

High
Efficiency
Solutions.

CAREL

Solutions for air-conditioning units and systems

[carel.com](https://www.carel.com)

Control Solutions and Humidification Systems for HVAC/R



high efficiency solutions

Can protecting the environment be reconciled with our industrialised society? Yes, today this is possible.

Indeed, this is the concept of sustainable development: improving the quality of the life, without overloading the supporting ecosystems that it depends on, now made possible by progresses in technology.

While until recently sustainable development was simply a desire, a cost and an obligation defined by legislators so as to bequeath a healthy planet to future generations, today it is the only plausible choice. Changing public awareness continues to focus on the more worthy companies, rewarding these with higher sales. A need has thus become an opportunity, a chance not to be missed to unite the need to develop products and services that save energy with the possibility to effectively reduce environmental impact.

To encourage sustainable development, many activities are underway as concerns both the environmental policies of individual nations and international organisations (above all the European Union), and specific research and development work.

Today, then, solutions to combat global warming and pollution, to live a sustainable existence, to make our cities more liveable and our factories more efficient and virtuous all exist: the technology is here.



CAREL has always developed and promoted evolved control systems, proposing innovative solutions in the HVAC/R sector. These are our "high efficiency solutions", a clear response for environmental protection through optimised and integrated control systems, capable of bringing significant energy savings and consequently reducing environmental impact. These are new solutions for the market, yet the choices made are still in line with our tradition: we have always invested in R&D, right since we first started business, and we continued to do so despite the global recession.

These cutting-edge control solutions are now available, and their full potential is ready to be exploited, to achieve an effective competitive advantage on the world scene and be rewarded by the market.

Using CAREL "high efficiency solutions" today means doing something concrete to contribute to protecting the environment. It means looking to the future with confidence.

Integrated solutions for high efficiency units

Higher performance solutions for maximum seasonal energy efficiency

With the European Energy Package, the EU has established targets to be met by 2020: 20% reduction in carbon dioxide, a gas responsible for the greenhouse effect, 20% increase in renewable sources, 20% increase in energy efficiency. The RES Directive (Renewable Energy Sources) has defined binding national objectives for Member States.

Within this context, evaluation of the energy efficiency of air-conditioning and heating units has evolved with the introduction of the Seasonal Performance Factor (SPF), which takes into consideration different seasonal climatic conditions.

The new criteria for calculating efficiency require manufacturers to provide the average seasonal performance coefficients for the units in specific reference conditions (Energy Efficiency Ratio - EER): the factors that affect such calculations assume unit operation at part load for a considerable amount of time.

To reach the predefined seasonal performance target requires the use of advanced control algorithms and cutting-edge technology to ensure effective control of the refrigerating unit at part loads.

Management of variable speed compressors with DC inverters, together with the use of the electronic expansion valve in fact allows the widest heat output modulation capacity currently available, maximising performance of the unit in response to the changing thermal loads and climatic conditions throughout the year. The added possibility of exploiting serial communication to control smart actuators (pumps, fans...) represents a further step forwards in the development of more reliable and efficient units.



-30%

Integrated management of DC inverter compressors and the electronic expansion valve ensures very high energy savings compared to a traditional solution.

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Applications



residential

With its residential air-conditioning solutions, CAREL represents a reliable and innovative technological partner for manufacturers of heat pumps and all operators (manufacturers, installers, system integrators) who want to offer an integrated controller for indoor comfort in the home and domestic hot water production systems, focusing on energy efficiency, respect for the environment and optimisation of resources, as well as easy operation and complete user satisfaction. To achieve these results, CAREL pays special care to technological innovation, usability and access to information.

Technological innovation

pCO sistema+ allows management of variable speed compressors with DC inverters that, when combined with electronic expansion valves, ensure the most extensive modulation of heating and cooling capacity currently available, maximising residential air-conditioning system efficiency in response to different comfort requirements and different climatic conditions throughout the year. Continuous evolution of the pCO series programmable controllers, the heart of the

system, guarantees performance is always in line with new needs.

Usability

The pGD touch series touch screen graphic displays make interaction between users and systems simple and appealing, even on complex systems with sophisticated operating logic.

Access to information

Real time monitoring of operating conditions on installed units, recording of data in abnormal situations, maintenance management, setting desired temperature in the home from a smart phone; these are just some of the many opportunities provided to designers and users of home systems, through the possibility to access CAREL systems at any time and from anywhere.

Continuous technological innovation and information management mean the units and systems developed are increasingly efficient, optimising performance, reducing running costs, improving reliability and guaranteeing clear and simple (and therefore effective) interaction with users.

Residential installation with air-water heat pump



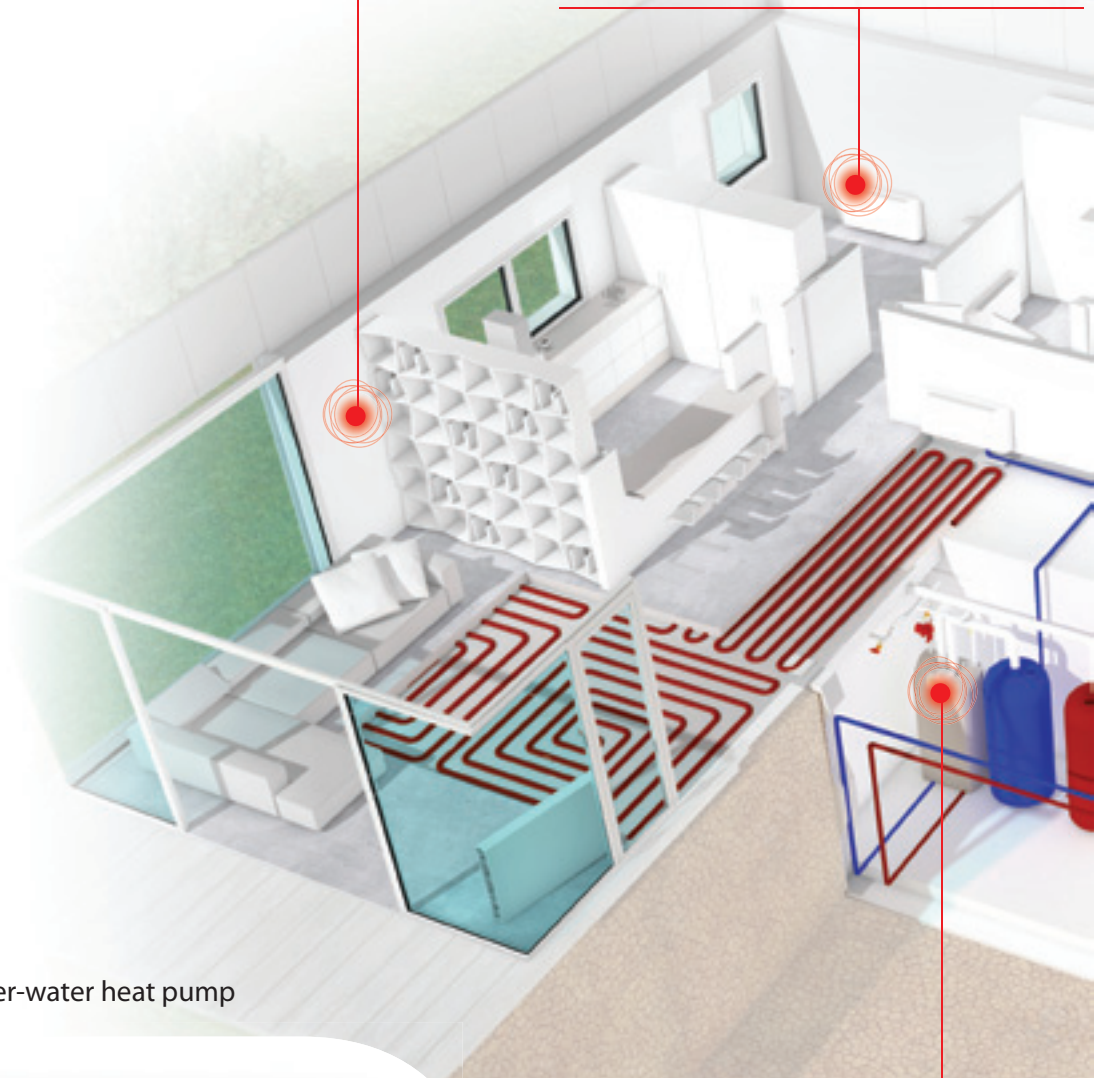
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humiSonic
Ultrasound humidifiers



e-drofan
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Residential installation with water-water heat pump



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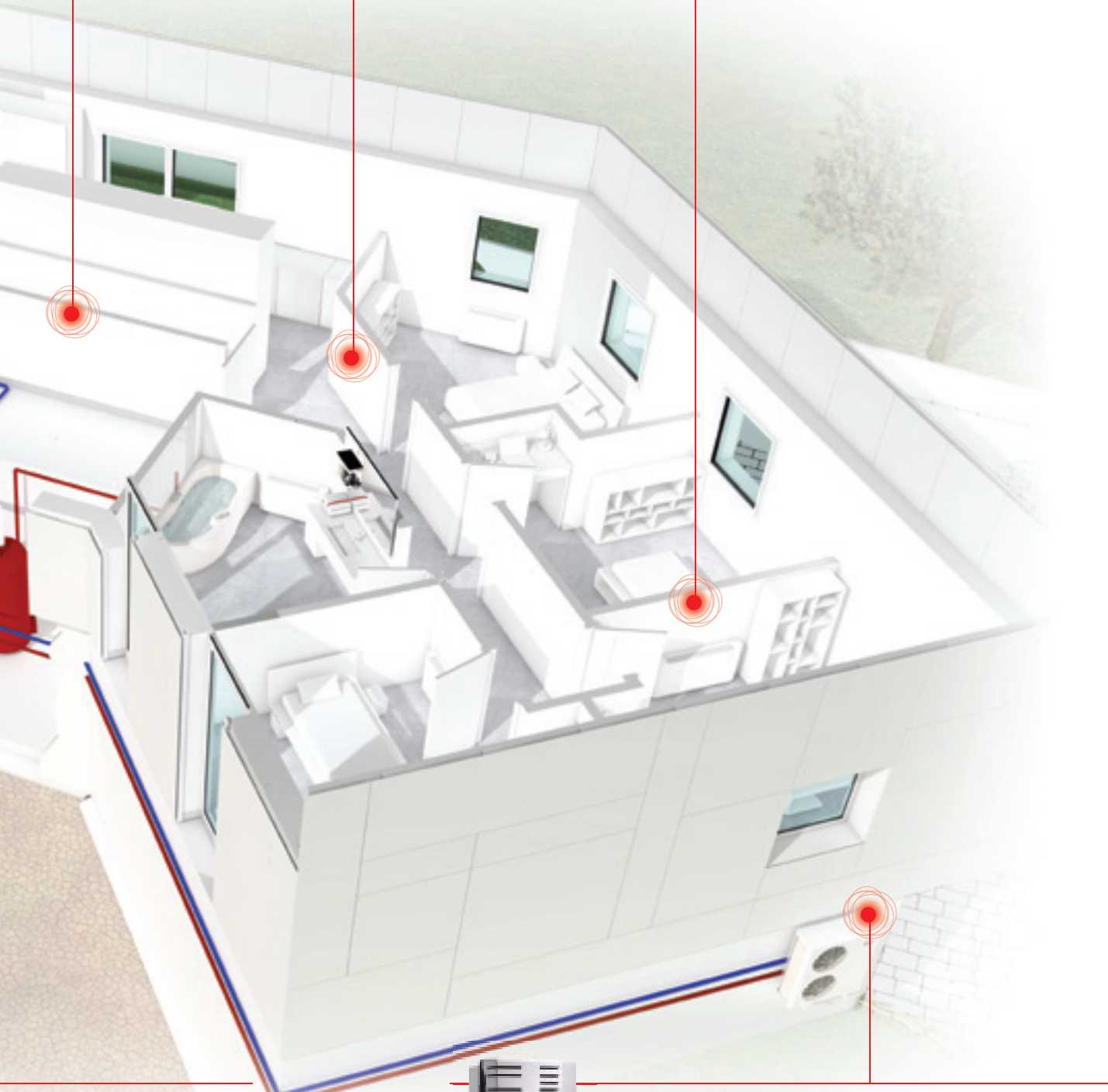
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Temperature-humidity probe
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NTC probes
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NTC probes and transducers
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pCO sistema

The wide range of pCO sistema programmable controllers is especially suitable for residential applications. In particular, the various different sizes available and extraordinary flexibility in managing sensors, external devices and serial communication, mean pCO sistema can be successfully used to:

- control units: more powerful, precise and flexible controllers increase heat pump efficiency (thanks to more accurate control temperature measurement, for example) and introduce new technologies (such as variable speed compressors). In addition, increasingly integrated solutions simplify the use of indispensable devices such as electronic expansion valves;
- manage systems: precise control of hot and cold water distribution from the heat pump to the utilities (radiant panels, fan coils, heat recovery units...), optimising system performance and guaranteeing maximum comfort;
- integrate heat sources: by controlling the operating conditions of each device, maximum efficiency can be achieved at any time at the lowest cost, enabling the most suitable heat source.



power+

power+ is the CAREL solution to control variable speed brushless compressors. Capacity modulation based on actual instant demand is the most effective strategy for reducing consumption, while at the same time increasing unit performance. Extension of this technology into the residential market is the key to the success of any policy for reducing consumption and CO₂ emissions.



ExV sistema

Electronic expansion valves are extremely effective devices for controlling air-to-water heat pumps, as they extend the unit's operating range in response to different outdoor conditions throughout the year, thus optimising operation. The advent of variable speed brushless compressors means these devices are essential in order to exploit the complete range of capacity modulation.



1tool solutions

CAREL has also focused special attention on residential applications when developing its 1tool programming solution: both dedicated application programs (SmartHP) and standard modules are available to make introducing innovative technology simple and reliable. These have been thoroughly tested at the CAREL thermodynamics research centre, and developed in collaboration with the leading and most innovative manufacturers of brushless compressors, fans, and so on.



pGD and pGD touch terminals

Whether developing the user interface for a heat pump or centralised point of access for managing the complete system, the pGD and pGD series terminals touch offer a highly attractive and technological solution. This aspect is particularly important in residential applications, where easy operation and technological appeal are decisive factors for end users.



