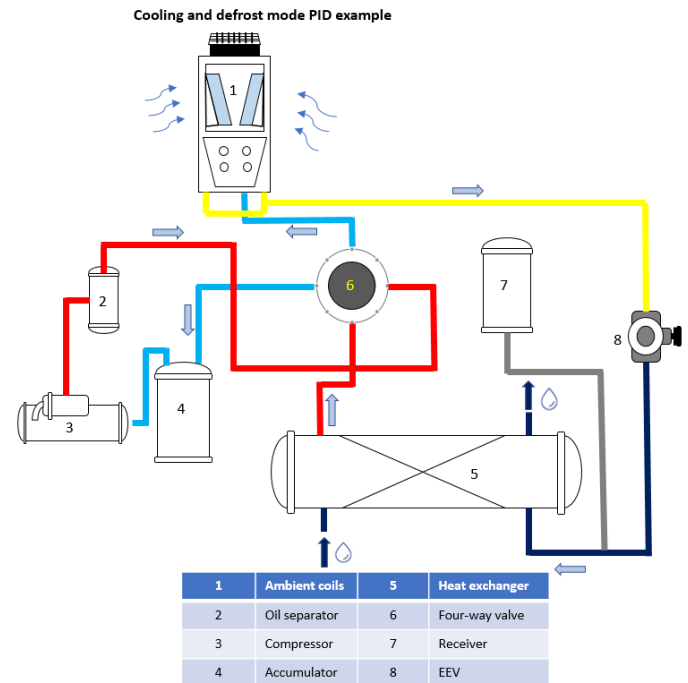
The ECOGREEN four-pipe heat pump has three operation modes:

- cooling only
- heating only and
- simultaneous heating and cooling.

Intelligent control logic of operation mode can meet dynamic cooling and heating load in one building, offering an integrated cooling and heating solution. A fourth operating mode, defrost cycle, is enabled automatically as necessary to remove ice buildup when the air source heat exchanger is functioning as an evaporator.

1.2.2 Cooling mode

Low-pressure liquid refrigerant enters the heat exchanger and is evaporated and superheated by the heat energy absorbed from the chilled liquid. Low-pressure vapor enters the compressor through the four-way reversing valve and accumulator, where pressure and superheat are increased. The high-pressure vapor is fed to the ambient coils and



fans through the four-way reversing valve, where heat is removed. The fully condensed and subcooled liquid passes through the expansion valve where

pressure is reduced and further cooling takes place before returning to the heat exchanger.

1.2.3 Heat pump mode

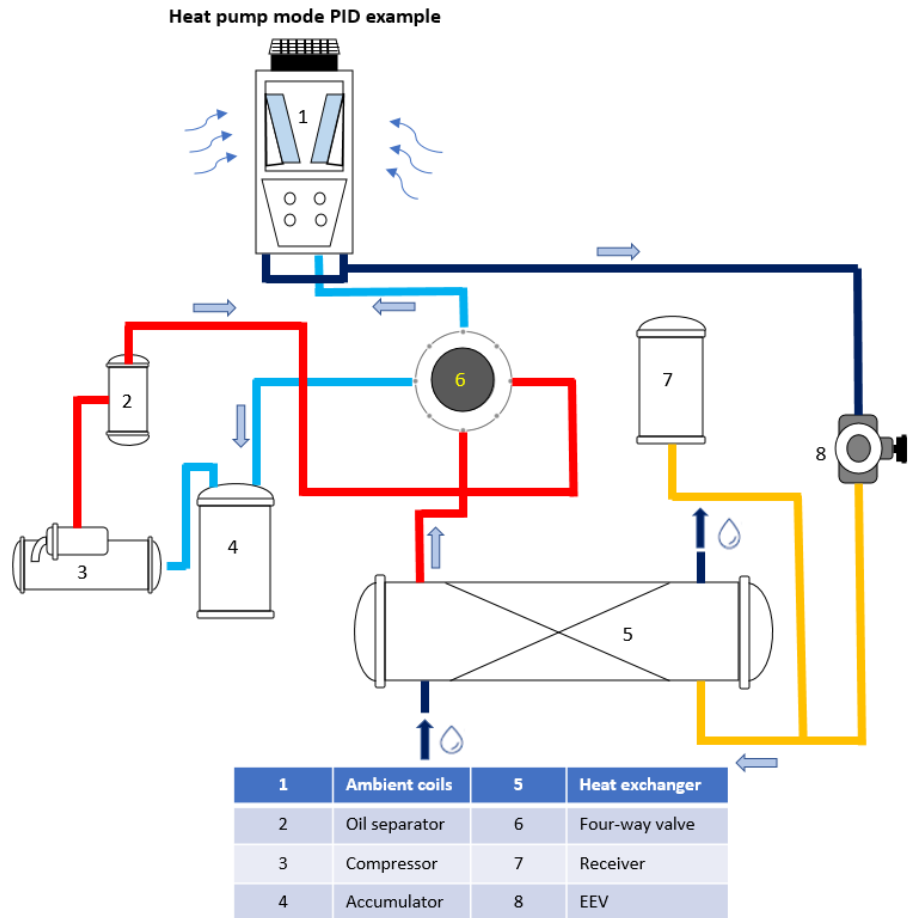
When ice builds up on the ambient coils, an automatic defrost cycle is initiated with the machine in a cooling mode. Each of the refrigerant circuits are defrosted separately. When in defrost mode, the circuit operating in heat pump mode is in balance with the circuit operating in defrost (cooling). Heat output is, at worst case, net zero during defrost period.

Advanced defrost logic is employed to reduce defrost cycle time and system impact. This includes the following capabilities:

- Defrost based on the refrigerant pressure
- Subcooling circuits are designed to prevent ice build-up at the bottom of the coil
- Defrost staging logic that cycles circuits through defrost sequentially, minimizing deviation from setpoint during defrost. No more than half of the total number of circuits can defrost at the same time. In the most extreme case, the system provides net zero heating output for the defrost period.
- The defrost generates water, which collects in the unit drain pan below the coils and channels out of the bottom of the unit frame through large diameter flexible tubing. The drain pan and tubing are freeze-protected by the heat generated inside the unit cabinet. Include a drain under each unit to collect

condensate water and move it away from the working area surrounding the unit.

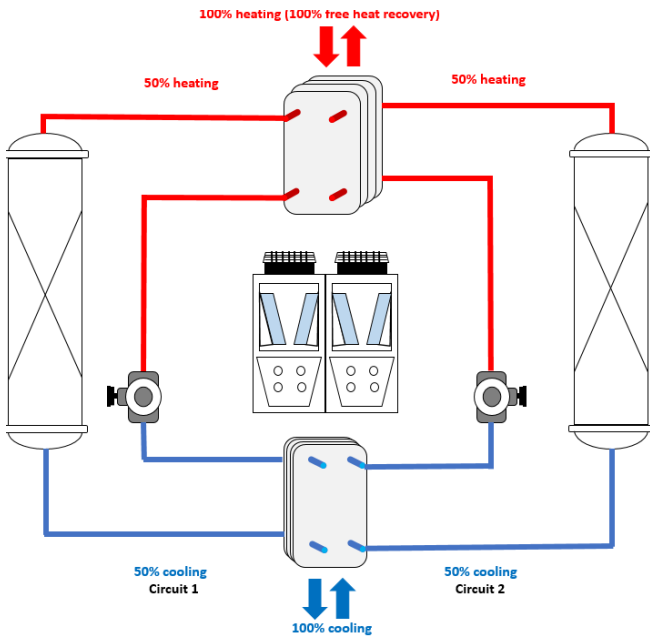
1.2.4 Simultaneous heating and cooling mode, four-pipe unit



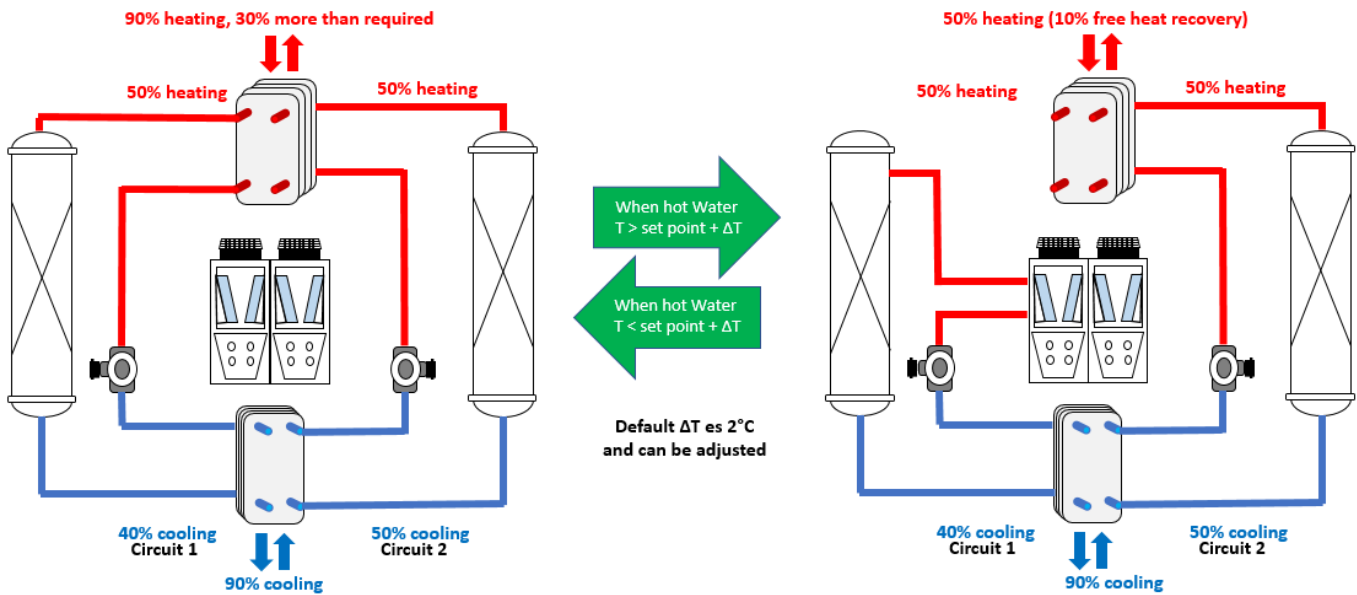
The heat pump can simultaneously provide both heating and cooling to different zones or areas within a building.

Control logic auto-balances cooling and heating within the ECOGREEN four-pipe chiller allowing

independent and dynamic control of both hot and chilled water temperatures. Auto-balance logic also maximizes the utilization of cooling with heat recovery to improve energy efficiency.



For example, the following figure shows a system in operation, targeting 90% cooling and 60% heating.



Firstly, the unit meets the 90% cooling demand and covers 90% of heat while working as simultaneous cooling and heating.

Heating is 30% more than the demand, so it switches to the right side and provides 50% heat, which is 10% less than the demand.

With the mode switching control, 90% cooling and 60% heat is achieved.

To avoid the unit frequently shutting off and turning on cycling and to ensure water temperature is stable, the building system water volume needs to be above the recommended value.

ECOGREEN cooling units are manufactured to the highest design and construction standards to ensure high performance, reliability and adaptability of all types of air conditioning installations.

Rigging and lifting should only be performed by a professional rigger according to a written rigging and lifting plan. The most appropriate lifting and rigging method will depend on job-specific factors, such as available rigging equipment and site needs. Therefore, a professional surveyor must determine the rigging and lifting method to be used, and it is beyond the scope of the manual to specify the details of rigging and lifting.

This manual contains all the necessary information for the correct installation and commissioning of the equipment, together with the operating and maintenance instructions. The manuals should be read completely before attempting to operate or repair the unit.

All procedures detailed in the manual, including installation, commissioning and maintenance tasks, should only be performed by properly trained and qualified personnel.

The manufacturer shall not be liable for any injury or damage caused by improper installation, commissioning, operation or maintenance as a result of failure to follow the procedures and instructions detailed in the manual.

1.3 WARRANTY

ECOCHILLERS warrants all equipment and materials against defects in workmanship and materials for a period of eighteen months from the date of shipment or 12 months from the date of commissioning, whichever comes first, unless labor or extended warranty has been purchased as part of the contract.

The warranty is limited solely to the replacement of parts and the shipment of any defective parts or sub-assembly that have failed due to poor quality or manufacturing errors. All claims must be supported by evidence that the failure occurred within the warranty period and that the unit was operated within specified design parameters.

- The initial start-up of the unit must be carried out by trained ECOCHILLERS Authorized Service personnel.
- Only genuine ECOCHILLERS approved spare parts, oils, coolants and refrigerants should be used.
- All scheduled maintenance operations detailed in this manual must be performed at specified times by appropriately trained and qualified personnel (see SECTION 4 - MAINTENANCE).
- Failure to comply with any of these conditions will automatically void the warranty (see Warranty on this page).

1.4 HANDLING

These units are shipped as fully assembled units containing the full operating load, and care must be taken to avoid damage due to rough handling.

-Handle yourself with care-

1.5 Responsibility for safety

All precautions have been taken in the design and manufacture of the unit to ensure compliance with the safety requirements specified above. However, the person who handles, lifts, maintains, operates or works on any machinery is primarily responsible for:

- Personal safety, safety of other personal and machinery.
- Correct use of the machinery according to the procedures detailed in the manuals.

The content of this manual includes best practices and suggested working procedures. These are issued for guidance only and do not take precedence over the individual responsibility mentioned above and/or local safety regulations.

This manual and any other document supplied with the unit are the property of ECOCHILLERS, which reserves all rights. They may not be reproduced, in whole or in part, without the prior written permission of an authorized representative of ECOCHILLERS.

1.6 MISUSE OF EQUIPMENT

1.6.1 Team approach

The unit is designed to cool water or glycol solutions and is not suitable for purposes other than those set out in these instructions. Any use of the equipment other than as intended, or operation of the

equipment contrary to the relevant procedures may result in injury to the operator or damage to the equipment.

This unit should not be operated with parameters other than those established in the manual.

1.6.2 Structural support

The structural support of the unit must be provided as indicated in these instructions. Failure to provide proper support can result in operator injury or damage to equipment and/or building.

1.6.3 Mechanical force

The unit is not designed to withstand loads or stresses from adjacent equipment, pipes or structures. No additional components should be mounted on the unit. Any of these foreign loads can cause structural failure and lead to operator injury or damage to equipment.

1.7 General access

There are a number of areas and features that can be dangerous and potentially cause injury while working on the unit, unless proper safety precautions are taken. It is important to ensure that access to the unit is restricted to suitably qualified persons who are familiar with the potential hazards and precautions necessary for safe operation and maintenance of equipment containing high temperatures, pressures, and voltages.

1.8 Pressure systems

The unit contains steam and pressurized coolant, the release of which can be dangerous and cause injury. The user must ensure that care is taken during installation, operation and maintenance to avoid damage to the pressure system. Access to pressure system components should not be attempted unless they are properly trained and qualified personnel.

1.9 Electrical systems

The unit must be grounded. No installation or maintenance work should be attempted on the electrical equipment without first shutting down, isolating and blocking the power supply. The service and maintenance of live equipment should only be carried out by properly trained and qualified personnel. Do not attempt to gain access to the control panel or electrical cabinets during normal operation of the unit.

1.10 Rotating parts

Fan guards must be in place at all times and should not be removed unless the power supply has been isolated. If ducts are to be installed that require removing wire guards from the fan, alternative safety measures should be taken to protect against the risk of injury caused by rotating fans.

1.11 Sharp edges

The fins of the air-cooled coils have metallic edges. Reasonable care must be taken when working in contact with coils to avoid the risk of minor abrasions and lacerations. The use of gloves is recommended.

Frame rails, brakes, and other components may also have sharp edges. Reasonable care must be taken when working in contact with any component to avoid the risk of minor abrasions and lacerations.

1.12 Refrigerants and Oils

The coolants and oils used in the unit are generally non-toxic, non-flammable and non-corrosive, and pose no special safety hazards. However, the use of gloves and safety glasses is recommended when working on the unit. The accumulation of refrigerant vapor, for example, due to a leak, presents a risk of suffocation in confined or enclosed spaces and attention should be paid to good ventilation.

1.13 High temperature and pressure cleaning

High temperature and pressure cleaning methods (e.g., steam cleaning) should not be used anywhere in the pressure system, as this may activate the operation of pressure relief devices. Detergents and solvents, which can cause corrosion, should also be avoided.

Important

1.14 Emergency stop

In case of emergency, the control panel is equipped with a safety switch that interrupts the power supply which causes a total stop in the unit.

2. COMPONENTS

2.1 Compressors

The compressors we use vary, depending on the parameters and capabilities of each equipment, as well as its function, these are the brands of compressors we handle: COPELAND, CARLYLE and BITZER.

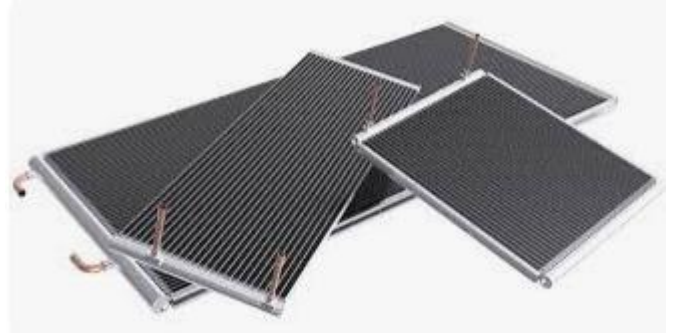


Of which there is a wide variety of models with the best conditions for cooling systems. Scroll, semi hermetic, screw or alternate type compressors incorporate a spiral design compatible in both axial and radial directions. All rotating parts are statically and dynamically balanced. A large internal volume and oil reservoir provide greater tolerance to liquids. Compressor crankcase heaters are also included for additional protection against liquid migration.

2.2 Air Coil

ECCLA-P Series Air-Cooled In models 025 to 240 the Air Coil is Microchannel type made of 100% aluminum—models 300 to 1200. The air-cooled coil consists of a 3/8-inch seamless copper pipe, which is mechanically expanded on the aluminum fins to ensure heat transfer.

Note: The Model 300 is being migrated to the Microchannel Air Coil, so your equipment can be assembled under this new platform.



2.3 Air Coil Fan Motors

To carry out the movement of the air, the equipment has axial-type fans; the fans are driven directly by means of single-phase motors in models 012 to 300 and three-phase in models 360 to 1200; these are rainproof to ensure continuous operation.



2.4 Water Coil Welded Plate Exchanger

The heat exchanger is composed of stainless steel plates, tightly joined and welded to ensure high efficiency in heat exchange. It is insulated with polyolefin elastomer foam with a minimum thickness of 1/2" to provide optimal thermal insulation.



2.5 Water Coil Shell and Tube Exchanger

The shell and tube heat exchanger are made of reinforced steel and inside copper tubes to ensure high efficiency, lined with elastomer foam with polyolefin of a minimum thickness of 1/2 " to provide optimal thermal insulation.



2.6 ShellBox (Heat Exchanger)

Shell and Tube heat exchanger is a kind efficiency heat exchanger which is composed of highly efficient style inner pipes and shell of baffle plastic plate. It has the advantages of shell and tube heat exchanger and Plate heat exchanger.

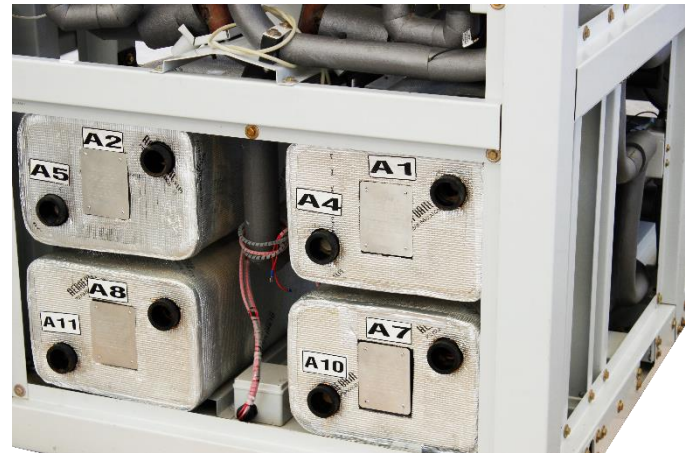
Both heat exchanging inner core with structure of Ω and plastic baffle plate possess the ability of elasticity to obtain the function of anti-freezing.

HZSS patented structure of plastic baffle plate and titanium inner core has long serve life and corrosion resistance.

Heat exchanging inner core are internal threaded to obtain more heat transfer area and turbulence flow in order to achieve higher efficiency.

Special refrigerant connection sealing to avoid leakage.

Easy maintenance and cleaning. The shell is designed to be dismountable to make maintenance and cleaning much easier.



2.7 Refrigerant Circuit

To ensure optimal operation, the circuit is loaded with factory **R-513A** refrigerant with its respective leak test, each is equipped with carefully selected thermostatic expansion valve to ensure continuous operation and adequate flow.

2.8 Fans

ZIHEL-ABEGG and ROSENBERG are the two lines we use to give the widest range of effectiveness, the Air Coil fans are composed of a corrosion-resistant aluminum hub and fiberglass-reinforced polypropylene composite blades molded into a low-noise aerodynamic section. They are designed for maximum efficiency and are statically and dynamically balanced for vibration-free operation. They are driven directly by independent motors and positioned for axial air discharge. Fan protectors are made of corrosion-resistant, large-caliber coated steel. All blades are statically and dynamically balanced for vibration-free operation.

2.9 Distribution blocks

The ABB range of terminals and distribution blocks offers a wide range of variants adapted to different needs. Saving installation time, Ease of installation of our distribution blocks with option of mounting on plate or profile. Increase in the number of outputs using our bridges (from two to four poles),

Connection capacity up to 185 mm² (350 Kcmil).
Distribution blocks: unipolar, tripolar and tetrapolar, up to 11 outputs. Connection terminals from two to ten poles, up to 20 outputs.

2.10 ABB

ABB is a technology leader in electrification and automation, the company's solutions connect engineering know-how and software to optimize the way things are manufactured, moved, powered and operated.

Many of the electrical components we use come from ABB, since they are of great utility and quality, they give us a more practical and simple use for electrical, electronic or thermomagnetic components such as:

1. Distribution blocks
2. Pin busbars
3. Terminals
4. Motor starters
5. Circuit breakers
6. Contactors
7. Connection jumper
8. Auxiliary contacts
9. Overload relays
10. Delay timer
11. Power Source
12. Interface relay
13. Voltage suppressor
14. Connection terminal
15. LED lighting

All these components are part of our electrical systems to provide better function and efficiency, each component works depending on the unit you want in addition to its models that vary in the same way.

2.11 Voltage relay

For our voltage relays we use the SELEC and VAGNER line, they are the most conventional and effective due to the easy use to thermomagnetic ally open and close the circuits, as well as monitor the electrical systems and isolate abnormal conditions of main and auxiliary circuits in electrical installations.

They work as a switch and can be used in voltages from 460v in the 900vpr series to 600v in the DTP3 series.

2.12 Control transformer

HONEYWELL, LEGRAND, SQUARE-D and Dayton, are the lines we manage for our electrical transformers. Power control transformers are designed to reduce supply voltages to control circuits. The complete line of transformers is available with optional primary and secondary fuse block installed in the plant or for panel mounting and can be dry contact, there are also several models for different voltages.

2.13 Distributor transformer

Like control transformers, these transformers are responsible for dissipating the electrical charge and distributing it gradually, thus dispersing a more precise voltage that can be controlled for functions of refrigerant use, such is the case of ACME transformers whose operation is for industrial use. In the case of single-phase transformers that only withstand up to 25KVA for the 3R range, they become energy economical, which makes them an excellent option for high voltage systems.

2.14 Crankcase heater

EMERSON, CARLYLE and BITZER, are the lines we use for the compressor of refrigeration and air conditioning system. The objective is to heat the compressor crankcase causing evaporation of the

stagnant refrigerant liquid with the oil or lubricant in the compressor crankcase.

The most frequent models are usually from Emerson, since it has a wider variety that gives us better results. It also has a lot to do with the durability of the product, it is about giving the longest life to the compressor to efficiently evaporate the refrigerant flow.

2.15 Pressure switch

SUPCO and DANFOSS, are the best in terms of cooling systems due to their use to close or open an electrical circuit depending on the pressure exerted by a fluid on an internal piston that moves until two contacts join, acts depending on the pressure when it is low, a spring pushes the piston in the opposite direction and the contacts separate. They offer a long and effective utility life for measuring air and liquid pressure.

2.16 Flow switch

The flow switch protects the water pump from freezing damage. When it detects the proper flow, it gives the start signal to the chiller, otherwise it deactivates it to avoid any breakdown. You have to remember that it's just a switch, it doesn't check the output gallop of the chiller, it's just a protection. If the pump fails or is cavitating, deactivates and does not let the chiller operate, this accessory is preventive, but it is the responsibility of the installer and end user to verify a correct installation that prevents interruption, cut or decrease of the flow of water to avoid damage by freezing. If this protective device is disabled by the customer, it invalidates the warranty.

2.17 Pressure transducer

The translators we use are from the CAREL and EVCO lines, they allow us to see and convert the pressure

to analog electrical signals with which the condensing unit, refrigeration or also called pressure transmitter is working.

2.18 Wires

We handle different calibers for electrical connections ranging from cal 16 to cal 2/0 that are equipped with terminals depending on the use of the wire have a resistance of up to 600 VDC and are of the brands QUINROZ and VIAKON. We keep our electrical panels well-ordered and structured so that our customers can understand the system and the routing on the boards is more visible.

2.19 Ball Valves – Actuated 3-way

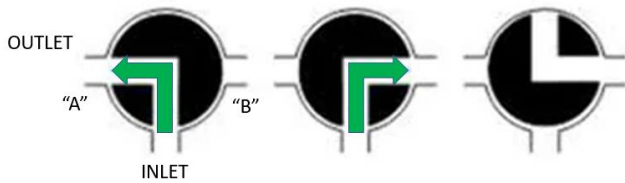


A three-way ball valve in refrigeration is a component used to control refrigerant flow in an air conditioning or refrigeration system.

The L-port 3-way valve mechanism allows the direction of media flow to be changed by turning a handle 90 degrees. This means that every time the handle is turned 90 degrees, the direction changes because one port closes and then another opens. The valve mechanism does not allow all three ports to be open at the same time.

The valve has three connection ports: one inlet (commonly referred to as "inlet"), and two outlets

("outlet A" and "outlet B"). Depending on the position of the ball, refrigerant flow can be directed from the inlet to outlet A, or to outlet B.



2.20 Expansion valves

From the CAREL line, they are the only ones we use for our units are designed to meet any cooling capacity of up to 2000 kW in air conditioning and refrigeration equipment, they stand out above all for their excellent flow control, even when the refrigerant flow is low.

There are 3 reasons why these valves are the best:

1. Reliability over time, the standard design process used for Carel ExV valves includes accelerated life tests of 1×10^6 cycles.
2. Very precise control: this is ensured by Carel electronic controllers, specially designed to optimize the management of air conditioning and refrigeration equipment, with special emphasis on energy saving.

3. Perfect coolant tightness: Despite the rotational movement of the engine, the moving parts do not rotate during movement. This allows the use of a high-quality Teflon seal, which rests gently on the valve seat, without any slippage.

2.21 Head Pressure Control Valve Operation

2.21.1 High and Low Ambient Stability

The design of air conditioning systems, utilizing air cooled condensing units, involves two main problems that must be solved if the system is to operate reliably and economically during high ambient and low ambient operation. If the condensing unit is properly sized, it will operate satisfactorily during extremely high ambient temperatures.

However, some units will be required to operate at ambient temperatures below their design dry bulb temperature during most of the year; the solution to low ambient operation is more complex.

Without good head pressure control during low ambient operation, the system can experience both running cycle and off-cycle problems. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low head pressure generally causes insufficient refrigerant to be fed to the evaporator. Failure to have sufficient head pressure will result in low suction pressure and/or iced evaporator coils. The primary off-cycle problem is refrigerant migration to the condenser. Insufficient flow through the TXV will cause a low suction pressure.

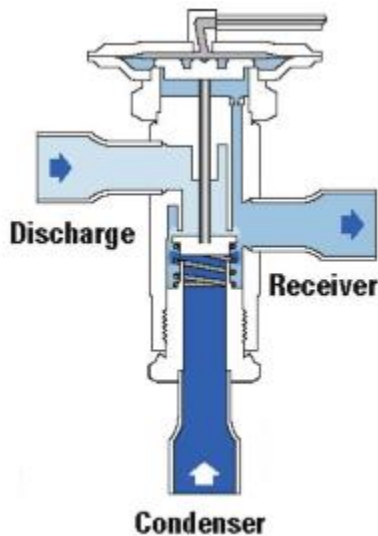
The typical method of maintaining normal head pressure in a refrigeration system during periods of low ambient temperature is to restrict liquid flow from the condenser to the receiver, and at the same time divert hot gas to the inlet of the receiver. This

liquid refrigerant backs up into the condenser reducing its capacity which in turn increases the condensing pressure. At the same time the hot gas raises liquid pressure in the receiver, allowing the system to operate normally.

2.21.2 Valve Operation (LAC) (OPTIONAL)

The valve designation LAC stands for **Low Ambient Control**.

The LAC is a three-way modulating valve that responds to receiver pressure. As shown in Figure, the receiver pressure acts under the diaphragm. As the receiver pressure drops below the valve setting, the seat moves away from the discharge port allowing discharge gas to bypass the condenser. This discharge gas warms the liquid in the receiver and raises the pressure to the valve setting. At the same time discharge gas is bypassing the condenser, liquid flow from the condenser is restricted, which allows liquid to back up in the condenser.



Flooding the condenser reduces the area available for condensing thus raising the condensing pressure. During summer conditions, the seat closes the discharge port due to high pressure in the receiver. Therefore, there is full liquid flow from the condenser to the receiver.

2.21.3 Refrigerant Migration

During an off cycle there is a potential for refrigerant to migrate from the warm receiver to the cold condenser.

An auxiliary check valve should be used in the liquid line between the LAC valves and the receiver to prevent this from occurring.

2.21.4 Low Ambient to 0°F

Factory installed variable speed fan control for all condenser fans provides optimum head pressure control. Liquid receivers, refrigerant relief valves and flood-back head pressure control valves are provided for all refrigerant circuits.

2.22 Driver for expansion valves

The EVD evolution driver can autonomously and independently control the CAREL EXV valve with the sole help of a digital input for commissioning. This solution adapts to any refrigeration circuit regardless of the controller used.

The EVCO drivers (EVDRIVE06) capable of managing both generic expansion valves and the most widespread stepper valves present in commerce, can also be used as a simple analog positioner and operate both in standalone mode and managed by a controller, guaranteeing an increase in the efficiency of the refrigeration circuit.

2.23 Cabinet

ABB and ELDON are the cabinets that we handle for their efficiency and excellent quality, as for the ABB cabinets of the SRN series are the most sophisticated in their line in addition to having the range of SR2 wall mounting cabinets is the offer of monobloc metal enclosures for small electrical panels and media for automation, Control and/or distribution command.

As soon as ELDON cabinets handle a series of cabinets Practical, efficient and with a wide range of standard sizes and accessories offers a solution to each application or can easily be customized to suit

Ecogreen®

specific requirements. Stainless steel cabinets are designed for greater cleanliness and protection, offer high corrosion resistance and ensure equipment performance.

3 INSTALLATION

3.1 Installation of ECOGREEN Units

This equipment must be installed by qualified personnel and such installation must meet all of the following requirements.

3.2 Proper installation

3.2.1 Location

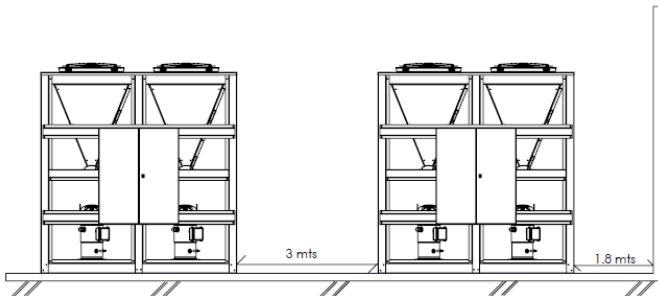
In order to obtain maximum capacity, the selection of the location of facilities must meet the following requirements:

1. The place must be ventilated so that air can circulate and discharge freely.
2. Install the unit in such a way that the discharge of hot air does not return again to the unit or other units.
3. Ensure that there are no airflow obstructions when entering or leaving the unit.
4. Remove obstacles that may block the entry or discharge of air.

3.2.2 Location of the Equipment

Do not install equipment at outlets in contaminated air, and/or in other places with limited space. With this, the resonance and vibration of walls and other obstacles will be avoided as much as possible.

A 10 ft (3 m) gap between units is required for airflow and a 6 ft (1.8 m) gap between units and walls is required for servicing to prevent air clogging and discharge (hot) condensate from the unit.



Remove any obstacles that could block air suction and discharge. The final location of the equipment must ensure adequate ventilation so that the equipment operates at moderate condensing temperatures and pressures.

3.3 Installation of Heat Pumps

3.3.1 Inspection

All chillers are shipped without bumps, each one has been carefully checked. As soon as the equipment is received, it should be inspected for any damage it may have suffered during the transport of the unit.

3.3.2 Storage of the Equipment

In case of not being installed within a few days of being received, it is strictly forbidden to stow one on the other, since they may suffer damage and the responsibility falls on the client.

3.3.3 Erroneous installations

1. Good ventilation cannot be guaranteed when the unit is installed indoors, it is advisable to place exhaust fans or ducts as short as possible so that the air goes outside, consult a ventilation specialist and the ECOCHILLERS engineering department.

2. To prevent flooding and promote proper drainage, fix the unit level, on a base 15 cm or 20 cm high that supports the weight of the unit or on the roof.

3. The air in the installation should not be susceptible to dust or oil to prevent the coil from becoming blocked. As a general precaution, it is recommended that the unit not be located near flammable gases.

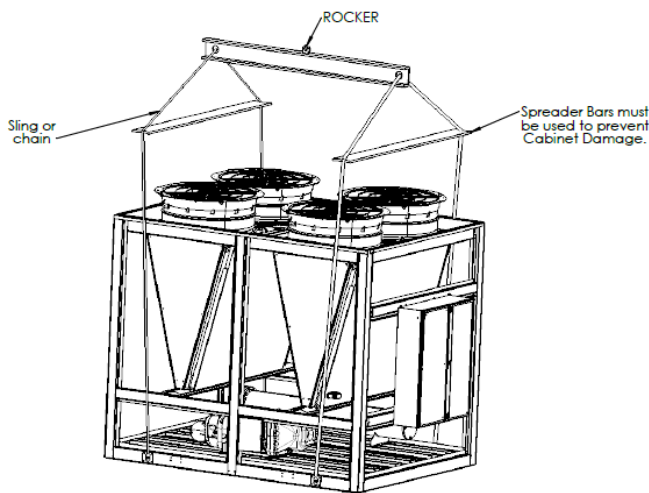
4. It is recommended that the unit has enough space around it not only for adequate air suction and discharge but also to facilitate access to maintenance services.

3.4 Basis for assembly

The equipment can be installed on a concrete or plan base or and at the level of 15 cm or 20 cm high, on ceilings, or on type "I" joists capable of supporting a weight of at least 400 kg / m². It is also recommended to fix the unit to the base of concrete or joist type I with neoprene rubbers of a thickness of at least 20 millimeters.

3.5 Delivery and Maneuvering

When transporting the unit, it is advisable to use a forklift or crane to lift it, for equipment of capacities from 50 to 100 tons, you should use space bars on top. When lifting the unit, secure it in such a way as to avoid contact with ropes or chains, keep the unit stable and not tilt. Consult the ECOCHILLERS service department.



3.6 Assembly

When mounting, it is recommended to use expansion screws to support the unit to the base; It is recommended to place on the support points, neoprene heels or some other type of shock absorber to absorb vibration.

3.7 Water Pipe

The cold-water pipe must be lined with insulation to avoid loss of efficiency, in addition to installing a filter to ensure its quality, and fixing connections with clamps.

The air purge valve should be installed at a higher point of the cold-water piping system, after installation is complete, perform leak tests and test at a pressure of 0.4 MPa (58 Psi) to ensure that there is no failure, then fill the system with water, open the vent valve, purge all air trapped in the pipe and close the air purge valve. A drain valve must be installed at the lowest point of the cold-water piping system. In order to obtain a long-lasting operation, it is advisable to use plastic water pipes, such as PVC, never use galvanized pipe.

1. **Caution:** The unit should be connected to the automatic water supply system whose pressure should be greater than 1.5 Bar (21.75 Psi) and less than 6 Bar (87.9 Psi). The accessories shipped with the unit must be installed or premature failures may occur.
2. **Caution:** Be sure to use clean water when filling the system to prevent corrosion and clogging of the system. If the chiller is operated with oily, salty, chlorinated or acidified water, it can cause loss of heat capacity.
3. **Caution:** Do not use the Chiller water pump to clean the system (pipes). If you use the pump to fill the pipe, you must fill the system with clean water while the pump operates for 30 minutes and then clean the filter.

Note: The design, construction, and acceptance check of the hydraulic system must comply with the applicable ASHRAE installation practice standards and codes. (American Society of Heating Refrigerating and Air Conditioning Engineers).

3.8 Power Supply

Warning: All electrical work must be performed by the technician in accordance with local codes or regulations and the instructions provided in this manual.

The appliance shall be installed according to national wiring regulations.

Before connecting the power, make sure that the supplied voltage is according to the unit's data board. Use



the proper conductor gauge to power the unit. Connections must be made in such a way as to avoid tension at the terminals.

The unit must be connected to physical ground. Do not connect the physical ground conductor to the gas pipeline, city water pipe, or telephone pipelines, improper physical grounding can result in electric shock. Please install protective switch to prevent electric shock.

Make sure the sequence of the phases, for three-phase equipment identify L1, L2 and L3 and connect them to the terminal block on the electrical board, for single-phase equipment EEC012 to 060 (1 to 5 Ton.) feed on the bottom of the contactor, control board of the unit, or else the system will not boot and the controller will not turn on. Each electrical conductor must be firmly connected without voltage to the terminals.

No power supply cords should be in contact with refrigerant pipes and moving components such as compressor and motor fans.

The regulation of power supply or electrical connection varies according to the country and city, so the works must be carried out in accordance with the rules and regulations of each country.

Caution: In case of emergency (if the equipment suffers from a fire burn) stop the unit and disconnect the switch OFF power. Do not cover the air discharge from the unit with your hands or other foreign parts, or else the unit will be damaged or you will be damaged.

4 COMMISSIONING

Commissioning of this unit should only be carried out by ECOCHILLERS Authorized personnel.

Commissioning personnel should be thoroughly familiar with the information contained in this literature, in addition to this section.

Perform the commissioning using the detailed checks outlined in the START-UP CHECK LIST as the commissioning procedure is carried out.

4.1 PREPARATION – POWER OFF

The following basic checks should be made with the customer power to the unit switched OFF.

4.2 Inspection

Inspect unit for installation damage. If found, take action and/or repair as appropriate.

4.3 Refrigerant Charge

Packaged units are normally shipped as standard with a full refrigerant operating charge. Check that refrigerant pressure is present in each system and that no leaks are apparent. If no pressure is present, a leak test must be undertaken, the leak(s) located and repaired. Repaired systems must be evacuated with a suitable vacuum pump/recovery unit as appropriate to below 100 microns before charging.

Do not charge liquid with static water in the cooler. Care must also be taken to charge liquid slowly to avoid excessive thermal stress at the charging point.

Once the vacuum is broken, charge into the condenser coils with the full operating charge as given in the Technical Data section.

Liquid subcooling measured at the liquid line should be between 5°C and 8°C when unit is operating in cooling mode and fully loaded. Subcooling is determined by the level of refrigerant charge in each system.

4.4 Service Valves

Ensure that the compressor discharge and suction service valves are set correctly (OPEN).

4.5 Compressor Oil

The units are charged with sufficient oil to ensure the effective and reliable operation in full envelope. However, the units may need additional oil charge in field in case leakage is detected or the compressor is being replaced.

To add oil to a circuit – connect an ECOCHILLERS hand oil pump to the 1/4" oil charging connection before the accumulator with a length of clean hose or copper line, but do not tighten the flare nut. Using clean oil of the correct type (POE oil for Copeland compressor), pump oil until all air has been purged from the hose then tighten the nut.

Stroke the oil pump to add oil to the oil system. Approximately 1.6 liters is present in single compressor system and 5.0~5.5 liters in tandem compressor system. Too much oil may cause excessive oil carryover in the system. High oil concentration in the system may cause nuisance trips resulting from incorrect readings on temperature sensors. Temperature sensor errors may result in poor liquid control and resulting liquid overfeed and subsequent damage to the compressor.

4.6 Fans

Check that all fans are free to rotate and are not damaged. Ensure blades are at the same height when rotated. Ensure fan guards are securely fixed.

4.7 Isolation/Protection

Verify all sources of electrical supply to the unit are taken from a single point of isolation. Check that the maximum recommended air switch sizes given in the Technical Data section has not been exceeded.

4.8 Control Panel

Check the panel to see that it is free of foreign materials (wire, metal chips, etc.) and clean out if required.

4.9 Power Connections

Check that the customer power cables are connected correctly to the terminal blocks or circuit breaker. Ensure that connections of power cables within the panels to the circuit breaker or terminal blocks are tight.

4.10 Grounding

Verify that the unit's protective ground terminal(s) are properly connected to a suitable grounding point. Ensure that all unit internal ground connections are tight.

4.11 Supply Voltage

Verify that the site voltage supply corresponds to the unit requirement and is within the limits given in the Technical Data section.

5 PREPARATION – POWER ON

Perform the commissioning using the detailed checks outlined in the START-UP CHECKLIST as the commissioning procedure is carried out.

Apply power to the unit. Turn ON the panel circuit breaker.

The machine is now live!

5.1 Switch Settings

Ensure the status of the unit is OFF. Place the circuit breaker handle on the panel door to ON. The customer's disconnection devices can now be set to ON.

5.2 Water System

Verify the chilled liquid system has been installed correctly, and has been commissioned with the correct direction of water flow through the cooler. Purge air from

the top of the water system using the plugged air vent mounted on the top of the piping.

Flow rate and pressure drops must be within the limits given in the Technical Data section. Operation outside of these lists is undesirable and could cause damage.

If main power must be switched OFF for extended maintenance or an extended shutdown period, the compressor suction and discharge service stop valves should be closed (clockwise). If there is a possibility of liquid freezing due to low ambient temperatures, the coolers should be drained or power should be applied to the unit. This will allow the cooler heater to protect the cooler from freezing down to -20°C . Before placing the unit back in service, valves should be opened and power must be switched on (if power is removed for more than 8 hours) for at least 8 hours before the unit is restarted.

5.3 Flow Switch

A unit flow switch has been fitted on the cooler outlet. If the units are connected for central control, it is

recommended to install an additional flow switch on the main outlet. Make sure the switch is wired into the control panel correctly using shielded cable.

There should be a straight run of at least 5 pipe diameters on either side of the flow switch.

5.4 Temperature Sensor(s)

Leaving liquid temperature sensors is used for modular control. Ensure the sensor is coated with heat conductive compound and is inserted to the bottom of the water outlet sensor well in the main pipe. This sensor also provides some anti-freezing protection and must always be fully inserted in the water outlet sensor well.

5.5 Control Supply

Verify the control panel display is illuminated.

6 FIRST START-UP CHECKS

The unit must absolutely not be put into operation, even if for a very short period, without having first meticulously checking the following list in its entirety.

This general commissioning checklist can be used as a guideline and reporting template during the commissioning and hand-over to the user.

For more detailed commissioning instructions, please contact the local Ecochillers S.A. de C.V. Service department or authorized representative of the manufacturer.

ATTENTION: THE EQUIPMENT MUST BE ENERGIZED WITH 230 VOLTS OR 460 VOLTS ACCORDING TO THE SELECTED VOLTAGE, 24 HOURS BEFORE INITIAL START-UP, THIS IS THE RESPONSIBILITY OF THE END-USER OR THE CONTRACTOR WHO CARRIED OUT THE ELECTRICAL INSTALLATION.

GENERAL	Si	No	N/A
Check for external damage			
Is the equipment located in a machine room with adequate ventilation?			
Does the equipment have the recommended spaces according to the Manual?			
Is the equipment permanently wired and energized 24 hours before startup?			
Does the equipment have pipes and hydraulic pumping in the evaporator?			
Open all isolation and/or shut-off valves			
Verify that the unit is pressurized with refrigerant in all of its parts before making the connection to the hydraulic circuit.			
Check the oil level in the compressors			
Control wells, thermometers, manometers, controls, etc. installed			
Availability of at least 25% of the machine load for testing and control settings			
REFRIGERATED WATER	Si	No	N/A
Piping completion			
Install the water filter (even when not supplied) at the inlet of the exchangers.			
Install a flow switch, calibrate and test (off-on-off switching according to the water flow) the flow switch			
Water circuit filling, air bleeding			
Pump installation, (rotation check), filter cleaning			
Operation of the controls (three-way valve, bypass valve, damper, etc.)			
Water circuit operation and flow balance			
Check that all water sensors are correctly fixed in the heat exchange			
ELECTRICAL CIRCUIT	Si	No	N/A
Does the equipment have a thermo-magnetic main switch?			
Power cables connected to the electrical panel			
Starter and wired interlocking of the pump			
Electrical connection in compliance with local electrical regulations			
Install a main switch upstream of the unit, the main fuses and, where required by the national laws of the country of installation, a ground fault detector.			
Connect the pump contact(s) in series with the contact of the flow switch(es), so that the unit can operate only when the water pumps are running, and the water flow is sufficient.			
Provide the main voltage and check that it is within $\pm 10\%$ of the classification given on the nameplate.			

7 MAINTENANCE

7.1 Introduction

In ECOCHILLERS we are committed to providing efficient and long-life units, but if you want to become even more efficient and further extend its operation, it is necessary to implement preventive maintenance periods that help us keep the unit in perfect condition and for a much longer period. This process is the responsibility of the unit owner, if it is not performed; Eventually the unit will begin to present failures and imperfections that over time would damage its useful life and its correct operation.

7.2 Important

If a system failure occurs due to improper maintenance during the warranty period, ecochillers will not be responsible for the costs incurred to get the system back up and running satisfactorily. The following is only a guide and covers only the components of the chiller unit. It does not cover other related system components that may or may not be supplied by ecochillers. System components should be maintained in accordance with the recommendations of the individual manufacturer, as their operation will affect the operation of the chiller.

7.3 Compressors

The oil level can only be tested when the compressor is operating in stabilized conditions, to ensure that there is no liquid refrigerant in the bottom housing of the compressor. When the compressor is operating in stabilized conditions, the oil level should be between 1/4 and 3/4 in the oil sight glass. When shutting down, it is acceptable for the oil level to fall to the lower limit of the oil sight glass.

7.4 Fan motors

In general, these motors are lubricated and do not need constant maintenance, however, it is advisable to be attentive to any imperfect that may occur.

7.5 Air Coil

Do not allow dirt to accumulate on Air Coil surfaces. Cleaning should be as frequent as necessary to keep the coils clean.

7.5.1 Cleaning Air Coil Procedure

Dirty coil decreases the capacity of the system, its energy efficiency and may potentially cause system failures. It's necessary to put a sufficient protection grid and air filter when appropriate. In addition to this, the system and the coil should be periodically inspected and cleaned in accordance with the cleaning procedures.

Relative to fin and tube heat exchangers, micro channel coils tend to accumulate more of the dirt on the surface and of the less dirt inside which can make them easier to clean. The cleaning procedures are as follows:



7.5.2 Remove surface debris

Remove surface dirt, leaves, fibers, etc. with a vacuum cleaner (preferably with a brush or other soft attachment rather than a metal tube), compressed air blown from the inside out, and/or a soft bristle (not wire!) brush. Do not impact or scrape the Air Coil with the vacuum tube, air nozzle, etc.

7.5.3 Rinse

Do not use any chemicals (including those advertised as coil cleaners) to wash micro channel heat exchangers. They can cause corrosion. **Rinse only.**

Hose the Micro Channel Air Coil off gently, preferably from the inside out and top to bottom, running the water thru every fin passage until it comes out clean. Micro channels fins are stronger than traditional tube & fin coil fins but still need to be handled with care. Do not bang the hose into the coil. We recommend putting your thumb over the end of the hose rather than using a nozzle end because the resulting spray is gentler and the possibility for impact damage is less.