Temperature, pressure and combined sensors

CAREL proposes a complete range of sensors for temperature and pressure control, both on the units and in rooms. Each individual function (water temperature, compressor discharge temperature or room temperature control) can be managed by the different versions available, which stand out for the range of measurement, sensor protection and protective materials used.



e-drofan

e-drofan is the CAREL solution for controlling fan coils, and is perfect for systems that exploit serial communication between the heat pump and utilities to create a "system" that can operate in the most efficient and effective way and guarantee maximum comfort at all times.



humiSonic

humiSonic creates the ideal humidity level for personal comfort. This ultrasonic humidifier, installed inside fan coils, eliminates the annoying effects of dry air in winter: cracked skin, sore eyes, runny nose and dry throat. In addition, low air humidity causes breakages and cracks in objects made from wood (paintings, furniture, parquet), paper and fabrics, problems that humiSonic resolves through providing a stable and optimum humidity level.



air-conditioning in commercial applications

Air-conditioning represents the process that enables and maintains specific temperature, relative humidity and indoor air purity conditions. Over and above outdoor conditions, this process enables, via the control of four variables, (air temperature, humidity, movement and quality), hygroscopic comfort for the occupants of a specific environment. In commercial buildings, there are two solutions to achieve such comfort : hydronic systems and air-to-air systems. In hydronic systems, water is used as a heat exchange fluid. The units producing hot or cold water to provide comfort are called chillers. Beside the chiller units, there are hydronic terminals (fan coils) and air handling units that heat and chill the individual environments, managing air quality. On the other hand, the fluid used for the heat transfer in air-to-air systems is air. The units used in these types of systems are air handling units and roof-tops. The latter are also called packaged units because they come in a single unit comprising the refrigerant circuit and the air handling section.

CAREL's control offering for commercial applications is based on programmable controllers, scalable in terms of inputs/ outputs depending on the application to manage and having a full range of accessories such as displays, sensors and options such as communication modules that can offer a reliable, yet flexible solution, to respond to various needs. One important aspect regarding commercial buildings is high electricity consumption. For this reason, another distinctive feature of CAREL's offering is the continuous technological innovation to integrate into your own system, high-efficiency devices such as electronic expansion valves, and drivers for brushless variable speed compressors, which are elements of fundamental importance for achieving high energy efficiency applications in the services sector and minimising environmental impact.

CAREL offers a complete solution for climate control in commercial applications while maintaining optimal conditions of air temperature, humidity and purity and at the same time ensuring high unit efficiency to minimise power consumption and environmental impact.



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terminals" p. 39



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th-Tune
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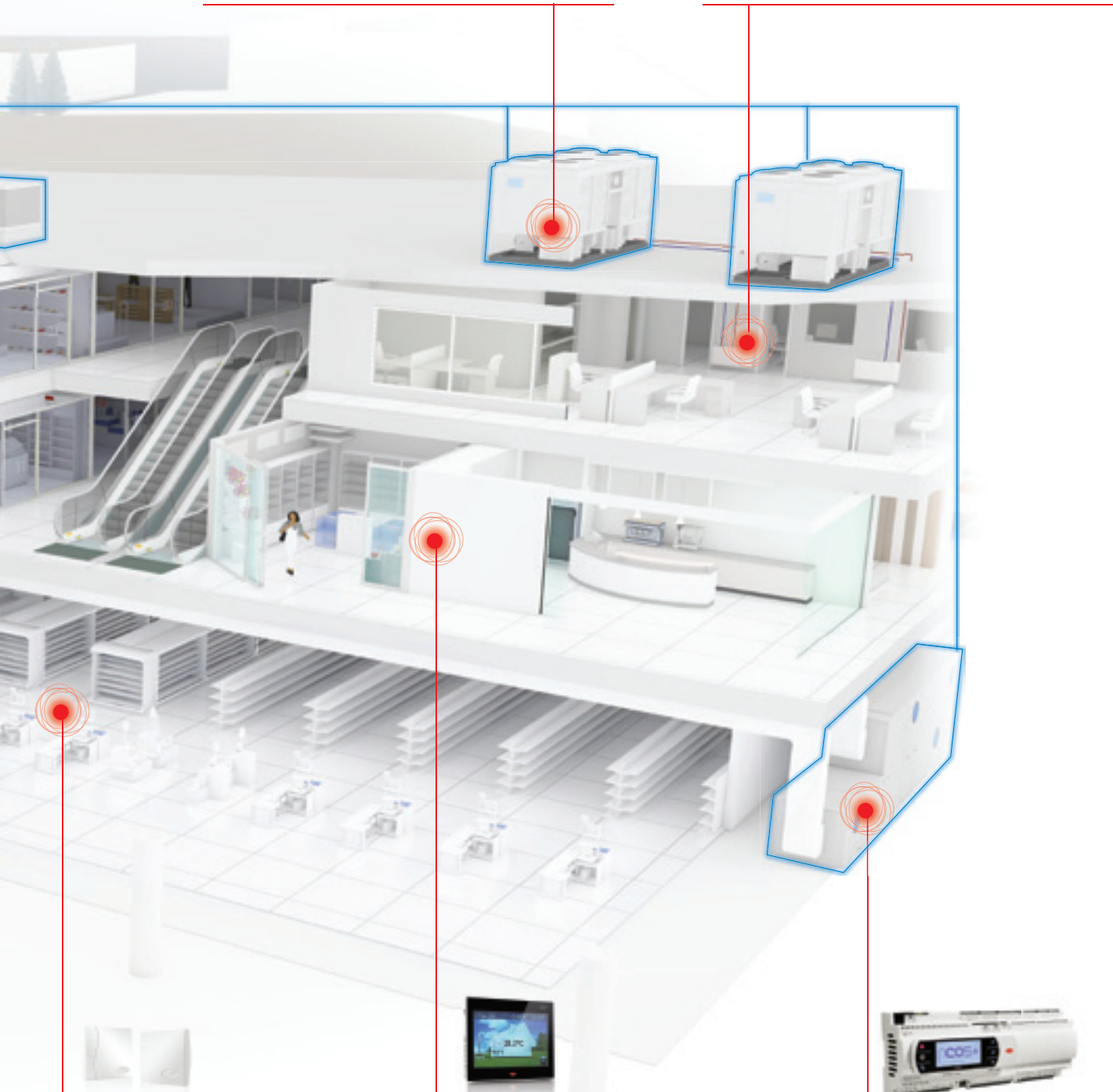
E4V and EVD ultracap
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Air quality probes
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Solution for chillers/heat screw-type pump

The CAREL solution has been developed around the new range of programmable controllers pCO5. The application allows you to manage and control air/water units or water/water units with screw-type compressors with stepless or stepped splitters. The maximum configuration includes a screw compressor for each circuit, up to 2 circuits. The application allows the control of the envelope of the main compressors on the market (Bitzer, Refcomp and Hambell), thereby ensuring the utmost reliability.



Solution for roof-top units

The CAREL solution allows to manage the temperature and humidity of the roof top unit with two circuits and 4 compressors. Specific functions such as free cooling and free heating, optimise the operation of the unit, taking advantage of the outdoor temperature while saving energy at the same time. The maximum configuration includes 4 hermetic compressors (2 per circuit), 2 resistors and an integrated or external humidifier. The application also manages air quality and heat recovery.



Solution for AHU

The CAREL application program CAREL for AHU allows adjustment of the main devices that contribute to the control of temperature, humidity and air quality: dampers, heat exchangers, humidifiers and fans. The functions are developed with algorithms of the PID type, in this way the user is able to structure a fine adjustment of the plant, for the various devices. The application also offers maximum adaptability to any type of AHU, the installer, in fact, can customise by changing the electrical wiring from the terminal position of the inputs and outputs.



Terminals

CAREL offers a wide range of terminals to respond precisely to customer needs:

- pGD Touch is the new range of touch screen displays designed to make user navigation easy and intuitive.
- pGD1, the basic model of the pCO sistema family "terminals", designed with graphic LCD for versatility and customisation while maintaining a high aesthetic standard.
- th-Tune, the room terminal that allows the user to adjust the temperature and humidity in a residential or light commercial environment.



EVD EVO and Ultracap module

The CAREL electronic valve driver allows stable and efficient control of the unit. The new ultracap module ensures the closing of the electronic expansion valve in the event of power failures. The advantages of the Ultracap module include lower unit costs because the solenoid valve * can be removed, the space in the cabinet (a module handles up to 2 electronic valves) is reduced and there is a low environmental impact because harmful elements for the environment such as lead are not used. The Ultracap is available in the integrated version on the pCO5 or as an external module. *combined with CAREL valve.



tERA

tERA is a new CAREL platform based on cloud servers, for monitoring and centralised control of installations. Connectivity to the installation is simple and straightforward, thanks to the wireless transmission, and in this way the system is able to collect all the site data via GPRS, a channel that is independent of site infrastructure. Therefore it is possible to access, at any time and anywhere, all the site information through any means available: desktop PC, tablet or smartphone. Reports, charts and alarms allow you to quickly assess the status of the unit and make the appropriate changes to improve its operation remotely or plan any necessary targeted operations on site.



datacenters – precision air-conditioning

Air conditioning is one of the essential infrastructures for the operation of Information Technology equipment: processing and storage devices produce heat which has to be removed to maintain optimal operating conditions. Increasing use of IT technologies in every activity has made the continuity of service imperative, often spoken of as “Mission Critical” applications. The high power installed, up to 2 kW/m², also requires the development of “Energy Saving” solutions. For the proper functioning of IT equipment, the inlet air must be at a controlled temperature (typically between 22 and 27° C) so that the fans on the devices can cool the chips inside. Moisture is also frequently controlled, since values that are too low increase the probability of electrostatic discharge while any excessive values accelerate corrosion or slow down the performance processes of some equipment.

The technological solution most widely used today is the so-called Computer Room Air Conditioner (CRAC) or Close Control Units (CCU) which, installed on the perimeter, provide for cooling the air in the room and any humidification or dehumidification to maintain the set point;

these air conditioners are equipped with fans, cooling coils with direct expansion or chilled water, and often heater humidifiers to correct the temperature if it reaches a minimum limit.

The continuous development of technology and the constant search for energy savings are reflected in an evolution of air-conditioning solutions: from monitoring the distribution of the air to the development of air conditioners placed near heat sources, using motors with permanent magnets for high efficiency, the use of Air Handling Units for freecooling, where possible and by lowering the temperature with adiabatic humidifiers (Evaporative Cooling).

Such a wide variety of configurations requires flexible control solutions, based on scalable, programmable controllers and equipped with a full range of accessories such as displays, sensors and communications modules, integrated in a system that includes high-efficiency devices such as the electronic expansion valve and drivers for brushless variable RPM compressors.

CAREL offers the most complete and developed range of solutions for air-conditioning control in datacenters, a “Mission Critical” application with high heat disposal: flexible, reliable, customisable and integrated systems to optimise efficiency by guaranteeing continuous service and energy savings.



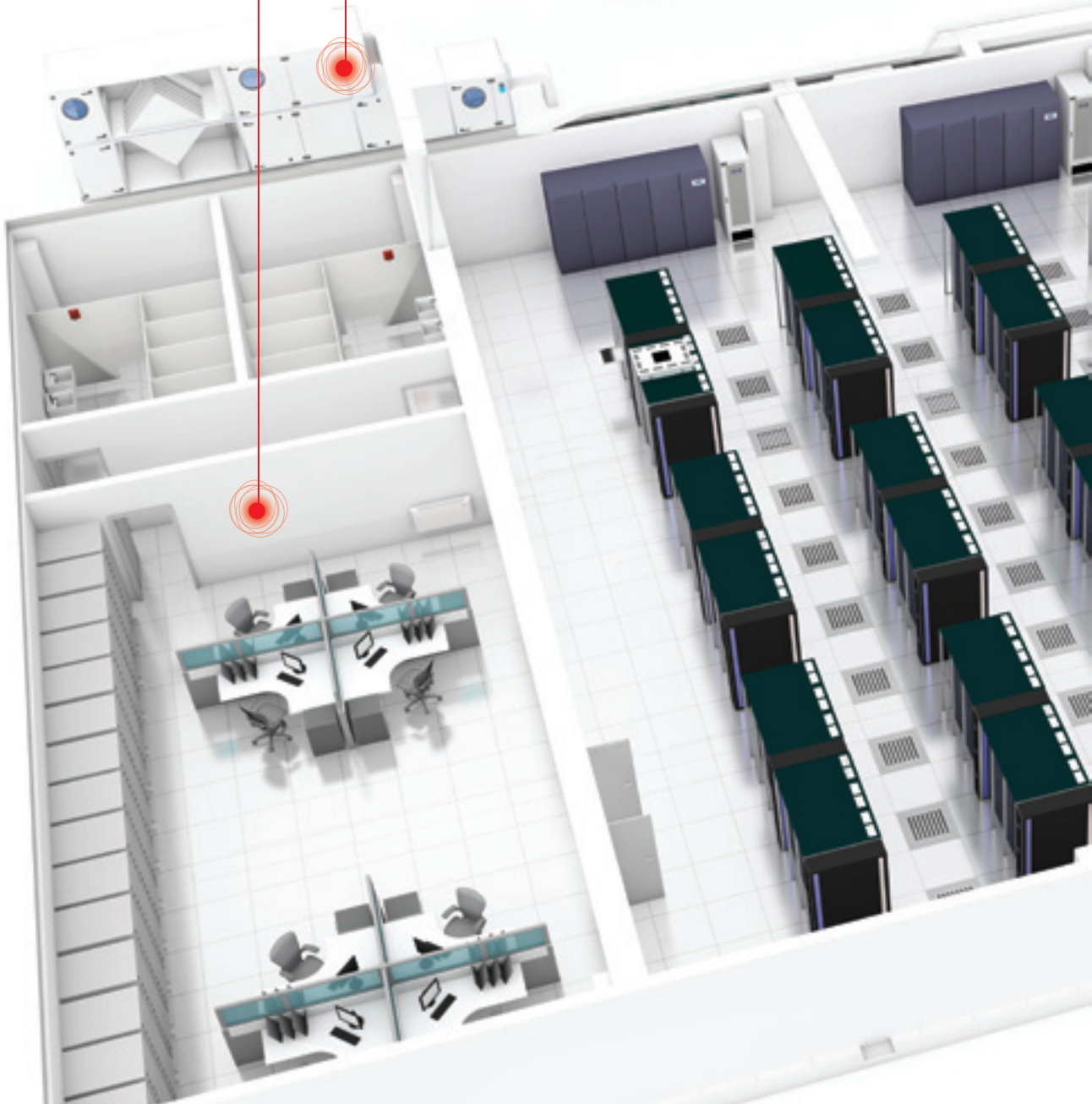
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pCO5+
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Stand-alone speed regulators
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CPY
Immersed electrode
humidifiers