7.5.4 Optional blow dry

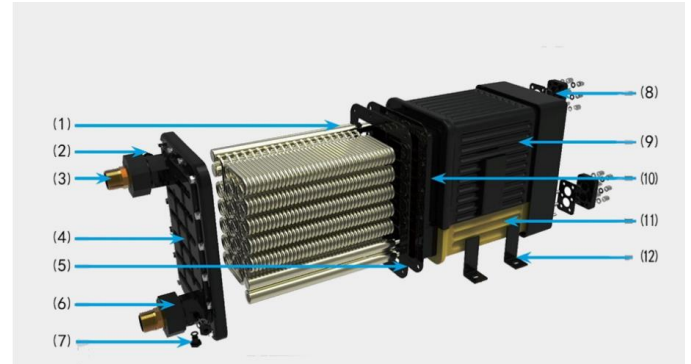
Micro channel Air Coil heat exchangers, because of their fin geometry, tend to retain water more than traditional fin & tube coils. Depending on the specific design and installation of your coil, it may be beneficial to blow or vacuum out the rinse water from your unit to speed drying and prevent pooling.

Warning!

It is possible to carefully clean a coil with a pressure washer, **but it is also possible to totally destroy a coil with a large pressure washer so we do not recommend their use. The washer water rated pressure of nameplate must be less than 50Bar, the ejection pressure of nozzle is less than 2Bar; the distance between nozzle and coil must be more than 1000mm, and keep nozzle centerline and coil surface as vertical angle as much as possible.**

Warranty claims related to cleaning damage, especially from pressure washers or chemical attack, will not be honored.

7.6 Shellbox maintenance



(1) heat transfer inner core (2) temperature sensor point (3) metal joint (4) steel cover
 (5) water loop seal plate (6) plastic cover (7) water outfall (8) seal ring of refrigerant loop
 (9) steel shell (10) plastic shell (11) foam material (12) bracket

Scale on the inside of a heat exchanger pipe is a solid deposit that builds up over time and can negatively affect heat exchange efficiency. These scales are mainly the result of precipitation processes of substances present in the fluid that flows through the pipes. Here are some of the common causes of scale formation:

1. ****Supersaturation of the fluid: **** When the concentration of certain substances in the fluid exceeds their dissolution capacity, supersaturation occurs. This may be due to factors such as changes in temperature, pressure, or the chemical composition of the fluid.
2. ****Precipitation of inorganic salts: **** In many cases, scale consists of inorganic salts that precipitate when the fluid experiences changes in temperature or pressure conditions. Common examples are carbonates, sulfates and phosphates.
3. ****Scale Deposits: **** When inorganic salts precipitate and accumulate on the walls of pipes, they form solid deposits known as scale. Scale can gradually build up, reducing the effective diameter of the pipe and negatively affecting flow and heat transfer.
4. ****Microbiological growth: **** The presence of microorganisms in the fluid can lead to the formation of biofilms and microbiological deposits on pipe surfaces. These deposits can act as favorable places for the accumulation of other substances.

5. ****Contaminants in the fluid: **** The presence of impurities or contaminants in the fluid, such as suspended solid particles, can also contribute to scale formation.

Scale formation can have several negative effects, such as reduced heat exchange efficiency, clogging of pipes, and loss of pressure in the system. To prevent scale formation, chemical treatments, cleaning techniques, and regular system monitoring can be applied to control conditions that favor precipitation and accumulation of substances in pipes.

7.6.1 Specific steps for cleaning scale:

7.6.1.1 **Backwashing:** Before pickling, open backwashing is performed on the heat exchanger, which can improve the pickling effect and reduce the acid consumption during pickling (the inlet and outlet are reversed, causing the water flow direction to be reversed from the original).

7.6.1.2 Pour the cleaning solution into the cleaning equipment and then inject it into the heat exchanger.

7.6.1.3 **Pickling:** The pickling solution should be prepared at a concentration of 5% oxalic acid, 1.2% buffer, and 0.8% surfactant. The pickling temperature should be controlled at 60 °C for a better cleaning effect. Soak the heat exchanger filled with an acid solution in a static state for 2 hours. Then continuously and dynamically cycle for 3-4 hours. During this period, alternating positive and negative cleaning should be carried out every 0.5 hours. During the pickling process, samples should be taken frequently to test the pickling concentration. When the difference in concentration between two adjacent assays is less than 0.2%, the pickling reaction is considered to have ended.

7.6.1.4 **Neutralization:** After acid cleaning, prepare NaOH (Sodium Hydroxide) and Na₃PO₄

(Trisodium Sodium Phosphate), and softened water in a certain proportion, and use dynamic circulation to perform alkaline cleaning on the heat exchanger to achieve acid-base neutralization.

7.6.1.5 **Water washing:** After alkaline washing, rinse the heat exchanger repeatedly with clean softened water for 0.5 hours to thoroughly clean any residue inside the heat exchanger.

Note: Due to the differences in water quality and the use of heat exchangers in different regions, there are significant differences in cleaning cycles and methods. The recommended cleaning cycle is up to 3 months.

7.7 Friendly operation

7.7.1 Water pipes for Air Coil

(Applies only to water-cooled equipment) Water-cooled condensers can be connected directly to city water or well water, or used with a recirculation system equipped with a cooling tower.

a) In applications where city or well water is used to condense the coolant, an automatic flow regulation valve must be installed, operated by the discharge pressure, this valve is installed at the condenser water outlet.

b) System with cooling tower. When installing these cooling tower units, it is advisable to use a 3-way regulating valve as it is highly recommended, keeps the condensation pressure constant regardless of outside temperature conditions and ensures proper operation of the expansion valve at all times (not included, optional).

7.8 Recommendations

Pre-boot recommendations

1.- Close the inlet and outlet valves and open the bypass valve (if any) installed on the outside of the chiller.

2.- Operate the pump to circulate water in the system for a while.

- 3.- Open the filter and inspect it in case it requires cleaning.
- 4.- Clean the filter if necessary to avoid any type of clogging of the system pipe.
- 5.- Close the bypass valve and open the water inlet and outlet valves.
- 6.- With these recommendations, the system will be ready to start by qualified personnel of ECOCHILLERS Inc.

7.9 Considerations for the use of Heat Pumps

1. To prevent freezing of water in the winter, if the chiller is out of service, all cold water in the hydraulic system must be completely drained, and thus avoid damage to the pipe due to freezing water, if operating in ambient temperature conditions below 5°C glycol-based antifreeze should be used. The service department always recommends the use of antifreeze in any water-cooling system, the use and installation of flow switches and flow meters to ensure proper operation and minimize the risks of freezing.
2. Do not obstruct condenser air inlets and discharges. Obstacles or some other material can cause the reduction of cooling capacity of the equipment and reduce the useful life of the equipment.
3. Antioxidant take measures against oxidation and regularly remove oxides when using water pipe vulnerable to corrosion.
4. Regularly carry out maintenance services, this will help you prolong the life of your equipment, and work at its maximum capacity and efficiency.
5. Recommend using clean water, and installing high-efficiency water filters.

7.10 Closed system vs. Open system

The Ecogreen Chillers have been designed to be installed in both options or open or closed water piping systems, it is the responsibility of the installer to select the most appropriate system according to the site, ECOCHILLERS recommends the open system with tanks for which we offer the Process series. In an open system, the chiller discharges the cold water into the tank while an external pump it into the process. It is recommended that the water tank has a division with the system of separate flows, it will prevent the hot water from the process.

7.11 Security Controls

Protective accessories such as high pressure, low pressure and electrical overload control in each of the compressors are supplied for the safety of the equipment during operation. The temperature control system intervenes directly in the stop and start option, if the water temperature falls below a value lower than desired, the freeze control will automatically stop the system (in equipment 012 to 240) and ensures the safety of the equipment. In models 300 to 1200 the freeze control optionally energizes the hot gas bypass solenoids, preventing the temperature inside the exchanger from falling below the parameter of 5°C, or reducing the chiller capacity, as long as the outlet temperature remains below the preset limit, the system will operate in hot bypass mode so the compressors work, but the temperature will not drop further, once the water outlet temperature rises from 5 ° C the bypass is deactivated allowing the cooling cycle again at 100% capacity.

7.12 Services and Maintenance

Contact the ECOCHILLERS engineering department regularly to give adequate efficiency and safe durability of your equipment. The design offers ease of maintenance and proper hydraulic or chilled

water system and will eliminate the possibility of problems that may occur during normal operation, therefore, there is no need to maintain the cooling pipes while the unit is operating properly, except if the water pump fails or the insulation of the flow adjustment pipes and valves is deteriorated. It is recommended to keep track of the filter and replace it if it is dirty or clogged. Check the water level of the system to protect the hydraulic components from overheating and to protect them from freezing. All ice water systems must be completely drained during the winter when the unit is not operating to prevent damage to the water pipe from freezing. Corrective or preventive services must be performed by qualified personnel; In dirty, greasy or dusty environments, the Air Coil or heat exchanger should be properly cleaned at least once a month to maintain the maximum capacity of the equipment. Before reoperating the unit, do a new check of the unit's security checks. Under a normal environment and proper installation, you will only need to check the proper air circulation (suction and discharge).

7.13 Volume of Water in the System

The water flow for normal operations will be approximately 1.2 times more than the design flow required by the chiller. For example, if a chiller requires a flow of 120 GPM, then a flow of 134 GPM is recommended. Considering that the volume of water in the system is not only in the capacity of the Water Coil, but also in the piping system and additional tank to ensure the adequate supply of water to the chiller and the process. If the volume of

water is very low, there will be operating problems which may occur such as: compressor cycling, lack of cooling flow in chiller, inadequate cooling of the compressor, etc. It is for this reason that it is recommended to install water tanks with sufficient capacity to avoid problems of operation and capacity of the equipment.



Important

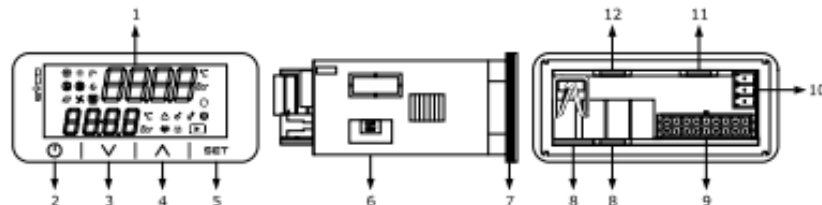
Read this document carefully before installation and before using the devices and follow all warnings;

Keep this document with the devices for future questions. Use the devices only in the modalities described in this document; Do not use the devices as security devices.

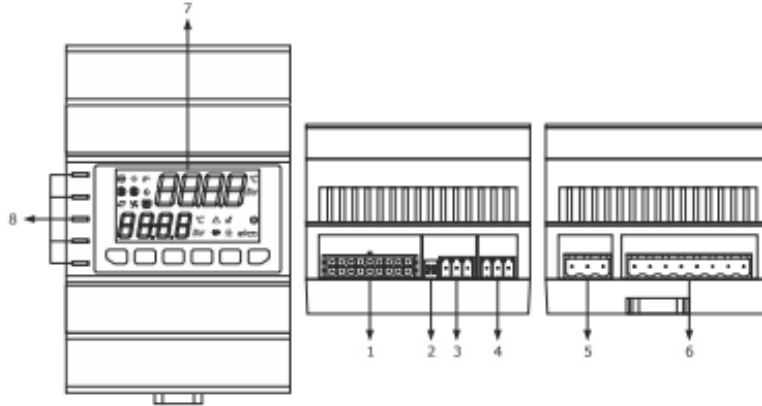
EV3 CHIL/HP and EVD CHIL/HP (EVCO) DRIVERS

8.1 Introduction

EV3 CHIL/HP and EVD CHIL/HP are controllers for the management of chiller and mono- and bi-circuit air-water and water-water heat pumps up to 6 compressors. EV3 CHIL/HP is available in standard 74 x 32 mm form factor, with integrated user interface; The interface is composed of a two-line LED display (with decimal point and function icons), four touch keys and guarantees a degree of protection IP65, easy to clean. The supply voltage is 12 VAC and the installation is planned of three panels with holding springs.



EVD CHIL/HP is available in standard format 4 DIN modules, in blind version (without display) or with two-line LED display. The supply voltage is 115... 230 VAC and the installation is planned on DIN rail, on a control board. For both types of controllers, two different remote user interfaces are available: EV3K01 (available in standard format 74 x 32 mm, consisting of a two-line LED display, by four touch keys, for installation on panel) and EVJ LCD (in 111 x 76 mm format, composed of a two-line static LCD display, by six touch keys, for installation on panel or wall).



Configuring the regulation based on evaporation pressure, or condensation, it will be possible to manage condensing motor units (cooling) or dry cooler units. It is also possible to configure the controllers to respond to digital controllers (up to 6), or to an analog remote control from a remote master unit. The controllers can manage compressors and fans of type "on/off", as well as modulating type.

8.1.1 Available models, codes and technical characteristics

8.1.1.1 Drivers

The following spreadsheet describes the available models, codes and technical characteristics of the controllers.

In total there are 4 models of (evco) controllers which are: EV3 CHIL, EVD CHIL, EV3 HP AND EVD HP.

Code:

- (A) EV3904LM2 (EV3904LM2GF with RS-485 communication port and clock)
- (B) EV3906LM2GF
- (C) EVD904BM9
- (D) EVD904BM9MF
- (E) EVD904LM9MF
- (F) EV3914LM2 (EV3914LM2GF with RS-485 communication port and clock)
- (G) EV3916LM2GF
- (H) EVD914BM9
- (I) EVD914BM9MF

(J) EVD914LM9MF

Of which:

(A) AND (B) are EV3 CHIL model

(C), (D) AND (E) are from the EVD CHIL model

(F) and (G) are from the EV3 HP model

(H), (I) AND (J) are from the HP EVD model

Device code	Connection kit code
EV3904LM2	CJAV37
EV3904LM2GF	CJAV37
EV3906LM2GF	CJAV39
EVD904BM9	CJAV38
EVD904BM9MF	CJAV38
EVD904LM9MF	CJAV38
EV3904LM2	CJAV37
EV3914LM2GF	CJAV37
EV3906LM2GF	CJAV39
EVD904BM9	CJAV38
EVD904BM9MF	CJAV38
EVD904LM9MF	CJAV38

Connectors (link kits) for wiring controllers must be ordered separately. The following worksheet shows the correspondence between the code of the controllers and the corresponding connectors.

8.1.1.2 Remote user interfaces

The following worksheet describes the available models, codes, and technical characteristics of remote user interfaces

EV3K01.

Size -74 x 32 mm

User interface - Two-line LED display + 4 capacitive keys

Installation - panel

Connections - Removable screw terminals

Power supply - 12 VAC/DC not isolated

Communication ports - INTRABUS

Other features - Alarm buzzer.

Codes - **Code EV3K01X0CT**

8.2 Description

The following paragraphs describe the different devices that can be used for the management of chiller and heat pump units.

8.3 Description of EV3 CHIL/HP

The following worksheet illustrates the meaning of EV3 CHIL/HP parts.

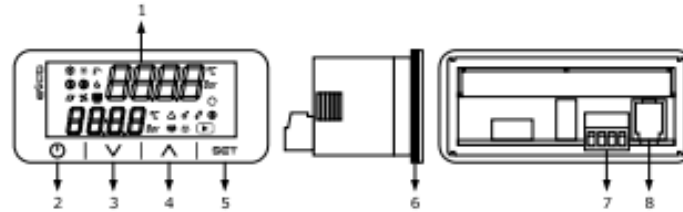
Part	Meaning
1	Display
2	On/off button (hereinafter also referred to as "on/stand-by button")
3	Decrease button (hereinafter also referred to as "down key")
4	Increment button (here and after also referred to as "UP button")
5	Settings button (here and after also referred to as "set button")
6	Termination line for microswitch RS-485 MODBUS
7	Board
8	Connection of the Edge connector to wire the electromechanical relay digital outputs (with reference to the following paragraphs, the digital outputs DO1... DO4)
9	Male Micro-Fit connector for power cabling, analog inputs, digital inputs, analog outputs and INTRABUS port
10	Removable screw terminal box only male to wire RS-485 MODBUS port
11	Connecting the Edge connector for wiring the triacs output (with reference to the following paragraphs, the TK1 output)
12	Connecting the Edge connector for wiring the triacs output (with reference to the following paragraphs, the TK2 output)

8.3.1 EVD CHIL/HP description

The following worksheet illustrates the meaning of the EVD CHIL/HP parts.

Part	meaning
1	Male Micro-Fit connector for wiring analog inputs, digital inputs, analog outputs and open collector digital output (with reference to the following paragraphs, OC1 digital output)
2	Micro switch for RS-485 MODBUS line
3	Removable screw terminal box only male to wire RS-485 MODBUS port
4	Removable screw terminal box only male to wire the INTRABUS port
5	Removable male screw terminal for wiring electromechanical relay digital outputs (with reference to the following paragraphs: DO1 and DO2 digital outputs)
6	Removable screw terminal for power cable, electromechanical relay digital outputs (with reference to the following paragraphs, digital outputs DO3 and DO4)
7	User interface (not available in blind versions).
8	Signal LED

8.3.2 EV3K01 description

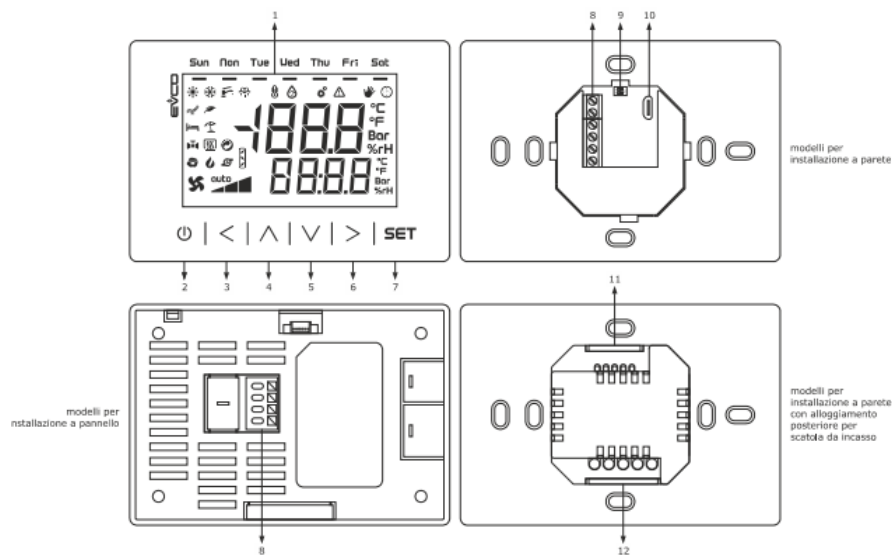


The following worksheet illustrates the meaning of the EV3K01 parts.

Part Meaning

- | Part | Meaning |
|------|--|
| 1 | Display |
| 2 | On/off button (here and after referred to as "on/stand-by button") |
| 3 | Decrease button (here and after referred to as "down key"). |
| 4 | Increase button (here and after referred as "bottom UP") |
| 5 | Configuration button (here and after referred as "bottom set") |
| 6 | Board |
| 7 | Screw terminal for power wiring and INTRABUS port |
| 8 | Not used. |

8.3.3 Description of EVJ LCD

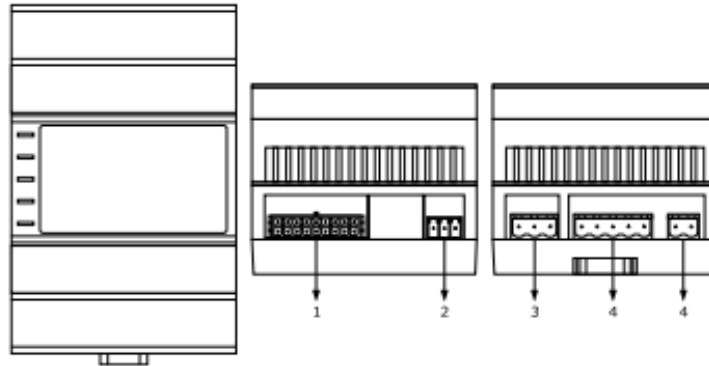


The following worksheet illustrates the meaning of EVJ LCD parts.

Part Meaning

1	Display
2	On/off button (hereinafter also referred to as "on/stand-by button")
3	Left key (hereinafter also referred to as "left")
4	Increment button (hereinafter also referred to as "UP button")
5	Decrease button (hereinafter also referred to as "down")
6	Right key (hereinafter also referred to as "Right")
7	Settings button (hereinafter also referred to as "set").
8	Screw terminal for power wiring and INTRABUS port
9	- Micro switch for the termination of the RS-485 INTRABUS line in the EVJD900N2VWTX model - Not present, depending on model
10	Not used
11	Screw terminal for wiring analog inputs and INTRABUS port
12	Screw terminal for power wiring

8.3.4 Description of EVD094



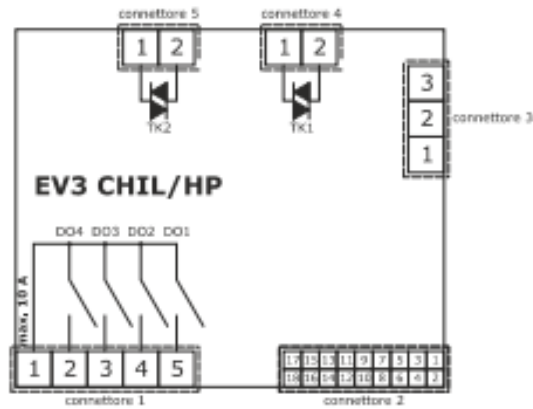
The following worksheet illustrates the meaning of the EVD094 parts.

Part Meaning

1	Male Micro-Fit connector for wiring analog inputs, digital inputs, analog outputs and open collector digital output (with reference to the following paragraphs, OC1 digital output)
2	Removable screw terminal for wiring the INTRABUS port
3	Removable male screw terminal for wiring electromechanical relay digital outputs (with reference to the following paragraphs, digital outputs DO1 and DO2)
4	Removable male screw terminal for wiring electromechanical relay digital outputs (with reference to the following paragraphs, digital outputs DO3 and DO4)

8.4 Electrical connection

8.4.1 Description of EV3 CHIL/HP connectors



The following worksheets illustrate the meaning of EV3 CHIL/HP connectors. The forms refer to the maximum endowment.

Connector 1	
part	Description
1	Digital outputs of electromechanical relay DO1... DO4 (max. 6A): common
2	Digital output electromechanical relay DO4 (2A SPST): normally open
3	Digital output electromechanical relay DO3 (2A SPST): normally open
4	Digital output electromechanical relay DO2 (2A SPST): normally open
5	Digital output electromechanical relay DO1 (2A SPST): normally open.

Connector 2	
part	Description
1	IN10 dry contact digital input
2	Analog input IN1 (NTC/4-20 mA)
3	IN9 dry contact digital input
4	Analog input IN2 (NTC)
5	IN8 dry contact digital input
6	Analog input IN3 (NTC)
7	IN7 dry contact digital input
8	Analog input IN4 (NTC)
9	Voltage-free digital contact input IN6
10	IN5 Digital Input
11	AO1 analog output (0-10 V/phase cut-off/PWM)
12	Reference (GND) for analog inputs, digital inputs, analog outputs and powered INTRABUS port
13	AO2 analog output (0-10 V/phase cut-off/PWM)
14	INTRABUS port power signal
15	Power supply of analog inputs 4-20 mA (12 VDC, max. 40 mA)
16	Reference (GND) for analog inputs, digital inputs, analog outputs and powered INTRABUS port
17	EV3 CHIL power supply (12VAC not isolated)
18	EV3 CHIL power supply (12VAC not isolated)

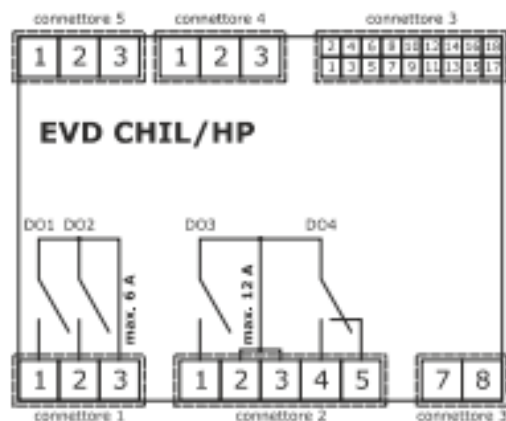
Connector 3	
part	Description
1	Port RS-485 MODBUS: +
2	Port RS-485 MODBUS: -
3	Port RS-485 MODBUS: reference (GND). NB: Do not connect the cable shield.

Connector 4	
part	Description

1	Out Triac TK1: GND
2	Out triac TK1 (200 mA): OUT

Connector 5	
part	Description
1	Out Triac TK2: GND
2	Out Triac TK2 (2 A): OUT

8.4.2 Understanding CHIL/HP EVD Connectors



The following worksheets illustrate the meaning of EVD CHIL/HP connectors.

Connector 1

Part	Meaning
1	Normally open digital output of electromechanical relay DO1 (3 A SPST)
2	Normally open digital output of DO2 electromechanical relay (3 A SPST)
3	Common digital outputs of electromechanical relay DO1... DO2 (max. 6 A)

Connector 2

Part	Meaning
1	Normally open digital output of electromechanical relay DO3 (12 A SPST)
2	Common digital outputs of electromechanical relay DO3... DO4 (max. 12 A)
3	Common digital outputs of electromechanical relay DO3... DO4 (max. 12 A)
4	Normally open digital output of DO4 electromechanical relay (8 A SPDT)
5	Normally open closed digital output of electromechanical relay DO4
7	Power supply EVD CHIL/HP (115... 230 VAC insulated)
8	Power supply EVD CHIL/HP (115... 230 VAC insulated)

Connector 3

Part	Meaning
1	AO2 analog output (0-10 V/PWM/By phase cut)
2	AO1 analog output (0-10 V/PWM/By phase cut)
3	Reference (GND)
4	IN1 analog input (NTC/4-20 mA/0-5 V/0-10 V or dry contact)
5	IN10 analog input (NTC or dry contact)

6	IN2 analog input (NTC/4-20 mA/0-5 V/0-10 V or dry contact)
7	IN9 analog input (NTC or dry contact)
8	IN3 analog input (NTC or dry contact)
9	IN8 Pulse Dry Contact Digital Input
10	IN4 analog input (NTC or dry contact)
11	IN7 Pulse Dry Contact Digital Input
12	IN5 analog input (NTC or dry contact)
13	Reference (GND)
14	IN6 dry contact digital input
15	Power supply analog inputs metric ratios (5VDC, Max 40 mA)
16	Auxiliary power output 12 VDC, max. 40 mA
17	Digital output open collector OC1 (12 V, max. 40 mA)
18	Reference (GND)

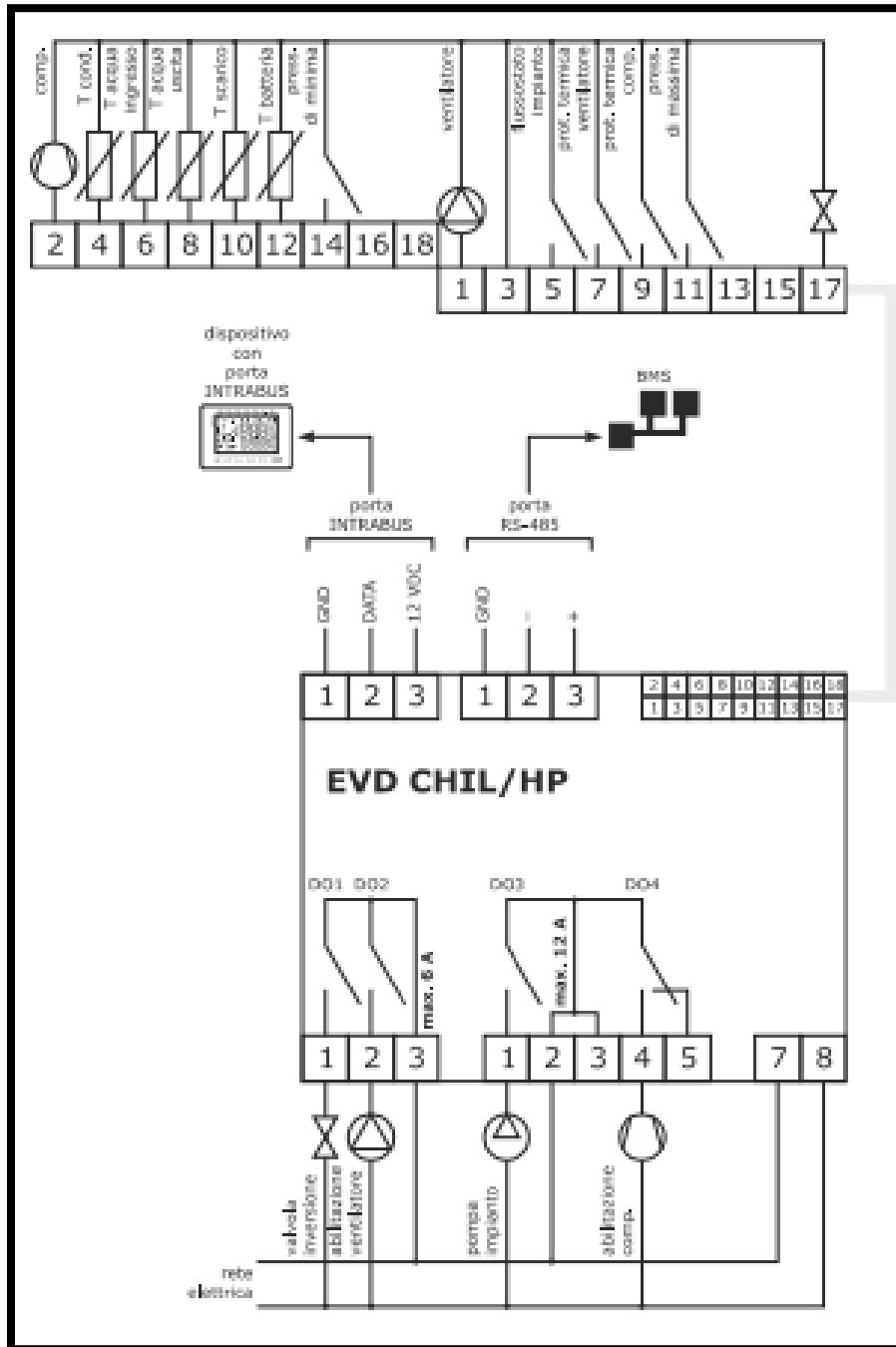
Connector 4

Part	Meaning
1	Reference (GND)
2	Negative signal port RS-485 MODBUS
3	Positive signal port RS-485 MODBUS

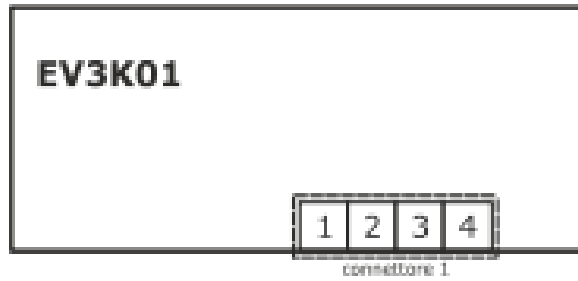
Connector 5

Part	Meaning
1	Reference (GND) INTRABUS port
2	INTRABUS signal port
3	12 VDC OUT

5.3.1.1 Example of CHIL/HP EVD electrical connection



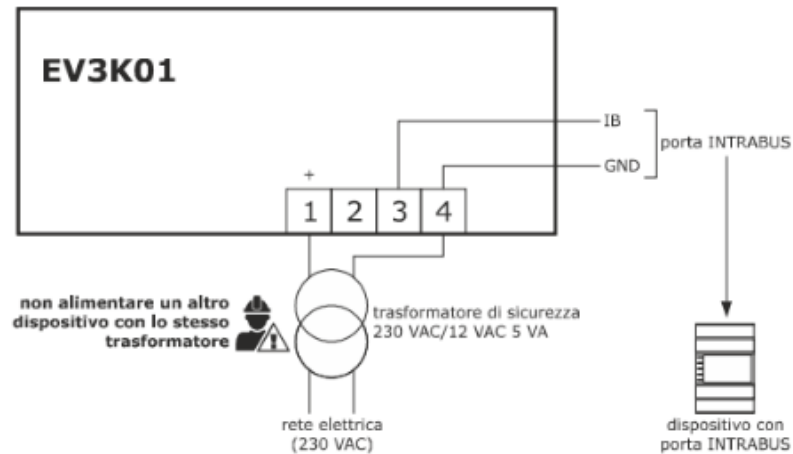
8.4.3 Understanding EV3K01 Connectors



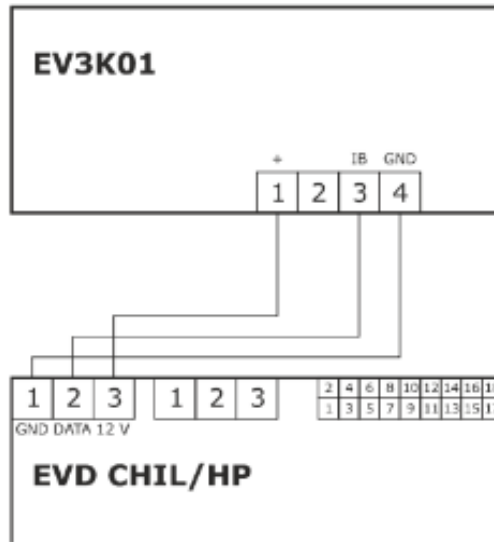
Connector 1

Part	Meaning
1	EV3K01 power supply (12 VAC/DC not isolated); If the device is DC powered, connect the positive terminal
2	Reserved EVCO
3	INTRABUS Port Signal
4	Reference (GND) power and INTRABUS Port

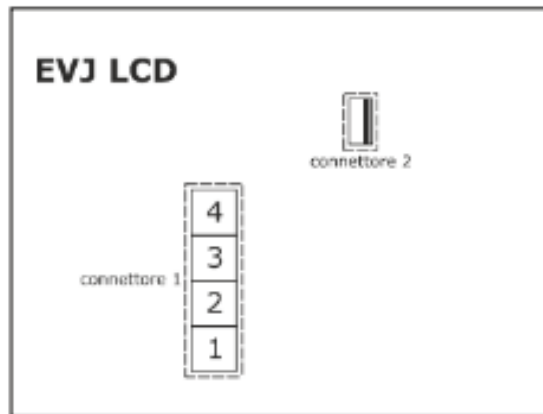
8.4.3.1 EV3K01 electrical connection example



The following drawing illustrates an example of EV3K01 linking. In the EV3K01 example powered by a CHIL/HP EVD controller.



8.4.4 Understanding EVJ LCD Connectors

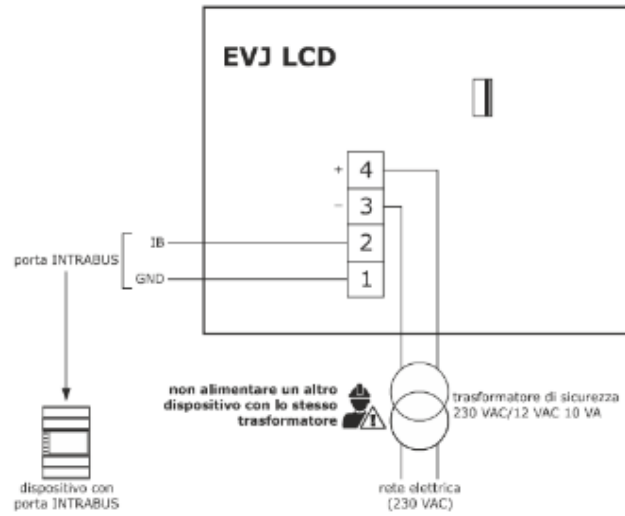


Connector 1

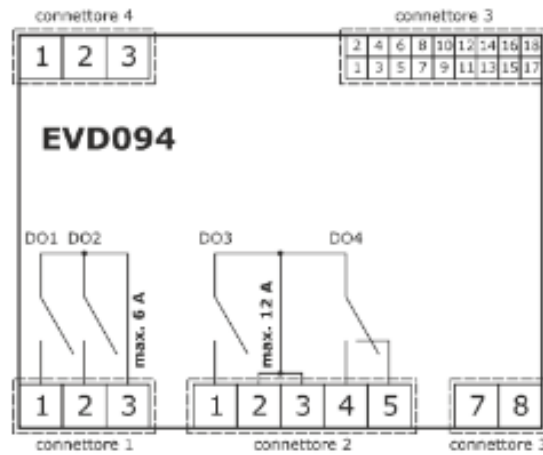
Part	Meaning
1	Reference (GND) INTRABUS port
2	INTRABUS Port Signal
3	EVJ LCD power supply (12 VAC/DC not isolated); If the device is DC powered, connect the negative terminal
4	EVJ LCD power supply (12 VAC/DC not isolated); If the device is DC powered, connect the negative terminal

8.4.4.1 Example of electrical connection of EVJ LCD models for panel installation

The following drawing illustrates an example of linking EVJ LCD models for panel installation. In the example EVJ LCD has Independent feeding.



8.4.5 Understanding EVD094 Connectors



The following worksheets illustrate the meaning of EVD094 connectors.

Connector 1

Part	Meaning
1	Normally open digital output of electromechanical relay DO1 (3 A SPST)
2	Normally open digital output of DO2 electromechanical relay (3 A SPST)
3	Common digital outputs of electromechanical relay DO1... DO2 (max. 6 A)

Connector 2

Part	Meaning
1	Normally open digital output of electromechanical relay DO3 (12 A SPST)
2	Common digital outputs of electromechanical relay DO3... DO4 (max. 12 A)
3	Common digital outputs of electromechanical relay DO3... DO4 (max. 12 A)
4	Normally open digital output of DO4 electromechanical relay (8 A SPDT)
5	Normally open closed digital output of electromechanical relay DO4
7	EVD094 power supply (115... 230 VAC isolated)
8	EVD094 power supply (115... 230 VAC isolated)
9	EVD094 power supply (115... 230 VAC isolated)

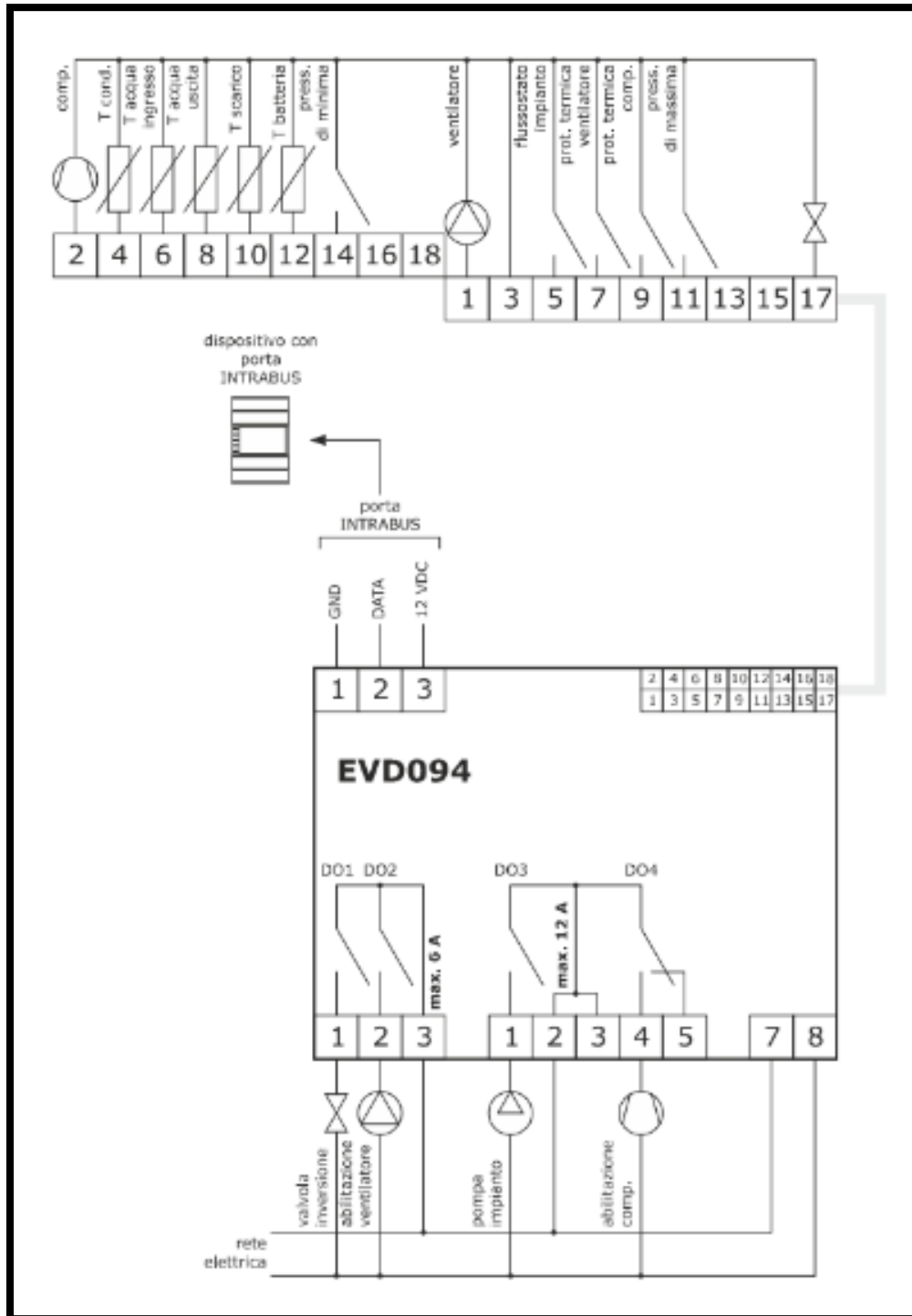
Connector 3

Part	Meaning
1	AO2 analog output (0-10 V/PWM/By phase cut)
2	AO1 analog output (0-10 V/PWM/By phase cut)
3	Reference (GND)
4	IN1 analog input (NTC/4-20 mA/0-5 V/0-10 V or dry contact)
5	IN10 analog input (NTC or dry contact)
6	IN2 analog input (NTC/4-20 mA/0-5 V/0-10 V or dry contact)
7	IN9 analog input (NTC or dry contact)
8	IN3 analog input (NTC or dry contact)
9	IN8 Pulse Dry Contact Digital Input
10	IN4 analog input (NTC or dry contact)
11	IN7 Pulse Dry Contact Digital Input
12	IN5 analog input (NTC or dry contact)
13	Reference (GND)
14	IN6 dry contact digital input
15	Reserved
16	Auxiliary power output 12 VDC, max. 40 mA
17	Digital output open collector OC1 (12 V, max. 40 mA)
18	Reference (GND)

Connector 4

















Part	Meaning
1	Reference (GND) INTRABUS port
2	INTRABUS Port Signal
3	12 VDC OUT

8.4.5.1 EVD094 Electrical Connection Example



8.5 Description of the user interface

8.5.1 Key functionality

EV3 Button	EVD Butoon	EVJ Button	Name	Functionality
			ON/stand-by	- if you press and hold turn the device on or off and return to the home page if a bottom menu is being displayed - During parameter settings, it has the "back" button function
			Set	-if you press and hold allows you to enter the settings menu (SET menu) - A short press allows you to modify the setpoint and confirm it - in the menu navigation, it becomes the "Enter" button
			UP	- Allows you to scroll in a top menu - Allows you to increase the value of a parameter - A prolonged pressure allows the visualization of I/O states
			Down	- Allows you to scroll in a lower menu - Allows you to decrement the value of a parameter - If no digital input is set as operating mode, the Machine Operation mode will be modified at each extended pressure according to the sequence Cold heat <input type="checkbox"/> heat <input type="checkbox"/> + cold DHW <input type="checkbox"/> (if functions are enabled)
-			Left	EVJ - from the home page, with a simple press allows access to the quick menu of setpoint parameters. EV3 - not present EVD - not used
-			Right	EVJ - from the home page, with a simple press allows access to the quick configuration menu of the Time Bands. EV3 - not present EVD - not used

8.5.2 Display

The device can be turned on or off using the on/stand-by button. When the device has been turned on from button, it can be put on Stand-By from remote acting on the digital input on/off remote by means of an interrUptor.

The user interface has two display modes.

Primary display mode:

- The upper line shows the regulated value (parameter I01), while the lower line displays one of the probes of choice, the setpoint or the schedule (parameter G08). If present, active alerts are displayed. If remote regulation is active, the upper line shows the status (ON or off) and the lower line the number of steps or the percentage of activation of the compressors.
- When the device is turned on from button but in Stand-by from remote, the label "oFFd" appears in the bottom line.
- When the device is turned off from the button, the label "off" appears in the upper line and the time in the lower line (if present and enabled: the RTC, otherwise 4 lines are displayed: ----).

Menu display modes:

- Visualizations depend on the level one is at, according to a "tree" system in which the bottom line visualizes a subcategory of what is displayed on the top line. To assist the user in identifying the configured display type, labels and codes are used.

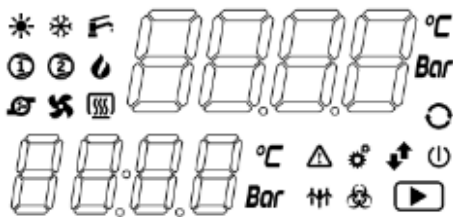
8.5.2.1 Icons

The icons have four flicker modes:

- Slow flashing: 0.5 Hz
- Normal flashing: 1 Hz
- Fast flashing: 2.5 Hz
- Flashing every 5 s (1 s off, 4 s on).

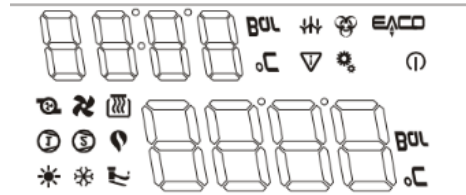
The following worksheet illustrates the meaning of the EVJ LCD, EV3 CHIL/HP, EVD CHIL/HP and EV3K01 signage icons.

EV3 CHIL/HP and EV3K01 display:

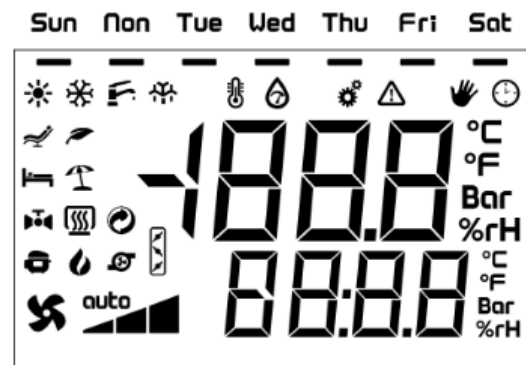


8.5.2.2 Signages

EVD CHIL/HP display:











EVJ LCD display :




EVJ LCD	EV3 CHIL/HP, EVD CHIL/HP, EV3K01	COLOR	MEANING
❄️ ❄️	❄️ ❄️	Green	Active function Depends on parameter G05 (default 0) 0 ❄️ = Heating ON / ❄️ =cooling ON 1 ❄️ = Heating ON / ❄️ =cooling ON
🚿	🚿	Green	Domestic hot water (DHW) - ON function available not active - OFF function not available - BLINK function available active
no present	①	Green	Compressor1 Single-circuit unit:

			<ul style="list-style-type: none"> - ON if a single compressor is turned on - OFF if all compressors are turned off - BLINK if the first compressor is on timing <p>Bi-circuit unit</p> <ul style="list-style-type: none"> - ON if at least one compressor in circuit 1 is switched on - OFF if no compressor in circuit 1 has turned on - BLINK if a timing is active (regardless of the circuit)
No present		Green	<p>Compresor2</p> <p>Single-circuit unit:</p> <ul style="list-style-type: none"> - ON if at least two compressors are switched on - OFF if no more than one compressor is turned on - BLINK if a compressor other than the first is temporized <p>Bi-circuit unit</p> <ul style="list-style-type: none"> - ON if at least one compressor in circuit 2 is switched on - OFF if no compressor in circuit 2 switched on - BLINK if the timing is running (regardless of the circuit)
	No present	Green	<p>Compressor</p> <ul style="list-style-type: none"> - ON if one or more compressors are turned on - OFF if all compressors are turned off - BLINK if timing is running
		Green	<p>Bomb</p> <ul style="list-style-type: none"> - ON if the pump is on - OFF if the pump is off
		Green	<p>Ventilador</p> <ul style="list-style-type: none"> - ON si el ventilador está encendido - OFF si el ventilador está apagado
		Green	<p>Installation resistance</p> <ul style="list-style-type: none"> - ON if the resistor is on - OFF if the resistor is off
°C °F	°C °F	Ambar	Unit of measurement of the value displayed on the top display when the probe is set to temperature
Bar	Bar	Ambar	Unit of measurement of the value displayed on the top display when the probe is set to pressure
		Ambar	<p>Desescarche</p> <ul style="list-style-type: none"> - ON if defrost is in operation - OFF if defrost is not working or has finished - BLINK (2 s), if a defrost entry timing is running, or (1 s) if drip is running
No present		Ambar	<p>Run</p> <ul style="list-style-type: none"> - ON if the controller is turned on - OFF if the controller is disabled
		RED	<p>Alarm</p> <ul style="list-style-type: none"> - ON if an alarm is running - OFF if no alarm is in operation

		RED	LED configurations - ON if the device is not in primary display - OFF during normal operation
No present		RED	On/stand-by - ON if the controller has been turned off (along with "off" signaling on display) - OFF if the controller turns on
		RED	Unit of measurement of the value displayed on the top display when the probe is set to temperature
<i>Bar</i>	<i>Bar</i>	RED	Unit of measurement of the value displayed on the top display when the probe is set to pressure
No present		Ambar	Antilegionella - ON if the function is active - OFF in alternative
No present		Ambar	Logos (present only on the EVD9 LED display) - Always on
No present		RED	INTRABUS/RS-485 - Slow flashing if an INTRABUS or RS-485 communication is in operation - OFF if no communication is active

The following worksheet illustrates the meaning of EVD CHIL/HP signaling LEDs.

Led	Color	Meaning
On	Green	LED power supply - ON if the controller is powered - OFF if the controller is not powered
Run	Green	LED RUN - ON if the controller turns on - OFF if the controller is disabled
	RED	LED alarma - ON if an alarm is running - OFF si no alarm is operating
IB	Ambar	LED INTRABUS - BLINK if an INTRABUS communication is in operation - OFF if no communication is active
RS485	Ambar	LED RS-485 - BLINK if an RS-485 communication is in operation - OFF if no communication is in operation

8.6 MENU

8.6.1 Accesibilidad

The display of the menu is conditioned by the level of visibility (modifiable from serial port) associated with each item, the display of the parameters is conditioned to the visibility of each parameter. The user can modify the level of visibility by configuring the desired value (see paragraph parameters, controls reference) via serial port, both for the different items of the menu and for each parameter.

For navigation within the menus are available 3 levels of accessibility, of which 2 subject to password insertion:

U User: always visible

S Service: visible if the Service password (parameter G11, default -12) or the manufacturer password (parameter CF10, pre-determined: -123) is inserted.

M Manufacturer: visible if the manufacturer password is inserted (parameter G12, pre-determined -123)

H Hidden: never visible from user interface.

8.6.2 Quick menu

A simple press of the SET (EV3) / Send (EVD) / OK (EVJ) button allows you to enter directly into the SET menu; the prolonged press of the down key, if no digital input is configured as an operating mode, modifies the active operating mode of the machine and is according to the sequence cold heat heat + cold ACS (if the functions are enabled); the prolonged press of the UP button (up arrow) allows you to enter directly into the Pro sub-menu of the IO (input/output) menu.

Pressing the on/Standby (EV3/EVJ) / esc (EVD) button allows you to exit the active menu.

8.6.3 Access to the general menu

From the home page, pressing for 3 seconds the SET button (- EV3), send (- EVD) or OK (| OK | - EVJ LCD) you enter the first accessible page of the general menu. By pressing the UP or Down keys you can navigate between the menus according to the order displayed in the following paragraph. Pressing the SET/send button takes you to the selected menu. The level of access is determined by the active password that is inserted by accessing the relative menu (PSS); Once the desired password has been entered, the device does not return immediate feedback but, if the password entered is correct, it will allow access to previously inaccessible parameters/menu. Pressing the on/Standby (EV3/EVJ) / esc (EVD) button allows you to exit the active menu.

8.6.4 List of menus

Here are the available menus:

SEt Allows access to the quick configuration of setpoint of regulation

IO Allows access to the display of I/O input/output values

Pro Displays the temperature or pressure values of inputs configured as probes

DiG Allows you to view the status of inputs configured as digital inputs

AO Displays the status of outputs configured as analog outputs or triacs/open collector

REL Allows you to view the status of outputs configured as digital outputs

ALM Allows you to view the list of alarms in operation

PAr It allows to visualize and modify the parameters of the device; the parameters are agrUPados based on its functionality (identified on display with a label), while each parameter is characterized by an alphabetical index followed by 2 digits, according to the following sheet:

Group	Identification label	Parameter index
Generals	PG	G
Alarms	PA	A
I/O	PI	I
Regulation	Pr	r
Descarche	Pd	d
Compressors	PC	C
Fans	PF	F
Pump	PP	P
Electric resistance	PH	H
Solar panels	PS	S

OHr Allows you to view the operating hours of

OR UNITED

OC1 compressor 1

OC2 compressor 2

OC3 compressor 3

OC4 compressor 4

OC5 compressor 5

OC6 compressor 6

OP pump

OF1 fan 1

OF2 fan 2

OF3 fan 3

OF4 fan 4

-The operating hours can be overridden with a prolonged press (about 3") of the set button if the password is inserted at least at service level. This operation clears the eventual "operating hours" alert of the loads.

HiS Allows you to record up to 20 alarm events.

diS: History details are displayed on the lower display with the following sequence: Progressive alert (starting from 0) Alert code

And xx Year if available clock or alarm enumerative

M xx Mes si reloj available

D xx Day if available clock

Hh:mm Hours:minutes if available watch

CLS: Erase the history

PSTN On devices equipped with a clock, allows you to set the time

YEA: Set year

Month: set month

DAY: Set day of the month

UdA: Set day of the week

Hou: Set time

Min: Set minute

InFo Allows you to visualize the data related to the project in this sequence

-Project

-Variation

- Revision:Version

PAS Allows you to enter the password to access the desired level: parameter C18 for Service level, C19 for Manufacturer level.

8.6.5 Menu alarms and historical alarms

The Alarms Menu allows you to visualize in sequence all the possible active alarms, for the reset of manual reset alerts (if the conditions that have generated the alarm disappeared) it is requested to pay / turn on the device. The Historical Alarms Menu contains the last 20 alarms no longer active. By accessing the diS submenu (history display) and pressing the on/Standby (EV3) / Send (EVD) button, the information related to this alarm will flash in sequence (see previous paragraph). Pressing the UP button reaches alarms with higher index (older), pressing the Down button reaches alarms with lower index (more recent).

The cLS sub-menu allows the deletion of the history if the level of password entered is sufficiently high. Accessing the sub-menu and pressing the UP button will display the written "donE", which will confirm the cancellation of the history.

8.6.5.1 Menu visibility

The visibility level of all menus is modifiable via serial port analogously to that of the parameters, for example, using the EVCO Parameters Manager parameter configuration tool downloadable free of charge from the EVCO www.evco.it site. It becomes easy to customize the display not only of the parameters, but also of the entire menus for easier navigation by users.

8.6.5.2 Selecting operating modes

Based on the configuration of the dedicated parameters, the controller provides for the possibility of heating and cooling management. There are three possibilities for selecting the operating mode:

- Digital input
- From keyboard/supervisor.

If a digital input has been configured as operating modes, then it is the status of this input that determines the mode of operation.

If switching modes from digital input is active, any attempt to modify keyboard mode will not work and there will be no explanation. If a dedicated digital input is not configured, the operating mode is defined from the keyboard: at each long press of the Down key the operating mode ...-> COOL -> HEAT will be modified. In this situation it is possible to force the supervisory operating mode (State S05).

8.7 Setting up a device

The following paragraphs list all possible configurations of EV3 CHIL/HP and EVD CHIL/HP. The G02 parameter allows you to set a delay in turning on the device: as long as this time is not over, the regulation does not start. This time allows the loads to reach regular operation.

8.7.1 Parameters

For each parameter a visibility level will be assigned that is modifiable (only from serial port, using for example the free EVCO tool for managing the parameters "Parameters Manager") with 4 possible values (the value set to visibility modifies the level of password to be inserted to be able to access the relative parameter from keyboard):

0 = hidden (H)

1 = User (U)

2 = Service (S)

3 = Manufacturer (M)

Label	Chiller default value	Heat pump default value	Chiller default visibility	Heat pump default visibility	Min	Max	Measure unit	Description
setup								setpoint
Coo	8.5	8.5	U	U	r07	r05	°c,°f, Bar,psi* 10	Setpoint cooling mode
HEA	40.0	40.0	H	U	r08	r06	°c,°f, Bar,psi* 10	Setpoint heating mode
dhU	50.0	50.0	H	U	r08	r06	°c,°f	Setpoint ACS mood
HGb	10.0	10.0	U	H	-58.0	99.9	°c,°f	Set point hot gas bypass
PG								Generals
G01	0	0	H	H	0	255		Reserved
G02	5	5	H	H	5	255	S	Regulation activation delay from Power ON
G03	1	1	S	S	1	247		ModBus direction
G04	2	2	S	S	0	3		Baud rate Modbus

								0: 2400 1: 4800 2: 9600 3: 19200
G05	2	2	S	S	0	2		Modbus Equality 0: none 1: Odd 2: EQUALITY
G06	0	0	S	S	0	1		Stop bits Modbus 0: 1 bit of stop 1: 2 bit of stop
G07	0	0	S	S	0	1		Measure unity 0: °C/Bar 1: °F/PSI
G08	3	3	M	M	0	15		Second display 0:hour 1: AI1 2: AI2 3: AI3 4: AI4 5: AI5 6:AI6 (EV3)/AI10(EVD) 7:AI7 (EV3)/AI9(EVD) 8: AI1 EXP 9: AI2 EXP 10: AI3 EXP 11: AI4 EXP 12: AI5 EXP 13: AI10 EXP 14: AI9 EXP 15: Setpoint
G09	0	0	S	S	0	0		Meaning icon "sun" (☀) 0= heating 1= cooling
G10	0	0	S	S	0	0		Clock enable 0 = OFF 1 = ON
G11	-12	-12	S	S	-127	127		Service password
G12	123		M		-127	127		Manufacturer password

G13	0	1	H	M	0	1		Enabling heating mode 0: off 1: ON
G14	1	1	H	M	0	1		Enabling cooling form 0: off 1: ON
G15	0	0	H	M	0	1		ACS Enablement 0: off 1: ON
G16	1	1	M	H	1	2		Number of circles
G17	1	1	M	M	0	6		Number of compressors per circuit 0: for Dry Cooler units /remote capacitor
G18	0	0	M	M	-127	127	S	Operating modes Valve solenoid 0: Based on the evaporation probe. Other negative values: time waits only on on. Other positive values: time of Wait on and off.
G19	0		M		0	1		Type of ventilation 0: separate 1: unique
G20	0		M		0	1		Enabling expansion 0: Not enabled 1: enabled
G21	0	1	H	M	0	1		Enabling installation resistors for integration 0: deshabilitadas 1: enabled
G22	0	0	H	M	0	1		Enabling operation

								Exclusive boiler and resistors installation 0: Disabled 1: enabled
G23	0		M		0	1		Dynamic set point enablement 0: Disabled 1: enabled Dynamic set point enablement 0: Disabled 1: enabled
G24	0	1	H	M	0	1		Heat pump shutdown due to low outside temperature 0: Disabled 1: enabled
G25	0	0	H	M	0	2		Antilegionella mode 0: Disabled 1: enabled 2: Cycle-enabled in Power ON
PA								Alarms
A01	3	3	M	M	0	255		Number of events/alarm time LP (bass pressure) to switch from automatic to manual reset. Note: The appliance handles as a single event all events that occur within 225 seconds (1/16th of an hour) from the first. Valid for all alarms with this management

A02	120	120	M	M	0	255	S	Time "bypass" alarm LP b.pressure
A03	-10,0	-20,0	M	M	-58,0	99,9	°C;°F;Bar ;psi*10	Setpoint alarma LP
A04	10,0	10,0	M	M	0,0	99,9	°C;°F;Bar ;psi*10	Hysteresis alarm LP
A05	3	3	M	M	0	255		Number of events/hour of HP alarm (high pressure) to switch from automatic to manual reset.
A06	55,0	55,0	M	M	-58,0	99,9	°C;°F;bar ;psi*10	HP Setpoint Alarm HP Setpoint Alarm
A07	25,0	25,0	M	M	0,0	99,9	°C;°F;bar ;psi*10	Hysteresis alarm HP
A08	5	5	M	M	0	255		Number of events per alarm flow hour to move from automatic to manual reset.
A09	30	30	M	M	0	255	S	Flow alarm bypass time (from ON pump)
A10	3	3	M	M	0	255	S	Flow alarm delay (from flowstat activation)
A11	5	5	M	M	0	255	S	Reset reset flow alarm (by reset flowstat)
A12	30	30	H	H	0	255	S	Ice alarm bypass time
A13	3	3	S	S	-58	99	S	Setpoint anti-icing alarm
A14	2,0	2,0	S	S	0,0	99,9	°C;°F	Hysteresis anti-icing alarm
A15	0	0	M	M	o	1		Freeze fan lock by anti-icing alarm 0= Disabled 1= enabled

A16	99	99	H	M	-58	99	°C;°F	Setpoint alarm high temperature regulation
A17	5	5	H	M	0	255	S*10	Delay alarm high temperature regulation
A18	105	105	M	M	50	300	°C;°F	Setpoint alarm high temperature discharge compressor
A19	15,0	15,0	M	M	0,0	25,5	°C;°F	Hysteresis alarm high temperature discharge compressor
A20	0	0	M	M	0	255		Number of events/alarm time Fans to go from automatic to manual reset.
A21	0	0	M	M	0	255	S	Time "bypass" alarm fans
A22	0	0	M	M	0	9.99 9	H*10	Maximum limit of fan hours 0 = Disabled
A23	0	0	M	M	0	9.99 9	H*10	Maximum compressor hour limit 0 = Disabled
A24	0	0	M	M	0	9.99 9	H*10	Maximum limit of pump hours 0 = Disabled
A25	0	0	M	M	0	255		Number of events/hour of compressor thermal alarm to move from automatic to manual reset.
A26	40	40	M	M	0	255	Hz;%	Setpoint oil reset modulating fan
A27	5	5	M	M	0	255	Min	Delay restoring oil modulating fan

A28	0	0	M	M	-58,0	99	°C;°F	Setpoint disabling heat pump by low outside temperature
A29	2,0	2,0	M	M	0,0	99,9	°C;°F	Hysteresis disabling heat pump by low outside temperature
M								I/O
I01	0	0	M	M	0	4		Regulation probe configuration 0: Probe return temperature 1: Probe drive temperature 2: Probe/Temperature Sensor/Condensing Pressure Circuit1 3: Probe/Temperature Sensor/ Evaporation pressure circuit 1 4: remote mando 0 10V / 4-20mA
I02	0	0	M	M	0	3		Input type configuration1 0 = NTC/Digital input 1= 4-20mA 2 = 0-10 V 3 = 0-5 V
I03	0	0	M	M	0	3		Input type configuration2
I04	0	0	M	M	0	3		Configuration type entry expansion IN1
I05	0	0	M	M	0	3		Configuration type entry expansion IN2
I06	102	102	M	M	-30	120		Input function configuration1

I07	100	100	M	M	-30	120		Input function settings2
I08	101	101	M	M	-30	120		Input function settings3
I09	109	109	M	M	-30	120		Input function settings4
I10	-1	106	M	M	-30	120		Input function settings5
I11	-2	-1	M	M	-30	120		Configuration function input IN6 (EV3) / IN10 (EVD)
I12	-5	-5	M	M	-30	120		Configuration function input IN7 (EV3) / IN9 (EVD)
I13	-7	-7	M	M	-30	30		Input function configuration8
I14	-17	-17	M	M	-30	30		Configuration function input IN9 (EV3) / IN7 (EVD)
I15	-19	-19	M	M	-30	30		Configuration function input IN10(EV3)/IN6 (EVD)
I16	0	0	M	M	-30	120		Configuration IN1 expansion input function
I17	0	0	M	M	-30	120		Configuration IN2 expansion input function
I18	0	0	M	M	-30	120		Configuration IN3 expansion input function
I19	0	0	M	M	-30	120		Configuration IN4 expansion input function
I20	0	0	M	M	-30	120		Configuration IN5 expansion input function
I21	0	0	M	M	-30	120		Configuration IN10 expansion input function
I22	0	0	M	M	-30	120		Configuration IN9 expansion input function

I23	0	0	M	M	-30	32		Configuration IN8 expansion input function
I24	0	0	M	M	-30	30		Configuration IN7 expansion input function
I25	0	0	M	M	-30	30		Configuration IN6 expansion input function
I26	0,0	0,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Home IN1 SCALE[@4 mA/0V] Note: In case the input is configured as "remote control" it is necessary, however, to configure the linearization parameters using the value 0V/4mA for the minimum and 10V/20mA for the maximum.
I27	50,0	50,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Final SCALE IN1[@20mA/10V]
I28	0	0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Home IN2 SCALE[@mA/0V]
I29	20,0	20,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Final ESCALAEIN2[@mA/0V]
I30	0,0	0,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	HOME ESCALE IN1 expansion[@4mA/0V]
I31	50,0	50,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Fund SCALE IN1 expansion [@20mA/10V]

I32	0,0	0,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	HOME ESCALE IN2 expansion[@4mA /0V]
I33	20,0	20,0	M	M	-15,0	300,0	Bar ; Psi*10; V; mA	Fund ESCALEIN2 expansion [@20mA/10V]
I34	0,0	0,0	S	S	-99,9	99,9	°C;°F;Bar ; psi*10	Offset Analog Input IN1
I35	0,0	0,0	S	S	-99,9	99,9	°C;°F;Bar ; psi*10	Offset Analog Input IN2
I36	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset Analog Input IN3
I37	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset Analog Input IN4
I38	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset Analog Input IN5
I39	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset Analog Input IN6(EV3)/IN10(EVD)
I40	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset Analog Input IN7(EV3)/IN9(EVD)
I41	0,0	0,0	S	S	-99,9	99,9	°C;°F;Bar ; psi*10	Offset Analog input. IN1 expansion
I42	0,0	0,0	S	S	-99,9	99,9	°C;°F;Bar ; psi*10	Offset analog input. expansion IN2
I43	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset analog input. expansion IN3
I44	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset analog input. expansion en4
I45	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset analog input. expansion IN5

146	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset analog input. expansion IN10
147	0,0	0,0	S	S	-99,9	99,9	°C;°F	Offset analog input. expansion IN9
148	2	2	M	M	0	4		AO1 output type configuration 0= Disabled 1= Phase cut [%] 2= 0-10 V [%] 3= PWM [%] 4= Frequency [Hz]
149	1	1	M	M	0	4		AO2 output type configuration
150	0	0	M	M	0	4		Settings. output type AO1 expansion
151	0	0	M	M	0	4		Settings. output type AO2 expansion
152	100	100	M	M	1	200	Hz*10	PWM frequency
153	100	100	M	M	1	200	Hz*10	PWM frequency
154	1	16	M	M	-22	22		Settings. DO1 digital output function
155	12	12	M	M	-22	22		Settings. DO2 digital output function
156	2	2	M	M	-22	22		Settings. DO3 digital output function
157	3	3	M	M	-22	22		Settings. DO4 digital output function
158	0	0	M	M	-22	22		TK1(EV3)/OC(EVD) Digital Output Function Configuration
159	0	0	M	M	-22	22		Settings. TK2 digital output function

160	0	0	M	M	-22	22		Settings. AO1 digital output function
161	0	0	M	M	-22	22		Settings. AO2 digital output function
162	0	0	M	M	-22	22		Configuration digital output function expansion DO1
163	0	0	M	M	-22	22		Configuration digital output function DO2 expansion
164	0	0	M	M	-22	22		Configuration digital output function expansion DO3
165	0	0	M	M	-22	22		Configuration digital output function expansion DO4
166	0	0	M	M	-22	22		Configuration digital output function AO1 expansion
167	0	0	M	M	-22	22		Configuration digital output function AO2 expansion
168	0	0	M	M	-22	22		Configuration digital output function OC expansion
169	0	0	H	H	-22	22		Reserved
170	0	0	M	M	0	6		AO1 output function configuration 0= Disabled (usable as DO) 1 = modulating compressor circuit 1

									2 = modulating compressor circuit 2 3 = installation pump 4 = Circuit fans 1 5 = Circuit fans 2 6 = Hot gas bypass valve
171	4	4	M	M	0	6			AO2 output function configuration
172	0	0	M	M	0	6			Configuration analog output function expansion AO1
173	0	0	M	M	0	6			Configuration analog output function AO2 expansion
174	2	2	M	M	0	4			Output function configuration TK1(EV3)/OC(EVD)) 0= Disabled (usable as DO) 1 = installation pump 2 = Circuit fans 1 3 = Circuit 2 fans 4 = Hot gas bypass valve
175	0	0	M	M	0	4			Configuration TK2 output function
176	0	0	M	M	0	4			Configuration analog output function OC expansion
Pr									Regulation
R01	5,0	5,0	s	S	0,0	99,9	°C-°F- bar- psi*10		Regulation band in Cooling mode
R02	5,0	5,0	H	S	0,0	99,9	°C-°F- bar- psi*10		Regulation band in Heating mode

R03	5,0	5,0	H	S	0,0	99,9	°C;°F	DHW regulation band
R04	0	0	S	S	0	255	S*10	Full regulation time (PI)
R05	30,0	30,0	S	S	Coo	99,9	°C-°F-bar-psi*10	Maximum setpoint value in mode cooling
R06	60,0	60,0	H	S	HEA	199,9	°C-°F-bar-psi*10	Maximum setpoint value in mode heating
R07	4,0	4,0	S	S	-58,0	Coo	°C-°F-bar-psi*10	Minimum setpoint value in mode cooling
R08	20,0	20,0	H	S	0,0	HEA	°C-°F-bar-psi*10	Minimum setpoint value in mode heating
R09	5,0	5,0	S	S	-99,9	99,9	°C-°F-bar-psi*10	Dynamic setpoint offset in mode cooling
R10	10,0	10,0	H	S	-99,9	99,9	°C-°F-bar-psi*10	Dynamic setpoint offset in mode heating
R11	30	30	S	S	-58	99	°C-°F-bar-psi*10	Temper. Reference exterior Dynamic SetPoint in Mode cooling
R12	15	15	H	S	-58	99	°C-°F-bar-psi*10	Reference outside temperature Dynamic SetPoint in Mode heating
R13	10	10	S	S	-50,0	50,0	°C-°F-bar-psi*10	Delta outdoor temperature setpoint Dynamic in cooling mode
R14	-10,0	-10,0	H	S	-50,0	50,0	°C-°F-bar-psi*10	Delta outdoor temperature setpoint

									Dynamic in heating mode
R15	-5,0	-5,0	S	S	-58,0	99,9	°C-°F-bar-psi*10		Setpoint Low Pressure Valve solenoid
R16	6,0	6,0	H	S	0,0	99,9	°C-°F		Delta setpoint resistors boiler ACS in integration
R17	3	3	H	S	0	255	S		DHW output bypass time in heating mode
R18	70,0	70,0	H	S	50,0	199,9	°C-°F		Setpoint antilegionella
R19	5	5	H	S	0	255	Min		Maintenance time antilegionella
R20	7	7	H	S	1	200	Dias		Antilegionella interval
R21	1,0	1,0	s	H	0,1	R22	°C-°F		Hot Gas Bypass neutra zone
R22	3,0	3,0	S	H	R21	R23	°C-°F		Smart Band Hot Gas Bypass
R23	5,0	5,0	S	H	R22	99,9	°C-°F		Fast Band Hot Gas Bypass
R24	50,0	50,0	S	H	0,1	99,9	°C-°F		Proportional band hot gas bypass
R25	120	120	S	H	0	999	S		Bypass Integral time hot gas
R26	30	30	S	H	0	999	S		derivative time Hot gas bypass
R27	67	67	S	H	1	100	%		fast action Hot Gas Bypass
R28	90	90	M	H	50	A18	°C; °F		Set point inhibition hot gas bypass function
R29	15,0	15,0	M	H	0,0	99	°C; °F		Hysteresis inhibition hot gas bypass function
R30	5	5	M	H	0	99,9	S		Delay activation function hot gas diverted from compressor ignition

R31	50	50	M	H	0	100	%	Starting position Hot Gas Bypass regulation
R32	10	10	M	H	1	999	S	Period PWM hot gas bypass valve
R33	10,0	10,0	M	H	1,0	10,0	V	PWM output voltage (AO 0- 10V) for hot gas bypass valve piloting
Pd								Desercarce
D01	0	0	H	M	0	3		Defrost modalities 0: Disabled 1: Pressure/Temp erature 2: Compressor Stop 3: Time
D02	-5,0	-5,0	H	M	-58,0	99,9	°C;°F	Setpoint start defrost count
D03	20	20	H	M	0	255	Min	Defrost activation delay
D04	15,0	15,0	H	M	-58,0	99,9	°C;°F	End setpoint desescarce
D05	5	5	H	M	0	255	Min	Maximum defrost duration
D06	60	60	H	M	0	255	S	Waiting time from OFF compressor up to valve switching investment
D07	6	6	H	M	0	255	S*10	Drip time
D08	-10,0	-10,0	H	M	-58,0	D02	°C;°F	Setpoint forced defrost
D09	25	25	H	M	0	255	Min	2-circuit defrost delay
D10	3	3	H	M	0	255	S*10	Delay ignition compressors in desescarce
D11	50,0	50,0	H	M	-58,0	99,9	°C-°F- bar- psi*10	Setpoint activation fans in desescarce

D12	10,0	10,0	H	M	0,0	99,9	°C-°F-bar-psi*10	Hysteresis activation of ventilators in desescarche
D13	30	30	H	M	0	255	Hz-%	Speed fans in defrost
PC								Compressors
C01	0	0	M	M	0	5		Number of compressor partializations
C02	0	0	M	M	0	2		Compressor typology: 0: ON-off 1: Modulantes 2: Modulante + ON-off
C03	0	0	M	M	0	3		Compressor rotation modes 0: hours + saturation 1: fixed + saturation 2: hours + balance 3: Fixed + balance
C04	24	24	M	M	0	255	S*10	Minimum compressor OFF time; Note: This value was determined to prevent 2 possible LP (low press) alarm events from being considered as a single event
C05	36	36	M	M	0	255	S*10	Minimum time between Activations of the same compressor
C06	3	3	M	M	0	255	S*10	Minimum time between Different compressor activations
C07	5	5	M	M	0	255	S	Minimum time between



								shutdown of different compressors
C08	6	6	M	M	0	255	S*10	Time to minimum on ignition modulating fan
C09	20	20	M	M	10	255	Hz-%	Minimum modulating fan value
C10	100	100	M	M	10	255	Hz-%	Maximum modulating fan value
Pf								Fans
F01	20	20	M	M	0	255	S/10	Fan boot time
F02	1	1	M	M	0	10	Ms/2	Fan defasage
F03	1	1	M	M	0	1		Fan dependency on compressor status 0: on request 1: Standalone
F04	3,0	3,0	M	M	0,0	99,9	°C-°F-bar-psi*10	Fans control Delta cut-off
F05	2,0	2,0	M	M	0,0	99,9	°C-°F-bar-psi*10	Hysteresis cut-off control fans
F06	30	30	M	M	0	255	S	Preventilation duration in cooling mode
F07	20	20	M	M	0	255	S	Post-ventilation duration
F08	30	30	M	M	0	100	Hz-%	Minimum speed fans in cooling mode
F09	30	30	H	M	0	100	Hz-%	Minimum speed fans in Heating mode
F10	100	100	M	M	0	100	Hz-%	Maximum speed fans in cooling mode
F11	100	100	H	M	0	100	Hz-%	Maximum fan speed in Heating mode

F12	100	100	M	M	0	100	Hz-%	Maximum speed silent fans and pre and post ventilation speed in cooling mode
F13	100	100	H	M	0	100	Hz-%	Maximum speed silent fans and speed of pre and post ventilation heating mode
F14	30,0	30,0	M	M	-58,0	99,9	°C-°F-bar-psi*10	Setpoint minimum speed Fans in cooling mode
F15	9,0	9,0	H	M	-58,0	99,9	°C-°F-bar-psi*10	Setpoint minimum speed Fans heating mode
F16	57,0	57,0	M	M	-58,0	99,9	°C-°F-bar-psi*10	Setpoint maximum speed Fans in cooling mode
F17	0,0	0,0	H	M	-58,0	99,9	°C-°F-bar-psi*10	Setpoint maximum speed Fans in heating mode
F18	20,0	20,0	M	M	0,0	99,9	°C-°F-bar-psi*10	Proportional band ventilation in cooling mode
F19	6,0	6,0	H	M	0,0	99,9	°C-°F-bar-psi*10	Proportional band ventilation in Heating mode
F20	0	0	M	M	0	1		Rotation sequence fans by steps 0: hours. 1: fixed
PP								Bomb
P01	1	1	M	M		0	1	Pump operating mode 0: Always Active 1: with request for regulation

P02	20	20	M	M		0	255		Compressor ignition delay from pump ignition
P03	10	10	M	M		0	255		Pump shutdown delay from compressor shutdown
P04	4	4	S	S	-58,0	99	°C-°F-bar-psi*10		Anti-icing setpoint for activation bomb
P05	2,0	2,0	S	S	0,0	99,9	°C-°F-bar-psi*10		Anti-icing hysteresis for activation bomb
P06	50		M		0	100	Hz-%		Minimum modulating pump speed
P07	5		M		-58	99	°C-°F-bar-psi*10		Modulating bomb setpoint
P08	3,0		M		0,0	99,9	°C-°F-bar-psi*10		Modulating pump regulation band
PH									Electric heating elements
H01	4	4	H	S	H04	H03	°C;°F		Setpoint boiler resistors for anti-icing
H02	6	6	H	S	H04	H03	°C;°F		Setpoint resistors installation for anti-icing
H03	10	10	M	M	H04	127	°C;°F		Maximum value setpoint boiler resistors/anti-icing system
H04	-10	-10	M	M	-58	H03	°C;°F		Minimum value setpoint boiler resistors/anti-icing system
H05	2,0	2,0	H	S	0,0	99,9	°C;°F		Hysteresis boiler resistors/integration system

H06	180	180	H	M	0	255	S*10	Resistance activation delay Boiler/Integration System
H07	6,0	6,0	H	M	0,0	99,9	°C; °F	Differential Setpoint Resistors Integration System
PS								Solar panels
S01	5,0	5,0	H	S	0,0	99,9	°C; °F	Setpoint solar panels
S02	2,0	2,0	H	S	0,0	99,9	°C; °F	Hysteresis solar panels
S03	100	100	H	M	0	255	°C; °F	Over-temperature setpoint collector
S04	0	0	H	M	0	255	S	Time ON pump in envelope-Collecting temperature
S05	10	10	H	M	0	255	S	OFF time pump in envelope-Collecting temperature
S06	30	30	H	M	-58,0	99	°C; °F	Anti-icing setpoint solar panels
S07	10,0	10,0	H	N	0,0	99,9	°C; °F	Anti-icing hysteresis solar panels
S08	60,0	60,0	H	S	dhu	R06	°C; °F	Setpoint ACS solar
S09	70	70	H	S	0	99	°C; °F	Over-temperature setpoint ACS
S10	10,0	10,0	H	S	0,0	99,9	°C; °F	Hysteresis over-temperature ACS
S11	60	60	H	S	0	255	S	Movement time valve 3 ways ACS

8.7.2 Alarms

All alarms will run to automatic reset, except:

- Anti-icing alarm: manual reset
- High pressure alarm: manual reset if the event number / hour exceeds the value of parameter A05
- Relay alarm Phase sequence: manual reset
- Thermal alarm compressors: manual reset if the number of events / hour exceeds the value of parameter A25
- Low pressure alarm: manual reset if the number of events/hour exceeds the value of parameter A01
- Flow alarm: manual reset if the number of events/hour exceeds the value of parameter A08
- Circuit fan alarm: manual reset if the number of events/hour exceeds the value of parameter A20

Alarm events that occur within 225 seconds (1/16 hour) from the first of them are integrated into the first, in the count of the number of events / now. The reset of manual reset alerts is carried out by turning the unit off and on again.

CODE	DESCRIPTION
AFLo	<p>Flow alarm</p> <p>The alarm is activated when the input set to Flowstate remains active for a time equal to A10, with a delay of A09 from the ignition of the pump; stops when the input is not active for a time equal to A11.</p> <p>The alarm becomes manual reset if the number of events/hour exceeds the value of parameter A08.</p> <p>Main consequences:</p> <ul style="list-style-type: none"> - All compressors, fans, installation resistors and pump will be turned off immediately. The pump reactivates after exceeding the time of 225 seconds that determines the minimum interval for counting independent alarm events.
AHTR	<p>HIGH TEMPERATURE ALARM</p> <p>THE ALARM IS TRIGGERED WHEN THE TEMPERATURE VALUE OF THE INLET WATER EXCEEDS A16 FOR A TIME HIGHER THAN A17; STOPS WHEN THE TEMPERATURE VALUE IS BELOW A16-A14.</p> <p>MAIN CONSEQUENCES:</p> <ul style="list-style-type: none"> - ALL COMPRESSORS WILL SHUT DOWN
AbHp	<p>Heat pump lock</p> <p>If one of the probes is set as external temperature, the function is enabled (G24 = 1), the boiler is not on alert and the outside temperature is below A28 then the heat pump is blocked. Reactivation occurs if the outside temperature becomes higher than A28+A29.</p>

	<p>Main consequences:</p> <ul style="list-style-type: none"> - All compressors and fans will shut down
APH	<p>RELAY ALARM PHASE SEQUENCE</p> <p>THE ALARM IS TRIGGERED IF THE INPUT CONFIGURED AS PHASE SEQUENCE RELAY INPUT IS ACTIVE; STOPS IF THE ENTRY IS NOT ACTIVE.</p> <p>THE REARMAMENT OF THIS ALARM IS MANUAL.</p> <p>MAIN CONSEQUENCES:</p> <ul style="list-style-type: none"> - ALL LOADS ARE TURNED OFF
ArEb	<p>Thermal alarm boiler resistance</p> <p>The alarm is activated if the input configured as thermal input resistance boiler is active; Stops if the entry is not active.</p> <p>Main consequences:</p> <ul style="list-style-type: none"> - The boiler will turn off
APMP	<p>THERMAL PUMP ALARM</p> <p>THE ALARM IS ACTIVATED IF THE INPUT CONFIGURED AS THERMAL PUMP INPUT IS ACTIVE; STOPS IF THE ENTRY IS NOT ACTIVE.</p> <p>MAIN CONSEQUENCES:</p> <ul style="list-style-type: none"> - ALL COMPRESSORS, FANS, INSTALLATION RESISTORS AND PUMP WILL BE TURNED OFF.
UArn	<p>Generic signage</p> <p>The alarm is triggered if the input set as generic signaling input is active; Stops if the entry is not active.</p> <p>Main consequences:</p> <ul style="list-style-type: none"> - Only display signage
ALL	<p>GENERIC ALARM</p> <p>THE ALARM IS ACTIVATED IF THE INPUT CONFIGURED AS A GENERIC ALERT INPUT IS ACTIVE; IT STOPS IF THE INPUT IS NOT ACTIVE.</p> <p>MAIN CONSEQUENCES:</p> <ul style="list-style-type: none"> - ALL LOADS ARE SHUT OFF
ACnF	<p>Alarm configuration</p> <p>Triggered if at least one of the following statements is correct:</p> <ol style="list-style-type: none"> 1. More than 6 power outputs have been configured (number of compressors and number of partializations) 2. A digital output has been configured as Thermostat step 1, but not compressors of type only On-Off 3. It has been configured as a regulation probe for the return probe, but the relative analog input has not been configured <ol style="list-style-type: none"> 1. It has been configured as a regulation probe for the impulsion probe, but the relative analog input does not. has been configured 2. It has been configured as a regulation probe of the condensation probe circuit 1, but the relative input Analog has not been configured

	<p>3. It has been configured as a regulation probe of the evaporation probe circuit 1, but the relative input Analog has not been configured</p> <p>4. The remote control has been configured as a control probe, but the relative analog input has not been configured, or that this entry has been configured as NTC Main consequences: - All loads will be turned off</p>
EA	<p>CUMULATIVE ALARM PROBES INDICATES THAT ONE OF THE PROBES IS UNDER ALARM. UNCONFIGURED ANALOG INPUTS DO NOT CAUSE ALARM. MAIN CONSEQUENCES: - THE REGULATION INVOLVED IS INTERRUPTED</p>
AFr	<p>Anti-icing alarm The alarm is calculated on the minimum temperature recorded by the water probes at the entrance, outlet and toilet: the alarm is activated when the minimum value is less than A13; stops when the value is greater than A13+A14. The alarm is delayed by a time equal to A12 from the ignition of the heating mode. If the alarm occurs with machine in Stand-by, the machine turns on. The rearmament of this alarm is manual. Main consequences: - All compressors and fans will be turned off</p>
ACOM	<p>COMMUNICATION ALARM THE ALARM IS ACTIVATED WHEN COMMUNICATION WITH THE EXPANSION IS MISSING FOR MORE THAN 10 SECONDS. - THE REGULATIONS INVOLVED ARE INTERRUPTED. THE PROBES RELIEVED BY THE EXPANSION APPEAR IN PROBE ERROR, THE DIGITAL INPUTS RELIEVED BY THE EXPANSION ARE AT 0, AS WELL AS THE DETECTION OF THE FREQUENCY IN THE FAST INPUTS; THE ANALOG OUTPUTS AND RELAYS ACTIVATED BY THE EXPANSION ARE SET TO 0.</p>
AHou	<p>Alarm working hours compressors / fans / pump The alarm is triggered when the working hours of a compressor exceed A22, or if the working hours of a fan exceed A23, or the working hours of the pump exceed A24. Main consequences: - Only display signage</p>
AHP1 AHP2	<p>HIGH PRESSURE ALARM CIRCUIT 1/2 THE ALARM IS ACTIVATED BOTH IN SIGNALING OF THE MAXIMUM PRESSURE SWITCH, BOTH WHEN THE MAXIMUM VALUE BETWEEN THE CONDENSATION PROBE AND THAT OF THE EVAPORATION PROBE EXCEEDS THE THRESHOLD DEFINED BY A06. THE ALARM BECOMES MANUAL RESET IF THE NUMBER OF EVENTS/HOUR EXCEEDS THE VALUE OF PARAMETER A05. MAIN CONSEQUENCES: - THE COMPRESSORS OF THE AFFECTED CIRCUIT WILL BE TURNED OFF</p>
ALP1 ALP2	<p>Low pressure alarm circuit 1/2</p>

The alarm is activated both in signaling of the minimum pressure switch, both when the minimum value between that of the condensation probe and that of the evaporation probe drops below the threshold defined by A03. The alarm stops when Both conditions end.

The alarm is activated with a delay time A02 from the ignition of the compressor. The alarm becomes manual reset if the number of events/hour exceeds the value of parameter A01.

Main consequences:

- Compressors and fans of the affected circuit will be turned off Note: to avoid that 2 events in LP alarm sequence are considered a single event, the minimum OFF time of CO4 compressors is pre-determined in 240 seconds.

AF1	ALARM CIRCUIT FANS
AF2	THE ALARM IS TRIGGERED IF THE INPUT SET AS THERMAL FAN IS ACTIVE. THE ALARM STOPS IF THE INPUT SET TO THERMAL FAN IS NOT ACTIVE. THE ALARM BECOMES MANUAL RESET IF THE NUMBER OF EVENTS/HOUR EXCEEDS THE VALUE OF PARAMETER A20. MAIN CONSEQUENCES: - THE COMPRESSORS AND FANS OF THE AFFECTED CIRCUIT WILL BE TURNED OFF
At1	Thermal alarm circuit compressors 1/2
At2	The alarm is activated if the input configured as thermal circuit compressors 1/2 is active; Stops if the entry is not active. The alarm becomes manual reset if the number of events / hour exceeds the value of parameter A25. Main consequences: - All compressors in the affected circuit will shut down
AD1	HIGH TEMPERATURE ALARM DISCHARGE CIRCUIT COMPRESSORS 1/2
AD2	THE ALARM IS TRIGGERED IF THE VALUE OF THE CONFIGURED PROBE DISCHARGES COMPRESSORS CIRCUIT 1/2 RISES ABOVE THE VALUE OF PARAMETER A18, AND STOPS WHEN IT DROPS BELOW A18 - A19. MAIN CONSEQUENCES: - ALL COMPRESSORS IN THE AFFECTED CIRCUIT WILL SHUT DOWN
AOi1	Oil return alarm circuit 1/2
AOi2	The alarm is triggered if the modulating fan will remain on a lower percentage of A26 for a time greater than A27. The alarm ends only when the power request of this circuit will exceed 90%. Main consequences: - All compressors in the affected circuit will be turned off.
ATC1	COMPRESSOR THERMAL ALARM
ATC2	THE ALARM IS ACTIVATED IF THE INPUT SET TO THERMAL COMPRESSOR 1/2/3/4/5/6 IS ACTIVE; STOPS IF THE ENTRY IS NOT ACTIVE.
ATC3	THE ALARM BECOMES MANUAL RESET IF THE NUMBER OF EVENTS / HOUR EXCEEDS THE VALUE OF PARAMETER A25.
ATC4	MAIN CONSEQUENCES:
ATC5	- THE COMPRESSOR CONCERNED WILL TURN OFF
ATC6	
AdS1	High temperature alarm discharge compressor

AdS2	The alarm is triggered if the value of the configured probe discharges compressors 1/2/3/4/5/6 rise above the value of parameter A18, and stops when the value drops below A18 - A19. Main consequences - The compressor concerned will turn off
AdS3	
AdS4	
AdS5	
AdS6	
EA01	
EA02	PROBE ALARMS
EA03	THE ALARM IS ACTIVATED IN THE FOLLOWING CASES:
EA04	- WHEN A PROBE IS SHORT-CIRCUITED OR INTERRUPTED
EA05	- IN CASE OF EXCEEDING THE UPPER OR LOWER LIMIT OF THE VALUES CONFIGURED FOR A PROBE.
EA06	UNCONFIGURED ANALOG INPUTS DO NOT CAUSE ALARM MAIN CONSEQUENCES:
EA07	- THE REGULATION INVOLVED IS INTERRUPTED.
EA08	
EA09	
EA10	
EA11	
EA12	
EA13	
EA14	

9 c.pCO Programmable Controller (CAREL)



9.1 Introduction

c.pCO is a microprocessor-based, programmable electronic controller, featuring a multitasking operating system, compatible with the c.pCO Sistema family of devices, which includes programmable controllers, user terminals, gateways, communication devices and remote management devices. These devices represent a powerful control system that can be easily interfaced with most Building Management Systems (BMS) available on the market. The controller has been developed by CAREL to provide solutions for several applications in air-conditioning, refrigeration and HVAC/R in general. Its flexibility allows for creation of tailor-made control solutions according to customer specifications. Compared to pCO system, the range is enhanced by a new compact controller, and consequently comprises the c.pCOmini (4 DIN module and panel mounting version), featuring 10 universal inputs/outputs and available with built-in driver for single-pole electronic expansion valve, as well as the c.pCO Small, Medium, Large, ExtraLarge models. The number of inputs/outputs can be increased by connecting a c.pCOe expansion board.

Medium size controllers can also feature one or two built-in drivers for electronic expansion valves. The Ultracap module (accessory) can be used as an emergency power supply for valve drivers, so as to ensure total closure of the valves in case of power failures (alternating current).

c.pCO can be connected in an Ethernet LAN to other c.pCO family controllers. Each device in the LAN can exchange digital or analogue variables with all the others, based on the

application program used. c.pCO can also be connected via a pLAN (pCO Local Area Network) to the pGD range of terminals.

Each Fieldbus serial port, whether built into the controller or installed via an optional card, can be connected to controlled field devices such as valve and damper actuators and external drivers (e.g. drivers for electronic expansion valves, EVD Evolution).

Each BMS serial port, whether built into the controller or installed via an optional card, can be connected to field-level, automation-level or management-level standard bus systems, such as Konnex®, LON®, BACnet™, etc.

The real-time operating system (OS) manages priorities so as to ensure the application program cycle time, 32-bit data and floating point numbers, and the Ethernet multimaster and multi-protocol connection.

Main features:

- optimization of the memory occupied by the Operating System and the application program, of the boot time, of the time for loading the application program and of the cycle time;
- system response time optimization: the controller executes several processes in parallel, each managed with a different priority;
- independent processes: each process, whether a protocol, USB port management, data and alarm log (datalogger), data exchange with tERA cloud service, works independently of the others;
- runtime debug (on target)

- native management of TCP/IP multitasking protocol

Local connectivity:

- built-in web server, completely customizable, supports standard HTML and JavaScript. The 90 Mbyte memory can be used to store pages created using the most common website development tools. Dynamic methods (CGI, Common Gateway Interface) are available to read and write the application program variables. Other innovative functions include: the possibility to display the contents of the pGD1 terminal in the browser, display graphs of data recorded by the datalogger and plot data from probes and energy meters in real time (variable trends);
- file server (FTP): the c.pCO public file system can be accessed in the local network via FTP. Consequently, an FTP client can be used to connect to the controller so as to upload updates, web pages and documents. The “.csv” (comma separated value) files exported by the datalogger can be downloaded
- creation of accounts with different access privileges, associated to both a webserver and an FTP server;
- management of multiple simultaneous instances of Modbus TCP/IP Master and Slave protocol;
- management of BACnet™ protocol with B-BC profile (MSTP or TCP/IP, license to be purchased separately).

Remote connectivity:

- integrated connectivity to the Carel tERA cloud service: by connecting a normal router to the controller, a secure connection can be established to the tERA server. Remote services can be activated for the management of control variables, alarm notification, data analysis and reports. The Connections are encrypted using the SSL (Secure Socket Layer) standard, in compliance with NIST, international reference for information security over the internet.
- a firewall guarantees remote access only via a secure connection (tERA cloud connection or encrypted VPN)

Integrated USB peripheral: it can be used to update the controller and save web pages, documents and applications in the flash memory. Also used to download the logs from the controller.

- c.pCO Small...Extralarge: the host and device USB ports are managed directly by the operating system. USB host (top): a USB flash drive can be used to load updates (operating system/application program) on the controller. USB device port (bottom): by connecting c.pCO to a personal computer, its memory is made available as a removable drive, and at the same time a communication channel is established with the c.suite software for programming and online debugging.
- c.pCOmini: the 2 USB ports are physically integrated into a single micro USB port; the same performance is available as for the two ports on the larger models.

Other features:

- the same controller can be connected to up to 3 pGD1/pGDE terminals;
- external or built-in terminal with display and keypad with LED backlit buttons, can be used for uploading software and commissioning;
- universal inputs/outputs configurable via an application program, for connecting active and passive probes, digital inputs, analogue and PWM outputs. This extends the possibilities of configuring inputs/outputs without having to install a larger controller;
- possibility to use the c.suite software development environment, installable on a personal computer, for creating and customizing the application program, simulating operation, supervising performance and configuring the Ethernet network;
- wide range of models that differ in terms of:
- size (mini, Small, Medium, Large and Extralarge), to ensure maximum flexibility according to the application;
- digital outputs (24/230 V relay) and SSR (solid state relay);
- NO or NC relay outputs
- integrated optically-isolated/not optically-isolated serial ports;
- optional built-in display;
- various types of connectors (spring, screw, etc.).

Software programming suite, c.suite:

designed as a set of independent modules, one for each phase in HVAC/R software development, c.suite allows teams of professionals with different skills to work in a group on the same project, increasing efficiency and adopting joint development based on workflow. All the software modules cooperate with each other based on

centralized data exchange, optionally managed by a software version number (SVN):

- c.strategy: environment where expert algorithm programmers prepare the core of the application program. Features of the programming environment:
 - total independence of programming logic from the hardware and the connected devices;
 - availability of IEC 61131 standard languages: ST (structured text), FBD (function block diagram), SFC (sequential function chart), LD (Ladder diagram), which can also be used simultaneously;
 - datatype management: 32-bit, floating point, array and native structures;
 - debug on target via USB port or Ethernet;
- c.mask: dedicated environment for developers of the user interface.
- c.design: definition of configurations, such as controller type and size, type of inputs/outputs, master/slave protocols, default values parameter, datalogger, network address and user management, connection to tERA cloud services.
- c.factory: used to program the controller, loading the application program and the appropriate unit configuration during assembly.

Applications

When provided with a dedicated application program, the controller can be used to control different kinds of equipment:

- chillers and heat pumps;
- roof-top units;
- air-conditioners;
- small/medium-sized air handling units (on request);

- refrigerated showcases (on request and to specifications);
- cold rooms (on request and to specifications);
- curing rooms;
- compressor racks;
- universal stage controllers.

9.2 Functional layout

The figure below shows the functional layout of an air handling unit. Damper actuators and valve actuators are field devices that communicate through Fieldbus 1 (ref. C). Fieldbus 2 (ref. E) is the medium through which the serial probes communicate the measured values, and through which the humidifier control board and the fans exchange data and receive set points from the controller. The built-in terminal and the

remote terminal, which communicate via pLAN (ref. A), are used for installing the application program and for commissioning the system.