Differential pressure
transducers
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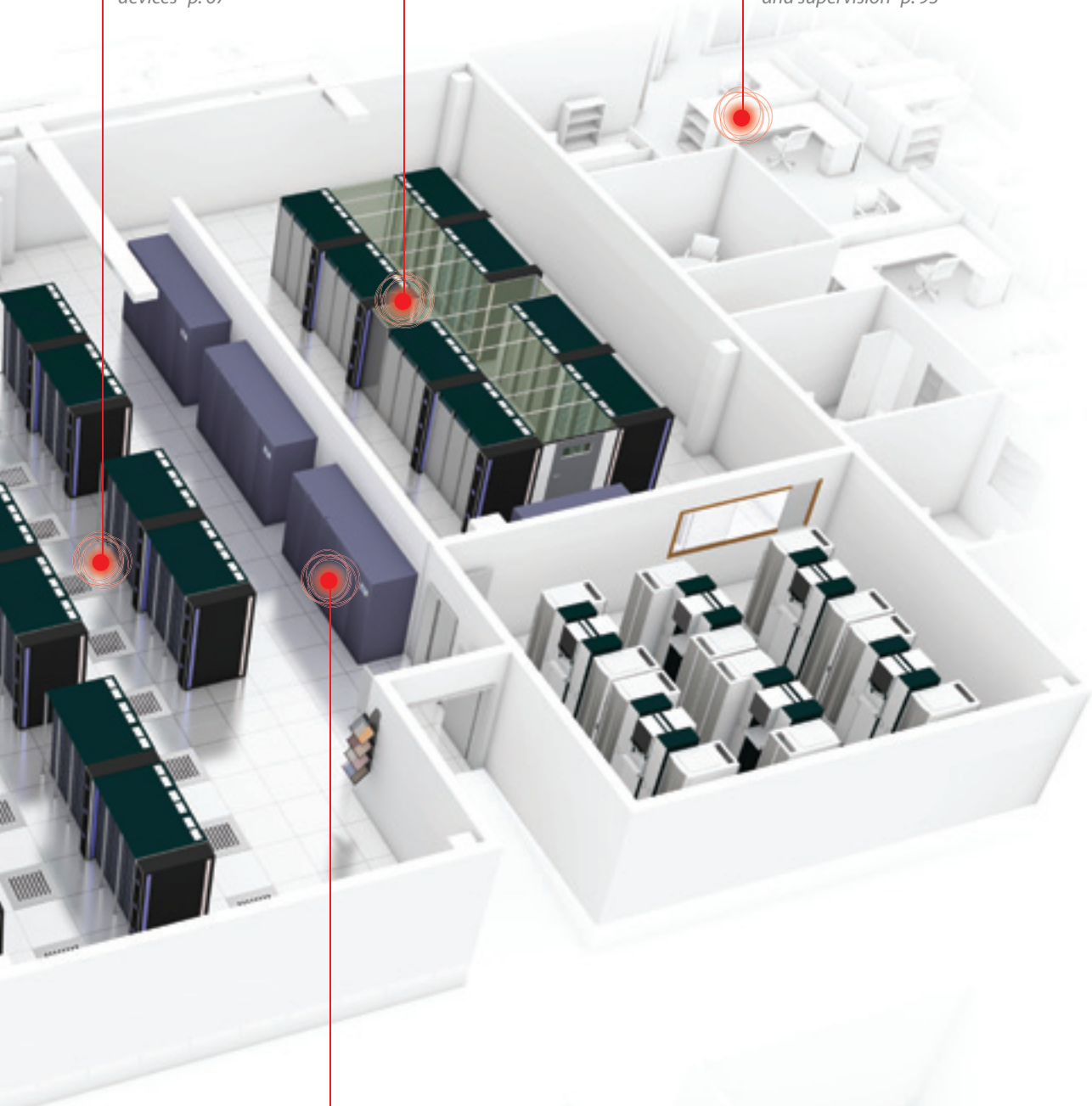
Flood detector
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pCO compact
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PlantVisorPRO
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Temperature humidity probe
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Pressure transducer
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E2V smart
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CRAC unit with direct expansion: pCO5+ with valve driver

pCO5 + integrated two-pole driver for an electronic expansion valve is an ideal solution for Computing Centre air conditioners (CRAC units) with direct expansion: the response speed and the wide control range in this technology optimises superheat, keeping operating parameters stable under varying conditions, especially in the case of compressors with variable displacement and multiple compressor circuits. The integrated driver also allows advanced control logic to optimise the transition and help to bring operating conditions within the parameters inside the envelope defined by the manufacturer. EXV technology is ideal in all contexts where air-conditioning works year-round since it makes the lowest condensing pressure setting possible, with considerable energy savings.



power+: supply control unit

The power + for handling BLDC variable displacement compressors represents an extremely advantageous solution for CRAC with direct expansion because it optimises efficiency at part loads and controls the CRAC supply temperature without the need for reheating. The possibility for modulation in this technology allows proportional sizing for the units under normal operation with part loads, producing the maximum cooling capacity only in a case of an anomaly on one of the units or overheating, representing a viable alternative for redundancy.



CPY with integrated serial KUE

The introduction of outside air and the dehumidification produced by cooling coils often requires humidification. The KUE series of humidifiers with immersed electrodes is the compact and reliable solution for air humidification inside CRAC units. The CPY control provides optimal management of the humidifier by optimising starts, transients and draining: integration with pCO5 via serial port means parameters can be displayed and set as part of control synergy.



Solutions based on connectivity

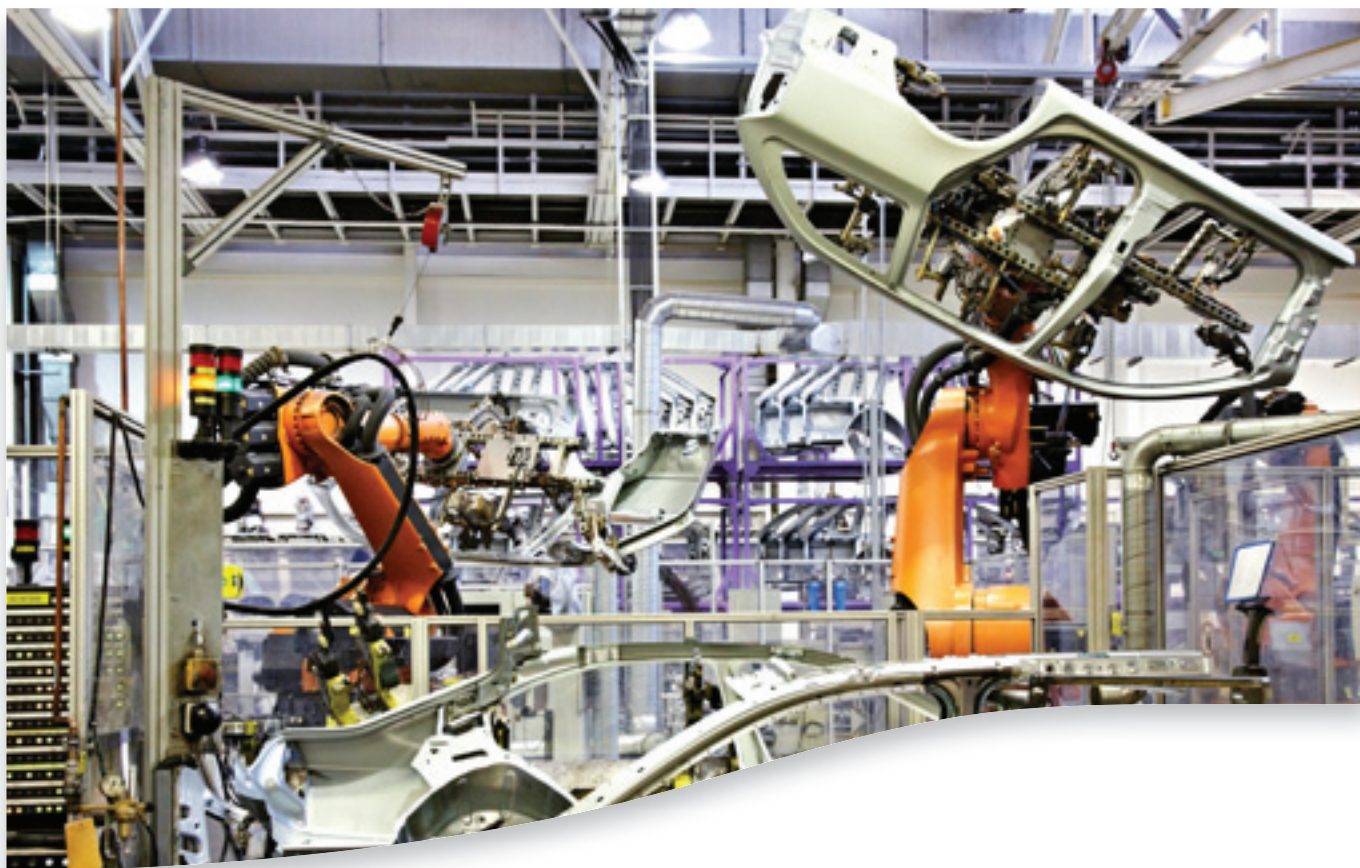
Flexible high-profile solutions often require the use of serial communication: the pCO5 + range is designed to support multiple communication levels, emphasising the benefits of sharing information. All pCO5 + controllers with embedded serial "pLAN" for communication between devices support distributed logic, often for multiple unit operation with synergy and redundancy of Mission Critical applications. The serial "fieldbuses" on the pCO5 + are ideal for managing the devices inside air conditioners, optimising the operation thanks to the greater amount of information acquired compared to simple hardwired logic. pCO5 + , which can have

up to two serial fieldbuses (one integrated and the other with an optional card) is the ideal solution to simultaneously drive both CAREL devices and those made by third parties with different protocols or speeds, such as fans, pumps, valves, network analysers, etc. pCO5 + , by supporting two serial BMS, lets you share information with both the general supervisory system always installed in the datacenter, and with a supervisor dedicated to air-conditioning or a remote monitoring system for remote assistance and service.



pCO compact: rack cooling

Ever increasing power density in the server has led to the development of the so-called "rack" air conditioners, positioned side by side on racks containing the equipment, or even inside them. These units can use cooled water or direct expansion, and are extremely compact. In these contexts the pCO5 + compact version represents an ideal solution that combines all the features of the pCO5 + family in terms of connectivity, I/O flexibility and processing power with a footprint of just 6 DIN modules. Using analogue outputs or a serial connection it can manage multiple modulating fans for differentiated ventilation at different heights of the rack.



industrial processing

Processing temperature control

In industrial processes there are many components which make use of temperature control: temperature controllers for plastic moulding units; dryers for plastics or compressed air, enclosure air conditioners for electrical cabinets, and chillers and cold water production systems (e.g. adiabatic cooling systems).

To meet these extremely varied needs, Carel offers a range of controllers and user interfaces, from the simple thermostat to the pCO5 + series programmable systems, with its graphical user interfaces and touch-screens.

Engineering

The complexity of temperature control in industrial processes can be addressed using universal controllers with 1 or 2 loops only in the simplest cases (for these applications, CAREL offers the Universal IR33 also featuring PID). In all other cases it is essential to have a programmable controller, which is flexible both in I/O configuration and with the ability to handle various communication ports with different protocols while also having

a system with simple programming, complete with an extensive library; for this type of needs Carel offers the pCO Sistema + which provides all the features mentioned.

Usability

Thanks to the pGD touch series graphic display touch screen, user interaction is made easy and comprehensive even while using complicated systems and sophisticated operating logic.

Communication

The temperature control applications in industrial processes are increasingly diversified and require the integration of many types of controllers. Thus it becomes crucial to communicate using international and manufacturer-independent standards, which can be flexibly combined, such as Modbus®, LON, BACnet, etc.....

Processing temperature control needs a wide range of technologically advanced products, from the simple thermostat with PID and autotuning to programmable controllers and with graphical user interfaces and touch screens to simplify operations for the user.



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ir33 universale
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humiSonic
Ultrasound humidifiers



easy



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E^V e EVD ultracap
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ChillBooster
Atomisers - evaporative
cooling



pCO sistema

The wide range of pCO Sistema programmable controllers is particularly suitable for industrial applications. In particular, thanks to the different sizes available and the extraordinary flexibility in managing external devices and sensors, the pCO Sistema serial communication can be used both as a control unit (eg., dehumidifier for individual appliance), and as a system controller (centralised dehumidifier). This is possible thanks to the different sizes of pCO5 +, and especially due to the extreme flexibility permitted by Universal inputs that allow connection of various types of sensors, both resistive - NTC, pt1000, pt100 (range-100T400° C), and active, such as 0 to 10 Vdc, 4 to 20 ... , as well as the possibility to select the inputs as digital or analogue outputs, 0 to 10 Vdc or PWM.

While the various serial ports allow both the integration of serially connected field components such as variable speed fans with brushless technology, and the connection to other controllers or supervision systems.



1tool solutions

The 1tool programming tool allows the desired application to be created, in a short time, thanks to the macroblock libraries available and the flexibility of graphics programming. For some devices (compressors, fans ... brushless) control blocks have been developed that make implementation of its complex logic plug & play.



ChillBooster

ChillBooster is an adiabatic system that uses air chillers and drycoolers, especially in industrial applications where energy savings become very high because operation is continuous and loads are high. ChillBooster atomises water into very fine droplets that evaporate spontaneously, cooling the air. The coil then comes into contact with a stream of cooler air and droplets, allowing more favourable operating conditions. Additionally, the droplets that evaporate from the surface of the fins actively contribute to increasing the cooling booster effect. This allows liquid coolers and condensers to provide rated capacity even in periods of high temperatures that often coincide with maximum load. All without expensive oversizing of systems.



ir33 universale

Universal Ir33 is a range of instruments for the control of temperature, pressure, humidity, etc. in units that require 1 or 2 control loops with PID; there are models able to satisfy the need for panel mounting or DIN rail mounting. The models available belong to two families: the first with single input temperatures, therefore suitable in generic applications that require the use of a thermostat in the range - 50T150° C; the second with universal type inputs (NTC, PTC, NTC-HT, PT100, PT1000, TC J/K, voltage: 0 to 1 V, -0.5 to 1.3 V, 0 to 10 V, 0 to 5. rat V, current: 0 to 20 mA, 4 to 20 mA).



PGD and pGD touch terminals

Whether it involves a user interface of a temperature controller or a chiller, or dryers for managing an entire multi-hopper system, the series pGD and pGD touch terminals offer a solution of high technological and aesthetic impact. This aspect is particularly important in industrial applications where ease of use for the end user is the decisive factor.



Temperature, pressure, and humidity sensors and combined sensors

Carel offers a complete range of sensors for temperature, pressure and humidity. Every single function, such as controlling water or air temperature, finds a suitable response in the different versions available, which are distinguished by their range of measurement for the protection of sensitive elements and the materials used for the casing. There are also combined temperature-pressure versions available.



remote operation centre

A ROC (Remote Operation Centre) is a structure established on qualified human resources, computer systems and state-of-the-art technology.

The final target is to supply added-value services to several customers that have the same demands and requirements. The world of cooling and the world of comfort increasingly highlight opportunities linked to remote management and monitoring, leading to the creation of new service-oriented business models.

In order to give best support to customers and facilitate the development of these new markets, CAREL offers a complete and reliable solution, representing an application and technological partner at all levels of the supervision system chain. From controllers on site to the individual system up to central information systems.

Connected anywhere

Thanks to the most modern computer technologies, CAREL offers user-friendly and quick configuration systems. Operators in the office or maintenance technicians on site can access the same information easily and quickly, thanks

to the integration of devices such as Smartphones or tablets.