The PGD touchscreen terminal, intuitive and simple to use, can be used while the unit is normally working to set switch-on and switch-off times, to enter the main parameters, to perform other advanced functions of the application program and to view any alarms triggered. In this case data are exchanged via Ethernet port (ref. D). In the same network it is possible to connect another c.pCO controller as well as to communicate with remote cloud service tEra or to BACnet™ supervisor. The system can be connected to other supervision systems (Konnex®, LON®, etc.) after installing the relative BMS1 expansion card (ref. B).

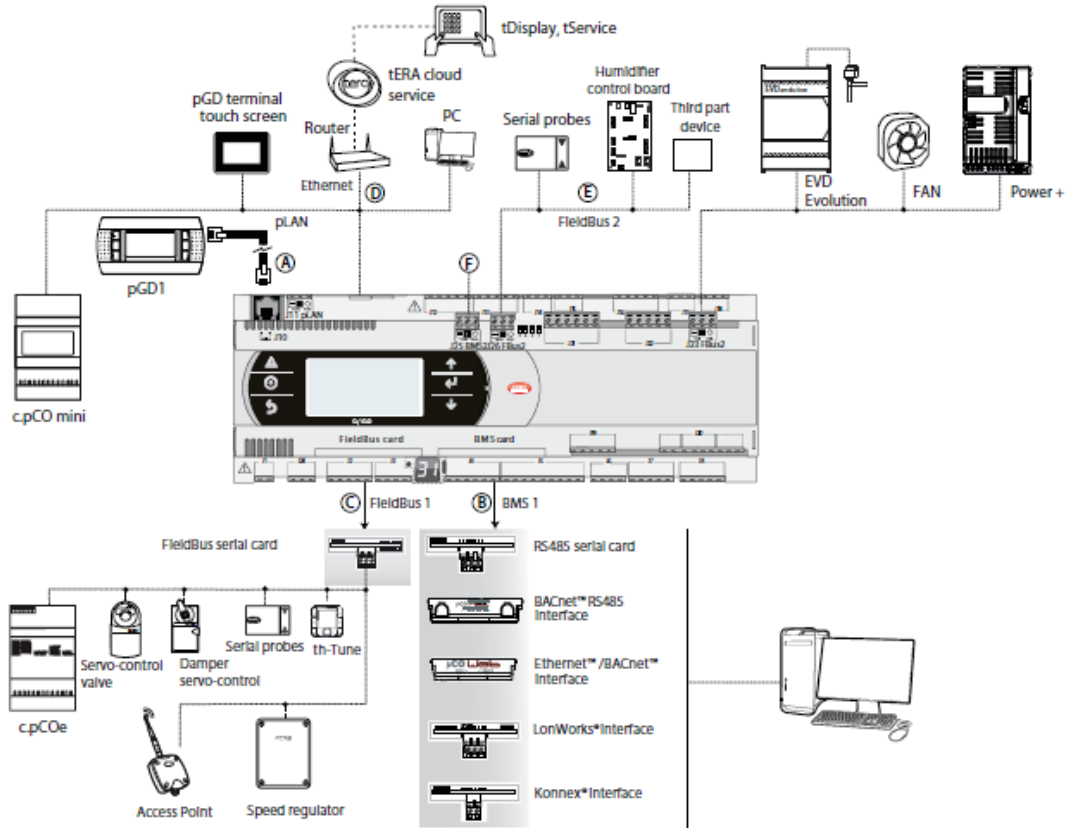


Fig. 1.a

Ref.	Serial port/Connectors	Connection to:
A	pLAN/J10, J11	up to 3 terminals (e.g. pGD1, pLDPRO)
B	BMS 1 Serial Card	a building automation system, after installing the special BMS card (see par. 1.3)
C	FieldBus 1 Serial Card	sensors, actuators, etc., on a Fieldbus, after installing the special card (see par. 1.4)
D	Ethernet	pGD Touch terminals, c.pCO controllers, Router→tERA
E	FieldBus 2 / J26 (e J23 in Large, Extralarge models)	sensors, actuators, etc., on a Fieldbus (built-in card)
F	BMS 2 / J25	other devices (built-in card)

9.3 Design

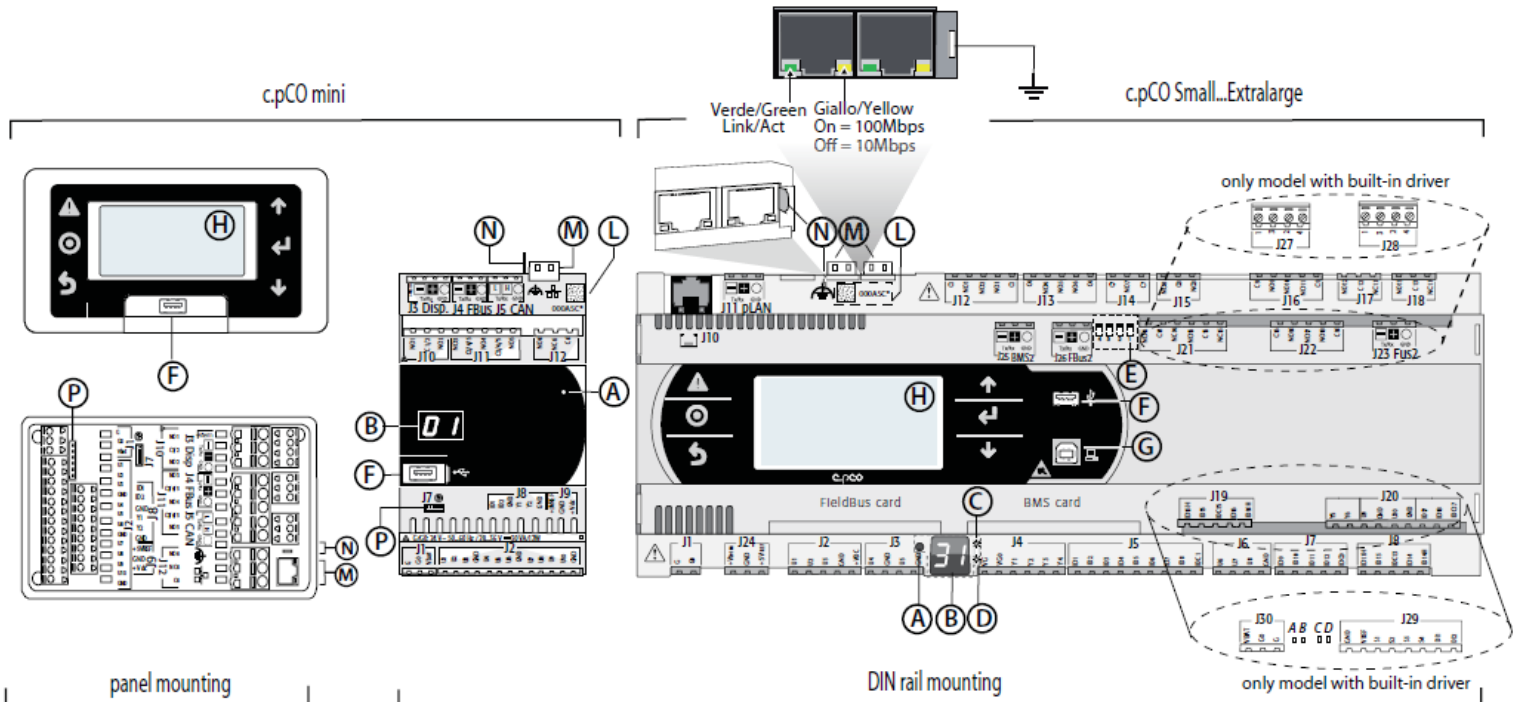
9.3.1 c.pCO Design

On the models where they are included, the front panel contains a display and a keypad with 6 backlit buttons that, when pressed individually or in combination, allow the following operations:

- uploading an application program;

• commissioning. During regular operation and depending on the application program installed, the terminal can be used:

- to edit the main operating parameters;
- to display the quantities measured, the active functions and any detected alarm.










Key:

A	Button to set pLAN address
B	Display pLAN address
C	Power LED
D	Overload LED
E	Jumpers to select FieldBus/BMS on port J26
F	Host USB port (master)

G	Device USB port (slave)
H	Main display
L	MAC address label
M	Ethernet port
N	Ethernet port spades
P	Single-pole valve connector

Each controller is provided with connectors for the inputs/outputs (see chap. 5) and the secondary display, which has a button and a LED for setting the pLAN address. Depending on the model, it can be supplied with a built-in terminal and USB ports.

Button	Descr.	Backlighting	Functions
	Alarm	White/Red	pressed together with Enter, accesses the screens managed by operating system.
	Prg	White/Yellow	-
	Esc	White	go back up one level
	UP	White	increase the value.
	Enter	White	confirm the value
	DOWN	White	decrease the value
	Select pLAN address	-	<ul style="list-style-type: none"> pressed briefly: the pLAN address is displayed brighter pressed repeatedly: increase the address release: after a few seconds, the brightness is dimmed and the pLAN address is saved



Note: Once the application program is installed, all button functions depend on the program and do not necessarily correspond to the descriptions above.

Display (c.pCO Small...Extralarge)

Two displays are available:

- the main display on the built-in terminal (if featured);
- the secondary display, which shows the controller pLAN address.

Display (c.pCOmini)

A built-in display is available (if featured), or a secondary display that displays the controller pLAN address.

LED (c.pCO Small...Extralarge)

Six LEDs are featured:

- 1 yellow LED indicating that the device is powered;
- 1 red LED indicating an overload on the +VDC (J2-5) terminal;
- 4 LEDs indicating valve status (only on c.pCO built-in driver models).

Flashing LEDs mean the valve is moving; steady on LEDs mean the valve is completely open or closed.

LED	Colour	Description
A	Yellow	Close Valve A (Connector J27)
B	Green	Open Valve A (Connector J27)
C	Yellow	Close Valve B (Connector J28)
D	Green	Open Valve B (Connector J28)

Microswitches (c.pCO Small...Extralarge)

Four microswitches are provided to configure port J26 as a Fieldbus or BMS port (see “Port J26 configuration”).

USB ports

c.pCO Small...Extralarge

The controller features two USB ports, which can be accessed after removing the cover in order to perform operations such as loading the application program and the operating system, saving the logs, etc.

- a “host” USB port for connecting pendrives;
- a “device” USB port for direct connection to the USB port of a computer.

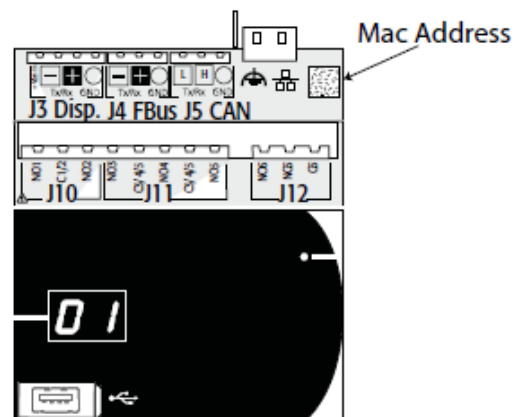
c.pCOmini

c.pCOmini models features a single micro USB port for operations such as loading the application program and the operating system, saving the logs, etc.

- the same USB port acts both as “host” port for connecting a USB flash drive, as well as “device” port for direct connection to a computer.

Mac Address label

Label with QR code containing the Mac Address that uniquely identifies the controller on the Ethernet network.



9.4 COMMUNICATION PORTS

9.4.1 Serial Ports

c.pCO Small...Extra-large

The controllers come with five serial ports:

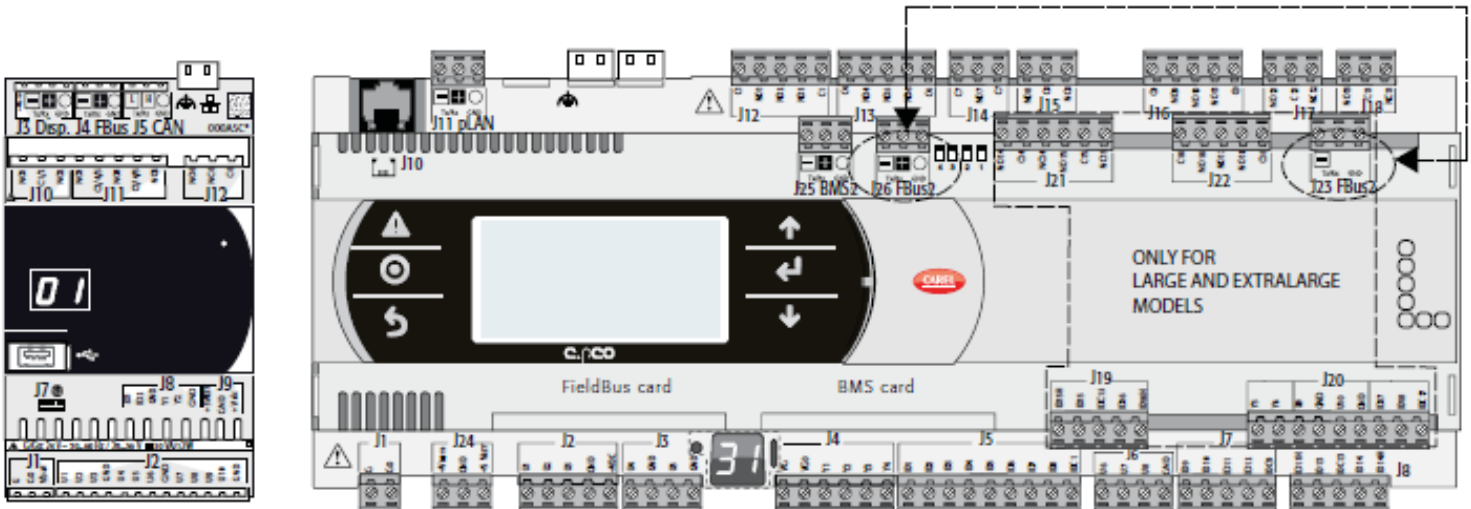
- to terminal port on connector J10-J11 (pLAN)
- a built-in BMS port on connector J25 (BMS2)
- a built-in Fieldbus port on connector J26 (FBus2).
- a BMS port to be used with the c.pCO family BMS expansion card (BMS1)
- a FieldBus port to be used with the c.pCO family BMS expansion card (FBus1)

On the c.pCO Large and Extra-large version, connector J23 is available, marked FBus2, in the same way as connector J26. From the point of view of application program management, this is the same serial line, so different addresses must be used for devices connected to both connectors, while from the electrical point of view the ports are independent (an electrical fault on port J26 does not affect port J23). See the “Technical Specifications” table).

c.pCOmini

The controller features:

- to terminal port on connector J3 (Available)
- a built-in BMS port on connector J6 (BMS, only on the c.pCOmini Enhanced model)
- a built-in Fieldbus port on connector J4 (FBus, on the c.pCOmini Enhanced and High End models).



Interface	Type/Connectors	Control	Features
Ethernet	RJ45	c.pCOmini High End c.pCO Small...Extralarge	<ul style="list-style-type: none"> one 10/100 Mbps Ethernet port two equivalent 10/100 Mbps Ethernet ports (100-BASE TX standard)
Serial ZERO	J3 Disp.	c.pCOmini	<ul style="list-style-type: none"> Integrated on main board
Serial ZERO	pLAN/J10, J11	c.pCO Small...Extralarge	<ul style="list-style-type: none"> HW driver: asynchronous half duplex RS485 pLAN Not optically-isolated Connectors: telephone jack + 3-pin plug-in connector (4-pin plug-in connector only on c.pCOmini)
Serial ONE	BMS 1 Serial Card	c.pCO Small...Extralarge	<ul style="list-style-type: none"> Not integrated on main board HW driver: not present Can be used with all c.pCO family BMS expansion cards
Serial TWO	FieldBus 1 Serial Card	c.pCO Small...Extralarge	<ul style="list-style-type: none"> Not integrated on main board HW driver: not present Can be used with all c.pCO family Fieldbus expansion cards
Serial THREE	J6 BMS	c.pCOmini Enhanced	<ul style="list-style-type: none"> Integrated on main board
	BMS 2 / J25	c.pCO Small...Extralarge	<ul style="list-style-type: none"> HW driver: asynchronous half duplex RS485 Slave Optically-isolated/non-optically-isolated serial port 3-pin plug-in connector
Serial FOUR	J4 FBUS	c.pCOmini Enhanced and High End	<ul style="list-style-type: none"> Integrated on main board HW driver: asynchronous half duplex RS485 Master
	FieldBus 2 / J26 (and J23 Large - Extralarge version)	c.pCO Small...Extralarge	<ul style="list-style-type: none"> Integrated on main board HW driver: asynchronous half duplex RS485 Master or Slave (see par. " J26 port configuration") J23: not optically-isolated J26: optically-isolated/not optically-isolated 3-pin plug-in connector J23 and J26 are both managed by the same protocol as serial 4, with the advantage of being electrically independent.

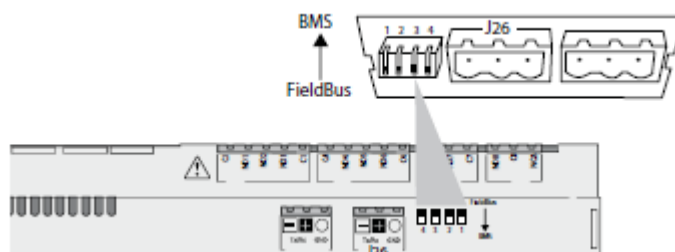
Port J26 configuration (c.pCO Small...Extralarge)

c.pCO Small...Extralarge controllers are provided with 4 microswitches for configuring serial port J26 (see figure):

- all down microswitches: port J26 set with Fieldbus hardware;
- microswitches all up: port J26 set with BMS hardware*.

Factory configuration: Fieldbus port.

(*) To use the serial port as a BMS connector, the correct communication protocol needs to be set in the application, using the c.suite programming environment.



9.4.2 Ethernet ports

The c.pCO Small...Extralarge controllers have two 10/100 Mbps/s Ethernet ports. These two ports are connected internally via a switch that automatically forwards any pass-through traffic not addressed to the controller. If the controller is not powered, pass-through between the two ports will be interrupted. The two ports feature auto crossover (Auto-MDIX). The c.pCOmini High End controller features one 10/100Mbps/s Ethernet port.

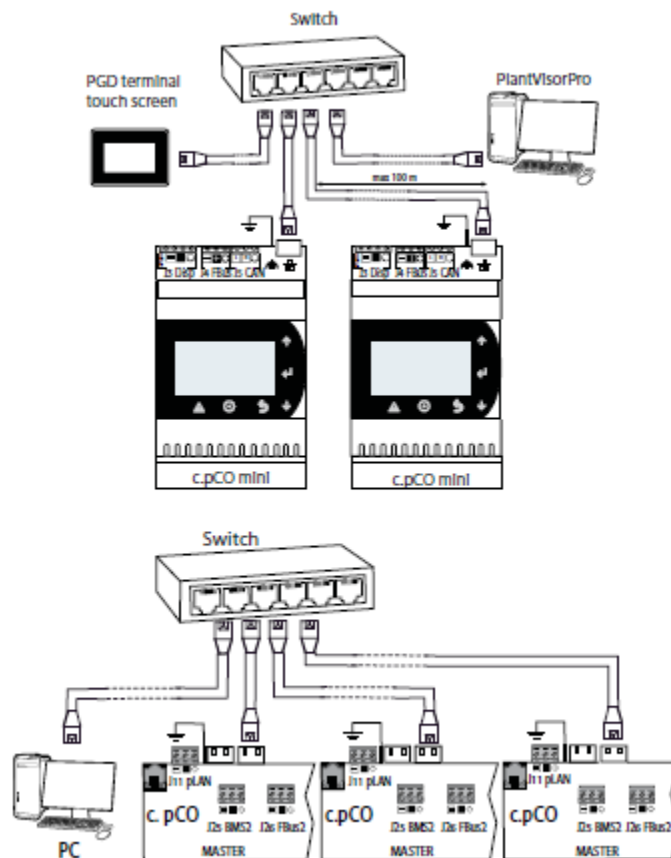
9.4.3 Controller network connections

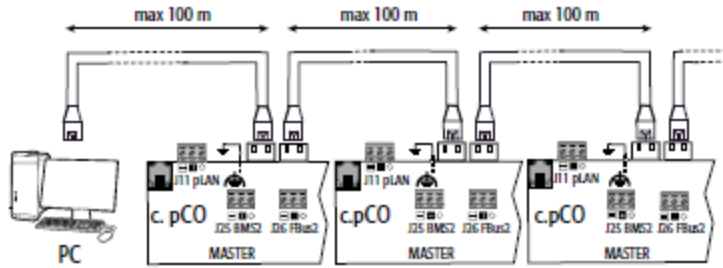
Multimaster or Master/Slave networks of c.pCO controllers can be created using the Ethernet ports and the serial ports:

Connection via Ethernet port

The built-in Ethernet ports on the c.pCO can be used to create multimaster and multiprotocol networks, with transmission speeds up to 100 Mbps.

The controllers can be connected together via an external switch (see the figure below). For c.pCO Small...Extralarge models, the two Ethernet ports are connected by an internal hub-switch, meaning a daisy-chain network can be created without needing an external switch.



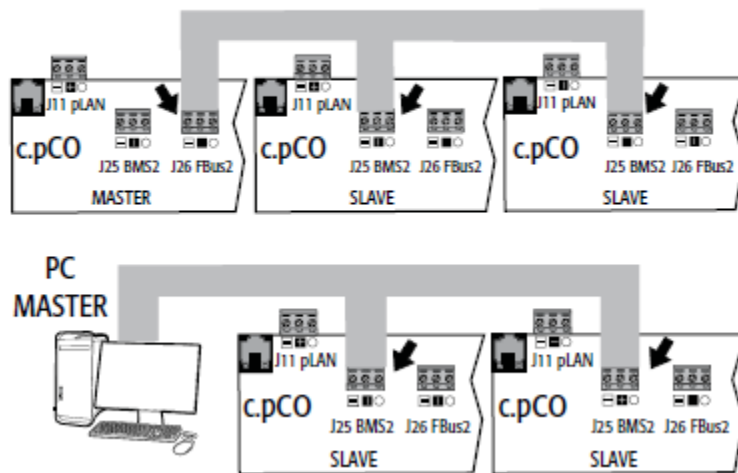


Connection via serial ports:

A master/slave network of c.pCO controllers can be created by using the RS485 serial ports. Such networks comprise:

- one c.pCO controller (Master) that communicates via the Fieldbus RS485 serial port using Carel Master or Modbus Master protocol;
- one or more c.pCO controllers (Slaves) connected to the point-to-point network via the BMS RS485 serial port using Carel Slave or Modbus Slave protocol.

MASTER - SLAVE network



Important warnings:

1. By applying appropriate impedance, a serial port with Master hardware (FBus) supplies the network with the required bias voltage to run all the connected devices, i.e. the master himself and his slaves; conversely, serial ports with slave hardware (BMS) do not provide bias voltage, so it is always advisable to connect at least one device with master hardware (FBus) to the network so that it is correctly biased;
2. However, no more than two devices with master hardware (FBus) can be connected to the same network, otherwise the total network bias impedance becomes too small and incapable of supplying the required voltage to the RS485 network.
3. It is recommended to connect the serial probes or other field devices

to an optically-isolated version of the Fieldbus serial port or to serial port TWO – Fieldbus 1 to exploit the filtering properties of optical isolation.

Special cases

- In networks consisting only of Master HW devices, no more than 2 devices can be connected. The max. length allowed for the network is 1000 m. If the network is longer than 100 m, apply the 120Ω, 1/4W terminating resistors to the first and last devices in the network;
- connect the computer to a network with no more than 1 master HW device or no more than 207 slave HW devices.

9.5 INSTALLATION

9.5.1 Mounting and dimensions

All models in the c.pCO family can be mounted on a DIN rail, except for the c.pCOMini panel version.

DIN rail assembly: c.pCOMini, c.pCO Small...Extralarge

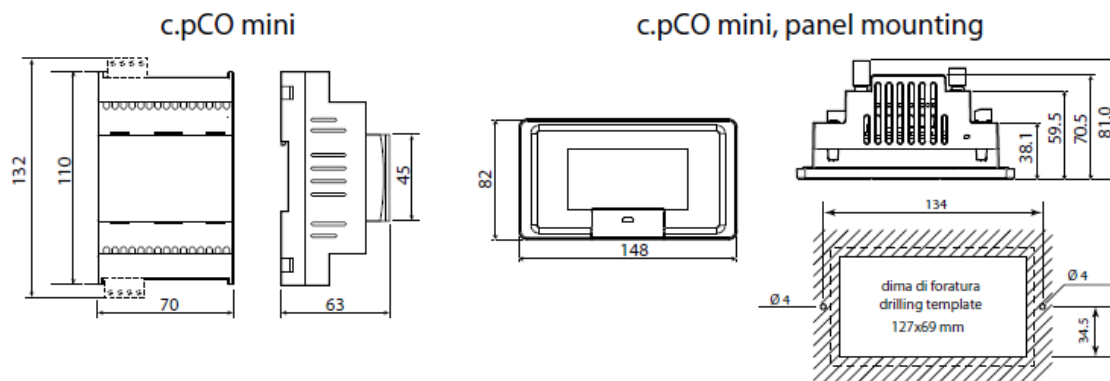
The following figure shows the dimensions of the c.pCO controllers, according to the model.

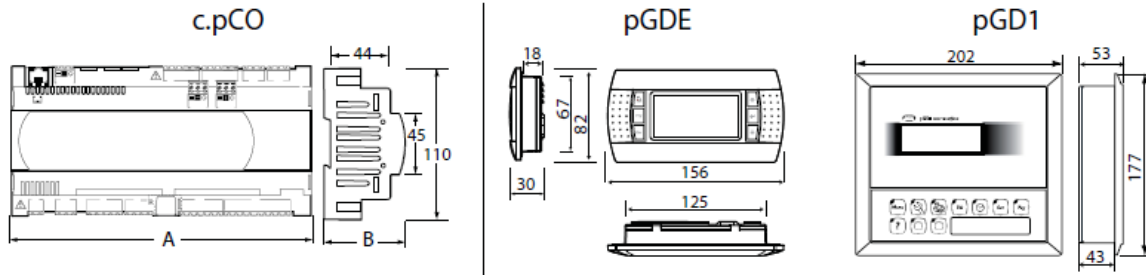
Mounting:

- place the controller on the DIN rail and press it down gently. The tabs at the back will snap into place and lock the controller.

Removing:

- lift the tabs using a screwdriver applied to their release slots. The tabs are kept in place by springs.





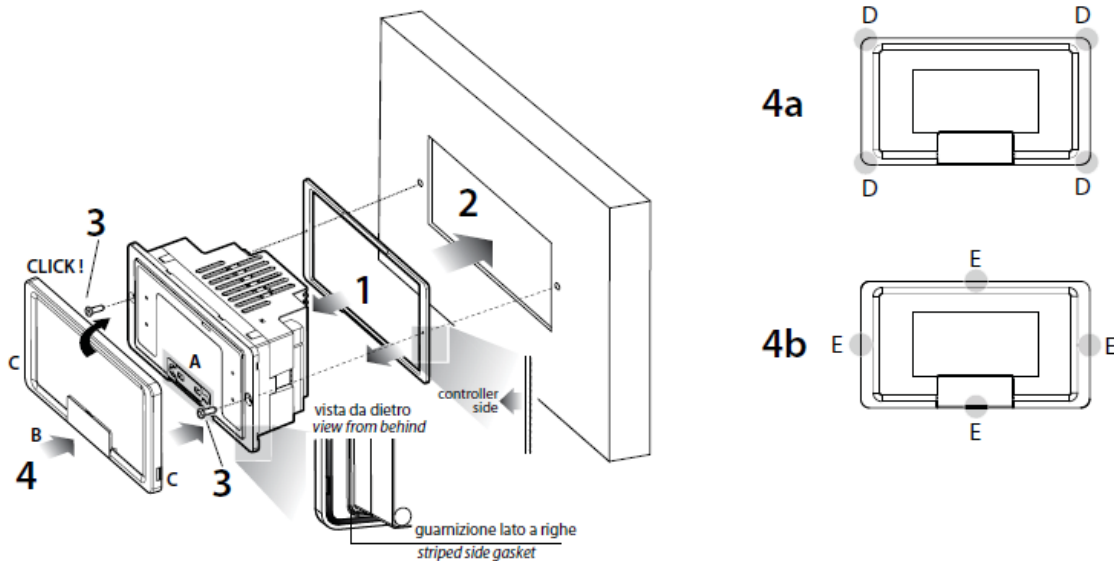
Dimensions (mm)

	Small	Medium	Buit-in driver	Large	Extralarge
A	227,5	315	315	315	315
B	60	60	60	60	60
B - with USB port / built-in terminal	70	70	70	70	70
B - with ULTRACAP module	-	-	75	-	-

Panel installation: c.pCOMini panel version

Procedure:

1. insert the gasket, with the smooth side facing the terminal;
2. place the terminal in the opening;
3. tighten the screws;
4. apply the frame, applying uniform pressure firstly on the 4 corners (points D) and then on the middle points of the frame (points E), until it clicks into place.



Note:

- for correct assembly, follow the instructions shown in the following diagram.
- Important: when assembling, make sure that the frame is securely in place on all four sides.
- if needing to remove the frame, use a screwdriver to lever it off in slot C.

- to access the USB port, open the cover B and lift the rubber cap A using the tab
- before closing the cover B again, make sure the rubber cap A is properly inserted (it must be flush with the outer plastic surface).
- if needing to cut sheet metal, it is recommended to use laser cutting;
- the thickness of the sheet metal or the material used to make the electrical panel must be suitable to ensure safe and stable installation of the terminal;
- the tension applied by the screws must not cause deformation of the sheet metal, so as not to compromise the degree of protection (IP) shown in the specifications. This degree of protection is guaranteed in the following conditions: maximum deviation of rectangular opening from flat surface $\leq 0.3\text{mm}$, maximum roughness of the surface where the gasket is applied $\leq 120\ \mu\text{m}$.

9.5.2 Installation

Environmental conditions

Avoid installing the controller and the terminal in places with:

- exposure to direct sunlight and to the elements in general;
- temperature and humidity outside the product operating range;
- large, rapid fluctuations in room temperature;
- strong magnetic and/or radio frequency interference (avoid installing near transmitting antennas);
- strong vibrations or knocks;
- presence of explosives or flammable gas mixtures;
- exposure to aggressive and polluting atmospheres (e.g. sulfur and ammonia vapors, salt mist, fumes) that can cause corrosion and/or oxidation;
- exposure to dust (formation of a corrosive patina with possible oxidation and reduced insulation);
- exposure to water.

Positioning the controller inside the electrical panel Install the controller inside an electrical panel in a position where it cannot be reached and it is protected from knocks or impact. The controller should be placed inside the panel in a position where it is physically separated from power components (solenoids, contactors, actuators, inverters, etc.) and their respective cables. The ideal solution is to house these two circuits in two separate cabinets. Proximity to such devices/cables may cause random malfunctions that are not immediately evident. The panel casing must allow an adequate flow of cooling air.

Important:

- For safety reasons the controller should be installed inside an electrical panel so that the only accessible parts are the display and the built-in terminal keypad;
- install the controller so that the disconnect devices can be used safely and without hindrance.
- when laying out the wiring, separate the probe as much as possible cables, digital input cables and serial line cables from the power cables, contactors, thermomagnetic devices, in order to avoid electromagnetic interference;
- never run power cables and probe signal cables in the same conduits (including the ones in the electrical panels);

- for control signals, use shielded cables with twisted wires. If the control cables have to cross over power cables, the intersections should be as close as possible to 90 degrees; under no circumstances should the control cables be laid parallel to the power cables;
- keep the paths of the probe cables as short as possible and avoid making spiral paths that enclose power devices;
- in case of malfunctions do not attempt to repair the device, but contact a CAREL service center.

9.5.3 Electrical Installation

Important: before servicing the equipment, disconnect the controller from the power mains by moving the system main switch to OFF.

Make sure the system is provided with a power disconnect conforming to regulations. Use cable lugs that are suitable for the terminals used. Loosen each screw and insert the cable lugs, then tighten the screws. There is no limit to the number of wires that can be connected to each individual terminal. When tightening the terminal screws apply a tightening torque no greater than 0.6 Nm. For information on the maximum allowable length of the connections

to the analogue/digital inputs and to the analogue outputs please refer to the “Technical Specifications” (chapter 12). In environments subject to strong disturbance use shielded cables with the braiding bonded to the earthing conductor in the electrical panel. After making the connection, gently tug on the cables to make sure they are sufficiently tight.

Note:

- secure the cables connected to the controller with clamps placed at 3cm from the connectors;
- if the power transformer secondary winding is earthed, make sure the earth conductor is bonded to the conductor that goes to the controller and is connected to terminal G0. This applies to all the devices connected to the controller through a serial network.

Important:

- using a supply voltage other than specified can seriously damage the system;
- connect the fuse close to the controller;
- the controller should only be installed, serviced and inspected by qualified personnel and in compliance with national and local regulations;
- all the extra low voltage connections (24 Vac/Vdc or 28 to 36 Vdc analogue and digital inputs, analogue outputs, serial bus connections, power supplies) must have reinforced or double insulation from the powermains;
- avoid touching or nearly touching the electronic components mounted on the boards to avoid electrostatic discharges from the operator to the components, which may cause considerable damage;
- do not press the screwdriver on the connectors with excessive force, to avoid damaging the controller;
- using the device in any way other than specified by the manufacturer can compromise its protection;
- use only optional boards and connectors supplied by Carel.

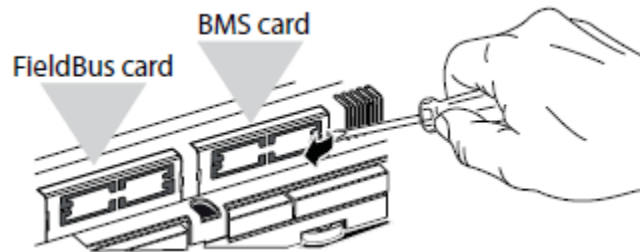
9.5.4 Preliminary operations

Installing the serial cards

If the Fieldbus and BMS serial cards built into the c.pCO are insufficient for the required application, you can add a Fieldbus serial port and a BMS serial port, which are available as accessories.

To install them, proceed as follows:

- Locate the Fieldbus or BMS serial port.
- using a screwdriver, take off the cover;
- using a pair of nippers, cut out the plastic knock-out to create an opening;
- plug the optional card into the edge connector, making sure it is firmly secured and makes contact;
- put the cover back so that the serial card connector is aligned with the opening;
- make the required electrical connections.



Note: see the technical leaflets for the cards being installed.

c.pCOe expansion board installation

See the technical leaflet +0500059IE.

Ultracap module installation

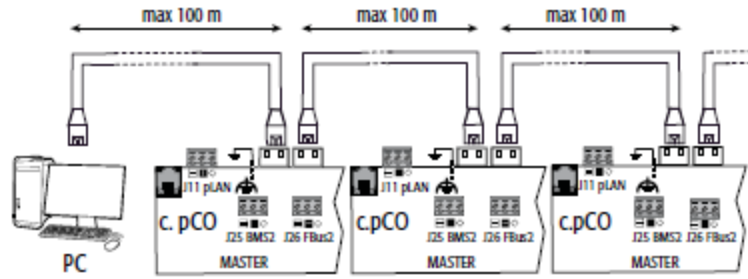
See the technical leaflets +0500042IE and +0500041IE.

9.5.5 Electrical connections

Ethernet network

Connections:

- use CAT-5 STP shielded cables;
- always make the earth connection using the male spade near the Ethernet connectors;
- the maximum length of an Ethernet connection is 100 m between consecutive devices



RS485 network

To improve the controller immunity against electromagnetic interference, the serial connection cable should be a shielded twisted pair cable, 2-wire or 3-wire depending on the isolation of the serial connection. The following rule applies:

- if the serial port is isolated (functionally) from the power supply, a third wire is required in the serial cable to act as a common reference for the controllers. If the serial port is not optically isolated and the common reference is already present, no third wire is required.

For the RS485 network, use a twisted pair cable with the specifications shown in the table.

Master device	HW	Lmax(m)	Wire/wire capacitance (pF/m)	Resistor on first and last devices	Max. no. of slave devices on bus	Data rate (bit/s)
c.pCOmini						
FBUS	RS485	2/500 (not shielded/shielded AWG 24)	< 90	120 Ω	64	19200
PC						207
c.pCO Small...Extralarge						
FBUS	RS485	1000	< 90	120 Ω	64	19200
PC		1000				207

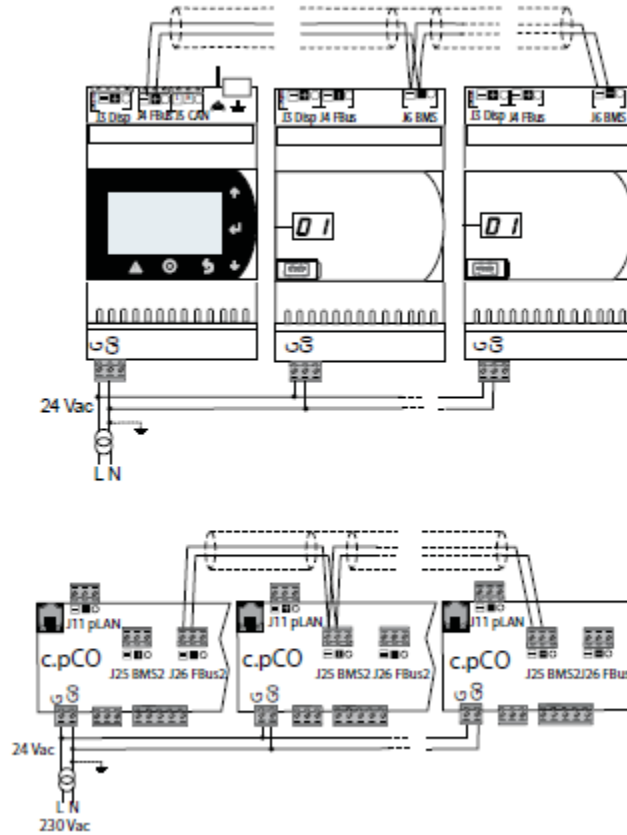
Note: in case of a Master–Slave network the max. allowable length is 1000 m. If the network is longer than 100 m, apply 120Ω, 1/4W terminating resistors to the first and last devices in the network.

Non-optically-isolated serial port

c.pCOmini: Fieldbus (J4) and BMS (J6).

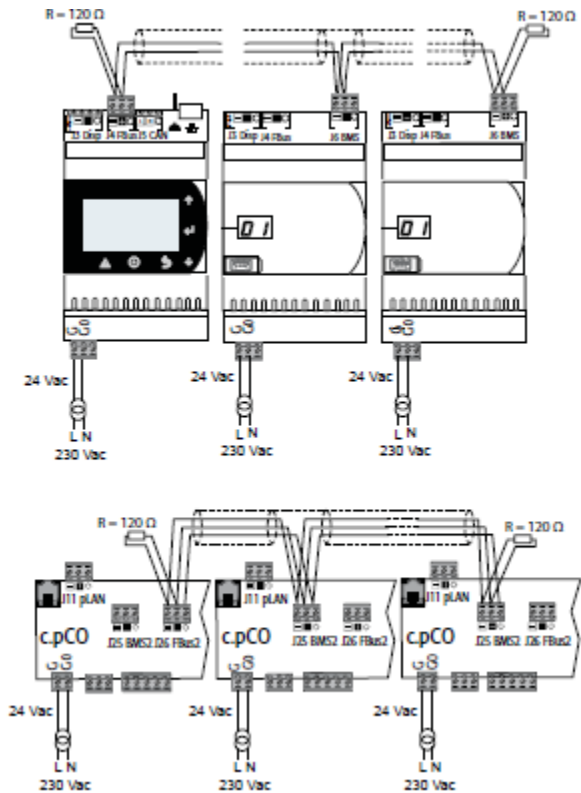
c.pCO Small...Extralarge: serial ZERO - pLAN (J11), FieldBus 2 (J23 and J26), and BMS2 if not optically isolated (on models with built-in ports that are not optically isolated).

Case 1: multiple boards connected to a Master/Slave network powered by the same transformer. Network length <100 m, terminating resistors are not required (for example, multiple boards connected inside the same electrical panel).



The procedure for grounding the shield is described in the corresponding paragraph.

Case 2: multiple boards connected to a Master/Slave network powered by different transformers (with G0 not grounded); This is a typical application of multiple boards inside different electrical panels. If the network is more than 100 m long, the 120 Ω, ¼ W terminating resistor is required.

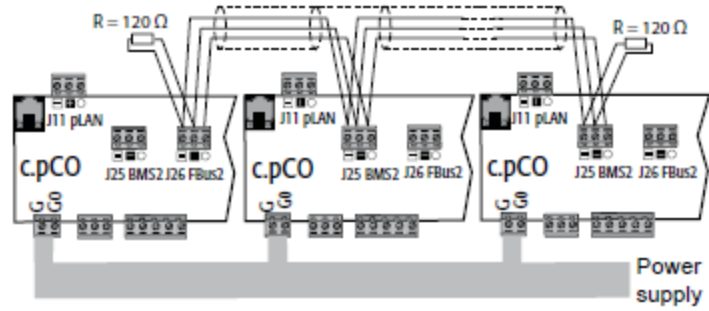


Important: the earth connection (if any) should be made only on one point of the earth line (same earthing terminal for all controllers).

The procedure for earthing the shield is described in the corresponding paragraph.

Optically-isolated serial port

This is the case of serial ONE - BMS1, serial TWO - Fieldbus 1 and the builtin ports serials THREE and FOUR on optically-isolated models. Regardless of the type of power supply or earthing, use a 3-wire shielded cable connected as shown in the figure. If the network is more than 100 m long, the terminating resistor is required.

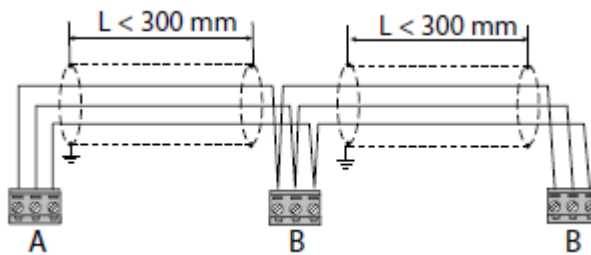


The procedure for grounding the shield is described in the corresponding paragraph.

Procedure for grounding the shield

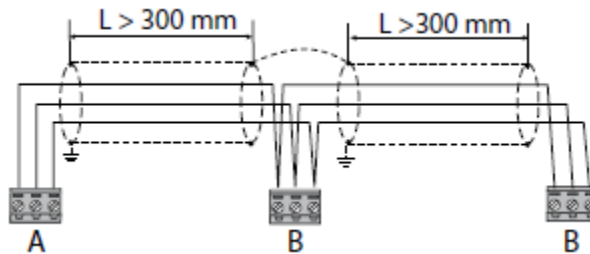
The shield of the serial cable is grounded differently according to the length, as shown in the figure (where A=FBus terminal, B=BMS terminal).

Case 1: distance between controllers less than 0.3 m: earth only one end of the cable.

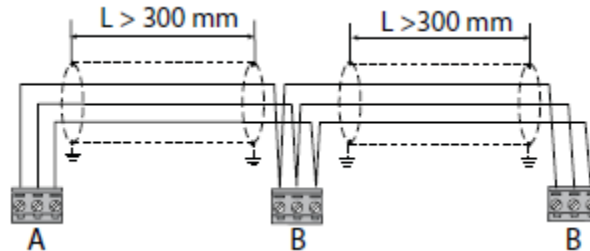


Case 2: distance between controllers greater than 0.3 m: two possibilities.

- earth one end with a bridge between the shields



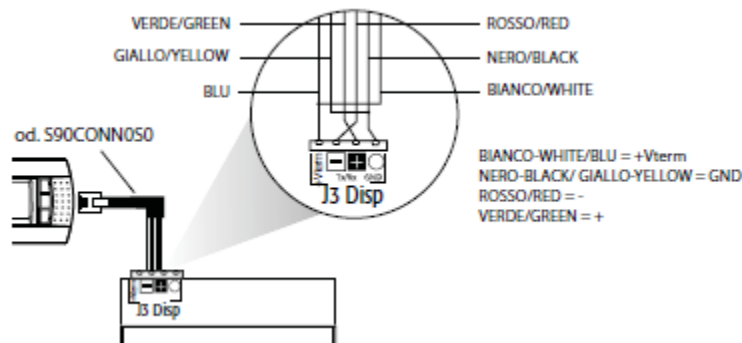
- earth both ends of the cable (no bridge between shields).



9.5.6 Connecting the terminal

c.pCOmini

Use the accessory cable P/N S90CONN050, connected as shown in the figure. The maximum distance allowed between controller and terminal is 10 m.



c.pCO Small...Extralarge

The controller and the terminal are connected to a pLAN network.

1: Connecting the terminal to one c.pCO controller

When connecting the controller to the terminal, the following restrictions should be kept in mind:

1. the overall length of the pLAN network should not exceed 500 m. Consequently, if the terminal is installed in a remote position, the length of the terminal cable must be included in the total length;
2. the unshielded telephone cable can be used for a max. length of 50m. Beyond this length, use a 3-wire shielded cable (see the table below);
3. for lengths greater than 200 m, the power supply for the terminal must be provided separately;

4. no more than 3 terminals can be connected to the same c.pCO controller. The terminals must be the same type (e.g. all pGD1). One terminal is powered by the controller, and the other two by an external power supply.

Important:

- in domestic installations, standard EN55014 requires the connection cable between the controller and the terminal to be shielded, with the shield earthed at both ends;
- in industrial installations with length >10 m, the connection cable between the controller and the terminal must be shielded and the shield must be earthed.

Case A: 1 terminal.

A.1: distance $L < 50$ m.

The typical connection for one terminal (e.g. PGD1) is made using a 6-wire telephone cable available from CAREL as an accessory (S90CONN00*).

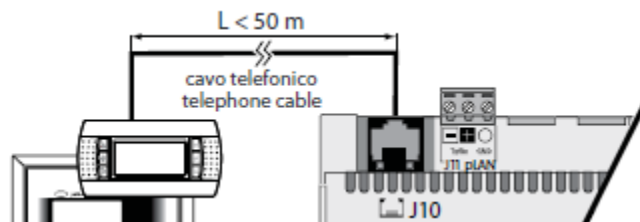
The telephone connector provides both data transmission and the power supply for the terminal.

To make the connection:

- plug the connector into terminal J10 until it clicks into place.

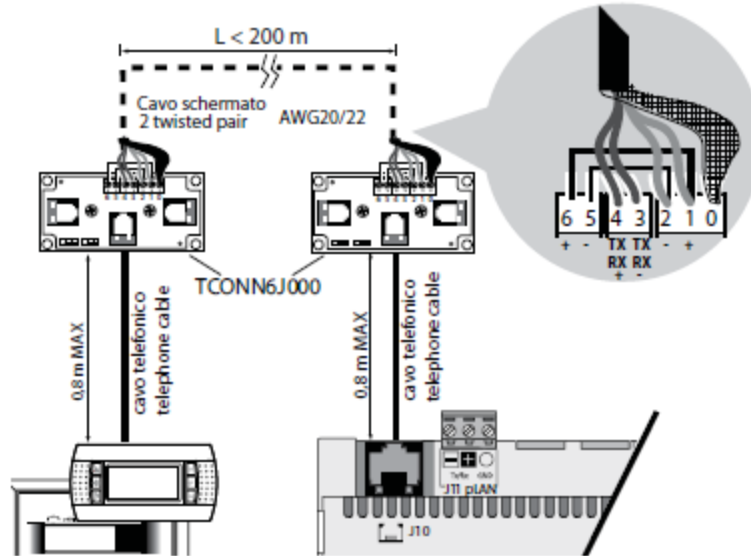
To remove the connector:

- Press lightly on the plastic catch on the connector and pull it out.



A.2: distance $50 < L < 200$ m.

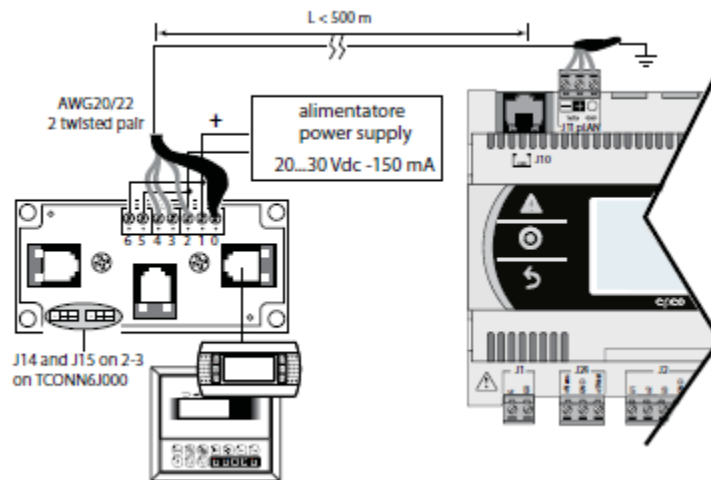
Lengths greater than 50 m require two TCONN6J000 cards connected with a 4-wire shielded cable, as shown in the figure. The terminal is powered by the controller.



Note: for information on the position of the jumpers on the TCONN6J000 board, see instruction sheet +050002895.

A.3: distance $200 < L < 500$ m.

The terminal must be powered by an external power supply. Connect a 3-wire shielded cable to the pLAN connector (J11). Provide a separate power supply for the TCONN6J000 card, as shown in the figure.



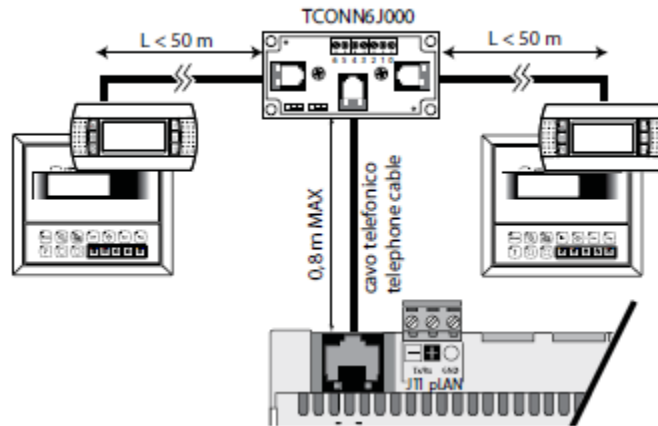
Note: to reach the maximum network length, use a bus layout with branches not exceeding 5 m.

Case B: 2 terminals

Two terminals can be directly connected only on small models. Other sizes require the second terminal to be powered separately. On Medium/Large/Extra-large controllers apply configuration A.1, A.2 or A.3.

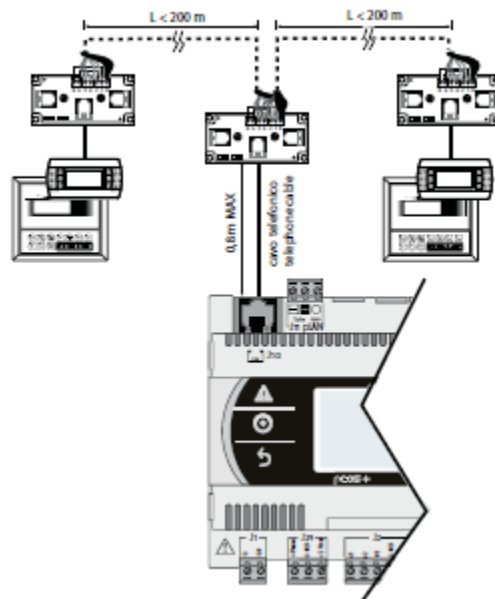
B.1: distance $L < 50$ m.

Use 1 TCONN6J000 card, connected as shown in the figure.



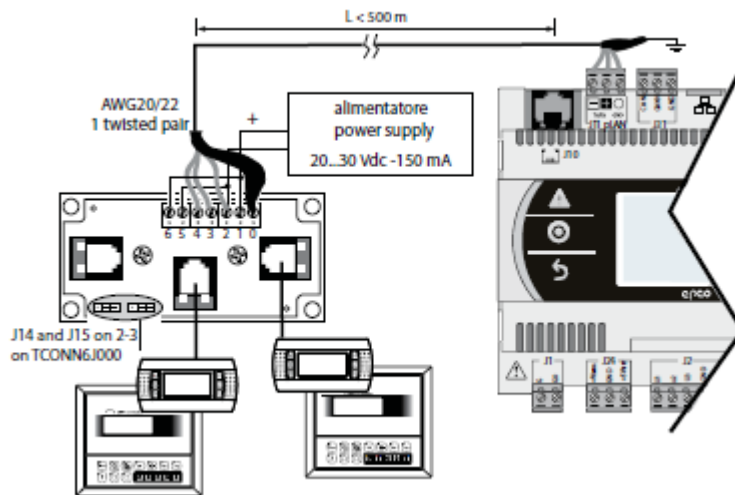
B.2 distance $50 < L < 200$ m.

Use 3 TCONN6J000 cards, connected as shown in the figure.



B.3 distance $200 < L < 500$ m.

If one of the terminals is connected at a distance > 200 m, connect it according to the diagram described in A.3. Connect the other terminal as described in A.1 or A.2. If both terminals are close to a distance > 200 m, connect them as shown in the diagram below:



Case C: 3 terminals.

For the first 2 terminals refer to Case B. For the third terminal use one of connections A.1, A.2 or A.3.

Important:

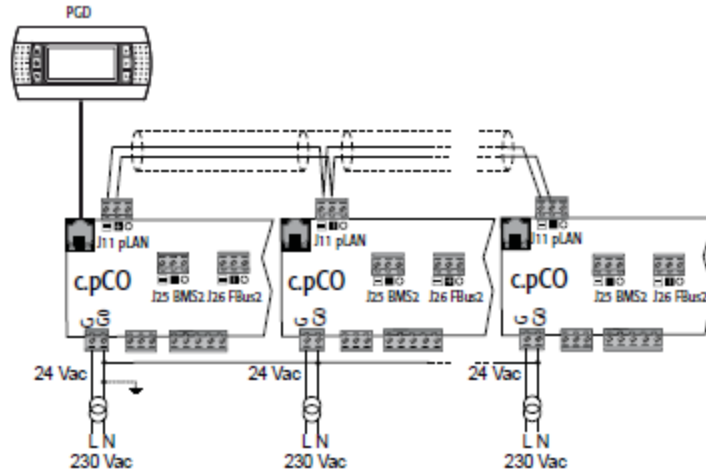
- the 24 Vdc at +Vterm (J24) can be used only in alternative to connector J10 to power an external terminal, with maximum current 1.5 W;
- in networks with a star layout, if the cable is longer than 5 m, connect the terminal only to the first or last c.pCO in the network (to avoid branches).

The following table applies.

	type of cable	MAX controller-terminal distance (m)	power supply	use TCONN6J000 card
1	telephone	50	from the controller (150 mA)	NO
2	shielded AWG24	200	from the controller (150 mA)	YES
3	shielded AWG20/22	500	separate	YES

2: Shared terminal connection in pLAN network

To share a terminal between several c.pCO controllers, these can be connected in a pLAN network, and the terminal connected to one of the controllers in the network (see the figure below). The previous details on the maximum length allowed between terminal and controller also apply in this case.





It is possible to use one terminal only, sharing it between controllers to display the information relating to each (see the paragraph "Private and shared terminal").

9.5.7 Input/output labels

c.pCO controllers are distinguished by size and provided with inputs and outputs and power supplies for the active probes most suitable for various applications. The features that depend on the model are:

- maximum number and type of inputs/outputs;
- availability of built-in driver for expansion valves;
- type of interfaces

label	Type of signal
U...	Universal inputs/outputs, can be configured via software as: Analogue inputs: - NTC PTC, PT500, PT1000 sensors - PT100 sensors - 0 to 1 Vdc or 0 to 10 Vdc signals - 0/4 to 20 mA signals - 0 to 5 V signals for ratiometric probes Digital inputs (not optically-isolated): - voltage-free contacts (not optically-isolated) - fast digital inputs Analogue outputs (not optically-isolated): - 0 to 10 Vdc signals - PWM signals
Y...	0 to 10 Vdc analogue outputs, PWM outputs
ID...	24 Vac/ 24 Vdc digital input
ID...H	230 Vac digital input
NO...	Relay output, normally open contact
NC...	Relay output, normally closed contact
C...	Relay output, common
Tx/Rx, GND	Serial port
	Ethernet port
	Functional earth

9.5.8 I/O table

		c.pCO Controllers										c.pCOe I/O expansion card						
		mini (Basic)	mini (Enhanced)	mini (High End)	Small	Medium	Large	Extra Large	Built-in driver	Label	In/Out	Type	Basic - c.pCOe	Label	In/Out	Type		
Universal inputs/ outputs	NTC input	10			5	8	10	8	8	8	U	In	Universal I/O	10	U	In	Universal I/O	
	PTC input	10			5	8	10	8	8	8	U	In	Universal I/O	10	U	In	Universal I/O	
	PT500 input	10			5	8	10	8	8	8	U	In	Universal I/O	10	U	In	Universal I/O	
	PT1000 input	10			5	8	10	8	8	8	U	In	Universal I/O	10	U	In	Universal I/O	
	PT100 input	max 5			max 2	max 3	max 4	max 3	max 3	max 3	U	In	Universal I/O	max 5	U	In	Universal I/O	
	0 to 1 Vdc / 0 to 10 Vdc input (powered by controller)	0			max 5	max 6	max 6	max 6	max 6	max 6	U	In	Universal I/O	0	U	In	Universal I/O	
	0 to 1 Vdc / 0 to 10 Vdc input (powered externally)	10 (Note ¹)			max 5	max 8	max 10	max 8	max 8	max 8	U	In	Universal I/O	10 (Note ¹)	U	In	Universal I/O	
	0 to 20 / 4 to 20 mA input (powered by controller)	max tot 4	max 2 (Note ²)		max 4	max 6	max 6	max 6	max 6	max 6	U	In	Universal I/O	max tot 4	max 2 (Note ²)	U	In	Universal I/O
	0 to 20 / 4 to 20 mA input (powered externally)		max 4		max 4	max 7	max 9	max 7	max 7	max 7	U	In	Universal I/O		max 4	U	In	Universal I/O
	0 to 5 V input for ratiometric probe (+5Vref)	max 2			max 5	max 6	max 6	max 6	max 6	max 6	U	In	Universal I/O	2	U	In	Universal I/O	
	Digital input w/ voltage-free contact	10			5	8	10	8	8	8	U	In	Universal I/O	10	U	-	Universal I/O	
	Fast digital inputs	max 2			max 2	max 4	max 6	max 4	max 4	max 4	U	In	Universal I/O	max 2	U	-	Universal I/O	
	0 to 10 Vdc output, not optically-isolated	max 5			5	8	10	8	8	8	U	Out	Universal I/O	max 5	U	-	Universal I/O	
	PWM output, not optically-isolated	10			5	8	10	8	8	8	U	Out	Universal I/O	10	U	-	Universal I/O	
		max tot 10			max tot 5	max tot 8	max tot 10	max tot 8	max tot 8	max tot 8				max tot 10				
Digital inputs	Optically-isolated 24 Vac/Vdc input	0			8	12	14	12	12	ID	In	Digital input	0	ID	In	Digital input		
	24 Vac/Vdc or 230 Vac (50/60 Hz) input	0			-	2	4	2	2	ID	In	Digital input	0	ID	In	Digital input		
	Voltage-free contacts	0	2	-	-	-	-	-	-	ID	In	Digital input	0	ID	In	Digital input		
	max tot 0			max tot 2	max tot 8	max tot 14	max tot 18	max tot 14	max tot 14				max tot 0					
Analogue outputs	0 to 10 Vdc output, optically-isolated	0			4	4	6	4	4	Y	Out	Analogue output	0	Y	Out	Analogue output		
	0 to 10 Vdc output, not optically-isolated	0	2	0	0	0	0	0	0	Y1, Y2	Out	Analogue output	0	Y1, Y2	Out	Analogue output		
	PWM output, optically-isolated	0			2	2	2	2	2	Y3, Y4	Out	Analogue output	-	-	-	-		
	PWM output, not optically-isolated	0	2	0	0	0	0	0	0	Y1, Y2	Out	Analogue output	0	Y1, Y2	Out	Analogue output		
	Output for single-pole stepper motor	0	1	0	0	0	0	0	0	J7	Out	Analogue output	0	J7	Out	Analogue output		
Output for two-pole stepper motor	0			0	0	0	0	1/2	1-3-2-4	Out	Analogue output	0	-	-	-			
	max tot 0			max tot 2	max tot 4	max tot 4	max tot 6	max tot 4	max tot 6				max tot 0					
Digital outputs	NO/NC relay output	1			1	3	5	3	3	NO/NC	Out	Digital output	1	NO/NC	Out	Digital output		
	NO relay output	5			7	10	13	26	10	NO	Out	Digital output	5	NO	Out	Digital output		
	24 V SSR output	2			1	2	3/4	2	2	NO	Out	Digital output	2	NO	Out	Digital output		
	230 V SSR output	2			1	2	3/4	2	2	NO	Out	Digital output	2	NO	Out	Digital output		
	max tot 6			max tot 8	max tot 13	max tot 18	max tot 29	max tot 13				max tot 6						

16 20 25 39 52 55 41 16 Total I/O



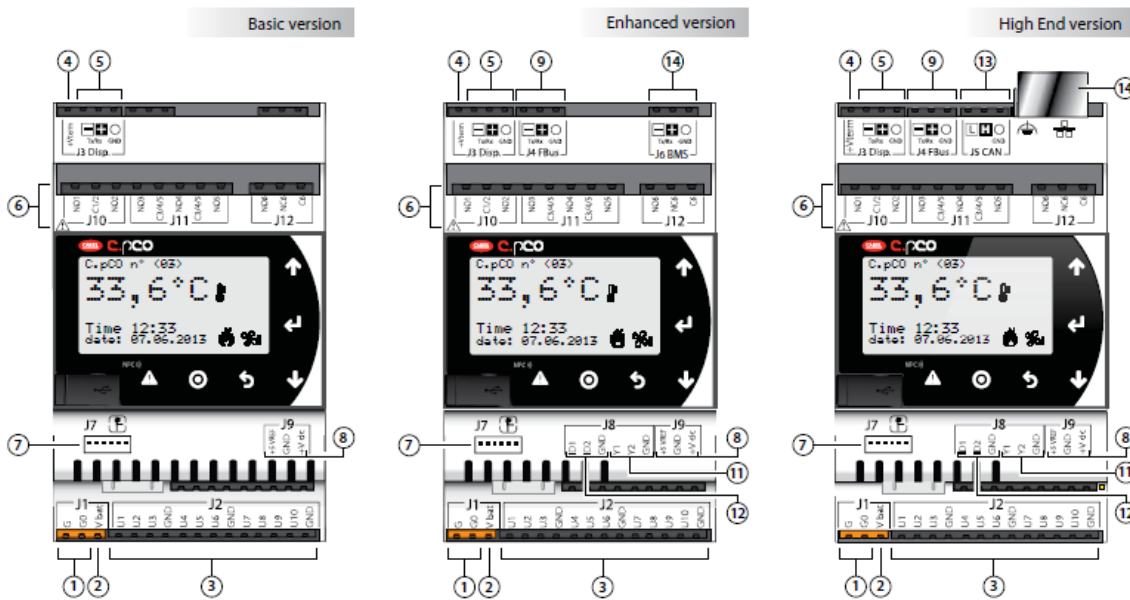
Note 1: CAREL probes, part numbers DP**Q and DP****2, can only be used with external power supply and not powered by c.pCOmini
Note 2: excluding CAREL probes part numbers DP**Q and DP****2.



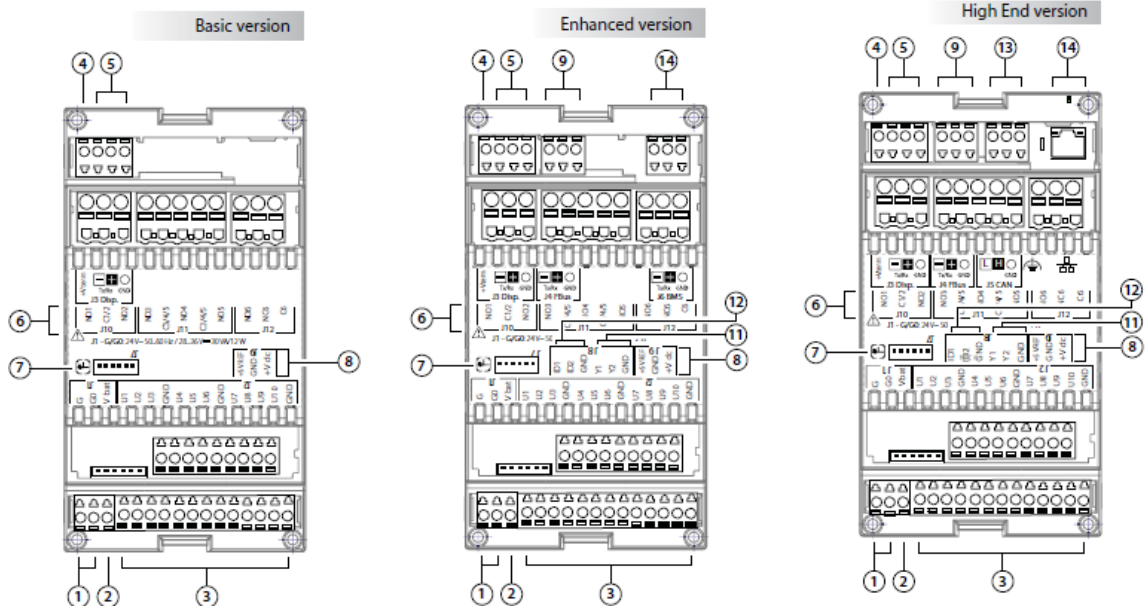
	c.pCO Controllers								c.pCOe I/O expansion card						
	mini (Basic)	mini (Enhanced)	mini (High End)	Small	Medium	Large	Extra Large	Built-in driver	Label	In/Out	Type	Basic - c.pCOe	Label	In/Out	Type
Power to terminal	0			1	1	1	1	1	J10			0	---		Telephone conn. (pLAN) J10
	1			0	0	0	0	0	J3 Disp			0			Display port J3
	1			1	1	1	1	1	+Vterm			0			Add. power to terminal
Power to probes	1			1	1	1	1	1	+VDC			1			Power to active probes
	1			1	1	1	1	1	+5VREF			1			Power to ratiometric probes
	1			1	1	1	1	1	VG, VGO						
Power to analogue outputs	0			1	1	1	1	1	VG, VGO			0			
Built-in Fieldbus ports	0	1	1	1	1	2	2	1	J23/ J26, J4 (Mini)			0			
Accessory Fieldbus ports	0			1	1	1	1	1	Fbus card			0			
Built-in BMS ports	0	1	0	1	1	1	1	1	J25, J6 (Mini)			1			
Accessory BMS ports	0			1	1	1	1	1	BMS card			0			
Host USB port	1			1	1	1	1	1				0			
Slave USB port	1			1	1	1	1	1							
Ethernet	0	0	1	2	2	2	2	2				0			

9.5.9 c.pCOmini e c.pCOe : connections terminals

c.pCOmini - DIN rail version



c.pCOMini - Panel version (rear view)

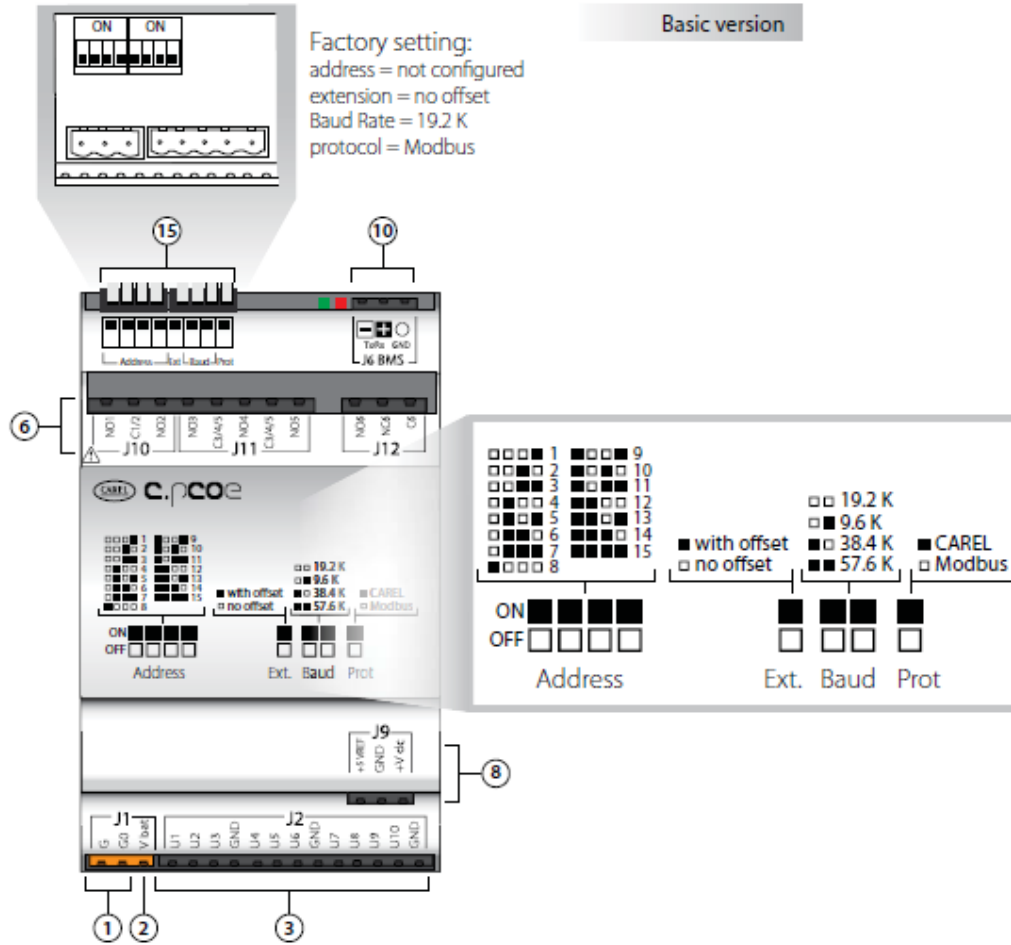


Key:

Ref.	Description
1	Power connector [G(+), G0(-)]
2	Vbat: terminal for external Ultracap module (accessory)
3	Universal inputs/outputs
4	+Vterm: terminal power supply
5	Terminal connector
6	Relay digital outputs
7	Single-pole valve connector
8	+5VREF: power supply for ratiometric probes +VDC: power supply for active probes

Ref.	Description
9	FieldBus connector
10	BMS connector
11	Analogue outputs
12	Digital inputs
13	CANbus connector
14	Ethernet port
15	Dip-Switches (only for c.pCOe)

c.pCOe - DIN rail version



Description of connection terminals on c.pCO mini/c.pCOe

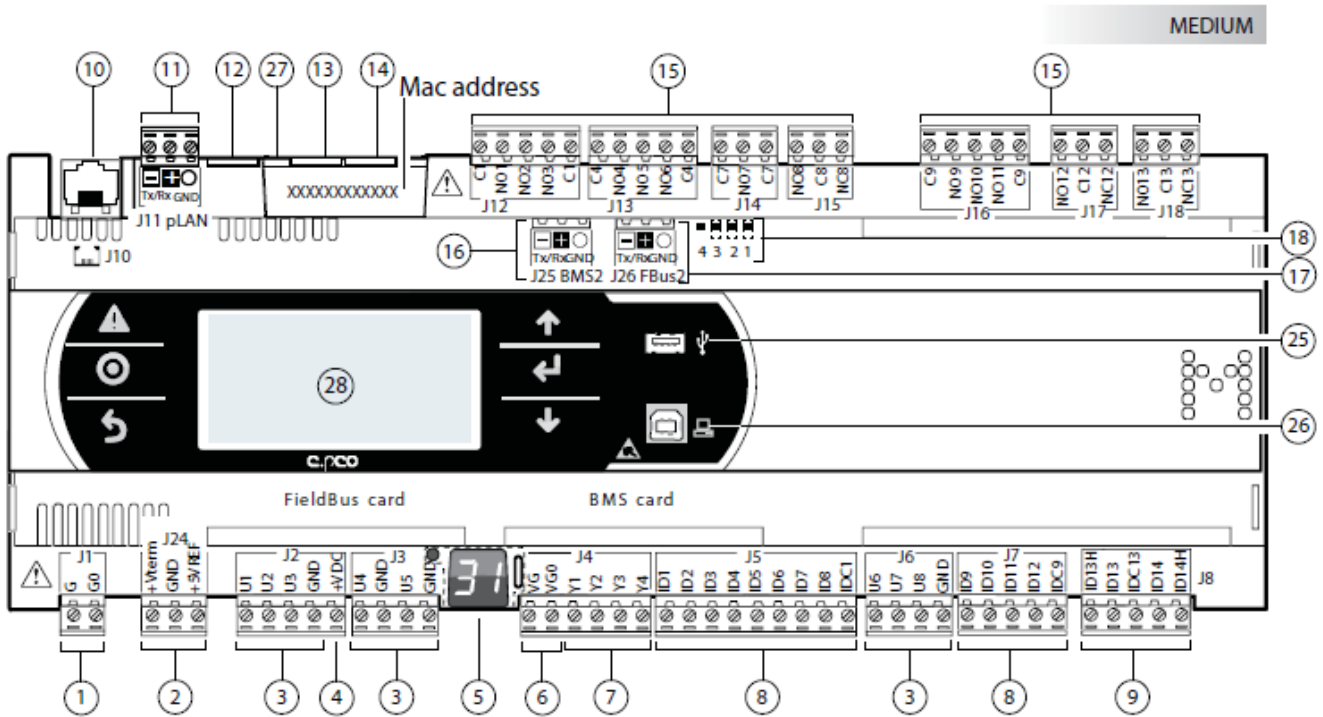
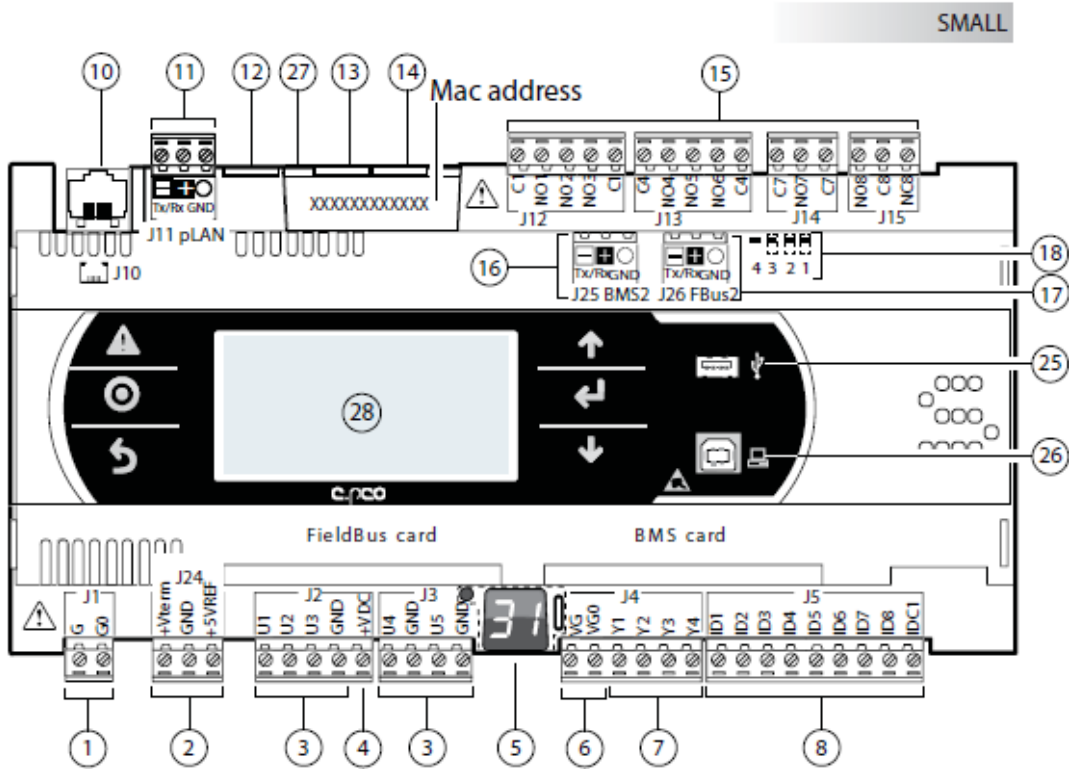
See the figures on the previous pages relating to c.pCO mini/c.pCOe

Ref.	Term.	Label	Description	
1	J1-1	G	Power supply at voltage A(*)	
	J1-2	G0	Power supply reference	
2	J1-3	Vbat	Power supply from external Ultracap module	
	J2-1	U1	Universal input/output 1	
	J2-2	U2	Universal input/output 2	
	J2-3	U3	Universal input/output 3	
	J2-4	GND	Common for universal inputs/outputs 1, 2, 3	
	J2-5	U4	Universal input/output 4	
	J2-6	U5	Universal input/output 5	
	3	J2-7	U6	Universal input/output 6
		J2-8	GND	Common for universal inputs/outputs 4, 5, 6
		J2-9	U7	Universal input/output 7
		J2-10	U8	Universal input/output 8
		J2-11	U9	Universal input/output 9
		J2-12	U10	Universal input/output 10
4	J2-13	GND	Common for universal inputs/outputs 7, 8, 9, 10	
	J3-1	+Vterm	Power supply for additional terminal	
5	J3-2	Tx-/Rx-	Terminal RS485 port Tx-/Rx-	
	J3-3	Tx+/Rx+	Terminal RS485 port Tx+/Rx+	
6	J3-4	GND	Terminal RS485 port GND	
	J10-1	NO1	Normally open contact, relay 1	
	J10-2	C1/2	Common for relay 1, 2	
	J10-3	NO2	Normally open contact, relay 2	
	J11-1	NO3	Normally open contact, relay 3	
		C3/4/5	Common for relay 3, 4, 5	
	J11-3	NO4	Normally open contact, relay 4	
		C3/4/5	Common for relay 3, 4, 5	
	J11-5	NO5	Normally open contact, relay 5	
		NO6	Normally open contact, relay 6	
	J12-1	NC6	Normally closed contact, relay 6	
		C6	Common for relay 6	
7	J7	-	Single-pole valve connector	
	J9-1	+5 V _{REF}	Power supply ratiometric probes 0 to 5 V	
8	J9-2	GND	Power supply common	
	J9-3	+VDC	Power to active probes	

Ref.	Term.	Label	Description
9	J4-1	Tx-/Rx-	FieldBus RS485 port Tx-/Rx-
	J4-2	Tx+/Rx+	FieldBus RS485 port Tx+/Rx+
	J4-3	GND	FieldBus RS485 port GND
10	J6-1	Tx-/Rx-	BMS RS485 port Tx-/Rx-
	J6-2	Tx+/Rx+	BMS RS485 port Tx+/Rx+
	J6-3	GND	BMS RS485 port GND
		J8-4	Y1
11	J8-5	Y2	Analogue output 2, 0...10 V
	J8-6	GND	Common for analogue outputs 1, 2
12	J8-1	ID1	Digital input 1
	J8-2	ID2	Digital input 2
	J8-3	GND	Common for digital inputs 1, 2
13	J5-1	TxL/RxL	CANbus port TxL/RxL
	J5-2	TxH/RxH	CANbus port TxH/RxH
	J5-3	GND	CANbus port GND

(*) Voltage A: 24 Vac o 28...36 Vdc

9.5.10 c.pCO Small and Medium: connection terminals



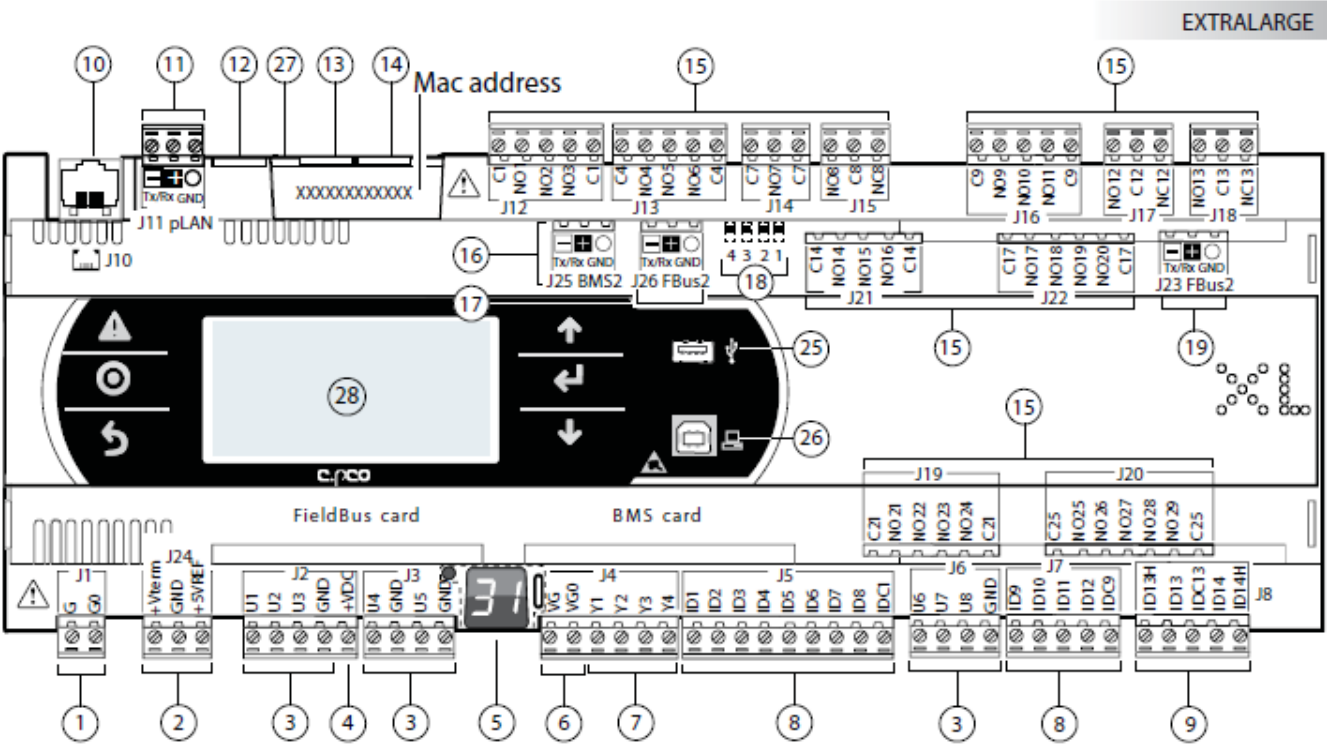
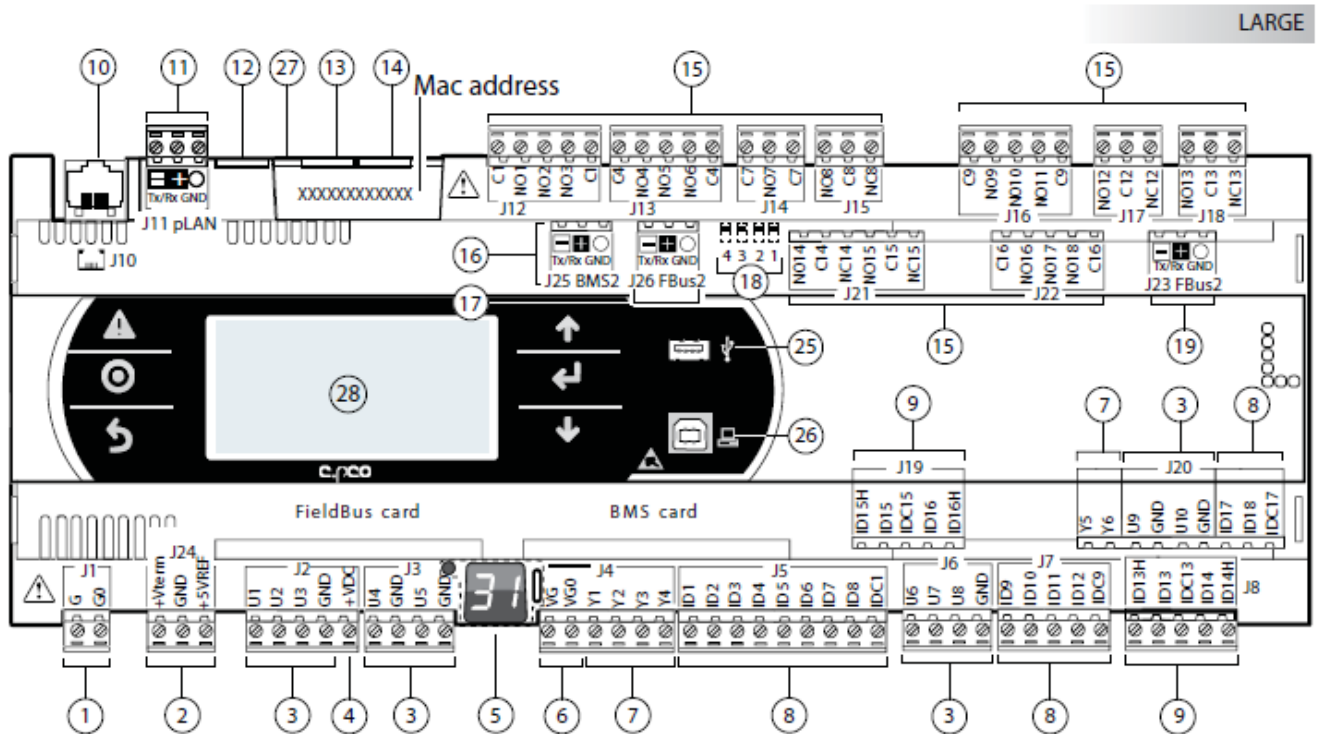
Key:

Ref.	Description
1	Power connection [G(+), G0(-)]
2	+Vterm: power supply for additional terminal +5 VREF power supply for ratiometric probes
3	Universal inputs/outputs
4	+VDC: power supply for active probes
5	Button for setting pLAN address, second display, LED
6	VG: power supply at voltage A(*) for opto-isolated analogue output VG0: power to optically-isolated analogue output, 0 Vac/Vdc
7	Analogue outputs
8	ID: digital inputs for voltage A (*)
9	ID.: digital inputs for voltage A (*) IDH.: digital inputs for voltage B (**)
10	pLAN telephone connector for terminal
11	pLAN plug-in connector

(*) Tensione A: 24 Vac o 28...36 Vdc; (**) Tensione B: 230 Vac - 50/60 Hz.

Ref.	Description
12	Reserved
13	Ethernet port 1
14	Ethernet port 2
15	Relay digital outputs
16	BMS2 port
17	FieldBus2 port
18	Jumpers for selecting FieldBus/ BMS
25	USB Host Port (Master)
26	USB Device Port (Slave)
27	Faston for earth connection to Ethernet Port
28	Display built-in and keypad

9.5.11 c.pCO Large and Extralarge: connection terminals



Key:

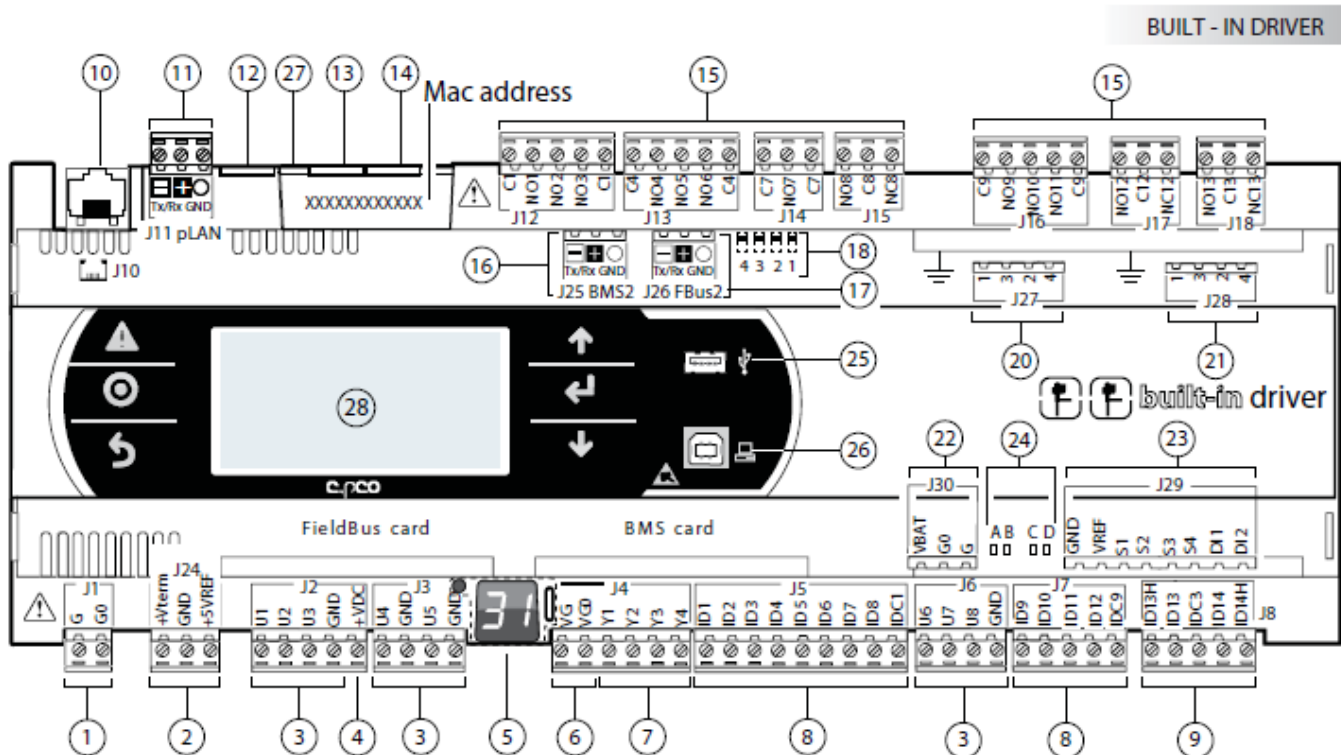
Ref.	Description
1	Power connector [G(+), G0(-)]
2	+Vterm: power supply for additional terminal +5 VREF power supply for ratiometric probes
3	Universal inputs/outputs
4	+VDC: power supply for active probes
5	Button for setting pLAN address, second display, LED
6	VG: power supply at voltage A(*) for opto-isolated analogue output VG0: power to optically-isolated analogue output, 0 Vac/Vdc
7	Analogue outputs
8	ID: digital inputs for voltage A (*)
9	ID.: digital inputs for voltage A (*) IDH.: digital inputs for voltage B (**)
10	pLAN telephone connector for terminal/downloading application
11	pLAN plug-in connector
12	Reserved

Ref.	Description
13	Ethernet port 1
14	Ethernet port 2
15	Relay digital outputs
16	BMS2 port
17	FieldBus2 port
18	Jumpers for selecting FieldBus/ BMS
19	FieldBus2 port
25	USB Host Port (Master)
26	USB Device Port (Slave)
27	Faston for earth connection to Ethernet Port
28	Display built-in and keypad

(*) Voltage A: 24 Vac or 28-36 Vdc; (**) Voltage B: 230 Vac - 50/60 Hz.

9.5.12 c.pCO built-in driver: connection terminals

Two models of c.pCO are available with one or two built-in electronic expansion valve drivers.



Key:

Ref.	Description	Ref.	Description
1	Power connector [G(+), G0(-)]	15	Relay digital outputs
2	+Vterm: power supply for additional terminal +5 VREF power supply for ratiometric probes	16	BMS2 port
3	Universal inputs/outputs	17	FieldBus2 port
4	+VDC: power supply for active probes	18	Jumpers for selecting FieldBus/ BMS
5	Button for setting pLAN address, second display, LED	20	Electronic valve A connector
6	VG: power supply at voltage A(*) for opto-isolated analogue output VG0: power to optically-isolated analogue output, 0 Vac/Vdc	21	Electronic valve B connector
7	Analogue outputs	22	Connector for external Ultracap module (accessory)
8	ID: digital inputs for voltage A (*)	23	Valve driver analogue and digital inputs
9	ID.: digital inputs for voltage A (*) IDH.: digital inputs for voltage B (**)	24	Valve status indicator LED
10	pLAN telephone connector for terminal	25	USB Host Port (Master)
11	pLAN plug-in connector	26	USB Device Port (Slave)
12	Reserved	27	Faston for earth connection to Ethernet Port
13	Ethernet port 1	28	Display built-in and keypad
14	Ethernet port 2		

(*) Voltage A: 24 Vac or 28-36 Vdc; (**) Voltage B: 230 Vac - 50/60 Hz.