24/7 System

The operator will have the real time situation of all alarms coming from the various systems available. Immediate viewing of times and maintenance notes assist with troubleshooting, in order to supply feedback to the user and improve the quality of service, thus creating a shared knowledge base at the same time.

Added-value information

No longer data will be confined to individual systems but centralised for the creation of value-added information. The call centre offers services regarding reports, consultancy on optimisation, remote commissioning. Services that help customers concentrate on their business and find a reliable and successful partner in the call centre.

Lowering operational costs

Optimises times and decreases operational costs by previously knowing system requirements.

A remote control specialist always at your side for the most critical interventions.

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remotepro
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monitoring and
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remote control
maintenance
technician



energy manager



call centre operator





Facility Management

A range of “no core business” activities for the company, which have the purpose of managing instruments/devices that make up the company’s infrastructure, are often outsourced. A clear situation of what’s happening in the systems and case histories allow faults to be resolved very quickly: consequently operating and management costs are reduced. Thanks to its supervision system, CAREL represents a reference partner for this type of service. Starting from the local system with the PlantVisorPRO and PlantWatchPRO range, up to the data processing centre with the RemotePRO.

Product quality

Ensuring product quality is a fundamental aspect that the customer takes for granted, but which a service must guarantee 24/7. Constant verification of the temperatures of the refrigerated counters and the generation of reports for conformity with standards (HACCP), are the instruments necessary to support these requirements. PlantWatchPRO and the CAREL rTM solution offer quick and accurate recording of temperature. The RemotePRO centralised system can generate temperature reports and archive them automatically for future reference.

Energy Manager

A figure that is much more than a reference within the chain. Energy saving means environmental sustainability and reduction of operating costs. CAREL can supply the essential instruments to make it easier for the energy manager to make the right decisions in order to optimise energy consumption. All of this is possible due to the PlantVisorPRO system in the installation and its plug-ins for the generation of energy reports, and the RemotePRO centralised system and benchmarking function.



Programmable controllers



pCO sistema

pCO sistema is the CAREL solution for managing HVAC/R applications and systems, the result of continual improvements in more than 25 years' experience in the sector.

It consists of programmable controllers, user interfaces, electronic expansion valves, inverters with DC technology and communication interfaces, remote management systems to offer OEMs working in HVAC/R a control system that is powerful yet flexible, can be easily interfaced to the most widely-used Building Management Systems. A complete solution made-to-measure for the new generation of high efficiency units: chillers, air-conditioners, heat pumps, shelter units, rooftop units, compressor racks and air handling units.

It is easily modifiable, so as to differentiate air-conditioning and refrigeration units in terms of both appearance and functions.

A range of sizes is available, according to the number and type of inputs and outputs and the use of the built-in terminal. Plastic cases with DIN rail mounting guarantee high mechanical protection of the board and can also host a built-in user interface. The inputs and outputs are separated in the layout to simplifying wiring.

Benefits

Configurability

New CAREL proprietary ASIC technology (Application-Specific Integrated Circuit) allows the analogue channels to be configured for all types of probes required in HVAC/R applications. They can also be configured as digital inputs or analogue outputs, making system configuration even more flexible.

Programmability

The 1tool development environment can be used to customise all aspects of the software, such as control logic, access to and display of parameters, and serial communication. The software can be transferred to the pCO from the personal computer using a "plug & play" electronic key, or USB pendrive (in the models where featured).

Interfaces

The pCO series terminals are available in semi-graphic and graphic alphanumeric LCD versions to display messages in Chinese, Cyrillic, Arabic and Japanese. To allow complete yet simple access to all the information on such advanced and high performance systems, pCO sistema offers a new range of user interfaces with the latest generation touch screen technology.

Technology

A 32-bit microprocessor guarantees high program execution speed, controlling even fast transients. Large memory space available means trends in temperature, pressure, unit status, etc. or events such as alarms, can be saved over long periods.

Communication

pCO sistema can interface with the most commonly-used communication standards, such as Modbus® BACnet™, SNMP, LonWorks®, Konnex® and Johnson METASYS®. All pCO sistema components can be connected to pLAN networks, so as to exchange data and information. Serial communication can also be used to control smart actuators, such as EC fans, variable flow-rate pumps, etc., allowing complete system integration and management. All further increasing the level of performance and system reliability. Finally, remote access to the system allows innovative remote control and maintenance services, as well as very useful functions for end users, such as control of home systems via mobile phone.



pCO5+

P+5*

The pCO5+ controller offers specific new functions for improving efficiency in HVAC/R systems:

- all analogue input channels can be configured as:
 - digital input (voltage-free);
 - analogue output (PWM or 0 to 10V);
 - wide selection of probes for different applications (NTC, PTC, PT100, PT500, PT1000, 0 to 1 V, 0 to 5 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA);
- integration of EVDEVO driver for control of electronic expansion valves with ultracap technology, guaranteeing stepper electronic expansion valves close in the event of power failures;
- connectivity, providing more demanding designers with up to 5 serial lines, 3 of which always available and configurable in terms of protocol (CAREL or Modbus®) and type (FieldBus or BMS), and 2 optional, again configurable in terms of protocol (Modbus®, BACnet™, CAREL, CANbus, Konnex, LonWorks) and physical support (RS485, Ethernet, Can, Konnex, FTT-10). Versions are available with USB "Host" and "Device" ports for programming the pCO5+ using a standard USB pendrive, or direct connection to a PC without requiring serial converters.

Integration of the above-mentioned functions therefore offers numerous benefits to manufacturers and designers of HVAC/R systems, including:

- reduction in the number of modules used to create the application, as configurability of the input channels as digital inputs or analogue outputs means all available channels can be fully exploited;
- reduction in space and electrical wiring: the EXV valve driver modules, battery charger modules and backup battery modules have been replaced on the pCO5+ by the integrated EXV driver with ultracap technology;
- ultracap technology means the solenoid valve that was previously required to

guarantee closing of the circuit when no battery module was available, is no longer needed;

- more powerful and distributed control thanks to 5 serial lines, allowing management of smart actuators such as drivers for DC inverter compressors, brushless fans (EC fans), centrifugal compressors, variable flow-rate pumps, serial sensors, wireless sensors, heat meters, etc.

The new pCO5+ also guarantees perfect compatibility with the entire range of pCO³ and pCO⁵ controllers, both in terms of hardware (pin to pin compatible) and software, so as to protect and guarantee CAREL customers' investments.

Technical specifications

Power supply: 24 Vac, -15/10 %
50/60 Hz or 28 to 36 Vdc -20/10 %;

Operating conditions: -40T70 °C, 90% RH non-condensing

Degree of protection:

- IP20;
- front IP40

Certification: CE / UL

Assembly: DIN rail

Number of I/Os:

- **analogue inputs:** da 5 a 12;
- **digital inputs:** 13 to 28;
- **analogue outputs:** 9 to 16;
- **digital outputs:** 8 to 29.

Serial ports: pLAN, 2BMS, 2 FieldBus

Dimensions:

- 13 DIN (227.5x110x60);
- 18 DIN (315x110x60).

Connections: plug-in terminals



pCO compact

PCOX*

Compact programmable controller, just 6 DIN modules, high capacity in terms of connectivity and integrated functions. Compatible as regards both the hardware and software with the pCO family; consequently, it's a versatile solution for all types of applications and requirements in the HVAC/R sector.

There are two versions of pCO compact, which differ in terms of the number and type of inputs / outputs, so as to best adapt to the needs of the application. Possibility to interface with the most commonly-used BMS communication protocols (BACnet, Modbus®, LonWorks Modbus®, Konnex, ...) by adding optional serial cards. pCO compact also has an integrated, optically-isolated Fieldbus RS485 / tLAN port. It also comes with two USB ports (host and device), used to upload and download the application program and data logs via pendrive or direct connection to a PC.

The built-in user interface has a white positive LCD, with 132x64 dot resolution, allowing a high degree of customisation, plus a six-button membrane keypad.

Technical specifications

Power supply: 24 Vac -15/10 %, 50/60 Hz o 48 Vdc (36 Vmin to 72 Vmax)

Operating conditions: -10T60 °C, 90% RH non-condensing

Degree of protection:

- IP20;
- front IP40.

Certification: CE / UL

Assembly: DIN rail

Number of I/Os:

- **analogue inputs:** 6 to 8;
- **digital inputs:** 4 to 6;
- **analogue outputs:** 2 to 4;
- **digital outputs:** 6 or 7.

Serial ports: pLAN, 1BMS, 1FieldBus

Dimensions: 6 DIN (105x110x60)

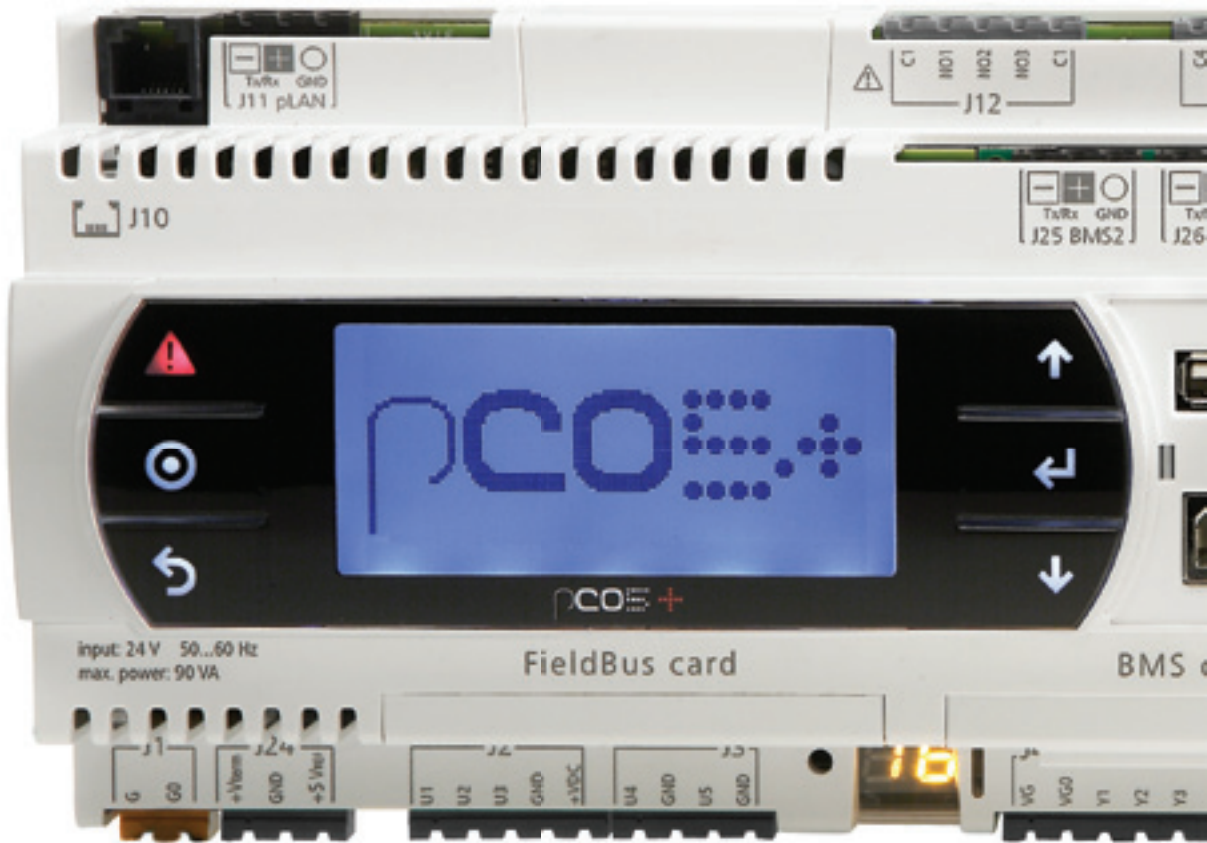
Connections: plug-in terminals

Table of pCO sistema models

Features	PCOX*A	PCOX*B	P+5*S	P+5*M	P+5* + EVD EVO	P+5*L	P+5*Z
Maximum flash memory capacity	4 MB		13 MB				
NAND flash	32 MB		50 MB				
Real Time Clock	●						
pLAN port	●						
tLAN port	●		□				
Integrated FieldBus port	●						
Integrated BMS port			●				
Ready for FieldBus card			●				
Ready for BMS card	●						
USB programming key	□						
Built-in pGD ¹ display	□						
Black box	●						
Max no. of analogue inputs	8	6	5	8	12	10	10
PT1000 inputs	2	2	5	8	8	8	8
PT500 inputs			5	8	8	8	8
PT100 inputs			2	3	3	4	3
PTC inputs			5	8	8	10	10
NTC inputs	8	6	5	8	10	10	10
0 to 10 Vdc inputs	4	4	5	8	11	10	10
0 to 1 Vdc inputs	6	6	5	8	10	10	10
4 to 20 mA or 0 to 20 mA inputs with power supply from pCO	2	2	4	4	6	4	4
4 to 20 mA or 0 to 20 mA inputswith external power supply	2	2	5	8	10	10	10
0 to 5 Vdc ratiometric inputs with power supply from pCO	4	4	5	6	8	6	6
0 to 5 Vdc ratiometric inputs with external power supply	4	4	5	8	10	10	10
Max no. of digital inputs	6	4	13	24	28	28	26
24 Vac/Vdc inputs			8	14	14	18	14
230 Vac/Vdc inputs				2	2	4	2
Voltage-free contact inputs	6	4	5	8	12	4	2
Fast digital inputs	1	1	4	4	4	4	4
Max no. of analogue outputs	2	4	9	12	12	16	12
optically-isolated 0 to 10 Vdc outputs			4	4	4	6	4
0 to 10 Vdc outputs	1	3	5	8	8	10	8
Optically-isolated PWM outputs			2	2	2	2	2
PWM outputs	1	1	5	8	8	10	8
Max no. of digital outputs	7	6	8	13	13	18	29
SPST relay outputs	5	4	7	10	10	13	26
SPDT relay outputs	2	2	1	3	3	5	3
Max no. of SSR outputs	2	4	1	2	2	3	2
48 Vdc power supply	●	●	□				

● standard

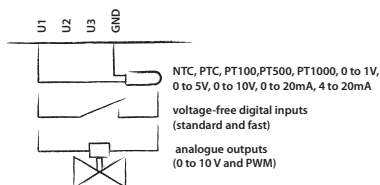
□ optional



Flexibility

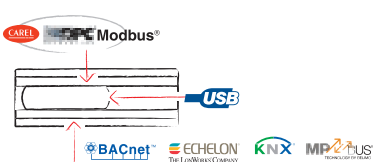
Up to 10 channels can be configured as inputs or outputs. All 10 channels can be configured to manage probes, voltage-free digital inputs and control analogue outputs.

Up to 10 sizes of controllers to cover various different solutions in HVAC/R applications.



Connectivity

Up to 7 communication ports available, with the most commonly-used protocols in HVAC/R applications, for complete system management: pLAN, 1 BMS1, BMS2, FieldBus1, FieldBus2, USB host, USB device. Energy Saving.

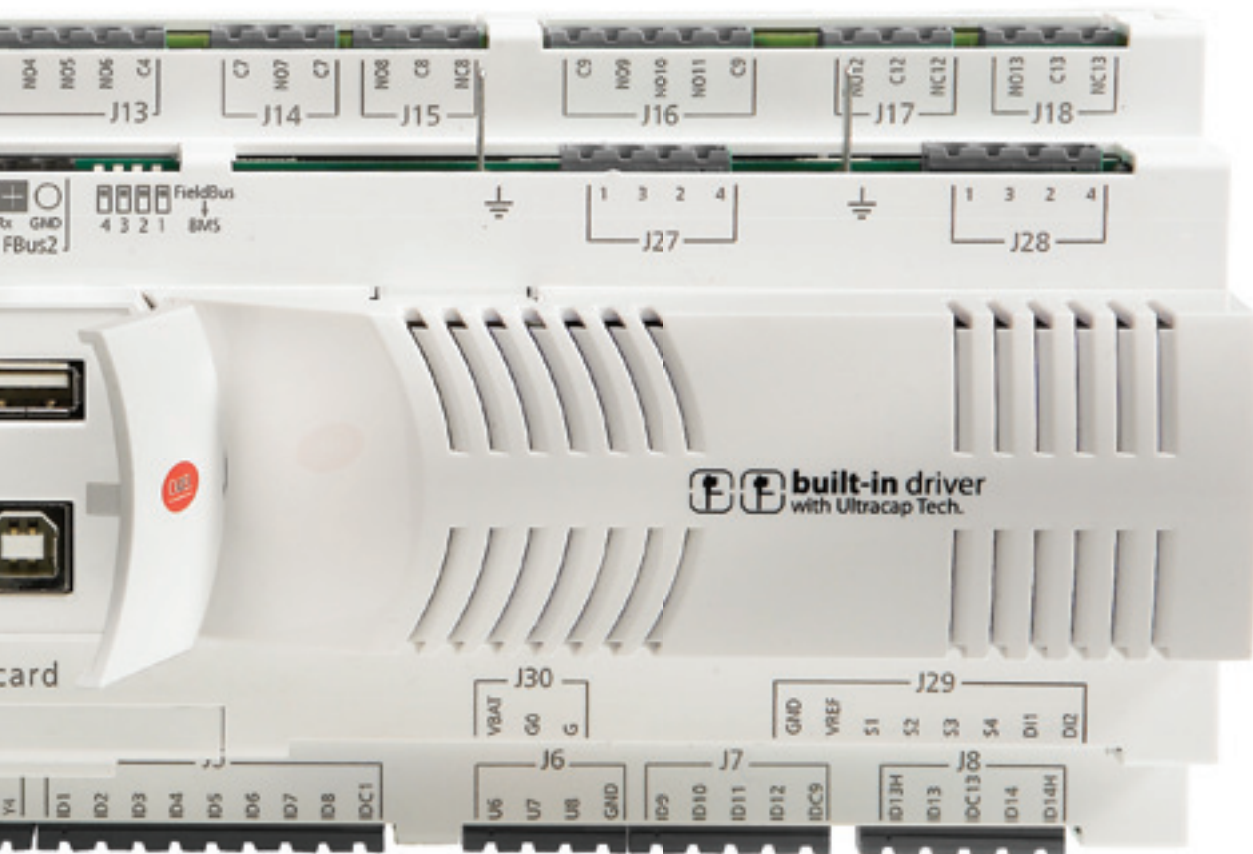


Energy Saving

Up to 2 integrated EVDEVO drivers for managing two Independent EXV electronic expansion valves.

The Ultracap module guarantees the two valves close in the event of power failures, saving the cost of installing a solenoid valve.





Cloud based

Possibility to perform actions via web, such as read and write unit variables, update the application on the controller, and Webserver to browse custom HTML pages, send emails.

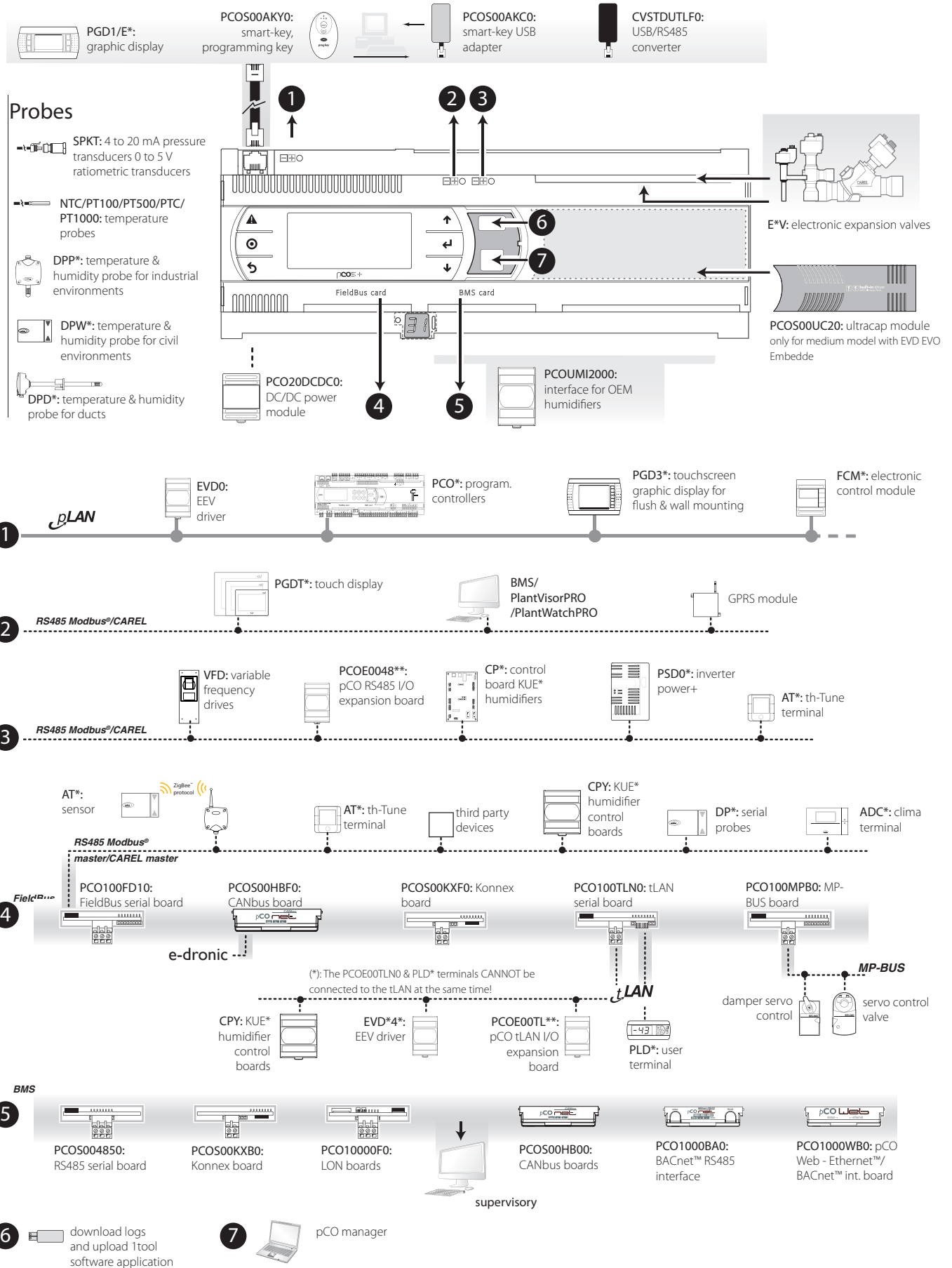


Backward compatibility

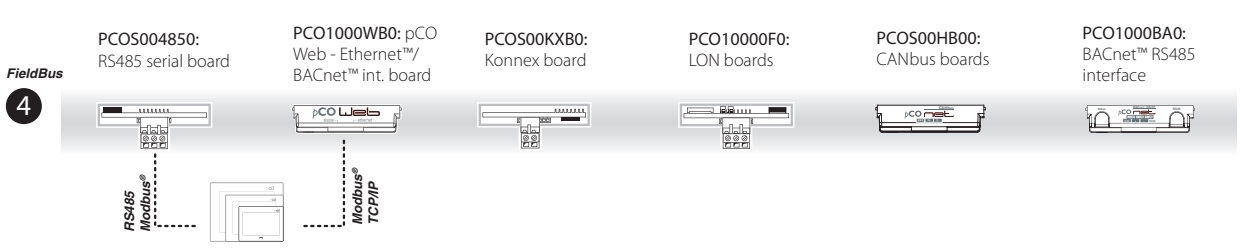
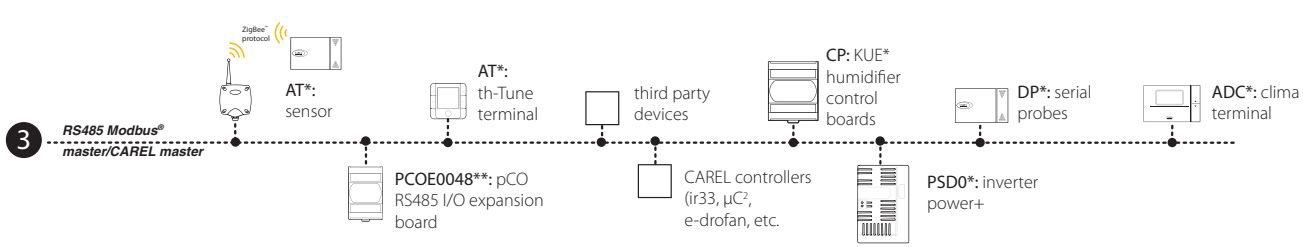
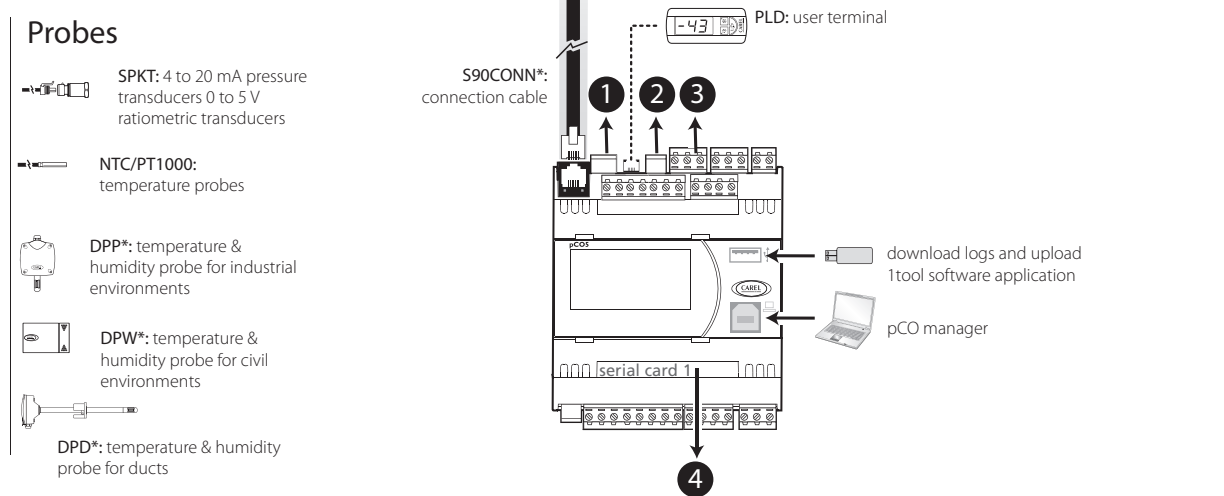
Hardware and software compatible with the two previous generations of the pCO family: pCO⁵ and pCO³. No change to the layout of the electrical panel and complete reuse of software developed for previous projects on pCO³ and pCO⁵.



OVERVIEW DRAWING pCO⁵⁺



OVERVIEW DRAWING *pCO compact*



Accessories and options



Ultracap module

(PCOS*UC20)

Closes the electronic expansion valve in the event of blackouts, avoiding the need to install a solenoid valve.



MP-BUS® card on FieldBus

(PCO100MPB0)

Provides communication with BELIMO actuators using the MP-BUS® protocol.



Ethernet™ interface card

(PCO1000WB0)

Used to interface pCO controllers with BACnet™ Ethernet™, TCP/IP, SNMP V1 V2, 2, FTP and HTTP protocols.



Electronic expansion valve drivers and Ultracap module

(EVD0*, EVD*UC0)

Refrigerant superheat management by controlling the majority of electronic expansion valves with stepper motors available on the market.



Konnex card on Fieldbus or BMS

(PCOS00KXF0 PCOS00KXB0)

Used to interface the controllers to a Konnex network.
info: konnex@carel.com



CANbus serial card on FieldBus or BMS

(PCOS00HBF0, PCOS00HBB0)

Provides communication using CANbus protocol to the CAREL system for managing e-dronic fan coils.



Programming key

(PCOS00AKY0)

Used to transfer programs from the key to the pCO and vice-versa.



RS485 serial card on FieldBus

(PCO100FD10)

Provides RS485 communication on the FieldBus serial port with a compatible external electronic device.



BACnet™ MSTP RS485 interface card

(PCO1000BA0)

Used to interface pCO controllers with BACnet™ MSTP protocol.



USB/pLAN converter

(PCOS00AKC0, CVSTDUTLF0 & CVSTDUMOR0)

The first solution connects the smart key to a PC's USB port.
The latter two, on the other hand, connect the pLAN port on the pCO to a PC's USB port.



tLAN serial card on FieldBus

(PCO100TLN0)

Provides communication using CAREL tLAN proprietary protocol with a compatible external electronic device.



LonWorks® serial card

(PCO10000F0)

Used to interface of controllers to a LonWorks network®. The type of interface is FTT-10 A 78 kbs (TP/FT-10).



Interface for OEM series humidifiers

(PCOUMI2000)

This allows fundamental parameters (water level and conductivity in the cylinder, TAM current sensor) on the OEM humidifiers produced by CAREL to be controlled directly by pCO sistema controllers. The values measured by the sensors are converted into signals read by the inputs on the control board.



RS485 serial card

(PCOS004850)

Provides a direct optically-isolated interface to an RS485 network.



pCO I/O RS485 and tLAN expansion cards

(PCOE004850 & PCOE00RS10; PCOE00TLN0 & PCOE00TL10)

Used to increase the number of I/Os on the pCO controllers. Connection via:

- RS485 protocol for distances up to 600 m;
- tLAN protocol for distances up to 10 m. Also available for mobile phone applications (shelters).



DC/DC module

(PCO2DCDC00)

This powers the pCO controllers with 48 Vdc storage batteries, typically used in telephone applications. DIN rail mounting by 4 DIN module plastic case.



Unit and room terminals

The structure and modularity of the pGD family displays always ensure the right solution for different requirements in terms of performance, cost and appearance.