Description of connection terminals on c.pCO Small... Extralarge

Ref.	Term.	Label	Description
1	J1-1	G	Power supply at voltage A(*)
	J1-2	G0	Power supply reference
2	J24-1	+Vterm	Additional power supply terminal
	J24-2	GND	Power supply common
	J24-3	+5 VREF	Power supply ratiometric probes 0 to 5 V
3	J2-1	U1	Universal input/output 1
	J2-2	U2	Universal input/output 2
	J2-3	U3	Universal input/output 3
	J2-4	GND	Common for universal inputs/outputs 1, 2, 3
3	J3-1	U4	Universal input/output 4
	J3-2	GND	Common for universal input/output 4
	J3-3	U5	Universal input/output 5
3	J3-4	GND	Common for universal input/output 5
	J6-1	U6	Universal input/output 6
	J6-2	U7	Universal input/output 7
	J6-3	U8	Universal input/output 8
	J6-4	GND	Common for universal inputs/outputs 6, 7, 8

Ref.	Term.	Label	Description
3	J20-3	U9	Universal input/output 9
	J20-4	GND	Common for universal input/output 9
	J20-5	U10	Universal input/output 10
	J20-6	GND	Common for universal input/output 10
4	J2-5	+VDC	Power to active probes
5			Button for setting pLAN address, secondary display, LED
6	J4-1	VG	Power to optically-isolated analogue output, voltage A(*)
	J4-2	VG0	Power to optically-isolated analogue output, 0 Vac/Vdc
7	J4-3	Y1	Analogue output 1, 0 to 10 V
	J4-4	Y2	Analogue output 2, 0 to 10 V
	J4-5	Y3	Analogue output 3, 0 to 10 V
	J4-6	Y4	Analogue output 4, 0 to 10 V
7	J20-1	Y5	Analogue output 5, 0 to 10 V
	J20-2	Y6	Analogue output 6, 0 to 10 V

Ref.	Term.	Label	Description
8	J5-1	ID1	Digital input 1 at voltage A(*)
	J5-2	ID2	Digital input 2 at voltage A(*)
	J5-3	ID3	Digital input 3 at voltage A(*)
	J5-4	ID4	Digital input 4 at voltage A(*)
	J5-5	ID5	Digital input 5 at voltage A(*)
	J5-6	ID6	Digital input 6 at voltage A(*)
	J5-7	ID7	Digital input 7 at voltage A(*)
	J5-8	ID8	Digital input 8 at voltage A(*)
J5-9	IDC1	Common for digital inputs from 1 to 8 (negative pole for DC power supply)	
8	J7-1	ID9	Digital input 9 at voltage A(*)
	J7-2	ID10	Digital input 10 at voltage A(*)
	J7-3	ID11	Digital input 11 at voltage A(*)
	J7-4	ID12	Digital input 12 at voltage A(*)
	J7-5	IDC9	Common for digital inputs from 9 to 12 (negative pole for DC power supply)
8	J20-7♦	ID17	Digital input 17 at voltage A(*)
	J20-8♦	ID18	Digital input 18 at voltage A(*)
	J20-9♦	IDC17	Common for digital inputs 17 and 18 (negative pole for DC power supply)
9	J8-1	ID13H	Digital input 13 at voltage B(**)
	J8-2	ID13	Digital input 13 at voltage A(*)
	J8-3	IDC13	Common for digital inputs 13 and 14 (negative pole for DC power supply)
	J8-4	ID14	Digital input 14 at voltage A(*)
	J8-5	ID14H	Digital input 14 at voltage B(**)
9	J19-1♦	ID15H	Digital input 15 at voltage B(**)
	J19-2♦	ID15	Digital input 15 at voltage A(*)
	J19-3♦	IDC15	Common for digital inputs 15 and 16 (negative pole for DC power supply)
	J19-4♦	ID16	Digital input 16 at voltage A(*)
	J19-5♦	ID16H	Digital input 16 at voltage B(**)
10	J10	-	Connector for telephone cable pLAN
11	J11-1	Tx-/Rx-	pLAN RS485 port Tx-/Rx-
	J11-2	Tx+/Rx+	pLAN RS485 port Tx+/Rx+
	J11-3	GND	pLAN RS485 port GND
12	-	-	Reserved
13	-	-	Ethernet port 1
14	-	-	Ethernet port 2
15	J12-1	C1	Common for relays 1, 2, 3
	J12-2	NO1	Normally open contact, relay 1
	J12-3	NO2	Normally open contact, relay 2
	J12-4	NO3	Normally open contact, relay 3
	J12-5	C1	Common for relay 1, 2, 3
	J13-1	C4	Common for relay 4, 5, 6
	J13-2	NO4	Normally open contact, relay 4
	J13-3	NO5	Normally open contact, relay 5
	J13-4	NO6	Normally open contact, relay 6
	J13-5	C4	Common for relay 4, 5, 6
	J14-1	C7	Common for relay 7
	J14-2	NO7	Normally open contact, relay 7
	J14-3	C7	Common for relay 7
	J15-1	NO8	Normally open contact, relay 8
	J15-2	C8	Common for relay 8
J15-3	NC8	Normally closed contact 8	
J16-1	C9	Common for relay 9, 10, 11	
J16-2	NO9	Normally open contact, relay 9	
J16-3	NO10	Normally open contact, relay 10	
J16-4	NO11	Normally open contact, relay 11	
J16-5	C9	Common for relay 9, 10, 11	
J17-1	NO12	Normally open contact, relay 12	
J17-2	C12	Common for relay 12	
J17-3	NC12	Normally closed contact 12	
J18-1	NO13	Normally open contact, relay 13	
J18-2	C13	Common for relay 13	
J18-3	NC13	Normally closed contact 13	
J21-1♦	NO14	Normally open contact, relay 14	
J21-2♦	C14	Common for relay 14	
J21-3♦	NC14	Normally closed contact 14	
J21-4♦	NO15	Normally open contact, relay 15	
J21-5♦	C15	Common for relay 15	
J21-6♦	NC15	Normally closed contact 15	
J22-1♦	C16	Common for relay 16, 17, 18	
J22-2♦	NO16	Normally open contact, relay 16	
J22-3♦	NO17	Normally open contact, relay 17	
J22-4♦	NO18	Normally closed contact 18	
J22-5♦	C16	Common for relay 16, 17, 18	
J21-1♦♦	C14	Common for relay 14, 15, 16	
J21-2♦♦	NO14	Normally open contact, relay 14	
J21-3♦♦	NO15	Normally open contact, relay 15	
J21-4♦♦	NO16	Normally open contact, relay 16	
J21-5♦♦	C14	Common for relay 14, 15, 16	

Ref.	Term.	Label	Description
15	J22-1♦♦	C17	Common for relay 17, 18, 19, 20
	J22-2♦♦	NO17	Normally open contact, relay 17
	J22-3♦♦	NO18	Normally open contact, relay 18
	J22-4♦♦	NO19	Normally open contact, relay 19
	J22-5♦♦	NO20	Normally open contact, relay 20
	J22-6♦♦	C17	Common for relay 17, 18, 19, 20
	J19-1♦♦	C21	Common for relay 21, 22, 23, 24
	J19-2♦♦	NO21	Normally open contact, relay 21
	J19-3♦♦	NO22	Normally open contact, relay 22
	J19-4♦♦	NO23	Normally open contact, relay 23
	J19-5♦♦	NO24	Normally open contact, relay 24
	J19-6♦♦	C21	Common for relay 21, 22, 23, 24
	J20-1♦♦	C25	Common for relay 25, 26, 27, 28, 29
	J20-2♦♦	NO25	Normally open contact, relay 25
	J20-3♦♦	NO26	Normally open contact, relay 26
J20-4♦♦	NO27	Normally open contact, relay 27	
J20-5♦♦	NO28	Normally open contact, relay 28	
J20-6♦♦	NO29	Normally open contact, relay 29	
J20-7♦♦	C25	Common for relay 25, 26, 27, 28, 29	
16	J25-1	Tx-/Rx-	Tx-/Rx- RS485 BMS2 port
	J25-2	Tx+/Rx+	Tx+/Rx+ RS485 BMS2 port
	J25-3	GND	GND RS485 BMS2 port
17	J26-1	Tx-/Rx-	Tx-/Rx- RS485 Fieldbus 2 port
	J26-2	Tx+/Rx+	Tx+/Rx+ RS485 Fieldbus 2 port
18	Port J26 configuration microswitches		
19	J23-1	Tx-/Rx-	Tx-/Rx- Fieldbus 2 RS485 port
	J23-2	Tx+/Rx+	Tx+/Rx+ Fieldbus 2 RS485 port
	J23-3	GND	GND RS485 port network Fieldbus 2
For pCO5+ built-in driver only:			
20	J27-1	1	Electronic expansion valve 1 control (see par. "Electronic valve connection").
	J27-2	3	
	J27-3	2	
	J27-4	4	
21	J28-1	1	Electronic expansion valve 2 control (see par. "Electronic valve connection").
	J28-2	3	
	J28-3	2	
	J28-4	4	
22	J30-1	VBAT	Power supply from external Ultracap module
	J30-2	G0	
	J30-3	G	
23	J29-1	GND	Common probe power supply
	J29-2	VREF	Probe driver power supply
	J29-3	S1	Probe 1
	J29-4	S2	Probe 2
	J29-5	S3	Probe 3
	J29-6	S4	Probe 4
	J29-7	D1	Digital input 1
	J29-8	D2	Digital input 2
24	A, B	Valve A status LED	
	C, D	Valve B status LED	

Tab. 4.c

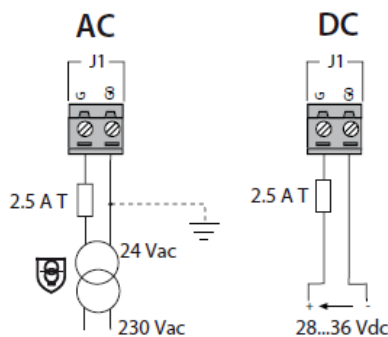
(*): voltage A: 24 Vac or 28...36 Vdc;
 (**): voltage B: 230 Vac - 50/60 Hz.
 ♦: Large model; ♦♦: Extralarge model



9.6 INPUT/OUTPUT CONNECTIONS

9.6.1 Power supply

The figure below shows the power supply connection diagram. Use a class II safety isolation transformer with short-circuit and overload protection. See the Technical Specifications table for information on the size of the transformer required by each model.



Important:

- power the c.pCO built-in driver with AC voltage only, with the transformer secondary winding earthed;
- if the Ethernet connection is featured and used, the transformer secondary must be earthed;
- using a supply voltage other than specified can seriously damage the controller;
- if the transformer secondary is earthed, make sure that the earth conductor is connected to terminal G0. This applies to all the devices connected to the c.pCO through a serial network;
- if more than one c.pCO board is connected to a pLAN network, make sure that the G and G0 references are observed (G0 must be maintained for all controllers);
- the power supply to the controller(s) and the terminal(s) should be kept separate from the power supply to the other electrical devices (contactors and other electromechanical components) inside the electrical panel.

Note:

- when the controller is powered, the yellow LED lights up;
- refer to the diagrams in par. 4.4 in case of controllers connected to a pLAN network and installed in the same electrical panel or in separate panels.

9.6.2 Universal inputs/outputs

Universal inputs/outputs are distinguished by the letter U...

They can be configured from the application program for many different uses, such as the following:

- passive temperature probes: NTC, PTC, PT100, PT500, PT1000;
- active pressure/temperature/humidity probes;
- ratiometric pressure probes;
- current inputs, 0 to 20 mA or 4 to 20 mA;
- voltage inputs, 0 to 1 Vdc or 0 to 10 Vdc;
- voltage-free contact digital inputs and fast digital inputs;
- analogue outputs, 0 to 10 Vdc;
- PWM outputs.

Important:

- the universal inputs/outputs must be pre-configured to handle their respective signals from the application program;
- the universal inputs/outputs cannot be used as digital outputs.

Max. number of connectable analogue inputs

The maximum number of analogue inputs that can be connected to the universal inputs/outputs depends on the type used.

Maximum number of inputs connectable to universal inputs/outputs Type of signal		cpCO			
		mini - cpCOe	Small	Medium/ Built-in driver/ Extralarge	Large
Analogue inputs	- NTC/PTC/ PT500/PT1000 probes	10	5	8	10
	- PT100 probes	max 5	2	3 (2 on U1...U5, 1 on U6...U8)	4 (2 on U1...U5, 1 on U6...U8, 1 on U9... U10)
	- 0 to 1 Vdc/0 to 10 Vdc signals from probes po- wered by the controller	0	max tot 5	5 max tot 8	6 max tot 10
	- 0 to 1 Vdc/0 to 10 Vdc si- gnals powered externally	10	5	8	10
	- 0 to 20 mA /4 to 20 mA inputs from probes po- wered by the controller	max tot 4	2 max tot 4	4 max tot 7	6: (max 4 on U1... U5, 3 on U6...U8)
	- 0 to 20 mA / 4 to 20 mA inputs from probes pow- ered externally	max tot 4	4 max tot 4	4 max tot 7	6: (max 4 on U1... U5, 3 on U6...U8, 2 on U9...U10)
- 0 to 5V signals from ratiometric probes po- wered by the controller	max 2	max 5	max 6	max 6	

Note: the table shows the maximum number of inputs that can be connected. For example, it is possible to connect to a small size controller a

maximum of five 0 to 1 Vdc inputs related to probes powered by the controller, and a maximum of five 0 to 1 Vdc inputs related to probes powered externally. In any case, maximum number of 0 to 1 Vdc inputs must be 5.

Remote connection of analog inputs

The table below shows the required cable sizes to be used for the remote connection of the analog inputs.

Type of input	Cross section for lengths <50 m (mm ²)	Cross section for lengths <100 m (mm ²)
NTC	0,5	1,0
PT1000	0,75	1,5
I (current)	0,25	0,5
V (current)	0,25	0,5

Important:

- if the controller is installed in an industrial environment (standard EN 61000-6-2) the connections must be less than 10 m long; do not exceed this length to avoid measurement errors.
- to avoid electromagnetic interference, keep the probe and digital input cables separate from the power cables as much as possible (at least 3cm). Never run power cables and probe signal cables in the same conduits (including the ones in the electrical panels).

10 DRIVE FOR ELECTRONIC EXPANSION VALVE



10.1 INTRODUCTION

The drivers of the EVDRIVE04 series are devices studied for the management of bipolar stepper electronic expansion valves.

They are available in built-in and blind version (according to the model).

The user interface of the built-in versions consists of a LCD graphic display, of six buttons and guarantees an index of protection IP40.

The blind versions must be used with a remote user interface.

They can be powered both in alternating and in direct current (24 VAC/DC).

The drivers can work with the most common temperature probes (NTC and Pt 1000) and with the most common pressure transducers (0-20 mA, 4-20 mA, 0-5 V ratiometric and 0-10 V).

They have configurable digital inputs (enable the operation, change parameters set, backup module status, etc.) and a 5 res. A @ 250 VAC digital output (electromechanical relay) configurable as alarm output, solenoid valve or resynchronization valve.

Through the USB port it is possible to make the upload and the download of the configuration parameters (using a common USB flash drive); through this port (or the RS-485 one), it is also possible to connect the devices to the setup software system Parameters Manager (through a serial interface).

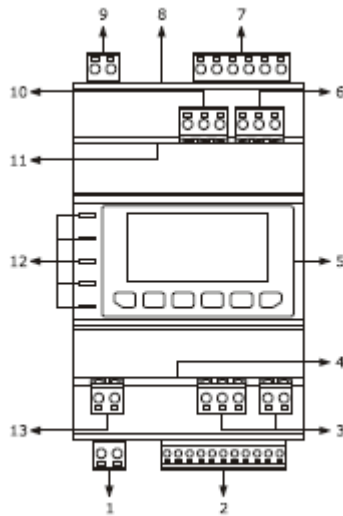
Through the CAN communication port (or the RS-485 one) it is possible to connect the devices to a controller or to a remote user interface instead.

Through the backup module EPS4B it is finally possible to close the valve in case of lack of power supply of the drivers. Installation is on DIN rail.

Among the several functions one highlights the possibility to work both in stand alone mode and under the supervision of a controller, the management both of generic electronic expansion valves and of the most common valves Sporlan, Alco, Danfoss, Sanhua, Castel and the management of the backup probes.

10.2 DESCRIPTION

The following drawing shows the aspect of EVDRIVE04.

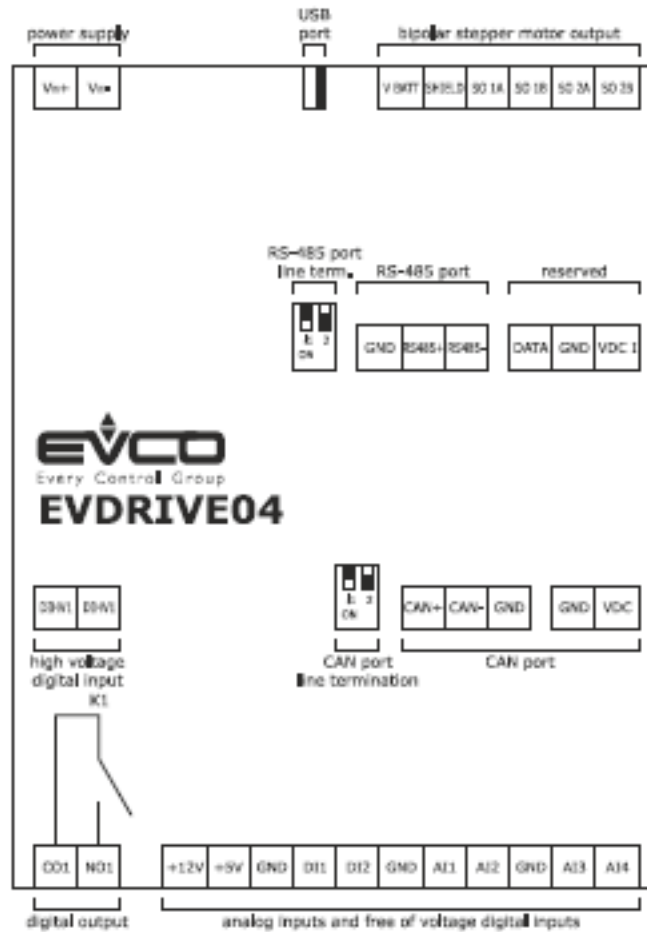


The following table shows the meaning of the parts of EVDRIVE04.

Part	Meaning
1	digital output
2	analog inputs and free of voltage digital inputs
3	CAN port (not available in model EPD4BX4)
4	CAN port line termination (not available in model EPD4BX4)
5	display and keyboard (not available in models EPD4BX4, EPD4BC4 and EPD4BF4)
6	reserved
7	bipolar stepper motor output
8	USB port
9	power supply
10	RS-485 port (not available in models EPD4BX4 and EPD4BC4)
11	RS-485 port line termination (not available in models EPD4BX4 and EPD4BC4)
12	signalling LEDs
13	high voltage digital input (not available in model EPD4BX4)

10.3 ELECTRICAL CONNECTION

The following drawing shows the EVDRIVE04 connectors



The following tables show the meaning of the connectors;

10.4 DIGITAL OUTPUT

Electromechanical relay.

Terminal	Meaning
CO1	common digital output
NO1	normally open contact digital output

10.5 ANALOG INPUTS AND FREE OF VOLTAGE DIGITAL INPUTS

Part	Meaning
Terminal	Meaning
CAN+	signal +
CAN-	signal -
GND	ground
VDC	power supply remote user interface (22... 35 VDC, 100 mA max.)
AI1	analog input 1 (which can be set via configuration parameter for NTC/Pt 1000 probes and for 0-20 mA/4-20 mA)
AI2	analog input 2 (which can be set via configuration parameter for NTC/Pt 1000 probes and for 0-20 mA/4-20 mA/0-5 V ratiometric transducers)
GND	common analog inputs and free of voltage digital inputs
AI3	analog input 3 (which can be set via configuration parameter for NTC/Pt 1000 probes)
AI4	analog input 4 (which can be set via configuration parameter for 0-20 mA/4-20 mA/0-5 V ratiometric/0-10 V transducers)

10.6 CAN port (not available in model EPD4BX4)

- the maximum number of devices that can make a CAN network (32) depends on the bus load; the bus load depends on the baud rate of the CANBUS communication and on the kind of device in the network (for example: a CAN network can be made of a programmable controller, of four I / O expansions and of four user interfaces with baud rate 500,000 baud)
- connect the CAN port using a twisted pair
- do not connect more than four I / O expansions.

For the settings about the CAN port look at chapter 7 "CONFIGURATION".

10.7 CAN port line termination (not available in model EPD4BX4)

Position microswitch 2 on position on (120 W, 0.25 W) to plug in the CAN port line termination (plug in the termination of the first and of the last element of the network).



10.8 BIPOLAR STEPPER MOTOR OUTPUT

Terminal	Meaning
V BATT	backup power supply input
SHIELD	common bipolar stepper motor shielded cable
SO 1A	bipolar stepper motor coil 1
SO 1B	bipolar stepper motor coil 1
SO 2A	bipolar stepper motor coil 2
SO 2B	bipolar stepper motor coil 2

With reference to the previous table, the following one shows how to connect to EVDRIVE04 the most common electronic expansion valves Sporlan and Alco.

Terminal	Wire (color)			
	Sporlan SER, SEI, SEH and ESX	Alco EXM/EXL-246	Alco EX4, EX5, EX6, EX7 and EX8	Danfoss ETS
SO 1A	green wire	blue wire	blue wire	green wire
SO 1B	red wire	yellow wire	brown wire	red wire
SO 2A	black wire	white wire	white wire	white wire
SO 2B	white wire	orange wire	black wire	black wire

10.9 POWER SUPPLY

Terminal	Meaning
V \equiv +	power supply device (not isolated; 24 VAC +10% -15%, 50/60 Hz \pm 3 Hz, 40 VA max. or 24... 37 VDC, 22 W max.)
V \equiv -	power supply device (not isolated; 24 VAC +10% -15%, 50/60 Hz \pm 3 Hz, 40 VA max. or 24... 37 VDC, 22 W max.)

- protect the power supply with a fuse rated 2 A-T 250 V
- if the device is powered in direct current, it is necessary to respect the polarity of the power supply voltage.

10.10 RS-485 PORT (not available in models EPD4BX4 and EPD4BC4)

Non optoisolated RS-485 port, with MODBUS communication protocol.

Terminal	Meaning
GND	ground
RS485+	D1 = A = + (terminal 1 of the transceiver)
RS485-	D0 = B = - (terminal 0 of the transceiver)

- connect the RS-485 MODBUS port using a twisted pair.

For the settings about the RS-485 MODBUS port look at chapter 7 “CONFIGURATION”.

10.11 RS-485 PORT LINE TERMINATION (not available in models EPD4BX4 and EPD4BC4)

Position microswitch 1 on position on (120 W, 0.25 W) to plug in the RS-485 port line termination (plug in the termination of the first and of the last element of the network).



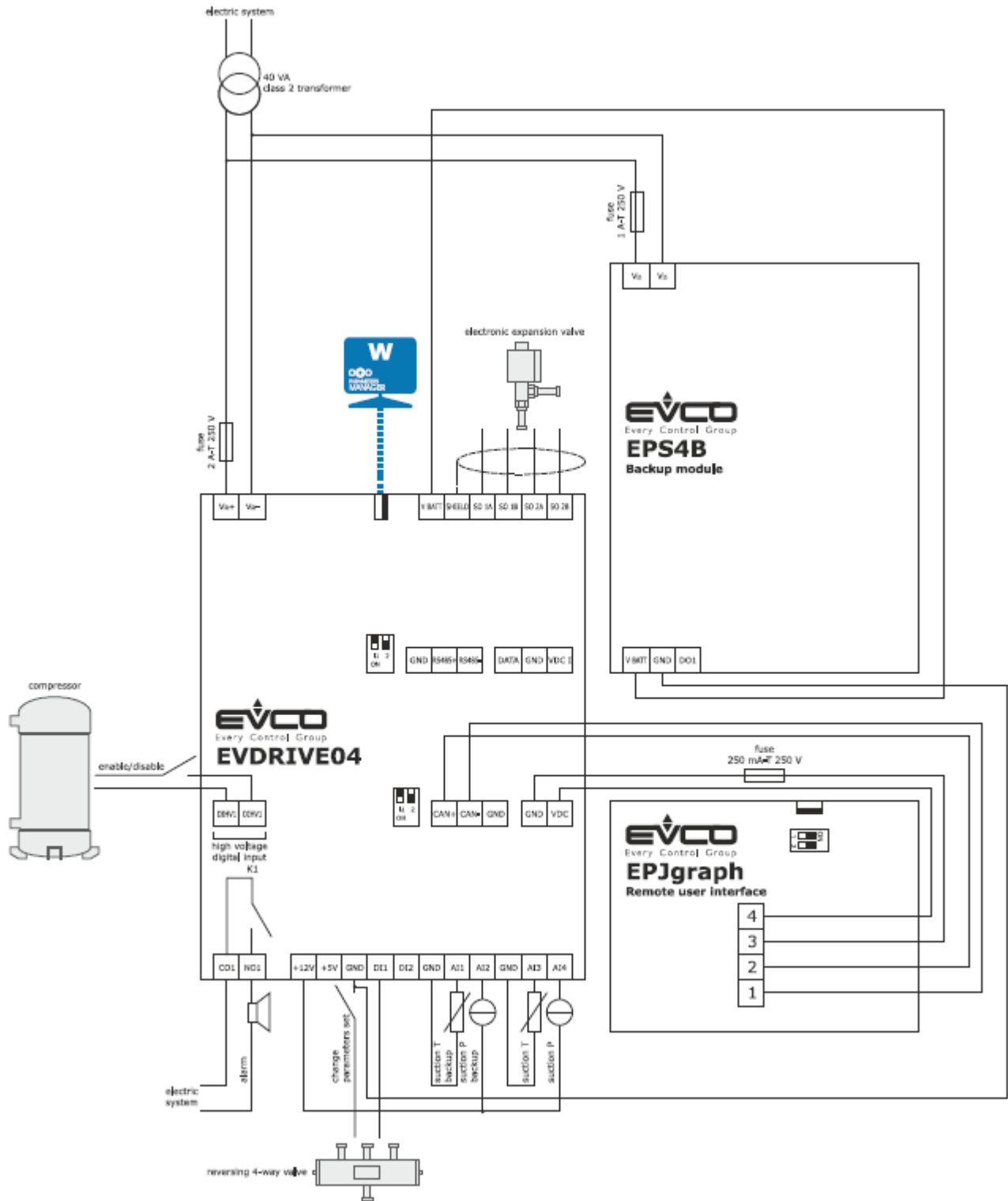
10.12 HIGH VOLTAGE DIGITAL INPUT

High voltage digital input (if present).

Part	Meaning
DIHV1	high voltage digital input (optoisolated contact; 115 VAC -10%... 230 VAC +10%)
DIHV1	high voltage digital input (optoisolated contact; 115 VAC -10%... 230 VAC +10%)

10.13 EXAMPLE OF ELECTRICAL CONNECTION

The following drawing shows an example of electrical connection of EVDRIVE04.



Please note the power supply of EVDRIVE04 and that of EPS4B are not isolated one another: it is important to wire correctly the devices as indicated in the drawing.

10.14 ADDITIONAL INFORMATION FOR ELECTRICAL CONNECTION

- do not operate on the terminal blocks of the device using electrical or pneumatic screwdrivers
- if the device has been moved from a cold location to a warm one, the humidity could condense on the inside; wait about an hour before supplying it
- make sure the power supply voltage, the electrical frequency and the electrical power of the device correspond to those of the local power supply; look at chapter 11 "TECHNICAL DATA"
- disconnect the power supply of the device before servicing it
- do not use the device as safety device
- for the repairs and for information about the device please contact the EVCO sales network.

10.15 USER INTERFACE

10.15.1 Preliminary information

EVDRIVE04 is available in built-in and blind version (according to the model).

The built-in versions can be programmed through the user interface, the blind ones must be used with a remote user interface (for example EPJgraph): both the versions can be programmed through the set-up software system Parameters Manager; look at chapter 7 "CONFIGURATION".

Using a common USB flash key it is also possible to make the upload and the download of the configuration parameters.

10.15.2 Keyboard (not available in the blind versions)

The following table shows the meaning of the keyboard.

Button	Preset function
	cancel, hereinafter also called "button ESC"
	move to left, hereinafter also called "button LEFT"
	increase, hereinafter also called "button UP"
	decrease, hereinafter also called "button DOWN"
	move to right, hereinafter also called "button RIGHT"
	confirmation, hereinafter also called "button ENTER"

10.15.3 Signalling LEDs

The following table shows the meaning of the LEDs at the front of the device.

LED	Meaning
ON	LED power supply if it is lit, the device will be powered if it is out, the device will not be powered
STEP 1	LED stepper output 1 if it is lit, the valve will be stopped and completely closed if it flashes slowly, the valve will be stopped and completely open if it flashes quickly, the valve will be moving if it is out, the valve will be stopped and open in an intermediary position

<p>STEP 2</p>	<p>LED auxiliary</p> <p><u>if parameter Ph80 = 0, LED status</u></p> <p>if it is lit, the device will be working in superheating algorithm modality</p> <p>if it flashes slowly, the device will be working in manual or in debugger modality</p> <p>if it flashes quickly, the device will be working in analog positioner modality</p> <p>if it is Off, the device will be in a different status</p> <p><u>if parameter Ph80 = 1, LED MOP/LOP alarm</u></p> <p>if it flashes quickly, the MOP alarm will be running</p> <p>if it flashes slowly, the LOP alarm will be running</p> <p>if it is out, no MOP/LOP alarm will be running</p> <p><u>if parameter Ph80 = 2, LED high superheating/low superheating alarm</u></p> <p>if it flashes quickly, the high superheating alarm will be running</p> <p>if it flashes slowly, the low superheating alarm will be running</p> <p>if it is out, no high superheating/low superheating alarm will be running</p>
<p>⚠</p>	<p>LED alarm</p> <p>if it is On, an alarm will be running</p> <p>if it flashes slowly, it is necessary to disable the device so that the modification of the configuration parameters has effect</p> <p>if it flashes quickly, it is necessary to switch off/on the power supply of the device so that the modification of the configuration parameters has effect</p> <p>if it is Off, no alarm will be running</p>
<p>COM</p>	<p>LED communication</p> <p>if it is ON, a device-controller communication alarm will be running and the valve is halted or if there is activity on the USB port</p> <p>if it flashes slowly, the device-controller communication will be in the warning status</p> <p>if it flashes quickly, a device-controller communication alarm will be running and the device will be working in stand alone modality</p> <p>if it is OFF, the device will be working in stand alone modality or no device-controller communication alarm will be running</p>

10.16 OPERATION

10.16.1 Switch on and resynchronization

At switch-on and after a resynchronization, the fundamental parameters for moving the motor are acquired.

The parameters of pressure and temperature units of measure are loaded at switch-on, and, if necessary, is performed the conversion of all the parameters of pressure and temperature.

The parameters that are loaded only during the initialization phase, and therefore require a reset to be loaded, are referred to as manufacturer parameters (Manufacturer menu) and can be modified only in the stand-by state.

10.16.2 Refrigerant selection

Parameter *Type of refrigerant* (Pi00) allow to select the proper gas for the application.

Pi00	Gas	Min. pressure [BarA]	Min. temperature [°C]	Max. pressure [BarA]	Max. temperature [°C]
0	R22	0.00	-75.9	49.88	96.1
1	R134A	0.00	-98.0	40.57	101.0
2	R402A	0.00	-80.8	40.66	74.1
3	R404A	0.00	-79.4	36.81	71.4
4	R407A	0.00	-72.0	43.59	81.1
5	R407C	0.00	70.4	45.30	85.5
6	R410A	0.00	-70.5	48.91	71.2
7	R417A	0.00	-68.5	37.91	84.4
8	R422A	0.00	-77.3	31.15	63.5
9	9R422D	0.00	-72.0	37.23	77.6
10	R507A	0.00	-80.8	36.88	70.4
11	R744	0.00	-56.5	73.75	30.9
12	R438A	0.00	-70.1	40.43	82.8
13	R401B	0.00	-64.9	46.01	105.0
14	R290	0.50	-56.9	42.00	96.0
15	R717	1.00	-33.5	112.77	131.9
16	R1270	0.00	-121.8	46.50	92.2
17	R32	0.00	-119.9	57.50	77.8
18	R407F	1.00	-39.7	32.00	65.5
19	R1234ZE	0.27	-45.6	17.57	73.9
20	R1234YF	0.32	-52.8	33.82	94.6
21	R723	0.10	-73.8	39.99	76.9
22	R452A	0.22	-70.0	35.40	70.0
23	R513A	0.20	-60.0	33.04	90.0
24	R454B	1.00	-50.2	42.63	68.3
25	R448A	0.17	-70.0	32.52	70.0
26	R449A	0.16	-70.0	31.59	70.0
27	R23	1.14	-80.0	46.99	25.0

10.16.3 Valve selection

To select the desired valve, it is necessary to set the correct value in Valve selection (parameter Pi07).

Setting this parameter to a value of 0 (generic valve) means setting the parameters Pr50 to Pr55 is required, with which it is possible to specify the value of each valve parameter.

With function “Copy selected to generic valve” it is possible to copy the default values of the selected valve into the ones of the generic valve, in order to use them as reference for possible modifications.

If a predefined valve is selected (parameter Pi07 > 0), all relevant parameters specific to that valve are loaded automatically from the flash memory, according to the table below:

Pi07	Valve name	Minimum regulation steps [step]	Maximum regulation steps [step]	Overdriving steps [step]	Stepping rate [step/s]	Operating phase current [mA]	Holding phase current [mA]	Recommended Step Mode
0	Generic valve	0	0	0	0	0	0	Full step 2ph
1	Sporlan CO2	0	2500	3125	400	275	0	Full step 2ph
2	Sporlan SER AA Sporlan SER A Sporlan SER B Sporlan SER C Sporlan SER D	0	2500	3500	400	120	0	Full step 2ph
3	Sporlan SERI F Sporlan SERI G Sporlan SERI J Sporlan SERI K Sporlan SERI L	0	2500	3500	400	120	0	Full step 2ph
4	Sporlan SER 1.5 to 20	0	1596	3500	400	160	0	Full step 2ph
5	Sporlan SEI 0.5 to11	0	1596	3500	400	160	0	Full step 2ph
6	Sporlan SEI 30	0	3193	6500	400	160	0	Full step 2ph
7	Sporlan SEI 50	0	6386	7500	400	160	0	Full step 2ph
8	Sporlan SEH 100	0	6386	7500	400	160	0	Full step 2ph
9	Sporlan SEHI 175 Sporlan SEHI 400	0	6386	6500	400	160	0	Full step 2ph
10	Sporlan SDR-3	0	3193	3512	200	160	0	Full step 2ph
11	Sporlan SDR-4	0	6386	7025	200	160	0	Full step 2ph
12	Sporlan ESX unipolar	24	224	300	40	260	0	Full step 2ph
13	Sporlan EDEV B unipolar Sporlan EDEV C unipolar	0	800	1250	200	120	0	Half step
20	Castel 261	0	415	515	35	200	0	Full step 2ph
21	Castel 262 Castel 263	0	195	255	25	200	50	Full step 2ph
22	Castel 264	0	985	1135	70	560	50	Full step 2ph
30	Alco EXM unipolar Alco EXL unipolar	16	250	350	45	130	0	Half step
31	Alco EX4 Alco EX5 Alco EX6	0	750	1000	500	500	100	Full step 2ph
32	Alco EX7	0	1600	2000	500	750	250	Full step 2ph
33	Alco EX8	0	2600	3250	500	800	500	Full step 2ph
40	Danfoss ETS 12C Danfoss ETS 24C Danfoss ETS 25C Danfoss ETS 50C Danfoss ETS 100C	30	600	628	240	800	160	Full step 2ph
41	Danfoss ETS 12.5 Danfoss ETS 25 Danfoss ETS 50	0	2625	3150	300	100	75	Full step 2ph
42	Danfoss ETS 100	0	3530	4250	300	100	75	Full step 2ph
43	Danfoss ETS 250 Danfoss ETS 400	0	3810	4550	300	100	75	Full step 2ph
44	Danfoss ETS 6 unipolar	0	240	260	25	260	0	Half step
50	Sanhua VPF 12.5 Sanhua VPF 25 Sanhua VPF 50	0	2600	3000	300	140	0	Full step 2ph
51	Sanhua VPF 100	0	3500	4400	300	140	0	Full step 2ph
52	Sanhua VPF 150 Sanhua VPF 250 Sanhua VPF 400	0	3800	4400	300	140	0	Full step 2ph
55	Carel ExV	50	480	500	50	450	100	Full step 2ph

The driving mode can be selected through parameter Driving mode selection (Pi01). If value 0 is selected (Pi01=0) the driving mode is automatically calculated to ensure the maximum speed according to the step rate of the selected valve. It means if the nominal step rate of the valve is higher than 625 steps/s, 8 microsteps/s will be used; while if the

nominal step rate is lower than 625 steps/s, 16 microsteps/s will be used.

It is recommended to use the driving type according to the valve features.

The Valve duty cycle (parameter Pr45) represent the limit of continuous operating of the valve: limiting the continuous activity of the valve reduces the heating of same.

For example: setting Pr45 = 70% means for every 70 ms in which operational current is used, there will be 30 ms in which maintenance current will be applied on the valve.

If the parameter is set to 100%, this algorithm is deactivated.

Furthermore, this procedure applies only to the normal operation of the valve: all forced movements (for example synchronisation closure, positioning caused by probe errors or communication errors) are continuous until the target position is reached.

10.16.4 Operation

During the re-synchronization phase (**Synchro wait** (1)) the valve is completely closed. When the instrument is switched on, to ensure complete closure, the valve is closed by *Overdrive steps* steps. Instead, during normal operation, to ensure complete closure, the valve is closed at 0 steps and then is closed another 10%**Maximum regulation steps* steps.

The valve is automatically resynchronized at every switch-on.

During normal operation of the valve, it assumes the 0% position corresponds to the physical position defined by Minimum regulation steps, and that the 100% position corresponds to the physical position defined by Maximum regulation steps.

A resynchronization request can be signalled using various methods:

- rising edge on digital input DI2 (if DI2 is configured as “resynchronization command” and Enabling mode (parameter Pr06) is configured as “standalone”
- rising edge on Resynchro request (ResR) if Enabling mode (parameter Pr06) is configured as “network”
- internal request from the algorithm
- upon reaching the maximum limit of operational hours (Working hours, parameter Pr40), Resynchronization interval (parameter Pr41), if configured.

A resynchronization request is performed only when it is safe to do, so when the state is Stand-by: this means that a resynchronization request made when the valve is enabled is performed automatically only when it is disabled.

It is not currently possible to cancel a request.

The valve moves with a maximum velocity defined by the Stepping rate parameter.

The positioning speed depends on the operation mode:

- during resynchronization is used the maximum speed, but towards the end of the positioning is made a deceleration ramp
- in debug mode is used the speed of the Debug step rate (parameter Prd0)
- in manual mode and for all other positioning is used the maximum speed.

Using Limit valve opening (parameter Pr30) it is possible to adapt the valve to the application.

For example, for a valve with a maximum rating of 10 kW fitted to a machine with 7.5 kW, Pr30 would be set to 75%.

So, if the request position target is 90%, the final real position of the valve may be 67.5% = 90 x 75% of the Maximum regulation steps.

The displayable variables for the current position and set-point in % are all referenced to the actual range of use of the valve (0 - Pr30%), while the position in steps is the real position.

If an invalid selection (Max steps = 0) is performed a Configuration error 23 is displayed.

10.16.5 Operating mode

10.16.5.1 Preliminary information

EVDRIVE04 implements a stepper motor control according to the state machine presented in the table here below (hereinafter the document will make reference to these status).

The state in which the algorithm is in may be readable in the FSM status (Finite State Machine, parameter Stat).

FSM	Meaning	
0	initialization	- Valve parameters acquisition - Request valve synchronization
1	synchronization wait	- Awaiting completion of synchronization - Request positioning to 0%
2	positioning wait	- Awaiting end of positioning - Positioning to Pr20
3	probe alarm	- Awaiting resolution of probe alarm - Positioning to Pr05
4	grid alarm	- Awaiting resolution of power supply alarm - Safe shutdown requested if backup battery is operative
5	communication alarm	- Awaiting positioning to communication alarm - Positioning to Pr48
10	stand-by off	- Evaluating resynchronization request flag - Acquisition of relevant parameters - Verifying consistency of parameters
11	stand-by on	- Evaluating Pr01 parameter to start the right valve control
30	analog positioner	- Analog positioner control in according to Pr01 selection
40	stabilization	- Positioning at stabilization position - Wait stabilization delay
41	start-up	- Positioning at start-up position - Wait start-up delay
42	algorithm selection	- Control algorithm selection - Set PID initializing request
50	manual	- Valve controlled in manual mode
51	debugger	- Debugging function active
61	SH or HGB algorithm	- Valve parameters acquisition - Request valve synchronization

10.16.6 Stand-by and operation mode selection

At the end of the resynchronization operations the machine will enter the stand-by state, during which the installer parameters are loaded and configurations are checked.

In this status can be modified the installer parameters, that take effect immediately, and also the manufacturer parameters, that require a reset.

If there are no configuration errors, represented in the Alarm status (parameter AlSt) and Configuration warning (parameter CoWa), the valve can be enabled.

The operation mode is set using Main control type (Pr01), and when the valve is enabled:

if PR01 = 0 the system remains held in the Stand-by on (11)
 if PR01 = 6 or 8 start SH or HGB algorithm or manual mode, according to functioning mode (Pr02)
 else analog positioner (30) operation mode begins

Please note regardless of the state of the enabled valve, disabling it will cause a positioning procedure using the value specified in stand-by position (parameter Pr20), after which the state is changed to Stand-by off (10).

10.16.7 Enabling EVDRIVE04

Excluding the automatic movements, it is necessary to enable the valve module EVDRIVE04 before moving it.

Enabling mode (parameter Pr06) configures the enabled features to be accepted.

When the valve module is to be used in standalone mode, an enable from digital input mode must be chosen (parameter Pr06 = 0 or Pr06 =1).

The selection must be made based on the type of input to be used.

A typical application of the DIHV (parameter Pr06 = 1) mode is to connect it in parallel to the compressor, such that the valve is enabled along with it.

To enable the valve using digital inputs, it is necessary for these to be configured correctly, otherwise a configuration alarm will be generated.

In particular:

If Pr06 = 0: the DI1 or DI2 input must be configured as enable > Ph11 = 1 or Ph21 = 1
 If Pr06 = 1: the DIHV input must be configured as enable > Ph31 = 1

Selecting the values from 2 to 9 the valve can be enabled via serial port using MODBUS or CAN communication protocols: this selection must be made if a controller manages the EVDRIVE04.

Selecting values from 6 to 9, it is possible to operate the EVDRIVE04 in standalone mode if a communications fault occurs, in this case the DI1 or DI2 inputs must be configured as enable (parameter Ph11 = 1 or Ph21 = 1).

The enabling of the valve using a communication network requires system which ensures the EVDRIVE04 can determine whether the controller is still online: specifically, the module expects the controller updates the variable Enable valve command (parameter EnaV) periodically. See the paragraph "Communication error"

The Enable valve command (parameter EnaV) has different addresses according to the communication system chosen:

- CAN (Pr06 = 2 or Pr06 = 6)
- MODBUS RS-485 (Pr06 = 4 or Pr06 = 8): EnaV address = 1281

10.16.8 Analog inputs

The configuration of each analog inputs is achieved by setting the related parameter: *Aix probe type* (Piax) determines the kind of probe connected to the analog input and *Aix probe usage* (Piux) determines the use of the analog input, where "x" is the input number.

The analog inputs AI3 and AI4 are dedicated to the measurement of the suction temperature Ts and Water Coil pressure Pe. The inputs AI1 and AI2 can be used as backup probe, or left free.

During the **Stand-by off** (10) is performed the verify to correctness and consistency of these parameters: a configuration error will prevent exiting this state. In this case an alarm is generated (bit 1 of *Alarm status* (AlSt)), and an error code in *Configuration warning* (CoWa) is readable.

The input type is set using parameter *Aix probe type* (Piax). The analog inputs must be configured according to the probe connected:

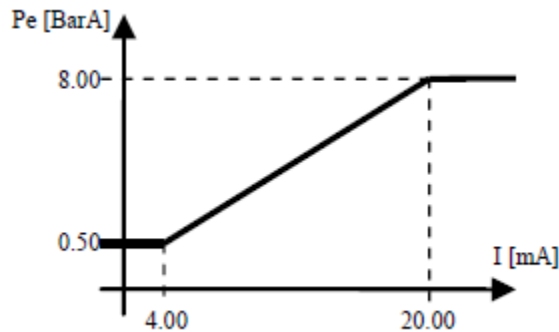
- AI1 and AI3 may be configured as NTC, Pt1000 or 0/4÷20 mA.
- AI2 may be configured as NTC, Pt1000, 0/4÷20 mA or ratiometric 0÷5V.
- AI4 may be configured as 0/4÷20 mA, 0÷10V or ratiometric 0÷5V.

Therefore, the temperature probe measuring the suction temperature (T_s), necessary for calculating the Superheat, must be connected to one of the three analog inputs AI1, AI2 or AI3, while the pressure probe for measuring the evaporation pressure may be connected to any of the four analog inputs. If the analog input is used for measuring pressure, this parameter also defines the conversion range.

The *Aix probe usage* (Piux) parameter defines the use of the analog input: primary or backup probe for measuring temperature or pressure.

For example:

if $Pia4 = 11$ the input will be configured as 4÷20 mA the pressure reading will be transformed into 0.5÷8 Barg



Each of the analog inputs may be configured as “scaling” (Piax = 30), this means its settings will be determined by parameters:

PxXty: type of input (0÷20 mA, 4÷20 mA for AI1, AI2 and AI3, 0÷20mA, 4÷20 mA, 0÷5V or 0÷10V for AI4)

PxYty: type of output (BarA or Barg)

PxXM: maximum input value (e.g. 15 mA, 20 mA, 5V, 10V, ...)

PxXm: minimum input value (e.g. 0 mA, ..., 10mA, 0V, 3V, ...)

PxYM: maximum output conversion value

PxXm: minimum output conversion value

PxYM and PxXm parameters are expressed in the units of the chosen measurement. E.g., if the input is configured as a pressure probe and the measurement unit is in Bar, these parameters should contain the minimum and maximum values hundredths of BarA or Barg according to PxYty.

In this example, the following values have been applied to the AI4 probe:

PH60 = 0 (pressure measurement unit = Bar)

P4Xty = 1 (0÷20 mA)

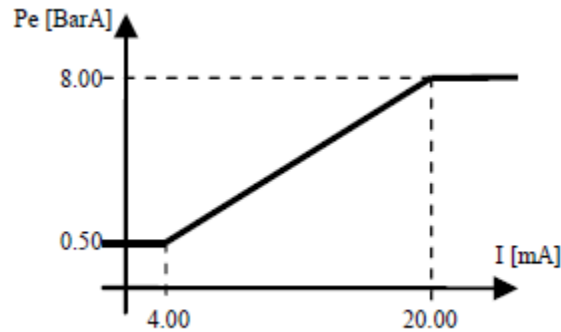
PxYty = 1 (BarA)

P4XM = 2000 (expressed in hundredths)

P4Xm = 400 (expressed in hundredths)

P4YM = 2500 (expressed in hundredths)

P4Ym = 1000 (expressed in hundredths)



10.16.9 Analog positioner control

The analog positioner mode permit to move the valve position linearly respect to the value applied to the active analog input.

To enter analog positioner mode, from the **Stand-by off** (10), set the *Main control type* (parameter Pr01) to the desired and enable the valve; if all the configuration is correct enter in **Stand-by on** (11), and then in the **Analog positioner** (30). To exit the analog positioner mode, it is necessary to disable the valve, which will cause a positioning movement to the value specified in *Stand-by position* (parameter Pr20), before entering the **Stand-by off** (10).

Pr01 = 01 -> analog positioner on AI1 (0÷20mA)☒

Pr01 = 02 -> analog positioner on AI2 (0÷5V)☒

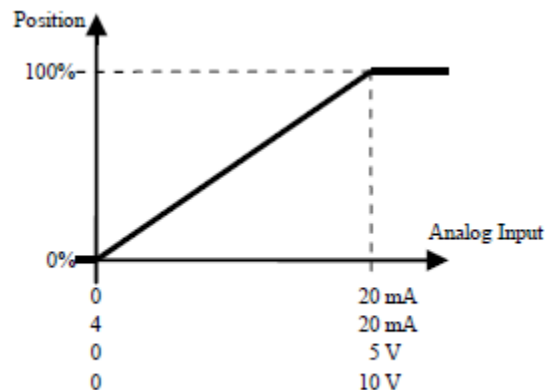
Pr01 = 03 -> analog positioner on AI3 (4÷20mA)

Pr01 = 04 -> analog positioner on AI4 (0÷10V)☒

Pr01 = 05 -> analog positioner on AI4 (using parameter Pia4 to select probe type)☒

Pr01 = 07 -> analog positioner on AI3 (4÷20 mA) and AI4 (0÷10V): the positioning is calculated using the maximum of the two. Resincronization request is performed only if the resulting positioning is <=1

The unused analog input are configured according to their respective Ai probe usage (parameter Pia).

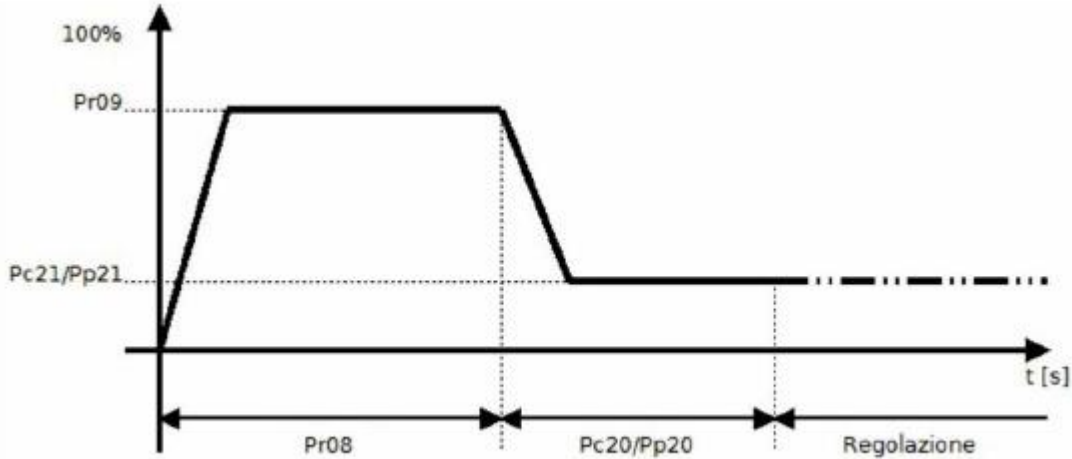


10.16.10 Algorithm start-up

To enter algorithm mode, from the **Stand-by off** (10), set the *Main control type parameter* Pr01 = 6 to perform Superheat (SH) control or Pr01 = 8 to perform hot gas bypass control. If all the configuration is correct enter in **Stand-by on** (11) and then in the **Stabilization** (40), in which is performed a positioning to Stabilization position (parameter Pr09) and await Stabilization delay (parameter Pr08).

Then enter in **Start-up** (41), in which is performed a positioning to Start-up position (parameters Pc21 or Pp21) and await Start-up delay (parameters Pc20 or Pp20).

Finally enter in the Algorithm selection (42) in which evaluates Main control type (parameter Pr01) and Functioning mode (parameter Pr02).



This state also enables manual mode, debugger mode, or one of the available SH-algorithm.

The *Functioning mode* (Pr02) defines the algorithm's operation mode, while *Main control type* (Pr01) defines which algorithm can be used.

Specifically:

- Pr02 = 0: enables control SH-algorithm defined by *Main control type* (Pr01)
- Pr02 = 1: enables manual algorithm, which permits movement of the valve to the position specified by *Manual set-point position* (Pr03)
- Pr02 = 2: activates a specific algorithm that moves the valve linearly up and down, at the desired step rate, between two specified positions

Loading of *Functioning mode* (Pr02) occurs every main cycle, and thus switching between the three algorithm operation modes occurs without forced intermediate positioning moves.

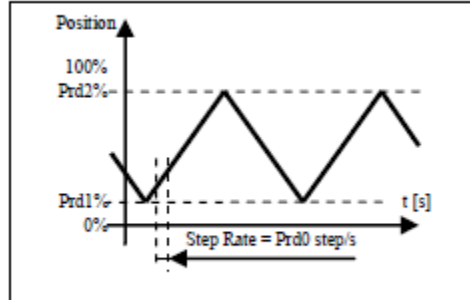
Note that Functioning mode (parameter Pr02) and Manual set-point position (parameter Pr03) are not saved into memory, this means that from reset the valve starts always in automatic mode with Functioning mode Pr02 = 0 and Manual set-point position Pr03 = 0.

10.16.11 Manual mode

In manual mode (parameter Pr02 = 1), this permits movement of the valve and bringing it to the percentage value stored in Manual set-point position (parameter Pr03) using the maximum step rate.