The new pGD Touch range has been designed for high level applications that require touchscreen technology combined with an elegant design and extensive connectivity possibilities.

The pGD¹-pGD^e series is focused on applications that require a good compromise between performance, competitiveness and appearance.

The pLD series (programmable LED display) is ideal for applications where the main requirements of the user interface are reductions in costs and the space required for installation.

The th-Tune series room terminals have been designed as simplified and intuitive interfaces, particularly suitable for end users.

Design and technology

The pGD Touch series interfaces represent the most high-tech CAREL product offering in this area.

The TFT full touchscreen display with 65000 colours and WVGA resolution, with on-board operating system, can manage transparency effects typical of a desktop operating system, a wide library of graphic objects for HVAC/R applications, logs, alarms and plot trends of values.

The touchscreen function helps the end user move easily around more complex system diagrams, without losing the overall view, thanks the immediate and intuitive navigation scheme.

pGD Touch also provides more demanding manufacturers in the HVAC/R market various possibilities for product customisation and differentiation.

Its attractive and modern design and extensive connectivity (including via web) make the user interface also suitable for residential applications.

Performance at competitive costs

The pGD¹-pGD^e series is the family of interfaces with graphic LCD designed for pCO sistema controllers.

The interfaces offer great versatility and extensive customisation possibilities, while maintaining a high aesthetic standard. When designing these instruments, CAREL focussed special attention on simplicity of programming and quality of performance.

pGD¹-pGD^e 132x64 pixel graphic displays can display graphic symbols of different sizes and in the main international alphabets, such as Greek, Chinese, Cyrillic and Scandinavian languages.

The th-Tune series is dedicated for temperature and humidity control in residential or commercial environments. The programming knob and intuitive icons on the display make it extremely simple to use.



pGD touch

PGDT*

These graphic terminals belong to the new range of TFT touch screen displays designed to make the user interface to the pCO sistema family controllers easier and more intuitive, including implementation of Modbus® and BACnet™ communication protocols as standard. The touchscreen panel makes interaction between the user and the unit much easier by simplifying navigation between the various screens.

The Windows CE operating system, the electronic technology used, the 65,000 colour display, the HVAC/R libraries and templates offered by the Carel 1Tool Touch Editor software, and the advanced graphic functions, including transparency, mean the terminals can manage high resolution images and achieve a high aesthetic standard that is usually only found on desktop applications.

pGD Touch offers additional new integrated functions that extend potential applications. Graphs are available in real time of controlled variables, which can be logged and exported to USB key for analysis of performance, operating modes, etc.

Functions available include daily, weekly and monthly scheduling to automatically control various activities, such as unit on/off or change set point, as well as the possibility to change screen language during normal operation and pop-up screens for alarm signals.

pGD Touch is available in a wide range of versions, which differ as regards display size and connectivity, so as to meet all HVAC/R application requirements.

The range includes four display sizes, from 4.3" to 7", 10" and finally 13".

The use of vectorial images in the 1tool Touch Editor software means the same design can be used on all four sizes.

pGD Touch can be supplied in models with RS485 serial communication or RS485 serial and Ethernet communication. The

following protocols are available: BACnet™ MSTP and TCP/IP, and Modbus® RTU and TCP/IP. This makes pGD Touch a global area controller that can monitor and manage a network of CAREL controllers and third party devices.

Connectivity to the outside world allows pGD Touch to offer remote access solutions based on web technology for desktop or mobile devices, as well as the gateway function to share managed variables with external systems such as BMS, using the Modbus® and BACnet™ protocols.

Technical specifications

Power supply:

- 4.3": 24 Vac -15/+10 % 50/60 Hz o 12...30 Vdc -5/+5 %;
- 7", 10", 13": 18 to 30 Vdc -5/+5%

Operating conditions:

- 4.3": -25T60 °C, 5 to 85% RH non-condensing;
- 7", 10", 13": 0T50 °C, 5 to 85% RH non-condensing.

Degree of protection:

- IP20;
- front IP65.

Certification: CE / UL

Assembly: panel mounted

Dimensions:

- 4.3": 107x147x55.8;
- 7": 176x136x45;
- 10": 276x221x42;
- 13": 337x267x46.

Serial ports: RS485 & Ethernet, number depending on models, see summary table

Connections: plug-in terminals



pGD¹ and pGD^e

PGD1* and PGDE*

pGD¹ and pGD^e are the CAREL proposal for pCO sistema user interfaces, an innovative series of terminals designed with semi-graphic LCDs so as to offer greater versatility and possibility of customisation. When designing these terminals, CAREL focussed special attention on simplicity of programming and quality of performance, while maintaining a high aesthetic standard.

The display features graphic representation on 120x32 pixels. pGD¹ is available with green or white backlighting, pGD^e with white backlighting.

pGD^e differs from pGD¹ as concern the symbols on the buttons, which recall the graphics used on the pCO5+/pCO5 compact built-in display.

pGD¹ and pGD^e can display graphic symbols of various sizes and the main international alphabets.

pGD¹ and pGD^e also respond to the logic of flexibility and ease of customisation that is the basis for the design of this series of CAREL products, offering more demanding customers several customisation possibilities at affordable costs even for limited quantities.

Technical specifications

Power supply: from power board using the telephone cable (code S90CONN00*) or from external source 18 to 30 Vdc via TCONN6J000

Operating conditions:

-20T60 °C, <90% RH non-condensing

Degree of protection:

- IP65 flush mounted;
- IP40 wall-mounted.

Certification: CE / UL

Assembly: panel mounted and wall-mounted

Dimensions: 156x82x30 mm

Serial ports: 1 pLAN

Connections: telephone connector



th-Tune

AT*

th-Tune is the CAREL room terminal that, together with the pCO* programmable controllers, allows users to control the temperature and humidity in residential or light commercial environments, providing of simplified interface that is ideal for end users. Compact dimensions and elegant design make it suitable for all types of rooms, as well as being ideal both as a simplified HMI (Human Unit Interface) for heat pumps, rooftop units, AHUs, etc. and as zone controller display for centralised systems.

The display integrates perfectly with pCO family displays, as the information displayed and settings available on th-Tune can be configured using 1tool, so as to adapt to the requirements of different applications. The RS485 serial connection over Modbus® protocol means architecture can be implemented in which multiple displays are connected to a controller to create synergic control logic.

Depending on the model, the terminal is fitted with a temperature probe or temperature and humidity probe, and power supply may be 230 Vac or 24 Vac/ Vdc.

th-Tune is compatible with the main flush mount distribution boxes available on the market (IT, US, DE, CN). Models are also available with wall-mounting for installations where flush mount boxes cannot be used.

Temperature and humidity control is simple and intuitive, using the knob on the front panel.

th-Tune allows the user to make some settings using the buttons and knob, such as operating mode and time bands (with on-board clock), as well as implement other basic operations using parameters programmed in 1tool.

The result is an extremely flexible solution that adapts to different applications.

Technical specifications

Power supply:

ATA*: 230 Vac (-15/+10 %) 50/60 Hz
ATC*: 24 Vac (-15/+10%), 22...35 Vdc

Operating conditions:

-10T60 °C, 10 to 90% RH non-condensing

Degree of protection: IP20

Certification: CE & UL

Assembly:

- AT*: flush mounted
- AT*: wall-mounted

Dimensions:

- flush mounted model: 86x30.55x86 mm
- wall-mounted model: 143x36x86 mm

Serial ports: 1 RS485

Connections: fixed terminals

The entry-level solution

PLD*

For all those applications where cost and compact dimensions represent important aspects of the application, CAREL offers the pLD terminal (programmable LED display) in the small and large sizes, with 3 and 4 digit display respectively.

The ease of customisation and programmability using the EasyTools environment guarantee a competitive solution.

In addition, as the pLD terminal is connected to the tLAN port, the use of this terminal does not preclude the possibility to connect another pGD family terminal (e.g. remote terminal) to the pLAN port (in this case, the two displays cannot operate at the same time).

Technical specifications

Power supply: 12 Vdc 8 24 Vdc

Operating conditions:

-20T50 °C, <80% RH non-condensing

Degree of protection:

- IP65 with flush mounting

Certification: CE & UL

Assembly: flush mounted

Dimensions:

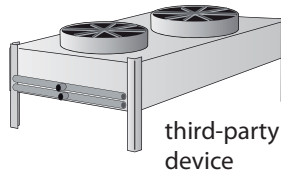
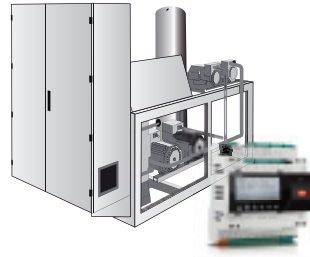
- small: 81x36x42 mm
- large: 167x36x31 mm

Serial ports: 1 tLAN

Connections: crimped connector

Area controller

To manage multiple CAREL or third party controllers using the Modbus® or BACnet™ protocols over RS485 or Ethernet



third-party device

Modbus®
BACnet™



Modbus®
BACnet™

Gateway

To share data with BMS supervisory systems using the Modbus® or BACnet™ protocols over RS485 or Ethernet



"Basic" remote access

For simple remote control of the main unit functions from mobile devices, by end users or service personnel



"Advanced" remote access

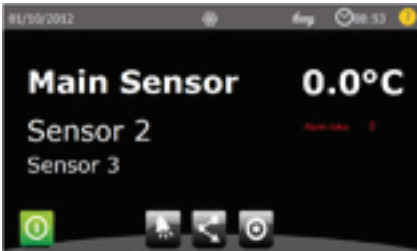
For control and programming of all functions from desktop devices, by the manufacturer or maintenance personnel



Touch Editor function

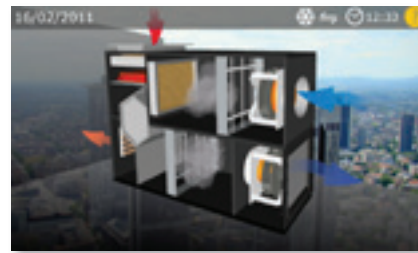
Templates

To quickly create new projects using pre-compiled modules.



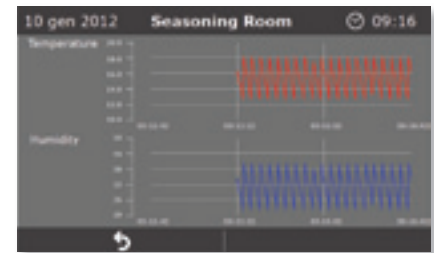
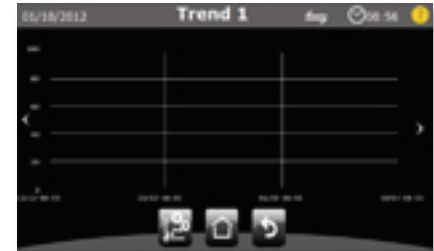
Transparency management

To achieve high standard graphic effects.



Graphs

To log and display values and perform system diagnostics.



Scheduler

To automate system management.



Integrated libraries

Wide range of objects for HVAC/R applications to enrich and simplify project design.



OVERVIEW DRAWING pGD touch

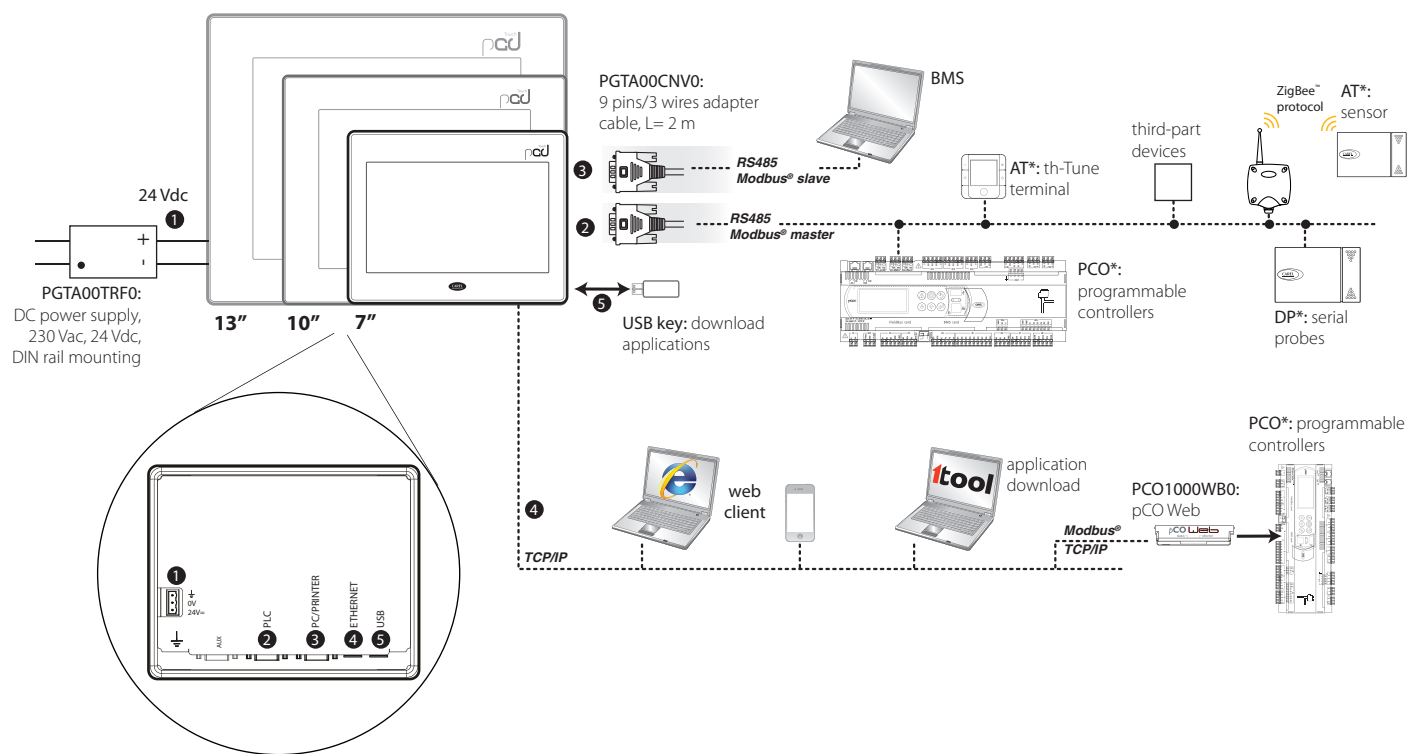
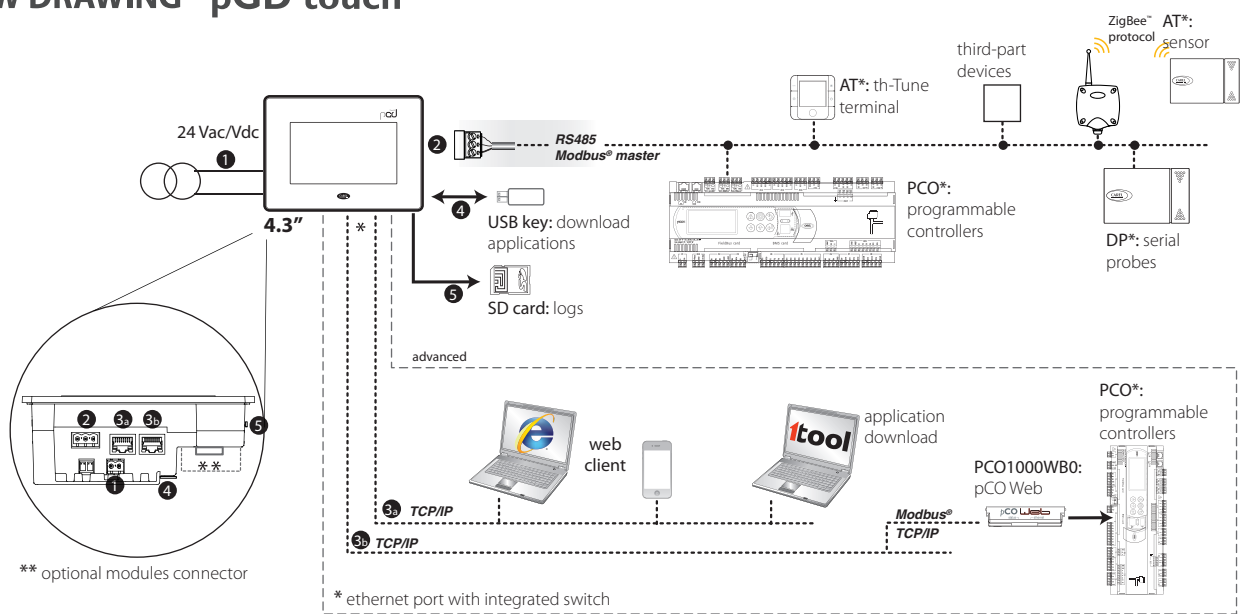


Table of terminal models

Features	PGDT04*FS*	PGDT04*FO*	PGDT07*FS*	PGDT07*FO*	PGDTM1*FR*	PGDTMA*FR*	PGD1/E*	AT*	PLD*
Hardware									
Flash memory	128 MB								
RAM	256 MB								
Colours	65000						mono-chromatic	mono-chromatic	
Display size	4.3"	4.3"	7.0"	7.0"	10.4"	13.3"			
Type of LCD display	WVGA (16:9)				VGA (4:3)	WVGA (16:9)			
Display resolution	480 x 272		800x480		640 x 480	1280 x 800	132 x 64	predefined icons	3-4 digit
Display backlighting	LED						green/white LEDs	white LEDs	green LED
Type of touch screen display	resistive								
Number of rows							8		
Number of columns							22		
Buzzer	●	●	●	●	●	●			●
Real Time Clock	lithium battery								●
External membrane keypad							●	●	●
Availability on pCOI plastic case							●		
Integrated temperature/humidity probes								● temp. □ humidity	
ConneUvitk									
RS485 serial ports	1 not optically-isolated	1 optically-isolated	2 not optically-isolated	1 optically-isolated 1 not optically-isol.	2 not optically-isolated			●	
Ethernet ports		2		2	1	1			
tLAN port							●		●
BACnet MS/TP® on first serial port	● (RS485 connector)				● (DB9 connector)			●	
Modbus® on first serial port	● (RS485 connector)				● (DB9 connector)				
pLAN on first serial port	● (RS485 connector)								
Modbus® on second serial port					● (DB9 connector)				
Web server		●		●	●	●			
FTP server to upgrade software		●		●	●	●			
BACnet TCP/IP		●		●	●	●			
BACnet RS485	●	●	●	●					
Modbus® TCP/IP		●		●	●	●			
USB Host 2.0 port	●	●		●	●	●			
SD Card		●		●					
Software									
Operating system	Windows CE 6.0								
Multilanguage (including chinese)	●	●	●	●	●	●	●		
Programmable fonts	●	●	●	●	●	●			
Alpha Blending	●	●	●	●	●	●			
Bold, italics, underline	●	●	●	●	●	●			
Vectorial objects	●	●	●	●	●	●			
Object libraries (thermometers, cursors,...)	●	●	●	●	●	●			
Animated icons	●	●	●	●	●	●			
Graphs	●	●	●	●	●	●			
Alarms	●	●	●	●	●	●			
Scheduler	●	●	●	●	●	●			
Parameter pre-configuration	●	●	●	●	●	●			
User and password	●	●	●	●	●	●	●	●	
Black box	●	●	●	●	●	●			

● standard
□ optional



1tool

1tool is the development system for the CAREL programmable control platform, consisting of six different environments in which the designer manages the application software in all its different stages: from design to simulation, to testing and debugging, to arrive at commissioning in the field.

A fundamental feature of 1tool is integration. Because all the different environments are interconnected to best support development of the application software. Each environment is in fact dedicated to the realisation of a specific function and interacts with the others to offer the designer:

- greater reliability thanks to real-time error notifications in the design stage;
- reduced development time using the advanced functions offered, first and foremost the new libraries of functional modules specific for HVAC/R;
- flexibility in terms of software customisation.

All these features, an intuitive graphic interface and user simplicity make 1tool an excellent product, responding to the most varied HVAC/R application needs.

Connectivity

As always CAREL, beyond offering its customers a product endowed with quality and reliability, pays particular attention to everything necessary to offer the HVAC/R market interfaces with the most varied BMS (Building Management Systems). For the designer, it has become essential to offer applications for interfacing with the most common protocols. Thanks to 1tool, an interface with the most common BMS, such as Modbus® LonWorrrks®, BACnet™, can be developed simply and intuitively.

Backward compatibility

During the development of 1tool, CAREL paid particular attention to all customers who, in developing applications in EasyTools, needed to capitalise on the work done in terms of the software created up to the present. Thanks to the Migration Wizard, a plug-in available for the 1tool package, it is possible to migrate applications created until now in EasyTools, in complete safety, thus safeguarding the work done until now.

Documents

The tool can be used to create documents based on the application, such as the list of I/Os, parameters list of supervision tables and alarms. In this manner, it is possible for the developer to simply and quickly obtain the basic useful information for creating the final manual of the application.

Real time information

Thanks to the RSS feed system ("Really Simple Syndication"), now one of the most popular formats for distribution of information on the Web, the 1Tool developer has the possibility, simply and conveniently, to stay informed in real time on his own computer about the latest news and updates published on the CAREL website.



Library of modules

The libraries of functional modules represent one of the strong points of 1tool. Modules are functional blocks made up of control algorithms and the related user interface.

Thus the designer with a simple click can import the desired algorithm into the design and all the related user interface with a considerable savings in development time.

CAREL, to better support its customers, provides a range of libraries of functional modules dedicated to the various applications in the HVAC/R market. The user can also transform their own specific algorithms into reusable modules so as to make the development of subsequent projects quick and secure being based on consolidated logic.



User Interface

Mask Editor is the 1tool environment created to easily develop the user interface for text-based and graphic terminals. With a guided language, part text and part graphic, a complete customisation of the application user interface can be developed. The environment is oriented to multilingual project management, so as to respond to the ever growing needs within HVAC/R for managing all the various languages of the project intuitively. The functions in the environment (implementation of texts, images, animated icons, etc.) are managed using simple graphic objects which make the tool easy and immediate to use.



Advanced graphic interface for touchscreen terminals

Thanks to the development tool 1Tool Touch Editor, it is possible to develop graphic interfaces with a high aesthetic standard which function in a quick and intuitive manner on pGD touch family terminals.

The powerful graphic engine of the terminal is able to manage transparencies, animated images, and three-dimensional vector graphics. Real time trends and histories are natively supported. Thanks to the integration of the Javascript language, it is also possible to implement control algorithms, enhancing the intelligence of the terminal



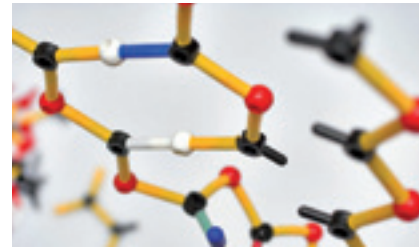
Application simulation

Thanks to the Simulation Editor, one of the 6 environments in 1tool, it is possible to quickly and reliably verify the operation of the applications created. The environment simulates in detail the control algorithm and the related user interface. The designer has at his disposal the various types of simulation, from continuous execution of the application to the insertion of break-points in the step-by-step execution of different functional blocks that comprise the algorithm. During simulation, it is possible to display the real-time values at the input and output of the various functional blocks.



pCO manager

The 1Tool pCO Manager module helps in using the function of configuring and commissioning the HVAC/R unit. Available in two versions, integrated in 1tool and the stand-alone version, it allows the user to quickly and safely configure the unit parameters, check the actual application thanks to serial connection between the on-board unit controller and the PC. Secure control over the parameters is ensured by different access profiles with different restrictions depending on the user. Finally, remote monitoring is managed via a modem connection (PSTN or GSM).



Distributed intelligence

Net Editor is the environment that connects the various elements of the pCO sistema (programmable controllers, terminals and electronic valve drivers) to the local pLAN network. Using this environment it is possible to define in a graphic manner the structure of the network, establishing how many and which units are present and what information each of them is exchanging with the others. In this manner, each pCO controller provides control of the devices connected to it and simultaneously exchanges information with the other controllers in the network to better coordinate climate control of the system or to manage special conditions, such as alarm events.



Parametric controllers



μC sistema

μC sistema is the result of CAREL's decades' long experience in the design and production of parametric controllers for HVAC units. μC sistema is made up of parametric controllers, in both the panel mounted and DIN rail versions, user interfaces, both local and remote, communication interfaces, input/output expansions and electronic expansion valve drivers.

Everything the OEM needs to operate in the HVAC/R sector with a flexible, economical and high performance control system. A wide range of applications can be customised by setting specific parameters, for chiller/HP units (air-to-water, water-to-water), air-to-air and rooftop units, with up to two circuits.

Benefits

- extremely compact dimensions;
- possibility to connect to a remote terminal;
- high reliability;
- management of electronic expansion valves;
- ergonomic and high efficiency display with icons;
- simple wiring (new tLAN serial network);
- modular architecture.

Main functions

- proportional water/air return and outlet control with timed logic;
- P+I control;
- stepped control in each circuit;
- condenser/evaporator control;
- part-winding management;
- solenoid valve control and pump down management;
- sliding defrost in HP mode;
- electric heating step as independent frost protection support on the evaporator;
- control and warnings on component operating hours;
- part load operation for high pressure in chiller mode;
- preventive ventilation when starting with high outside temperatures;
- stop compressors for low outside temperature values;
- part load operation for low pressure (HP);
- low noise in chiller and HP mode;
- set point variation and ON/OFF from time band;
- electronic expansion valve driver management;
- event logging: alarms with FIFO logic;
- data logging of evaporation and condensing temperature and pressure (last 100 alarms);
- smart key - download data logs to PC;
- self-diagnostics;
- automatic changeover;

- smart defrost;
- programming key.

Devices controlled

- compressors;
- condenser fans;
- reversing valve;
- water circulating pump or supply fan (air-to-air);
- frost protection heater;
- alarm signal device;
- electronic expansion valve;
- air damper (rooftop).

Options

- RS485 serial card;
- programming key;
- fan speed controllers, both single-phase and three-phase;
- electronic expansion valve driver;
- I/O expansion;
- ratiometric pressure probes.



µGEO

MCH2****4* + MCH2****6*

This is the parametric solution for the complete control of single circuit heat pumps with one or two compressors, managing the production of domestic hot water and hot or cold water for the heating or cooling system, based on the priority defined by the user.

Wiring is performed using Molex® plug-in connectors, thus reducing space, and making assembly faster and easier.

Technical specifications

Power supply: 24 Vac, -15/+10 %; 50/60 Hz

Operating conditions: -10T55 °C <90% RH non-condensing

Degree of protection: front IP65/IP40
Certification: CE, UL

Assembly:

- µGEO: panel mounted;
- I/O expansion: DIN rail.

Number of I/Os:

- **analogue inputs:** 8 (6 NTC inputs and 2 inputs configurable as NTC/ratiometric pressure probe/digital input);
- **digital inputs:** 10, voltage-free contact;
- **analogue outputs:** 2 PWM outputs;
- **digital outputs:** 10 relays with NO contact, 25 Vac 3 A res. 2 A.

Serial ports: tLAN, supervisor

Dimensions:

- µGEO: 75x33x74 mm;
- I/O expansion: 70x110x60 mm

Connections: tLAN, RS485

µC²SE

MCH200*03*

µC²SE is the controller for units with one and two circuits and up to four compressors.

It represents the technological evolution of the µC² series. All µC²SE series controllers in fact feature microprocessors with RISC technology and optional real time clock, ensuring top-of-the-range performance and user friendliness. The µC²SE series is available in the panel mounting version, and wiring is plug-in with Molex® connectors, reducing dimensions, simplifying and speeding up installation. µC²SE can manage up to four hermetic or two semi-hermetic compressors in a maximum of two circuits, as well as one electronic valve driver per circuit. Optimum management of air-to-water and water-to-water chillers/HPs, air- and water-cooled condensers, direct air/air units and heat pumps, rooftop units with free cooling by temperature.

Technical specifications

Power supply: 24 Vac -15/+10%, 50/60 Hz
Operating conditions: -10T55 °C, <90% RH non-condensing

Degree of protection: front IP65

Certification: CE, UL

Assembly: panel mounted

Number of I/Os:

- **analogue inputs:** 4 (3 NTC inputs and 1 configurable input as NTC/ratiometric pressure probe/digital input);
- **digital inputs:** 5, voltage-free contact;
- **analogue outputs:** 1 PWM output;
- **digital outputs:** 5 relays with NO contact, 250 Vac 3 A res. 2 A.

Serial ports: tLAN, supervisor

Dimensions: 75x33x74 mm

Connections: tLAN, RS485

Accessories and options



µC²SE

µGEO

Remote terminal

(MCH200TP00 - MCH200TW00)

Graphic LCD for panel mounting, installation on the unit, or remote wall-mounting. Access divided by level and complexity via password, management of units by graphic icons and access to the complete list of parameters.



µC²SE

µGEO

µAD room terminal

(ADM*)

LCD with icons for remote wall-mounting in the room as a simple user interface, with built-in temperature or temperature plus humidity sensor and time band management, for use in residential or smaller commercial / service applications.



µC²SE

µGEO

µAM terminal

(ADE*)

Area controller for management of the µe-dronic system. Automatic changeover of system operating mode based on requirements, energy saving according to load, coordination of set points and centralised time bands are just some of the benefits provided by this product.



µC²SE

µGEO

ON/OFF and 0 to 10 V converter

(CONVONOFF0, CONV0/10A0)

Condenser fan management in ON/OFF mode. Switchable power control relay 10 A 250 Vac in AC1 (1/3 HP inductive).