10.16.12 Debugging mode

The debugger feature is enabled when Pr02 = 2: the valve will move from a Debug minimum position (parameter Prd1) to a Debug maximum position (parameter Prd2) with the step rate defined by Debug step rate (parameter Prd0). Internally, the actuated step rate value is clamped to the maximum step rate of the selected valve.



10.16.13 Control algorithm

Setting the *Main control type* (parameter Pr01) selects the algorithm to enable:

- Pr01 = 6: Superheat (SH) control algorithm
- Pr01 = 8: Hot gas bypass control algorithm

10.16.14 Superheat control algorithm

The purpose of this control is to maintain the Superheat (SH) at its set-point value, in order to maximise the efficiency of the system and ensure that the compressor is protected by entrance of liquid.

The SH is usually controlled by a PID.

After selecting the control algorithm, it is necessary to set the various regulation parameters:

- SH set-point (Pc01, Pp01)
- LoSH set-point (Pc02, Pp02)
- HiSH set-point (Pc03, Pp03)
- LOP temperature (Pc04, Pp04)
- MOP temperature (Pc05, Pp05)
- PID proportional band (Pc13, Pp13)
- PID integral time (Pc14, Pp14)
- PID derivative time (Pc15, Pp15)
- Start-up delay (Pc20, Pp20)
- Start-up position (Pc21, Pp21)
- Fast action (Pr12)
- Neutral zone high threshold (Pr10)
- Smart band zone threshold (Pr11)
- SH filter time constant (Pr14)
- Fast action threshold (Pr13)

SH parameters set selection (SetP) supports selection of one of two different sets of regulation parameters. Each set includes SH set-point, PID parameters, and LoSH, HiSH, MOP and LOP alarm set points, start up position and delay.

Example uses are: using set1 parameters for a chiller, set2 for a heat pump.

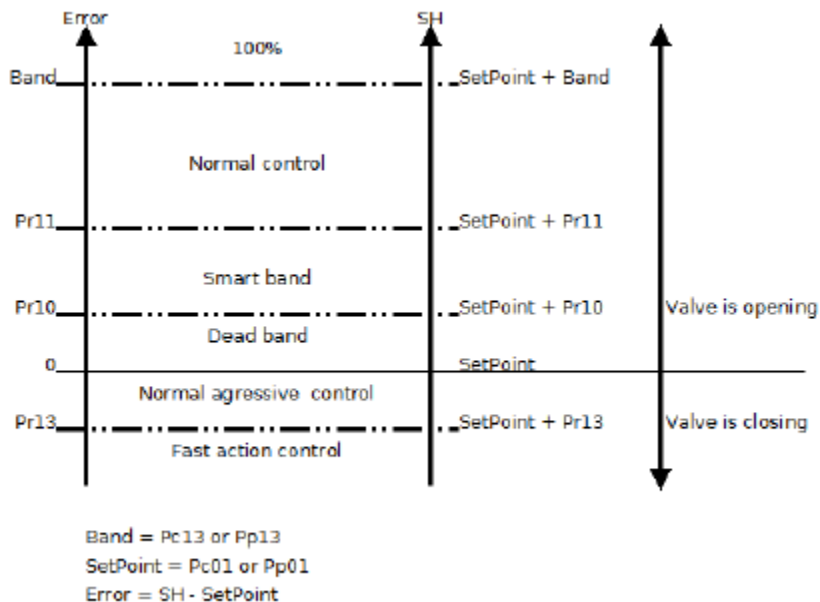
SH parameters set selection (SetP) supports switching from one control parameter set to another simply and quickly. It is possible to change the regulation parameter sets directly by modifying *SH parameters set selection* (Pr04), if a serial interface is present, or via correctly configured digital inputs on the standalone version. If one of the digital inputs (DI1 or DI2 or DIHV) is configured as "Change SetP" (*DI1 function* (Ph11) or *DI2 function* (Ph21) or *DIHV function* (Ph31) setting to 2), the parameter sets for the PID control are determined by the digital input status: set 1 is selected if the input is low, set 2 is selected if the input is high. If no DI is configured for parameter set modification, the data is taken directly from *SH parameters set selection* (Pr04).

With the operation mode selected, the regulator uses the related SH set-point parameter. This is a fundamental parameter for the proper functioning of the control algorithm. A low set-point ensures a higher Water Coil performance, lower temperatures, and minimum variations, but has the disadvantage that liquid may reach the compressor.

The algorithm uses different regulation parameters, depending on the working area:

- if the measured error is lower than 0 an aggressive normal control is performed.
- else if the measured error is in the dead band (error lower than Dead band threshold (parameter Pr10)) there is no changing in valve opening.
- else if the measured error is in the smart band (error lower than Smart band threshold (parameter Pr11)) a smart algorithm is used.
- else a normal PID control is performed

If the measured error is lower than *Fast action threshold* (parameter Pr13) at the above operation the "Fast Action" algorithm is added which further strengthens the algorithm response



All the input parameters, with the exception of the *Main control type* (Pr01), are acquired at every main cycle.

10.16.15 Hot gas bypass algorithm

The purpose of this control is to maintain the temperature at its set-point value.

After selecting the control algorithm, it is necessary to set the various regulation parameters:

- _ Temperature set-point (Pc06, Pp06)
- _ PID proportional band (Pc13, Pp13)
- _ PID integral time (Pc14, Pp14)
- _ PID derivative time (Pc15, Pp15)
- _ Start-up delay (Pc20, Pp20)
- _ Start-up position (Pc21, Pp21)
- _ Neutral zone high threshold (Pr10)
- _ Smart band zone threshold (Pr11)

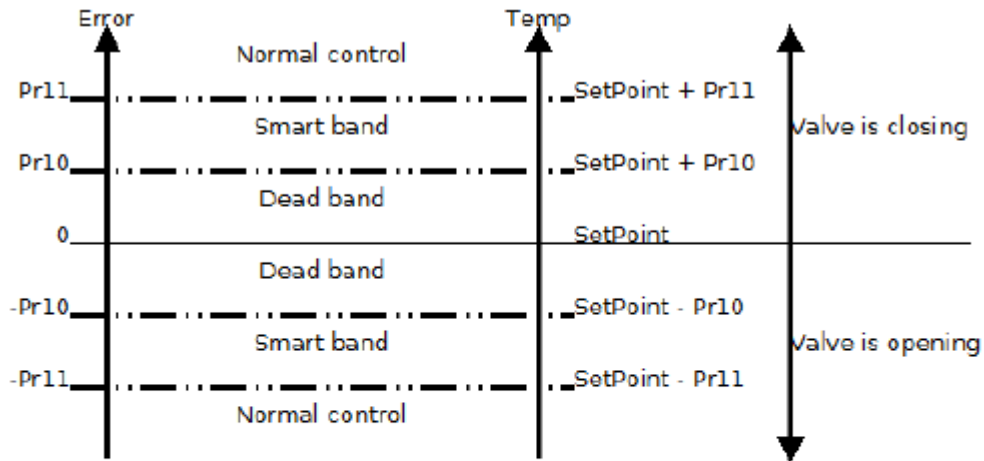
SH parameters set selection (Pr04) work in the same way as in SH control algorithm.

The algorithm use different regulation parameters, depending on the working area:

If the measured error is in the *Dead band* no regulation is performed

If the measured error is in the *Smart band threshold* a smart algorithm is used.

Out of this bands the normal algorithm is performed



Band = Pc13 or Pp13
 SetPoint = Pc06 or Pp06
 Error = T - SetPoint

10.16.16 Alarm relay

The alarm relay is managed directly by the application. It is possible to set the *Relay function* (parameter Ph01) and

Relay logic (parameter Ph02).

The alarm relay can be operate if there is an alarm situation depending of the choose (Ph01 = 1÷5): any alarm, only probe alarm, only LoSH alarm, only for MOP alarm, only for valve alarm.

If Ph01 = 6, the relay is used to control a solenoid valve which intervenes to block the flow of refrigerant in case of a power failure, or a disabled valve. The behavior is as follows: the relay remains in the excited state (solenoid valve open) while the valve is enabled, and is unexcited (solenoid valve closed) if the valve is disabled, or a power failure is detected.

The Ph01 = 7 combine the configuration 1 and 6.

If Ph01 = 8, the relay will be activated if the resynchronization is requested. To perform a resynchronization operation, the valve must be disabled.

If Ph01 = 0, the relay is not used by internal application and may be operated by a controller.

The relay remains in the OFF state, as defined by the value in parameter *Relay logic* (parameter Ph02), until it is changed by the condition defined in parameter *Relay function* (parameter Ph01). E.g: if Ph02 = 0 (normally not excited), and Ph01 = 1, the relay will be excited when any alarm is set.

10.17 CONFIGURATION

10.17.1 Unit of measurements

Units of measurement used in the internal algorithm are Celsius (oC) and Kelvin (K) degrees in tenths for temperatures, and barG in hundreds for pressure.

For the convenience of the user, it is possible to set temperature and pressure parameters in the preferred unit of measurement, specifying the unit in parameters Pressure unit of measurement (parameter Ph60) and Temperature unit of measurement (parameter Ph61).

These parameters are acquired only during **Initialization** (0) phase at the reset , thus any changes to these parameters will take effect only after a reset.

Setting of the Ph60 and Ph61 parameters affects:

- the limits of certain parameters
- the measurement read from state variables
- the temperature and pressure parameters

The modify of the parameters of measurement unit will trigger automatic conversion of existing temperature and pressure parameters: the automatic conversion of all the pressure and temperature parameters is performed in the Initialization (0) at the start-up, and then the board reset is needed after unit of measure parameters change.

The correct procedure should be performed in this order:

- disable the valve
- change parameters Ph60 and/or Ph61
- reset the board
- check Parameters alarm bit in the Alarm status (AlSt)
 - if parameters alarm is active, check and correct all the parameters of temperature and pressure, cancel the alarm leading to 1 bit 0 of the variable Command (Cmd), and then reset the EVDRIVE04
 - if parameters alarm is cleared check ParS variable and if necessary, reset the board again.

It is recommended not to abuse the automatic conversion of the parameters: is a delicate function as its disruption can lead to the invalidation of all the memory parameters.

In addition, repetitive conversions lead to a subsequent loss of precision in the values.

The Internal unit of measure (parameter UdM) indicates which units of measurements are actually used, since the

parameters Ph60 and Ph61 may have been changed. After the reset and the automatic conversion the Internal unit of measure (parameter UdM) mirrors the parameters.

Given that, as stated earlier, the internal algorithm work in Kelvin, Celsius and BarA, if the units of measurement chosen match these, no conversions are performed. If the user's units of measurements are in Fahrenheit and / or Psi, the following conversions are applied:

Param. in °F/R/Psi → val. in °C/K/Bar → algorithm → val. out °C/K/Bar → var. out °F/R/Psi

10.17.2 Configuring a built-in version

To modify a parameter operate as follows:

1. Press and release button UP or button DOWN to select a submenu.
2. Press and release button ENTER.
3. Press and release button UP or button DOWN to select the parameter.
4. Press and release button ENTER.
5. Press and release button UP or button DOWN to modify the value.
6. Press and release button ENTER to confirm the value.
7. Press and release button ESC over and over again to go back to the previous pages.

10.17.3 User menu

Make sure the power supply is switched on.

Move among the pages using the buttons as shown in the example here below, using the buttons or to scroll through the menu pages:

Page User.1

```

Status
Set      0.0 K
SH      0.0 K
Ts      0.0 °C
Te      0.0 °C
Pe      0.00Bar
Valve position 0.00%
<< No Alarm >>
    
```

```

Status
Set      0.0 K
SH      0.0 K
Ts      0.0 °C
Te      0.0 °C
Pe      0.00Bar
Valve position 0.00%
<< No Alarm >>
    
```

△ or ▽ to select << No Alarm >> and ← to enter ALARM STATUS page:

Page User.1.a

```

ALARM STATUS
Config      ok 0
Param1      ok
Param2      ok
Param3      ok
Param4      ok
Communication ok
EZ          ok
    
```

```

ALARM STATUS
Parameters  ok -
Power supply ok
Battery      ok
Data acquired
Algo running
Algo active
LowPressure ok
    
```

```

ALARM STATUS
LOP         ok
MOP         ok
LoSH        ok
HiSH        ok
    
```

△ or ▽ to scroll the page ESC to return to Page 1

Page User.2

```

Status
Valve Disabled
Initialization state
Algo mode active
Resynchro request
Disable request
Working time 0%
<< >>
    
```

Page User.3

```

Status
Current valve pos.:
0.00% [ 0Stp]
Set-point pos. 0.00%
Step rate 0Stp/s
Driving mode full 2 ph
<< >>
    
```

Page User.4

```

Status
R1 1 0.0
R1 2 0.0
R1 3 0.0
R1 4 0.0
D1 1 OFF DIhw OFF
D1 2 OFF Relay OFF
<< >>
    
```

Page User.5

```

User configuration
Set algo mode
Manual: set-p pos 0%
Debug:
step rate 25Stp/s
min 0%
max 100% >>
    
```

Page User.6

```

User configuration
PID param.set: used 0
set 1
Common parameters >
Set1 parameters >
Set2 parameters >
<< >>
    
```

```

User configuration
PID param.set: used 0
set 1
Common parameters >
Set1 parameters >
Set2 parameters >
<< >>
    
```

△ or ▽ to select << >> and ← to enter Set1 or Set 2 parameters page:

Page User.6.a

```

Set1 parameters >>
SH setpoint 5.0K
PID proport 40K
PID integral 120s
PID derivative 30s
Start-up delay 30s
Start-up pos. 50.00%
Gas bypass sp 10.0°C
    
```

```

Set1 param. settings
Alarm set-point 3
LoSH 15.0°C
HiSH -40.0°C
LOP 40.0°C
MOP
<<
    
```

Page User.6.b

```

Set2 parameters >>
SH setpoint 5.0K
PID proport 40K
PID integral 120s
PID derivative 30s
Start-up delay 30s
Start-up pos. 50.00%
Gas bypass sp 10.0
    
```

```

Set2 param. settings
Alarm set-point 3
LoSH 15.0°C
HiSH -40.0°C
LOP 40.0
MOP
<<
    
```



◀ or ▶ to scroll through the user menu Set1/2 parameters pages

The first pages are dedicated to the end user and permit display of major features of the EVDRIVE04, any alarm messages, or whether it is necessary to resynchronise or reset the machine after changing parameters. In the PageUser2 , the fourth line is visible and blinking only if there is a request for resynchronization; the last line signalizes a request to disable (blinking "disable request") or a request to reset the board (negative blinking "reset request").

In the "User configuration" pages, some manual and debug mode functions are also available, including the direct setting of SH set-point to pass to the algorithm.

In the "Alarm Status" page all the warnings and alarms are displayed.

10.17.4 Installer menú

Enter the Installer menu pressing  in Page User 1 or pressing  in Page User.6
The default level 1 password is "10".

```

Installer menu
Main parameters >
Alarm parameters >
Simulation >
Manufacturer menu >
Page Installer.1 <<
    
```

Page Installer.1.a	<pre> Main param. settings Main control type SH control Stabiliz. delay 5s Days to resynchro 1 Backup battery absent >> </pre>	<pre> Main param. settings Value position on -Stand by 0% -Stabiliz. 100% -Probe alarm 0% -Comm. error 0% << </pre>
--------------------	--	---

Page Installer.1.b	<pre> Alarm param. settings LoSH enable OFF delay 30s hyst. 0.5K HiSH enable OFF delay 30s hyst. 1.0K >> </pre>	<pre> Alarm param. settings LOP enable OFF delay 30s hyst. 1.0K << </pre>	<pre> Alarm param. settings NOP enable OFF hyst. 1.0 delay 30s bypass 30s maxSH 7.0 band 8.0 filter 1510s >> </pre>
--------------------	---	---	---

<pre> Alarm param. settings LowPressure enable OFF set-point 4.00Bar delay 180s hyst. 0.50Bar bypass 180s << </pre>	<pre> Alarm param. settings Communication enable OFF delay 30s << </pre>	<pre> Alarm param. settings Power supply enable OFF delay 1s Backup battery enable OFF delay 35s << </pre>
---	--	--




Page Installer.1.c	<pre> Simulation EnabOFF DI 10FF DI 20FF DI 30FF AI 10 AI 40 AI 30 AI 20 </pre>
--------------------	--

These menus permit modification of most driver parameters.

In the "Main param. settings" the user can change the control type (analog positioner or SH algorithm), the algorithm sample time, the algorithm parameters set to be used and the parameters for each set, valve start-up position, valve position in case of probe or communication error, valve stand-by position, etc.

The "Alarm param. settings" permit to enable or disable each alarm and settings the parameters.

10.17.5 Manufacturer menú

Enter the Manufacturer menu selecting “Manufacturer Menu” using  or  and  to enter; The default level 2 password is “20”.

To make operative the manufacturer parameters is necessary to reset the device

Page Manufacturer 0

Page Manufacturer 1

```

Manufacturer menu
Plant & valve >
Digital I/O >
Analog input >
Communication >
Parameters backup >
Parameters restore >
    
```

Page Manufacturer 1.a

Plant&Valve settings	Plant&Valve settings
refr. R-12342E	Enable valve mode
Valve Sp CO2	DI1 or DI2
Limit 100.00%	Frequency grid 50 Hz
Cycle 100%	Unit of measurement
Drv Full 2ph	temperature °C/K
Generic valve >	<< pressure Bar

Page Manufacturer 1.a.1

```

Generic valve setting
Minimum stp 200stp
Maximum stp 1596stp
Overdrive s 1600stp
Step rate 200stp/s
Max current 120mA
Hold current 0mA
Select copy...
    
```

Page Manufacturer 1.c

```

Digital I/O settings
Relay funct. Disabled NO
DI1 enable NO
DI2 change set NO
DIHV none NO
Led p Status
    
```

Page Manufacturer 1.d

```

Analog Input settings
Analog Input 1 >
Analog Input 2 >
Analog Input 3 >
Analog Input 4 >
Ts offset 0.0°C
Te offset 0.0°C
    
```

AI1 Settings	AI2 Settings
Usage: Not used	Usage: Not used
Type1: NTC	Type1: NTC
Scaling settings:	Scaling settings:
X axis: Y axis:	X axis: Y axis:
Type0-20mA relative p	Type0-20mA relative p
min 0.00 min 0.00	min 0.00 min 0.00
Max 20.00 Max 1.00	Max 20.00 Max 1.00

AI3 Settings	AI4 Settings
Usage: Ts primary	Usage: Pa primary
Type1: NTC	Type10: 0.5÷0Bar 4÷20
Scaling settings:	Scaling settings:
X axis: Y axis:	X axis: Y axis:
Type0-20mA relative p	Type0-20mA relative p
min 0.00 min 0.00	min 0.00 min 0.00
Max 20.00 Max 1.00	Max 20.00 Max 1.00

Page Manufacturer 1.e

```

Communication
CAN bus >
Modbus on RS 485 >
    
```

```

CAN Bus settings
CAN node address 0
CAN baud rate 10K
CAN timeout 0
    
```

```

Modbus on RS 485
Address 1
Baud Rate 9600
Parity even
Stop Bit 1 bit
    
```

Page Manufacturer 1.f

```

Parameters backup
Application param.
key memory
Drivers param.
key memory
Status:OK
    
```

Page Manufacturer 1.f

```

Parameters restore
Application param.
key memory
Drivers param.
key memory
Status:OK
Load default param.
    
```

The backup and restore functionalities are active only in **Stand-by off** (10). They are protected by the Level 5 password and permit to download a copy of the EVDRIVE04 application's parameters and/or the driver's parameters (communication settings, etc.) in the memory or in the parameters key. The user can restore the parameters with the copy in the memory or in the parameters key.

10.17.6 Configuring a blind version

The following procedures show an example of configuration of a blind version through an user interface (in the example EPJgraph) and through its user interface.

For further information please consult the hardware manual of the user interface.

Operate as follows:

1. Switch off the power supply of the device and of the interface.
2. Connect the device to the interface through the CAN port; look at chapter 4 "ELECTRICAL CONNECTION".
3. Switch on the power supply of the device and of the interface.
4. Keep pressed 2 s buttons OK and LEFT.
5. When the display of the interface will show the following menu release buttons OK and LEFT.

EPJgraph**Parameters****Contrast****CAN Network****Modbus****Info*****Real date and time***

6. Press and release button UP or button DOWN to select "**CAN Network**".
7. Press and release button ENTER.
8. Press and release button ENTER again to set the password value.
9. Press and release button DOWN over and over again to set "**-19**".
10. Press and release button ENTER again.
11. Set parameter *NW Node* using button UP or button DOWN to select the parameter and using button ENTER to modify and to confirm the value.

According to the factory setting the address of the CAN node of an electronic expansion valve driver has value *11* (therefore operate on the interface to set parameter *NW Node* to [1] *11*).

12. Switch off the power supply of the interface.
13. Switch on the power supply of the interface.

10.17.7 Main menu

The following procedures show how to gain access to the main menu.

The main menu provides information on the project, on the status of the inputs, allows to set the level's passwords, etc.

To gain access to the procedure operate as follows:

1. Make sure the power supply is switched on
2. If you are using a built-in version, keep pressed 2 s buttons UP and DOWN: the display will show the menu. If you are using a blind version through a remote user interface (by exemple EPJgraph), keep pressed 2 s buttons ESC and RIGHT: the display will show the internal menu.

The access to some submenus is protected by password.

To gain access to a not protected submenu operate as follows:

3. Press and release button UP or button DOWN to select the submenu.
4. Press and release button ENTER.

To gain access a protected submenu operate as follows:

5. From step 2, press and release button UP or button DOWN to select the submenu.
6. Press and release button ENTER.
7. Press and release button ENTER again to set the password value.
8. Press and release button DOWN over and over again to set "**-19**".

9. Press and release button ENTER again.

To modify a parameter operate as follows:

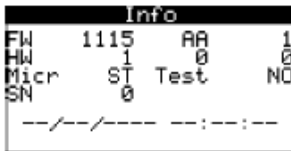
10. From step 4 or step 9, press and release button UP or button DOWN to select the parameter.
11. Press and release button ENTER.
12. Press and release button UP or button DOWN to modify the value.
13. Press and release button ENTER to confirm the value.
14. Press and release button ESC over and over again to go back to the previous pages.

To quit the procedure operate as follows:

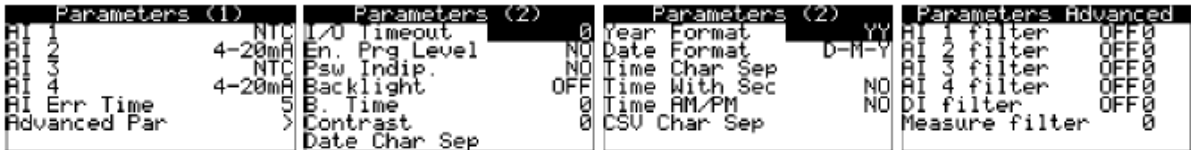
16. Press and release button ESC over and over again: possible modifications will not be saved.



Version information page



Common parameters and Advanced parameters pages



Networks pages

```

Networks
CAN Bus
UART 1
USB
    
```

CAN network configuration and status pages

CAN Bus	CAN Bus Bit Timing	DEBUG CAN
MyNode: 0 Master NO	TSEG1 0	Status INIT
Baud 10K Timeout 0	TSEG2 0	Bus Status Ok
NetworkNode[0] 0 >	BTR 0	Cnt Rx 0
	SJW 0	Cnt Tx 0
		Cnt Ovf 0
		Cnt Passive 0
		Cnt Bus Off 0

Modbus on RS485 configuration page

```

UART1: ModBus Slave
Address 0
Baud Rate 1200
Parity NONE
Stop 1 BIT
    
```

USB status page

```

USB
USB Status Init Device
Device Status Idle
Speed
    
```

Password setting page

Password		
Level 1:	10	OFF
Level 2:	20	OFF
Level 3:	30	OFF
Level 4:	40	OFF
Level 5:	50	OFF
Timeout:		240

Diagnostic page

Diagnostic	
Memory	ok
Stack	ok
5U Ratio	ok
12V Measure	ok
Math	ok
Key Par	ok

Internal status

Debug	
Main time	19 ns
...max time	27 ns
...free stack	96003
5U probe	0.0J
12V probe	0.0J

RS485 status

Modbus 1			
Comm.	State	Disab	
0	1200	none	1 bit

10.17.8 Connecting the device through the set-up software system Parameters Manager

The following procedure shows how to connect the device to the set-up software system Parameters Manager. For further information please consult the application manual of Parameters Manager.

Operate as follows:

1. To connect the device to the set-up software system Parameters Manager through the USB port, make sure to have an USB cable; to connect the device to the set-up software system Parameters Manager through the RS-485 port, make sure to have the non optoisolated RS-485/USB serial interface EVIF20SUXI.
2. Switch off the power supply of the device.
3. Connect the kit (or the interface) to the Personal Computer.

4. Switch on the power supply of the device.
5. Operate as related in the User manual of Parameters Manager.

10.17.9 Backup and restore

If the EVDRIVE04 driver version is displayed (using the built-in display or another display connected via the CAN port) you can view the backup / restore pages which permit to save a copy of the memory areas of the parameters. The copy can be done in another area of the memory or in an external memory (parameters key) connected to the communication programming port.

It is possible to save both the application parameters (EVDRIVE04 parameters) and the driver parameters (calibration network settings, ...).

It is possible to restore the parameters from copies in the memory (restore application or driver parameters) or load the default parameters (load default configuration from flash memory).

The backup and restore functionalities are active only in Stand-by off (10).

10.17.10 Configuring the device through an USB flash drive

The following procedures show how to make the upload and the download of the configuration parameters through an USB flash drive.

To copy the parameters from the device to the USB flash drive operate as follows:

1. Make sure the power supply is switched on.
2. Connect the flash drive to the device.
3. With reference to step 28 of the paragraph 7.2 "Configuring a built-in version", from page 37 press button UP or button DOWN to select "**key**" to copy the parameters in the flash drive or "**memory**" to copy the parameters in the internal memory of the device, belonging to the field "**Application param.**" to copy the application software parameters or belonging to the field "**Drivers param.**" to copy the configuration parameters.
4. Press and release button ENTER: the parameters will be copied (this operation usually takes a few seconds; the last line of the page provides information on the status of the process).
5. Disconnect the flash drive.

To copy the parameters from the USB flash drive to the device operate as follows:

6. Make sure the power supply is switched on.
7. Connect the flash drive to the device.
8. With reference to step 28 of the paragraph 7.2 "Configuring a built-in version", from page 38 press button UP or button DOWN to select "**key**" to copy the parameters from the flash drive or "**memory**" to copy the parameters from the internal memory of the device, belonging to the field "**Application param.**" to copy the application software parameters or belonging to the field "**Drivers param.**" to copy the configuration parameters.
9. Press and release button ENTER: the parameters will be copied (this operation usually takes a few seconds; the last line of the page provides information on the status of the process).
10. Disconnect the programming flash drive.

The copy of the parameters from the flash drive to the device is allowed on condition that the firmware of the devices coincides.

To quit the procedure operate as follows:

11. Press and release button ESC over and over again: possible modifications will not be saved.

10.18 REPROGRAMMING

It is possible to reprogram the device using a USB flash drive in which the work.ucjb and work.ucje files have been copied. Once the USB flash drive is inserted, the files are copied in the device, which restarts: if the downloaded program is suitable, the device is reprogrammed with the new version.

You can reprogram the Device using the Download Manager program, connecting the PC to the device using the USB port.

10.19 SERIAL COMMUNICATION

10.19.1 Preliminary information

It is possible to control the EVDRIVE04 driver by connecting it to a controller.

The controller sends information to the driver necessary for its correct functioning, and the driver responds with its internal states, such as (for example) the pressure and temperature measurements, alarms, certain parameters, etc. The connection methods available on the EVDRIVE04 are CANBUS, MODBUS RS-485 and MODBUS USB, according to the model.

The protocol to be used for communication with the controller must be selected via parameter Enabling mode (Pr06). See the “Enable EVDRIVE04” section.

The EVDRIVE04 behaves as an expansion to read the analog inputs AI1 and AI2, read digital inputs and write the relay. (Note that driving the relay by the controller completely bypasses its function set by parameter.)

10.19.2 CANBUS serial communication

The EVCO controllers primarily use a protocol based on CANbus for communication with controllable systems.

10.19.2.1 CAN Master tool

The exchange of data is based on a list of variables or parameters that the controller may send to the driver, and a list of variables the driver sends to the controller to provide its state data, using the CAN Master tool.

The variables and parameters to be monitored should be selected from lists proposed by SW development according to their own needs.

The protocol performs one send request every second and one receive request every second, which does not occur simultaneously. Each send/receive request is done on a different node, thru the nodes on the network.

You can give a different timing of the individual entities. The levels selected are:

- Level INIT: the value is written (or read) only once when the controller detects a new node in the network. If the node is disconnected and then reconnected the initialization is done again.
- Level LO: every 10 seconds is written (or read) one of the entities with this priority.
- Level HI: each 1 second is written (or read) one of the entities with this priority.

When you connect a device to the network, the controller read and write all entities without differentiating the priorities. Once this step is completed for each node, entities with priority INIT will no longer be requested.

The refresh time of the single entity depends, therefore, both on its level and on the number of entities of the same level and type (read / write).

10.19.2.1.1 Status variables

AI1 type (AI1T used if Piu1 = 0)	Calculated Water Coil temperature (Te)
AI2 type (AI2T used if Piu1 = 0)	Unit of measure in use (UdM)
Ai error timeout	Working hour (Pr40)
FSM status (Stat)	Control algorithm status (AlgS)
Used SH control parameters set (SetS)	Alarm status (AlSt)
Measured SH (SH)	Configuration warning (CoWa)
Used SH set-point (SpSH)	Enable valve status (EnaS)
Measured aspiration temperature (Ts)	Request a reset status (ParS)
Measured Water Coil pressure (Pe)	Resynchro request status (ResS)

10.19.2.1.2 CONTROL VARIABLES

Tipo AI1 (AI1T utilizado si Piu1 = 0)	DI1 function selection (Ph11)
Tipo AI2 (AI2T utilizado si Piu1 = 0)	DI1polarity (Ph10)
Tiempo de espera de error de Ai	DI2 function selection (Ph21)
Habilitar comando de válvula (EnaV)	DI2polarity (Ph20)
Command (Cmd)	DI1HV function selection (Ph31)
Resynchronization request (ResR)	DI1HVpolarity (Ph30)
Functioning mode (Pr02)	AI1 probe usage (Plu1)
Manual valve position set-point (Pr03)	AI2 probe usage (Plu2)
Debug valve step rate (Prd0)	AI1 probe type (PIA1)
Debug minimum opening (Prd1)	AI2 probe type (PIA2)
Debug maximum opening (Prd2)	AI3 probe type (PIA3)
Stabilization delay (Pr08)	AI4 probe type (PIA4)
Stabilization position (Pr09)	AI1 scaling X type (P1Xt)
Main control type (Pr01)	AI2 scaling X type (P2Xt)
SH control parameters selection (SEtP)	AI4 scaling X type (P4Xt)
set 1: SH set-point (Pc01)	AI1 scaling X max (P1XM)
set 2: SH set-point (Pp01)	AI2 scaling X max (P2XM)
set 1: LoSH set-point (Pc02)	AI4 scaling X max (P4XM)
set 2: LoSH set-point (Pp02)	AI1 scaling X min (P1Xm)AI2 scaling X min (P2Xm)
set 1: HiSH set-point (Pc03)	AI4 scaling X min (P4Xm)
set 2: HiSH set-point (Pp03)	AI1 scaling Y type (P1Yt)
set 1: LOP set-point (Pc04)	AI2 scaling Y type (P2Yt)
set 2: LOP set-point (Pp04)	AI4 scaling Y type (P4Yt)
set 1: MOP set-point (Pc05)	AI1 scaling Y max (P1YM)
set 2: MOP set-point (Pp05)	AI2 scaling Y max (P2YM)
set 1: PID proportional band (Pc13)	AI4 scaling Y max (P4YM)
set 2: PID proportional band (Pp13)	AI1 scaling Y min (P1Ym)
set 1: PID integral time (Pc14) set 2: PID integral time (Pp14)	AI2 scaling Y min (P2Ym)
set 1: PID derivative time (Pc15)	AI4 scaling Y min (P4Ym)
set 2: PID derivative time (Pp15)	Ts temperature offset (OfsTs)

set 1: start-up delay (Pc20)	Te temperature offset (OfsTe)
set 2: start-up delay (Pp20)	Type of refrigerant (Pi00)
set 1: start-up position (Pc21)	Enabling mode (Pr06)
set 2: start-up position (Pp21)	
Fast action start threshold (FaTh)	
Fast action (Fast)	
PID neutral zone high threshold (PNHi)	
PID neutral zone low threshold (PNLO)	
PID proportional constant threshold (Pcz)	
PID SH filter time constant (SHFi)	
Relay fuction selection (Ph01)	
Relay polarity (Ph02)	

10.19.3 COMMANDS

For the variables that need an immediate refresh, commands are implemented.

The CommandOut allows to write commands on the device. The device performs the new values as soon as possible.

The CommanIn allows to read variables from device. The device send a CommandIn every 5 seconds and on event (see table).

Code	UNIPRO/SoHVAC Name		Sent variables	Event
38	Send EVCm command	Controller to EVDrive	bit 0: Enable valve command bit 1: Resynchronization request bit 2: Functioning mode 0 = algo 1 = manual bit 3: SH control parameters selection 0 = set 1 1 = set2 bit 4-7: reserved bit 8-15: bit 0-7 mask	
39	Send EVCm Manual Pos	Controller to EVDrive	Manual valve position set-point	
40	Receive EVCm Current Pos	EVDrive to Controller	Current valve position %	Current position < 5%
41	Receive EVCm Status	EVDrive to Controller	bit 0-7: FSM status bit 8: Enable valve status bit 9: Resynchro request status bit 10: Used SH control parameters set 0 = set 1 1 = set2	Every change
42	Receive EVCm Status	EVDrive to Controller	Alarm status	Every change

10.19.4 MODBUS serial communication

Serial communication via the RS-485 port may use the ModBus protocol. The accessible variables and parameters are those shown in the tables in the section “Configuration”. These same tables also include ModBus addresses (base 1).

The same rules covered earlier for the communication alarm management also apply to the valve *Enable valve command* (EnaV) (see “Communication error”).

The port configuration can be performed using dedicated configuration pages on EPJgraph or LCD display. The default setting for ModBus communication via RS485 port is 9600 bps, even parity, 1 stop bit.

10.20 ALARMS AND ERRORS

10.20.1 Alarms and errors

The system supports a series of alarms related to both the system (memory, probes, communication, configuration, etc.), and the regulation algorithm (LoSH, HiSH, LOP, MOP, Low Pressure).

All the alarms, except the parameters alarm (EPar), are automatic, this means that they will be cancelled automatically once the cause of the alarm is removed.

The presence of an alarm status is signalled using the LED interface and using relays, if suitably configured. The alarm status is always available in the Alarm status (AlSt), Configuration warning (CoWA) and Algorithm status (AlgS).

Alarm Status	Short Code	Alarm description	Parameters
Bit 0	EHd1	Memory error	--
Bit 1	EHd2	Configuration error	
Bit 2,3	Ecom	Communication error	Pa01, Pa02, Pr48
Bit 4	EPr1	Probe Ai1 error	Pr05
Bit 5	EPr2	Probe Ai2 error	Pr05
Bit 6	EPr3	Probe Ai3 error	Pr05
Bit 7	EPr4	Probe Ai4 error	Pr05
Bit 8	PSer	Power failure	Pa70, Pa71, Pb01
Bit 9	Ebat	Backup battery error	Pa75, Pa76 , Pb01, Ph21, Ph20
Bit 10	Ealg	Algorithm status	Pa11, Pa12, Pa20, Pa21, Pa22, Pa30, Pa31, Pa32, Pa33, Pa40, Pa41, Pa42, Pa50, Pa51, Pa52
Bit 12	Epar	Parameters error	–

10.20.2 Memory error

A memory error occurs when it is not possible to access data stored in the EEPROM memory: it is not therefore possible to access the parameter values stored on it, so they will assume default values from flash memory. Is also not possible to store new parameter values.

This alarm can be occurred if the automatic conversion procedure of the temperature and/or pressure parameters is

halted. In this case also the parameters alarm is set and is necessary to reload the default parameters from the flash memory to clear the memory alarm.

10.20.3 Configuration error

In the Stand-by off state is checked the correctness and the congruence of the parameters. If the configuration is not correct, an alarm is generated, signalled by bit 1 of Alarm status (AlSt). To determine the significance of this single bit Configuration warning (CoWA) contains the error code generated during the parameter verification process.

10.20.4 Communication error

A communication error is signalled only if a suitable communication mode is selected ($Pr06 \geq 2$), and the communication alarm is active ($Pa01 = 1$). Under these conditions, the driver expects the controller to periodically refresh the Enable valve command (EnaV).

If the refresh does not happen for more than half the time set in Communication alarm delay ($Pa02$), a warning is given. If the refresh does not happen for more than the time set in Communication alarm delay ($Pa02$), the communication is considered lost and communication alarm is set.

Management of this alarm depends on the mode selected. If $Pr06 = 2 \div 5$, a communication alarm state will cause the valve to be forced to the position determined by Communication error position ($Pr48$), and will then enter the Communication alarm (5) until the positioning process has completed and the communication start again. If $Pr06 = 6 \div 9$, a communication alarm status will place the valve into standalone mode, and DI1 enable the valve.

When the communication alarm is cleared, the valve will automatically return to the online mode.

Bit3	Bit2	Significance
0	0	No communication alarm
0	1	Warning
1	0	Communication alarm in standalone mode
1	1	Communication alarm

10.20.5 Probe error

The probe alarm state is monitored every main cycle and is shown in bits 4÷7 of Alarm status (AlSt) and also signalled by the relay, if configured.

Each bit is associated with a single analog input:

- bit 4: error state for probe connected to analog input AI1
- bit 5: error state for probe connected to analog input AI2
- bit 6: error state for probe connected to analog input AI3
- bit 7: error state for probe connected to analog input AI4

A probe error state is signalled and, if necessary, managed, only when the respective probe is in use.

Be aware that the measurements are valid only in operation modes in which the valve is enabled ($FSM \text{ status} \geq 30$); in other states, the analog inputs might not be configured correctly.

When the state machine enter the Stand-by off, after the parameters check, it is possible to determine which probes will be used: for example, if an analog positioner is set using setting $Pr01 = 1$, only an error on probe 1 will generate an alarm. If, on the other hand, an algorithm ($Pr01 \geq 6$) is selected, both the selected primary probes (and, eventually, those chosen as secondary probes) will be able to set an alarm. The signalling of the alarms is thus active after the first entry into the Stand-by off.

In states where it is really necessary that the values from analog inputs are reliable, i.e. in analog positioner and SHalgorithm

mode, a more complete probe error management system is activated.

When the analog positioner function is selected (Analog positioner (30)), a probe error on a probe currently in use will trigger a positioning move to the value Probe alarm position (Pr05), and the system is changed to Probe alarm (3), where it will then wait for the clearing of the alarm from the relevant probe.

If a SH-algorithm is active, the probe errors monitored are those related to pressure and temperature measures. Any probe error will be handled as follows:

if the alarm relates to the primary probe (temperature or pressure), and another analog input has been configured as a backup probe (for temperature or pressure respectively), the measurement is automatically read from the backup probe; the corresponding Alarm status (AlSt) bit is set to signal a malfunction on the primary probe. Once the primary probe's alarm state has been cleared, the readings are taken from the primary probe once more.

if no backup probe is defined, or if also the backup probe goes in alarm, the algorithm is disabled; the valve is positioned at Probe alarm position (Pr05), and the FSM enters the Probe alarm (3), where it awaits the clearing of the alarm state.

In each case, positioner or SH-algorithm, when the probe alarm is cleared, the state is automatically changed to Stand-by off.

If the valve is disabled while is in Probe alarm (3), there is a positioning to Stand-by position (Pr20) and then it enter Stand-by off.

10.20.6 Power failure and backup battery error

The EVDRIVE04 supports connection to a backup battery in order to allow a complete closure of the valve in the case of power supply failure.

There are two alarms: one for the power supply failure (bit 8), the other for a malfunction of the backup battery (bit 9).

Clearly, both these alarms make sense only if a backup battery is present (parameter Backup battery (Pb01 = 1).

The backup battery alarm also requires the configuration of DI2 (DI2 logic (PH20) and DI2 function (PH21)).

Note that the backup battery alarm only signalize the malfunction of the battery.

However, if the power fail alarm occurs, in addition to reporting, a valve safety shutdown procedure is started.

Once the alarm is cleared, the system is reset.

An alternative to the backup battery, a solenoid valve connected to the relay may be used to block the flow of the refrigerant.

10.20.7 Algorithm status

Bit 10 of Alarm status (AlSt) is raised if the measures needed by the algorithm are not valid or for SuperHeat algorithm alarms and warnings (LOP, MOP, LoSH, HiSH, LowPressure).

This monitoring is in effect only while the system is working in SH-algorithm and in manual mode.

The Algorithm status (AlgS) variable holds the specific state that generated the alarm, according to this table:

Algorithm Status	Description	
	Value 0	Value 1
Bit 0	Measures acquired	Data not read (Alarm status.b10 0→1)
Bit 1	algorithm is running	control algorithm halted
Bit 2	algorithm is active	algorithm is skipped (manual mode is active)
Bit 3	No LoSH algorithm is running	LoSH algorithm is running
Bit 4	No LoSH alarm	LoSH alarm (Alarm status.b10 0 > 1)
Bit 5	No HiSH algorithm is running	HiSH algorithm is running
Bit 6	No HiSH alarm	HiSH alarm (Alarm status.b10 0 > 1)

Bit 7	No LOP algorithm is running	LOP algorithm is running
Bit 8	No LOP alarm	LOP alarm (Alarm status.b10 0 > 1)
Bit 9	No MOP algorithm is running	MOP algorithm is running
Bit 10	No MOP alarm	MOP alarm (Alarm status.b10 0 > 1)
Bit 11	No LowPressure	LowPressure (warning signal only)
Bit 12	No LowPressure alarm	LowPressure alarm (Alarm status.b10 0 > 1)

Note that if the manual mode is active, a read error of the measurement data due to incorrect probe configuration only generates a warning. While, if the control algorithm is running, the inability to read the measurements makes it impossible for the algorithm to continue, so this triggers a probe alarm.

Bits 0, 1 and 2 of Algorithm status (AlgS) are always calculated, while the other bits, given their dependencies on the active control algorithm, are only valid while SH-algorithm is running.

10.21 SUPERHEAT ALGORITHM PROTECTION FUNCTIONS

10.21.1 LoSH

When enabled (Pa10), this alarm is triggered when the SH drops below the low heating threshold (Pc02, Pp02, Pd02). The condition is signalled in the Algorithm status (AlgS) and, when the timeout (Pa12) expires, an alarm is set. The alarm and signal are cleared automatically when the SH returns above the threshold (hysteresis defined in Pa11).

10.21.2 HiSH

When enabled (PA20), this alarm is triggered when the SH rises above the high heating threshold (Pc03, Pp03, Pd03), a bit is set in Algorithm status (AlgS) and, after the timeout (Pa22) expires, an alarm is set. The alarm and signal are cleared automatically when the SH returns below the threshold (hysteresis defined in Pa21).

10.21.3 LOP

When enabled (parameter Pa40), this alarm is triggered when the evaporation temperature (Te) drop below the LOP threshold (parameters Pc04, Pp04) and in the **Start-Up** (41) status activates a specific algorithm for managing the LOP, forcing the valve to open 100%, and in case of alarm re-entry stopping it at the current opening. The condition is signalled in the *Algorithm status* (AlgS) and, when the timeout (Pa42) expires, an alarm is set. This protection is most useful during start-up of the machine, when the evaporation temperature is effectively low. It is possible to optimise this phase by setting a correct value in the valve opening on start-up parameter (parameters Pc21, Pp21). When the Te temperature returns within its limits (parameter Pa41 defines the hysteresis), the alarm and signalling are cleared and the normal regulation algorithm resumes.

10.21.4 MOP

When enabled (parameter Pa50), once the *Delay Bypass MOP* (parameter PA56) has elapsed since the activation of the regulation algorithm, this alarm is triggered when the evaporation temperature (Te) rise above the MOP threshold (parameters Pc05, Pp05) and activates a specific algorithm for managing the MOP, that increasing the superheat setpoint (parameters PA53, PA54, Pa55). The MOP correction algorithm can force the opening of the valve, closing it of *MOP forced delta* (parameter Pa57) each *MOP forced time* (parameter Pa58) seconds. This function is disabled if *MOP forced delta* (Pa57 parameter) is null. The condition is signalled in the *Algorithm status* (AlgS) and, when the timeout (parameter Pa52) expires, an alarm is set. When the Te temperature returns within its limits (parameter Pa51 defines the hysteresis), the alarm and its signal are cleared and the normal regulation algorithm resumes.

10.21.5 LowPressure

When enabled (Pa30), and the evaporation pressure (Pe) falls below the low pressure threshold (Pa31), an warning is signalled. After the timeout (Pa33) expires, the LP alarm is set. The alarm and its signal are cleared automatically when the pressure returns above the threshold. (Pa32 defines the hysteresis).

10.22 PARAMETERS ERROR

Bit 12 of Alarm status (AlSt) indicates that there was a problem during the automatic conversion of the parameters of temperature and/or pressure and it is possible that not all parameters have been successfully converted.

The automatic conversion of the parameters is performed only at the reset after a change in parameters Ph60 and/or Ph61.

If this alarm occurs, the user should check and correct all the parameters of temperature and pressure, cancel the alarm leading to 1 bit 0 of the variable Command (Cmd), and then reset the EVDRIVE04.

11 PHYSICAL DATA CARLYLE RECIPROCATING ASHP

UNIT ECCLA – Nominal Cap (Tons)	025	050	075	100	125	150	175	200
WEIGHT TOTAL (lb)								
Operation	3812.5	7625	11437.5	15250	19062.4	22874.9	26687.4	30499.9
Shipping	3631	7262	10893	14524	18155	21786	25417	29048
REFRIGERANT	HFC/HFO, R513A							
Charge (lb)	105.82	211.64	317.46	423.28	529.1	634.92	740.74	846.56
COMPRESSORS	Semi-hermetic reciprocating compressor (VSD)							
Nominal Speed (rpm)	1750							
Quantity	1	2	3	4	5	6	7	8
Theoretical displacement (CFM)	99							
No. of cylinders (per compressor)	6	6	6	6	6	6	6	6
Oil charge (Pints per compressor)	19							
Oil type	RL68H							
Weight (lb)	520	1040	1560	2080	2600	3120	3640	4160
No. of loading stages%	50-100							
HEAT EXCHANGER	Shell Box							
Quantity	2	4	6	8	10	12	14	16
Weight (empty, per evaporator, lb)	152.19							
Water volume per evaporator (gal)	5.44							
Water Connections per evap. (in)	2	2	2	2	2	2	2	2
CONDENSER FANS	EC MOTOR							
No. Fans Al-Cu	2	4	6	8	10	12	14	16
Fan cfm (per fan)	17500	17500	17500	17500	17500	17500	17500	17500
Nominal speed (rpm)	1100	1100	1100	1100	1100	1100	1100	1100
Diameter in (per fan)	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
Weight (lb) (per fan)	114.4	114.4	114.4	114.4	114.4	114.4	114.4	114.4
HWH HEAT EXCHANGER	Shell Box							
Quantity	2	4	6	8	10	12	14	16
Weight (empty, per HWH, lb)	152.19							
Water volume per HWH (gal)	5.44							
Water Connections per evap. (in)	2	2	2	2	2	2	2	2
HYDRONIC MODULE								
Pump 1 (hp)								
Weight (Lb)								
Pump 2 (hp)								
Weight (Lb)								
Water storage tank cap (Gal)								
Weight (Lb)								



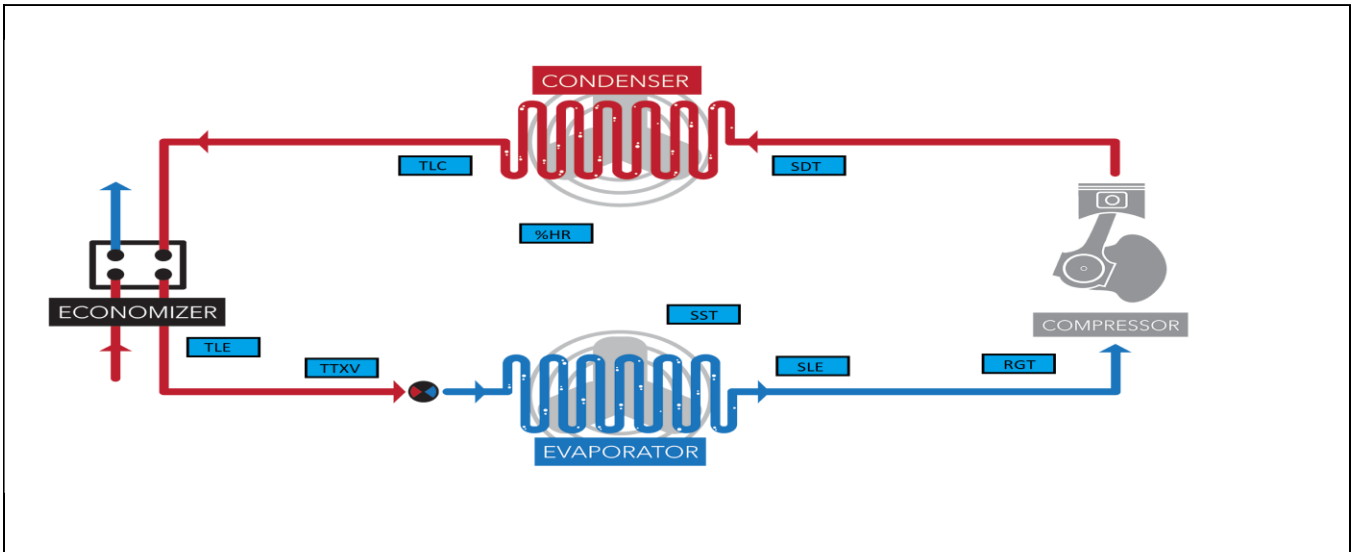
Performance Summary

Input Data			
Compressor Series :	06D/E	SST (F)	39
Refrigerant :	R513A	SDT (F)	105
Compressor Model:	06EA599	TLC (F)	105
Units :	IP	TLE (F)	83
Frequency :	60	TTXV (F)	83
Voltage :	460	RGT (F)	40
		SLE (F)	5

Compressor Type Semi-Hermetic Recips



Schematic Diagram

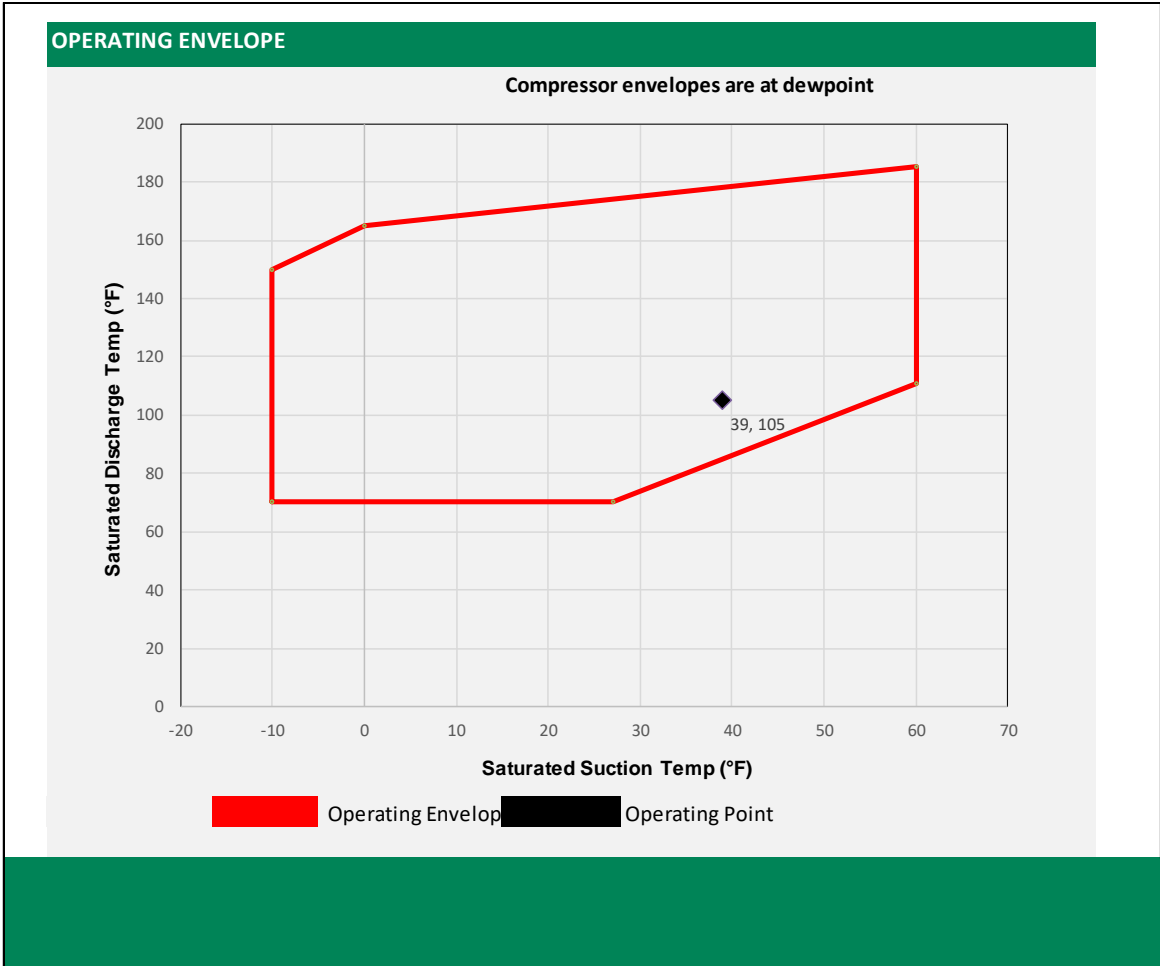




Refrigerant: R513A
Model : 06EA599

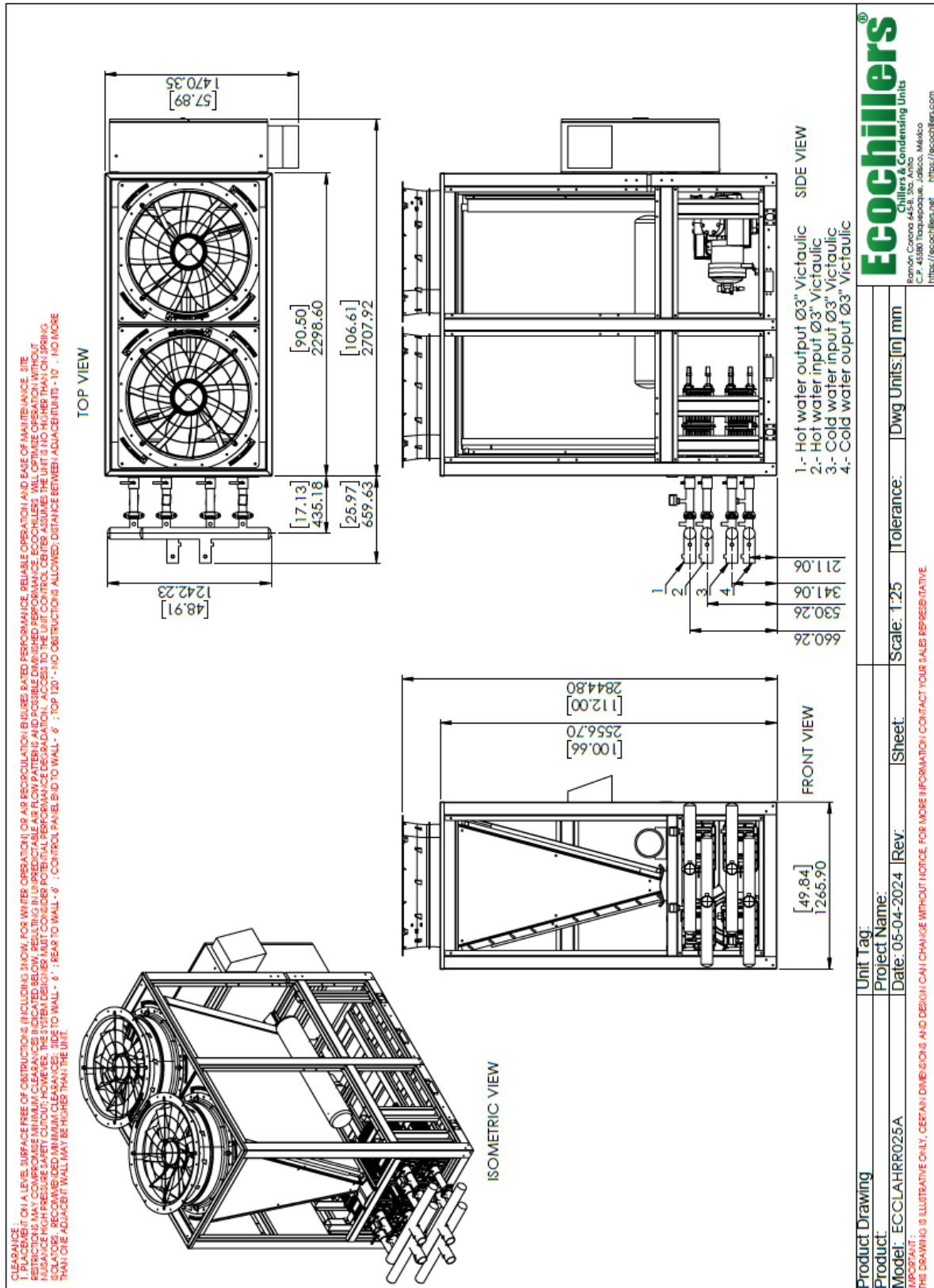
recip ashp compressor
11/08/2022

Technical Details

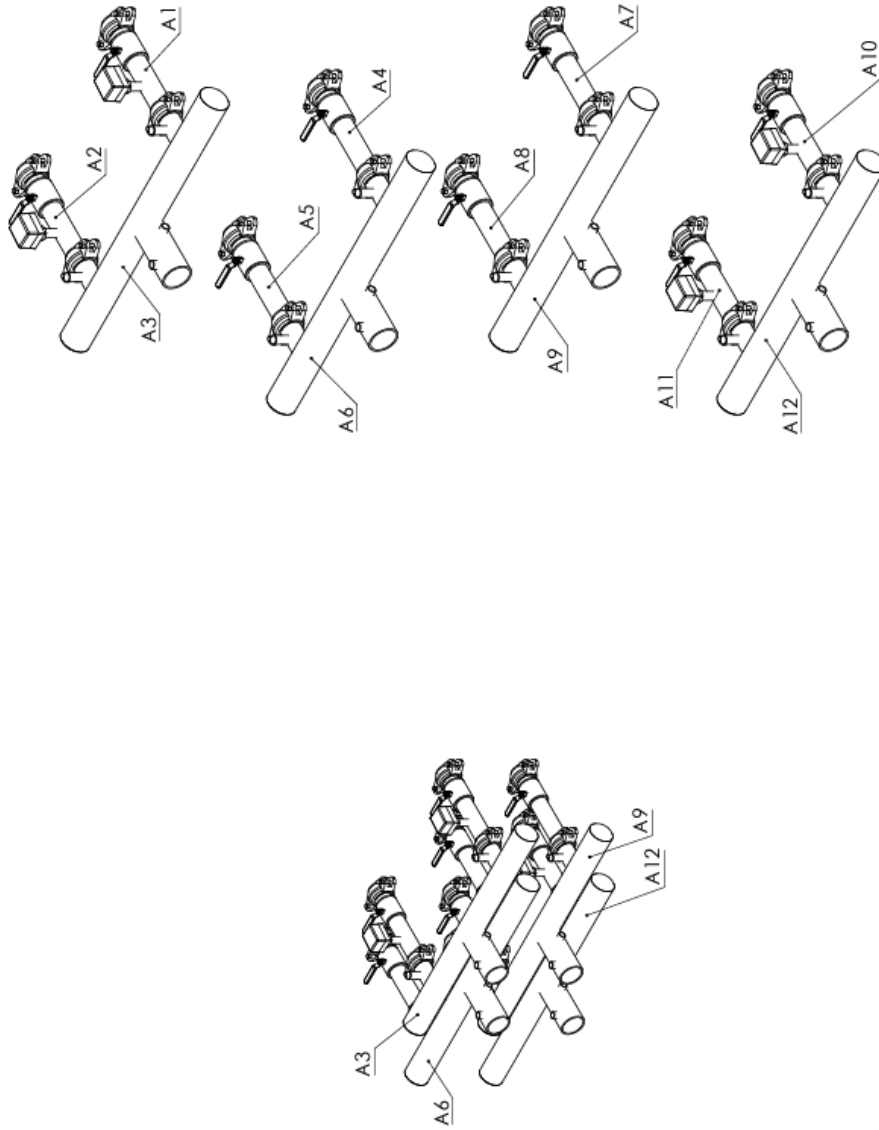


Output Details			
Compressor		System	
Capacity (BTU/Hr)	352583	THR (BTU/Hr)	400416
Power (KW)	27.2	ERE(BTU/Hr)	357826
EER (BTU/W*Hr)	13	Econ (BTU/Hr)	44867
Current (Amp)	22	Mc(lb/hr)	5853
Tdisc (F)	133	Me (lb/hr)	5853
SIT (F)	N/A	Mec (lb/hr)	0
PR (Psi/Psi)	2.9		

11.3 Unit dimensions

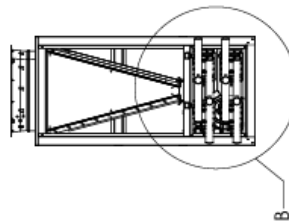
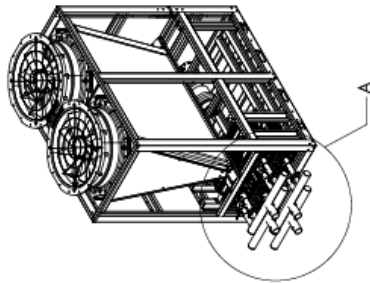
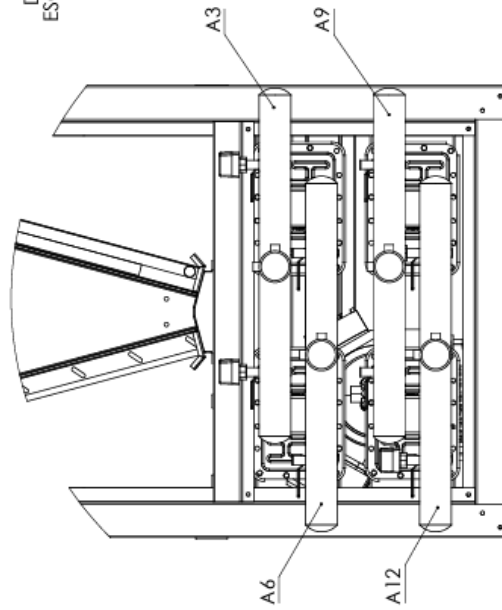
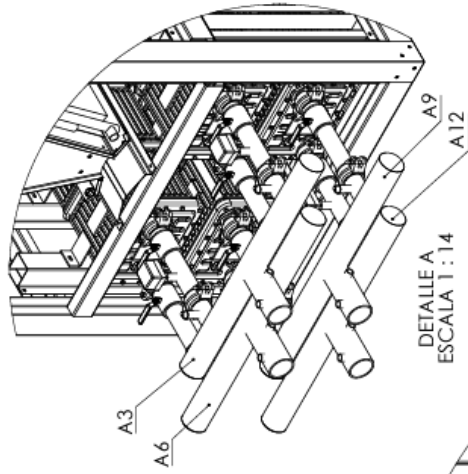


CLEARANCE : ON A LEVEL SURFACE FREE OF OBSTRUCTIONS (INCLUDING SNOW, FOR WATER OPERATION) OR AIR RECIRCULATION (ENSURES RATED PERFORMANCE, RELIABLE OPERATION AND EASE OF MAINTENANCE, AIR RESTRICTIONS MAY COMPROMISE MINIMUM CLEARANCES INDICATED BELOW, RESULTING IN UNDESIRABLE AIR FLOW PATTERNS AND POSSIBLE DIMINISHED PERFORMANCE. ECOCHILLERS WILL OPTIMIZE OPERATION WITHOUT NUISANCE HIGH PRESSURE SAFETY CUTOFF; HOWEVER, THE SYSTEM DESIGNER MUST CONSIDER POTENTIAL PERFORMANCE DEGRADATION, ACCESS TO THE UNIT CONTROL CENTER ASSUMES THE UNIT IS NO HIGHER THAN ON SPRING ISOLATORS. RECOMMENDED MINIMUM CLEARANCES: SIDE TO WALL - 6" ; REAR TO WALL - 6" ; CONTROL PANEL END TO WALL - 6" ; TOP 120" ; NO OBSTRUCTIONS ALLOWED; DISTANCE BETWEEN ADJACENT UNITS - 10" - NO MORE THAN ONE ADJACENT WALL MAY BE HIGHER THAN THE UNIT.



Product Drawing	Unit Tag:				
Product:	Project Name:				
Model: P2 ASHP PIPE 4	Date:				
	Rev:		Sheet:	Scale: 1:25	Tolerance: Dwg Units:[in] mm
<p>IMPORTANT : ILLUSTRATIVE ONLY. CERTAIN DIMENSIONS AND DESIGN CAN CHANGE WITHOUT NOTICE. FOR MORE INFORMATION CONTACT YOUR SALES REPRESENTATIVE. THIS DRAWING IS ILLUSTRATIVE ONLY. CERTAIN DIMENSIONS AND DESIGN CAN CHANGE WITHOUT NOTICE. FOR MORE INFORMATION CONTACT YOUR SALES REPRESENTATIVE.</p>					

CLEARANCE :
 PLACEMENT ON A LEVEL SURFACE FREE OF OBSTRUCTIONS INCLUDING SNOW, ICE, WINTER OPERATION, OR AIR RECIRCULATION ENGINES RATED PERFORMANCE. RELIABLE OPERATION AND EASE OF MAINTENANCE, SITE
 ACCESSIBILITY, AND LOW MAINTENANCE COSTS ARE THE DESIGN GOALS. THE SYSTEM DESIGNER MUST CONSIDER POTENTIAL PERFORMANCE DEGRADATION. ACCESS TO THE UNIT CONTROL CENTER ASSUMES THE UNIT IS NO HIGHER THAN ON SPRING
 ISOLATORS. RECOMMENDED MINIMUM CLEARANCES: SIDE TO WALL - 6" ; REAR TO WALL - 6" ; TOP TO - 6" ; NO OBSTRUCTIONS ALLOWED; DISTANCE BETWEEN ADJACENT UNITS - 10" . NO MORE
 THAN ONE ADJACENT WALL MAY BE HIGHER THAN THE UNIT.



Product Drawing

Unit Tag:

Project Name:

Date:

Model: P2 ASHP PIPE 4

Rev:

Sheet:

Scale: 1:25

Tolerance:

Dwg Units:[in] mm

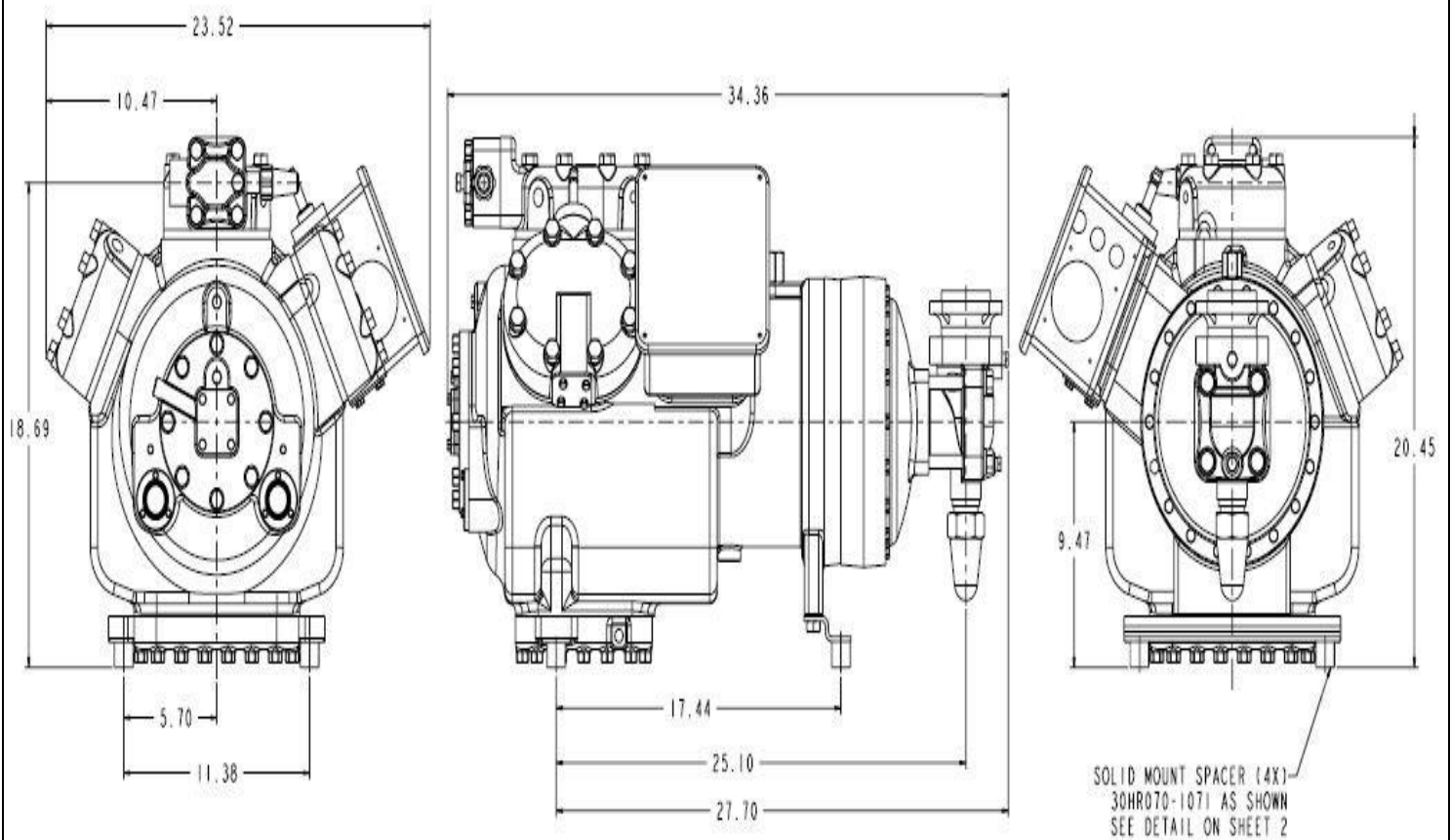
IMPORTANT : THIS DRAWING IS ILLUSTRATIVE ONLY. CERTAIN DIMENSIONS AND DESIGN CAN CHANGE WITHOUT NOTICE. FOR MORE INFORMATION CONTACT YOUR SALES REPRESENTATIVE.

Ecochillers®

Chillers & Condensing Units

Ramón Corona 446-B, 5ta. Avda
 C.P. 06800 Irapuato, Jalisco, México
<http://ecochillers.net> <http://ecochillers.com>

Outline Drawing



Notes: Drawing shows typical model configuration for reference only. Variations in unloading, service valves, terminal box etc.

TECHNICAL DATA SUMMARY

Physical Data

Model	HORSE POWER HP	Nom CFM	Nom hz	Min hz	Max hz	No. of Cylinders	BORE in	STROKE in	OIL CHARGE pints	UL	CE	Suction Line Size (in)	Discharge Line Size (in)	Shipping Weight (lbs)
06EA599	40	99	60	30	60	6	2 11/16	2 7/8	19	Yes	Yes	2 1/8	1 5/8	520

12 ELECTRICAL DATA

12.1 RECIPROCATING ASHP

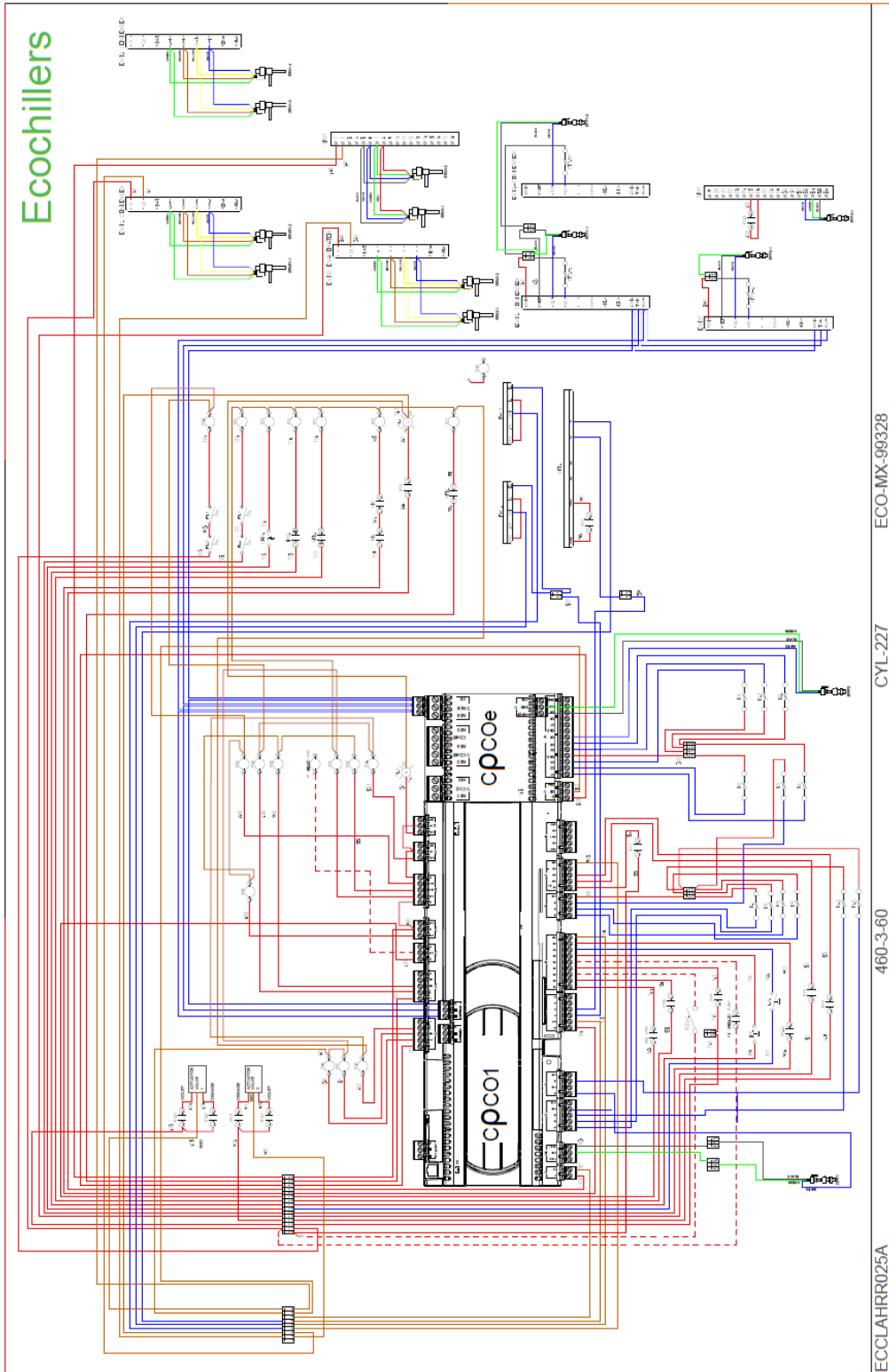
COMPRESOR ELECTRICAL DATA

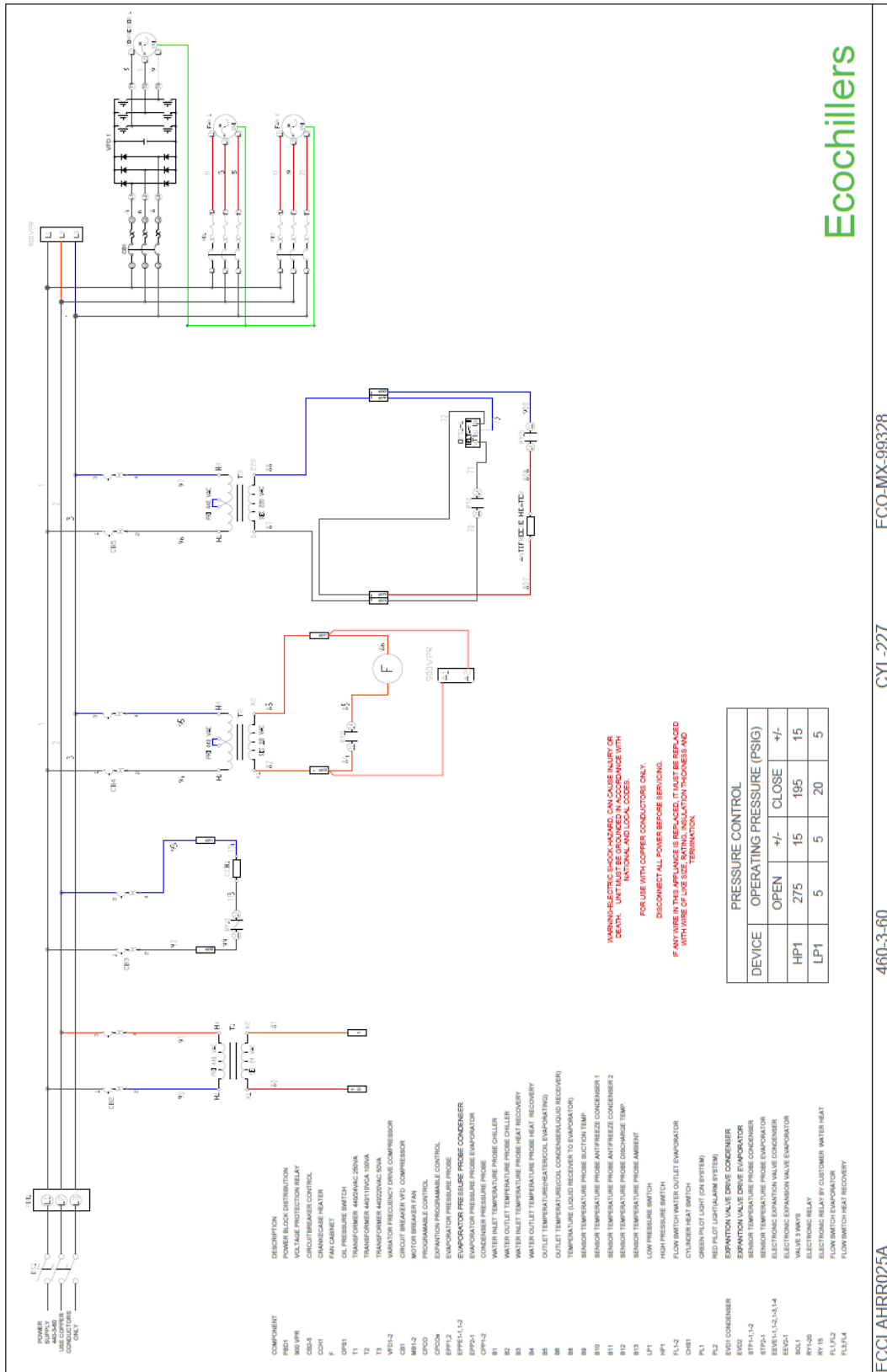
ASHP FRAME SIZE	UNIT VOLTAGE V/Ph/Hz	Supplied		CIRCUIT															
				A		B		C		D		E		F		G		H	
				RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA
25	208-230/3/60	208	240	189	690	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	460/3/60	420	480	95	345	/	/	/	/	/	/	/	/	/	/	/	/	/	/
50	208-230/3/60	208	240	189	690	189	690	/	/	/	/	/	/	/	/	/	/	/	/
	460/3/60	420	480	95	345	95	345	/	/	/	/	/	/	/	/	/	/	/	/
75	208-230/3/60	208	240	189	690	189	690	189	690	/	/	/	/	/	/	/	/	/	/
	460/3/60	420	480	95	345	95	345	95	345	/	/	/	/	/	/	/	/	/	/
100	208-230/3/60	208	240	189	690	189	690	189	690	189	690	/	/	/	/	/	/	/	/
	460/3/60	420	480	95	345	95	345	95	345	95	345	/	/	/	/	/	/	/	/
125	208-230/3/60	208	240	189	690	189	690	189	690	189	690	189	690	/	/	/	/	/	/
	460/3/60	420	480	95	345	95	345	95	345	95	345	95	345	/	/	/	/	/	/
150	208-230/3/60	208	240	189	690	189	690	189	690	189	690	189	690	189	690	/	/	/	/
	460/3/60	420	480	95	345	95	345	95	345	95	345	95	345	95	345	/	/	/	/
175	208-230/3/60	208	240	189	690	189	690	189	690	189	690	189	690	189	690	189	690	189	690
	460/3/60	420	480	95	345	95	345	95	345	95	345	95	345	95	345	95	345	95	345
200	208-230/3/60	208	240	189	690	189	690	189	690	189	690	189	690	189	690	189	690	189	690
	460/3/60	420	480	95	345	95	345	95	345	95	345	95	345	95	345	95	345	95	345

CONDENSER FAN ELECTRICAL DATA

ASHP FRAME SIZE	UNIT VOLTAGE V/Ph/Hz	Circuit A	FLA (each)	Circuit B	FLA (each)	Circuit C	FLA (each)	Circuit D	FLA (each)	Circuit E	FLA (each)	Circuit F	FLA (each)	Circuit G	FLA (each)	Circuit G	FLA (each)
		Quantity		Quantity		Quantity		Quantity		Quantity		Quantity		Quantity		Quantity	
25	208-230/3/60	2	7.2	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	460/3/60	2	5.2	/	/	/	/	/	/	/	/	/	/	/	/	/	/
50	208-230/3/60	2	7.2	2	7.2	/	/	/	/	/	/	/	/	/	/	/	/
	460/3/60	2	5.2	2	5.2	/	/	/	/	/	/	/	/	/	/	/	/
75	208-230/3/60	2	7.2	2	7.2	2	7.2	/	/	/	/	/	/	/	/	/	/
	460/3/60	2	5.2	2	5.2	2	5.2	/	/	/	/	/	/	/	/	/	/
100	208-230/3/60	2	7.2	2	7.2	2	7.2	2	7.2	/	/	/	/	/	/	/	/
	460/3/60	2	5.2	2	5.2	2	5.2	2	5.2	/	/	/	/	/	/	/	/
125	208-230/3/60	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	/	/	/	/	/	/
	460/3/60	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	/	/	/	/	/	/
150	208-230/3/60	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	/	/	/	/
	460/3/60	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	/	/	/	/
175	208-230/3/60	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	/	/
	460/3/60	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	/	/
200	208-230/3/60	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2	2	7.2
	460/3/60	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2	2	5.2







Ecochillers

ECO-MX-99328

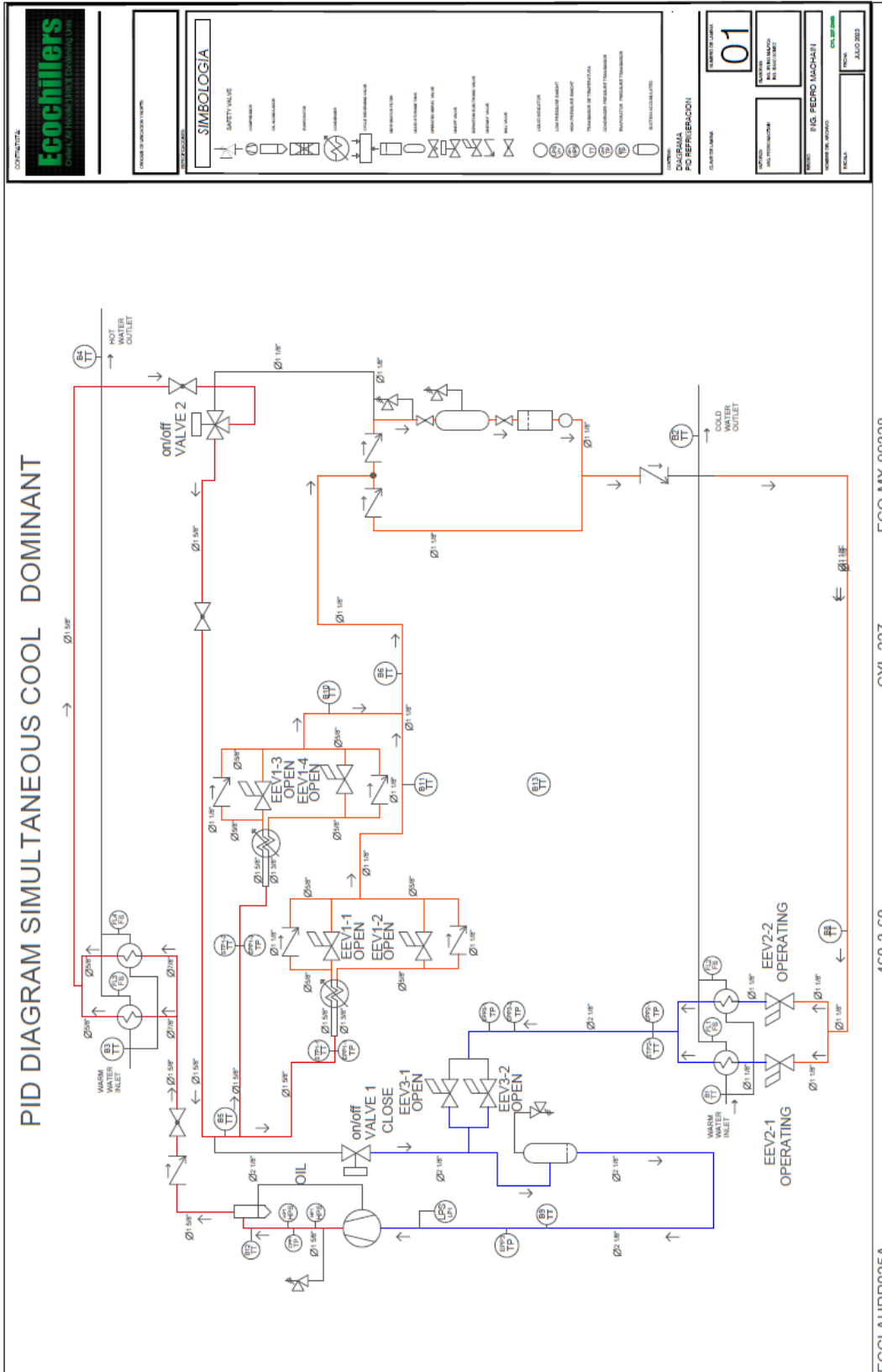
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460-3-60

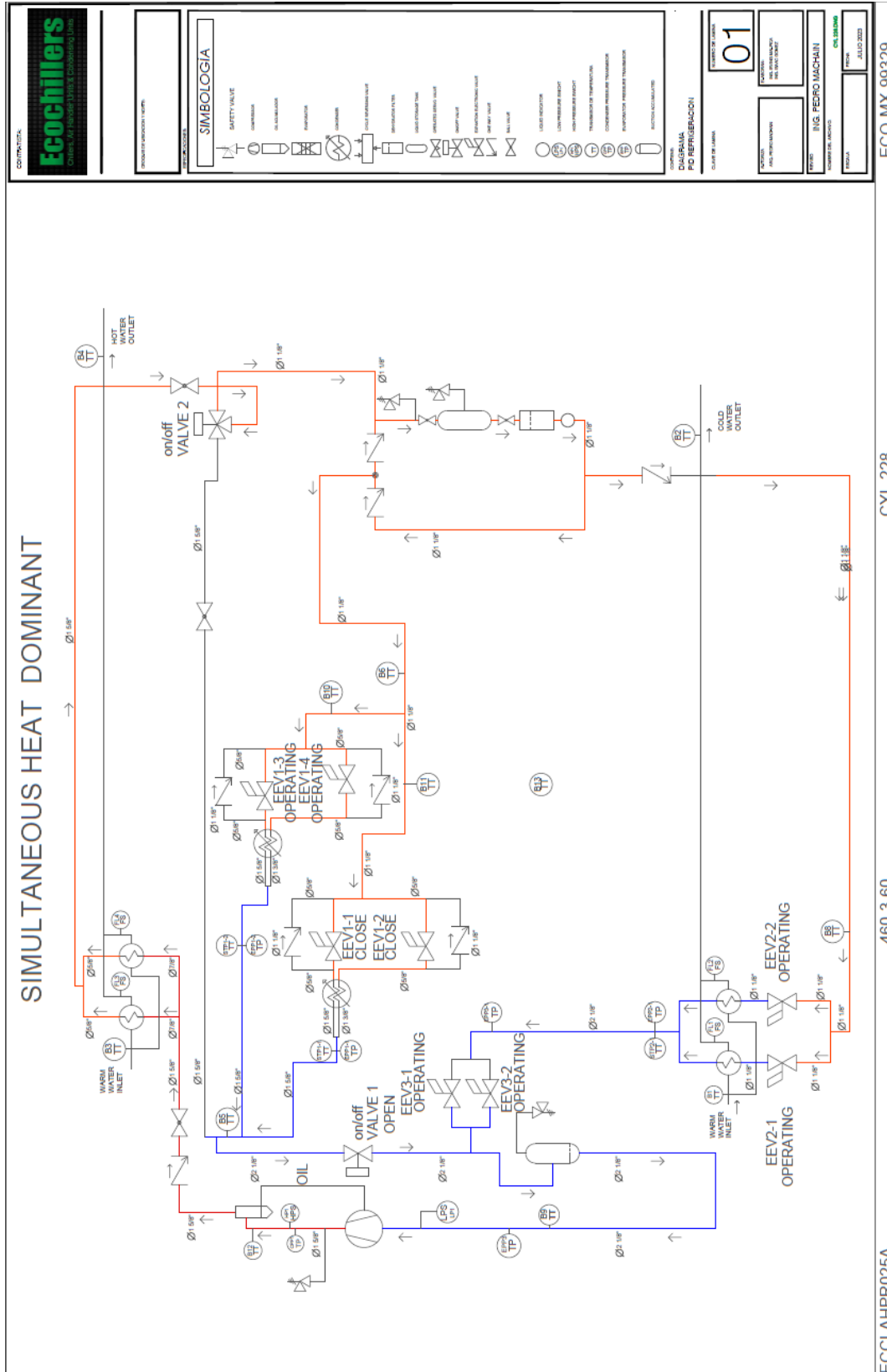
ECCLAHR025A



12.3.2 ECCLAHR025A (SIMULTANEOUS COOLING DOMINANT)



12.3.3 ECCLAHR025A (SIMULTANEOUS HEATING DOMINANT)





14 TROUBLESHOOTING

ANOMALY	CAUSE	SOLUTION
The chiller does not start up	No electric voltage	Check the presence of voltage Check the safety systems upstreams form the appliance
	Master switch at OFF Remote switch at OFF (If present) Control Panel at OFF Main switch at OFF Compressor Magnet circuit breaker at OFF	Position at ON
	Power Supply Voltage too low	Check Power Supply line
	Remote control switch coil broken Circuit board broken Peak condenser broken Compressor broken	Replace the component
Insufficient yield	No refrigerant Appliance dimensioning Functioning outside of operational limits	Check
Noisy compressor	Liquid refrigerant returns to the compressor Inadequate fixing of the pipping connections	Check Fastend properly
	Phase Inverted, compressor moving backwards (in three-phase version only)	Invert a phase
Noise and vibrations	Contacts between metal bodies	Check
	Weak rest	Restore
	Loose screws	Tighten the screws
The compressor stops due to intervention of the safety controls	High pressure Low pressure Low voltage Poor connections, relay contacts Functioning outside of operational limits	Check
	Pressure switch dysfunction	Replace the component
	Circuit breaker interruption	Check power supply voltage Check electric isolation of the windings
High discharge pressure	High external air temperature High water input temperature	Check
	Insufficient air flow Insufficient water flow	Check fan functioning Check pump functioning
	Fan regulation anomalous functioning	Check
	Air in the hydraulic system	Bleed
	Excessive gas load	Check
Low discharge pressure	High external air temperature High water input temperature	Check
	Insufficient air flow Insufficient water flow	Empty and restore the gas load

ANOMALY	CAUSE	SOLUTION
	Fan regulation anomalous functioning	Check
	Air in the hydraulic system	Bleed
	Excessive gas load	Check
High intake pressure	High external air temperature High water input temperature Thermostatic expansion valve too open or damaged	Check
Low intake pressure	Low external air temperature Low water input temperature Thermostatic expansion valve damaged or blocked Water filter blocked Plate heat exchanger blocked	Check
	Insufficient air flow Insufficient water flow	Check fan functioning Check pump functioning
Flow switch error 104	Loose wire on the pump Clogged filter Air in the system, low pressure in the system loop	Check the pump Clean filter Bleed the air

TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD TÜV SÜD
ZERTIFIKAT ◆ CERTIFICATE ◆ 證書 ◆ CERTIFICADO ◆ CERTIFICAT



CERTIFICATE

No. U8 003144 0001 Rev. 00

Holder of Certificate: Ecochillers Corporation s.a. de c.v.
Ramon Corona #645-B
45580 Guadalajara
MEXICO

Production Facility(ies): 003144
Certification Mark:



Product: Cooling and freezing appliances
Industrial Chillers
Model(s): ECCLASabbbb
Where

"a" can be C or H representing type of compressor employed (C: Screw Compressor, H: Semihermetic Compressor)
"bbbb" are four digits numbers representing tonnage

Parameters: Rated Input Voltage: 480Vac
Rated Frequency: 60Hz
Rated Input Current: Up to 258A per circuit Branch, up to 774A combined
Protection Class: PE-Connection

Tested according to: CAN/CSA-C22.2 No. 60335-2-40:2012
UL 60335-2-40:2012

The product was voluntarily tested according to the relevant safety requirements noted above. It can be marked with the certification mark above. The mark must not be altered in any way. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC 17067. Certification is based on the TÜV SÜD "Testing and Certification Regulations". TÜV SÜD America Inc. is an OSHA recognized NRTL and a Standards Council of Canada accredited certification body.

Test report no.: 7169000418-000

Date, 2019-01-11

(Alfio Marrello)



NOMENCLATURE

MODEL SERIES

ECT L A/W 012 A 25/46 N/P ST/B HR 4 B E S L

PRODUCT CATEGORY
ECT= Scroll
ECC= Ultra (semihhermetic, screw)

REFRIGERATION SYSTEM TYPE
L= Liquid chiller

APPLICATIONS
A= Air cooled scroll compressor
AP= Air cooled process includes recirculating pump, tank, float level ctrl.
ASH= Air cooled semihermetic compressor
ASHP= Air cooled semihermetic compressor process
ASC= Air cooled screw compressor
ASCP= Air cooled screw compressor process
W= Water cooled scroll compressor
WP= Water cooled scroll compressor process
WSC= Water cooled screw compressor
WSH= Water cooled semihermetic compressor
WSCP= Water cooled screw compressor process
WSHP= Water cooled semihermetic compressor process

NOMINAL COOLING CAPACITY-MBH

ECT/NANO/PICO		ULTRA	
012= 1 ton	025= 25 ton	011= 10.7 ton	068= 59.6 ton
018= 1.5 ton	030= 30 ton	013= 12.6 ton	072= 68.8 ton
024= 2 ton	035= 35 ton	015= 14.9 ton	090= 86 ton
003= 3 ton	038= 38 ton	018= 17.2 ton	108= 103.2 ton
005= 5 ton	040= 40 ton	022= 21.4 ton	126= 120.4 ton
008= 7.5 ton	050= 50 ton	026= 25.2 ton	144= 137.6 ton
010= 10 ton	060= 60 ton	031= 29.8 ton	158= 154.8 ton
013= 12.5 ton	070= 70 ton	036= 34.4 ton	180= 189.2 ton
015= 15 ton	105= 105 ton	047= 45 ton	200= 189.2 ton
020= 20 ton	140= 140 ton	053= 51.6 ton	215= 206.4 ton

AIR FLOW
A= Standard motor

VOLTAGE OPTIONS
25= 280/230/3/60
46= 460/3/60
38= 380/3/50
57= 575/3/50
06= 220/1/60
05= 110/1/60
40= 400/3/50

SERIES TYPE
N= Nano
P= Pico

HEAT EXCHAGER TYPE
ST= Shell and tube
B= Brazed plate
O= Open
SB= Shell box

OUTSIDER BRAND
L= Lennox
C= Carrier
Y= York

NATURAL ENERGY RESOURCE
S= Package of solar panels included

FAN OPTION
E= Electronically commutated fan

COMPRESSOR OPTION
B= Brush less compressor
V= Variable speed compressor
H= Hybrid compressor system (standard scroll + brush less scroll)

HEAT OPTION
HR= Heat recovery
HP= Heat pump

REFRIGERANT TYPE
4= R-410A
5= R-507
47= R-407C
22= R-22
14= R-134A

23/03/22

NOTE
Double underline can be inside or outside the model series

IMPORTANT NOTE
Any model change not found in the chart, will be analyzed by the engineering department for its approval, there's not allowed to be changes without prior notice.

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