Converts the PWM signal sent by the corresponding relay on the controller to a standard 0 to 10 V (or 4 to 20 mA) signal.



µC²SE

µGEO

Expansion card for second circuit

(MCH2*2*)

I/O expansion card for managing a second circuit.

 μ C²SE μ GEO

Electronic expansion valve driver

(EVD*4*)

Controls refrigerant superheat by managing electronic expansion valves with stepper motors and ratiometric pressure sensors, resident bypass algorithms and alternative control to superheat; considerable configuration possibilities available.

 μ C²SE μ GEO

Supernode

(SNM0000EM0)

Used to integrate μ C²SE and μ AD into a supervisor network (BACnet™, LON, Konnex, SNMP, HTTP, TREND,...).

 μ C²SE μ GEO

RS485 serial card for μ C²

(MCH2004850)

Used to interface μ C² built-in version to a RS485 supervisory network or remote terminal.

 μ C²SE μ GEO

RS485 serial card for supervisor

(MCH200TSV0)

Used to connect an RS485 supervisory system via a remote terminal.

 μ C²SE μ GEO

Fan speed controllers

(MCHRTF*)

These devices modulate the power delivered to a generic load according to the principle of phase cutting. They receive the control signal from CAREL controllers (Pulse Width Modulation signal) in order to vary the speed of the condenser fans; the models available can manage single-phase fans with currents of 2, 4, 6, 8 and 12 A at 230 Vac.

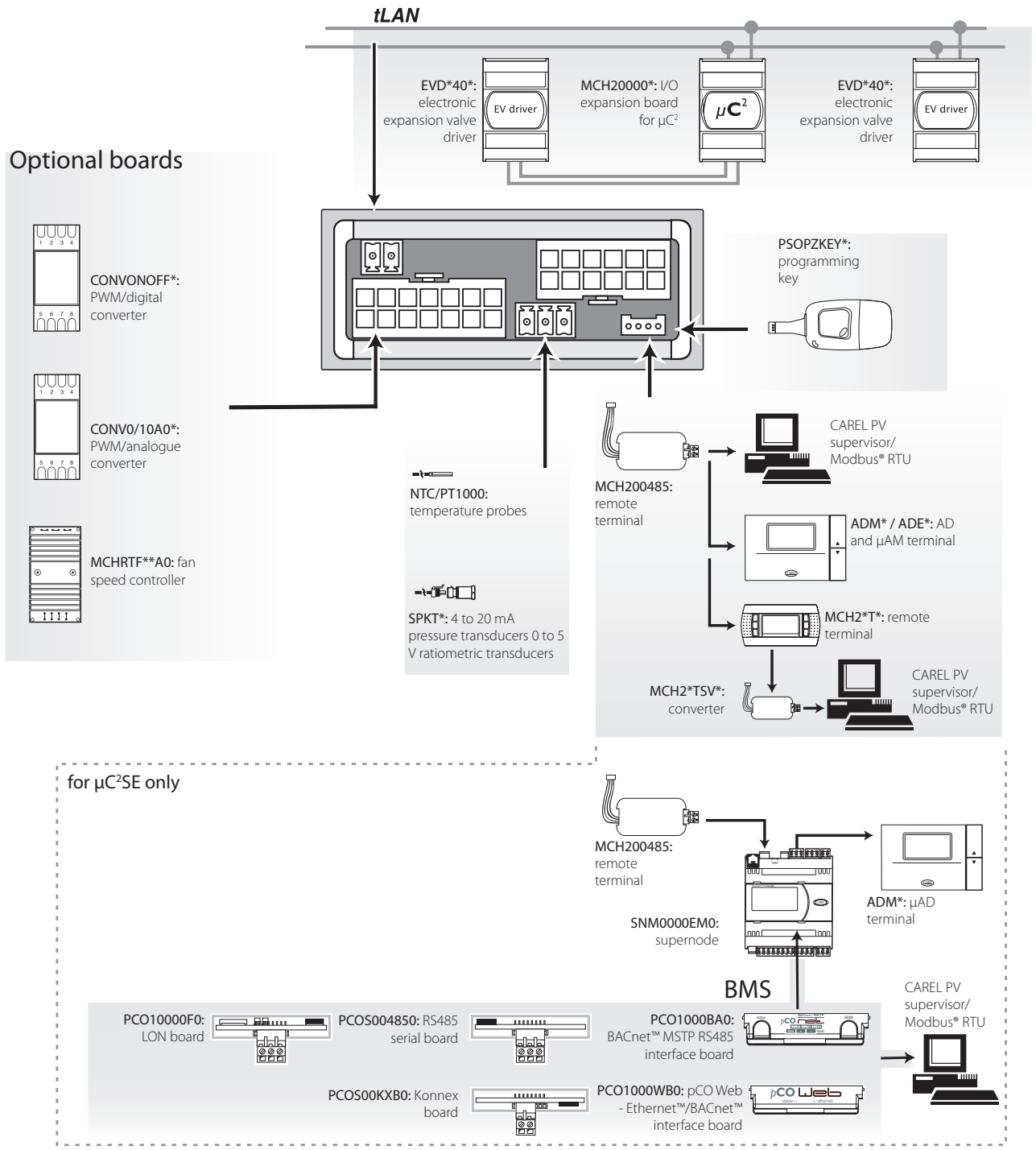
Table of μ GEO and μ C²SE models

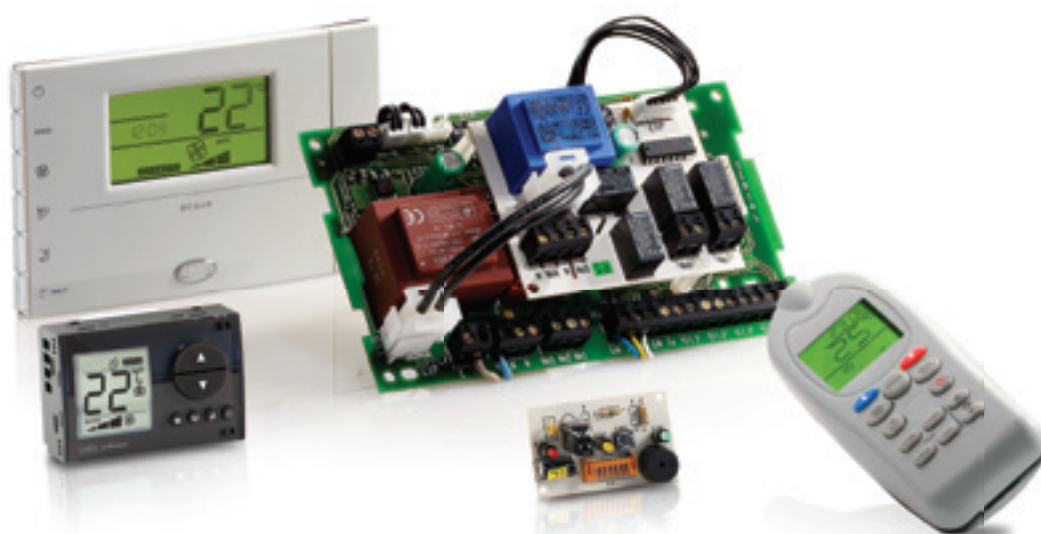
Features	μ C ² SE	μ C ² exp.	μ GEO
Hardware			
Real Time Clock	<input type="checkbox"/>		<input type="checkbox"/>
EVD4* driver connection for E ² V	●	●	●
Programming key	●		●
Built-in display	●		●
Remote display	●		●
I/O expansion	●		●
Alarm log	<input type="checkbox"/>		<input type="checkbox"/>
Carel - Modbus® RTU protocol	●		●
Number of analogue inputs	4	4	4+4
Ratiometric inputs	1	1	1+1
NTC inputs	3	3	3+3
Number of digital inputs with voltage-free contacts	5	5	5+5
Number of analogue outputs	1	1	1+1
PWM outputs	1	1	1+1
Number of digital outputs	5	5	5+5
SPST relay outputs	5	5	5+5
Software			
Proportional control with timed logic on water/air return and outlet	●	●	
Step circuit control	2	2	
Condenser/evaporator control	1 step or mod.	1 step or mod.	
Solenoid valve control and pump down management	● (E ² V only)	● (E ² V only)	
Sliding defrost in HP mode	●	●	
Electric heater step as independent frost protection support for evaporator	● (2)	●	
Control and warning of component operating hours	●	●	
Part load for high pressure in chiller mode	●	●	
Preventive ventilation when starting with high outside temperatures	●	●	
Stop compressors due to low outside temperature values	●	●	
Part load for low pressure (HP)	●	●	
Low noise in chiller and HP mode	●	●	
Set point variation and ON/OFF from time band	●	●	
Management of electronic expansion valve drivers	●	●	
Event logging: alarms with FIFO logic	● (25 alarms)	● (25 alarms)	
Autotuning	●	●	
Self-diagnostics	●	●	
Automatic changeover	●	●	
Smart defrost	●	●	
Programming key	●	●	

● standard

optional

OVERVIEW DRAWING µGEO / µC²SE





e-dronic

Integrated communication between chillers and fan coils is an increasingly important requirement for manufacturers of these air-conditioning units. CAREL has taken up the challenge of joining and combining these two different elements, offering its customers a solution that is easy to manage, ensures increased indoor comfort and considerable energy saving.

e-dronic is a system of user interfaces, I/O boards and accessories for managing and controlling chiller/fan coil systems. e-dronic is compatible with the already established pCO platform, and exploits its advantages in terms of flexibility.

Hardware architecture

Zone broadcast

Zone broadcast is the typical solution for single offices and small shops that require a limited number of fan coils per zone, and where the zones do not necessarily need to communicate with one another or with a centralised supervisory system. The communication protocol used is based on a broadcast approach, therefore all the slave units follow control on the master. The fact that unit addresses do not need to be set makes installation particularly simple.

e-drobus

e-drobus is a master/slave system that is ideal for installations that require a master in every zone, connected to a number of slaves to support the temperature control action of the master.

Typical applications are in homes in which the different zones (living room, bedroom, kitchen) are managed by different master/slave systems. The integrated hybrid e-drobus system uses the CANbus protocol for connection between the master fan coils and tLAN for the master/slave connection.

This means that the optional CANbus card only needs to be installed where needed. The pCO controller manages both the chiller/HP and the fan coils, optimising comfort and running costs. In this way, the chiller user terminal also acts as an interface for the hydronic system.

multimaster e-drobus

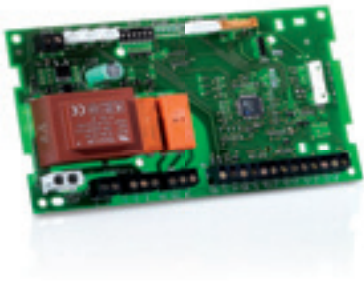
One special application of the e-drobus system uses the CANbus network to connect the master fan coils and the slaves on the same communication line. The fan coils must be configured as master or slave via software. This type of configuration is used to effectively and competitively manage flexible spaces, allowing the layout of the network and the relationships between master and slaves to be configured simply via software.

µe-dronic

µe-dronic is the typical solution for small installations (homes, shops, small offices) where the chiller/HP can be controlled by a µC²SE controller. Up to 10 master fan coils can be connected, each with a maximum of 5 slaves, on a RS485 network managed by a simple zone controller. The new µAM controller coordinates the small hydronic installation using a common reference set point, defining the operating time bands and coordinating the heating/cooling requests.

System design

CAREL presents e-droCAD, the software used to design, check and cost an air-conditioning system communication network based on the e-dronic product line, allowing the user to fully exploit CAREL's wealth of experience and technological innovation. The e-droCAD software is essentially designed for technical personnel (designers, electricians, plumbers, installers, etc.), and purchasing and/or sales personnel.



e-drofan

HYFC*

The main board in the e-dronic system (e-drofan) can manage and control fan speed and the local zone network. One board must be installed on each fan coil; the board is already fitted for serial communication.

Using the optional valve boards, e-drofan can also control the hot and cold water valves, and manage other important functions, such as signals to activate the boiler, chiller/heat pumps and electric heaters.

The devices can be controlled in ON/OFF or proportional mode.

In addition, using the integrated Modbus® RTU protocol and an optional RS485 card, the e-dronic system can interface directly to open BMS systems.

Technical specifications

Power supply: 230 Vac, -15/+10%; 50/60 Hz

Operating conditions: 0T60 °C, <90% RH non-condensing

Degree of protection: IP00

Certification: CE

Assembly: fastening by screws

Number of I/Os:

- **analogue inputs:** 3 NTC;
- **digital inputs:** 5, voltage-free contact;
- **digital outputs:** 3 relays, 2 A 250 Vac

Serial ports: tLAN (built-in), optional communication card

Dimensions: 160x95 mm

Connections: tLAN, optional cards

Accessories and options



acqua

HYPA*1*

The terminal has a liquid crystal display that makes operation simple and user-friendly, enhanced by a series of icons that simplify the reading of the data displayed. The acqua terminal, moreover, has 8 buttons for quick access to most of the configuration functions. Its simple and functional appearance makes it readily suited to any environment. CAREL has focused great attention on the aesthetics of the product, given its probable use in the home and shops. The terminal can be installed up to 30 m away using a 3 wire serial connection (serial plus power supply).



Relay expansion card

(HYVC000R*)

Fitted with 4 relays, 2 of which with voltage-free contacts for enabling and relaying control signals, and 2 directly powered by the main board at 230 V.



Expansion card with 2 triacs, 2 relays

(HYVC000M*)

This is fitted with two triacs for a 230 V three-position servomotor, one 2 kW relay for management of an electric heater plus 1 control relay with voltage-free contacts.



e-droset

HYPA*3*

e-droset, an alternative to the acqua terminal, is the flush-mounted user interface for the e-dronic system. It can be installed up to 30 m away from the controller, and is compatible with B-Ticino and Vimar wallplates. Alternatively, it can be flush mounted on the side of the fan coil. The compact dimensions and attractive design make e-droset the ideal solution for offices and residential installations.



RS485 card

(HYSC00F0P0)

Microprocessor serial card for CAREL or Modbus® RS485 network.



CANbus card

(HYSC00F0C0)

Microprocessor serial card for hydronic network and advanced functions.



Expansion card with 2 x 0 to 10 V outputs, 2 relays

(HYVC000V*)

This features 2 modulating outputs for 0 to 10 Vdc servomotors, and 2 relays with voltage-free contacts.



Expansion card with 4 triacs

(HYVC000T*)

This is fitted with 4 triacs for the control of 230 V 3-position servomotors.



Remote control

(HYHS*)

IR remote control fitted with LCD and 13 buttons for local or zone programming.



IR receiver board

(HYIR*)

This allows e-drofan to receive the settings from the remote control and displays, using 3 LEDs, unit status and any alarms.

Fitted with a button for setting operation if the batteries are discharged.



Programming key adapter

(HYKA)

Used together with the PSOPZKEY* programming key.



CANbus-USB converter

(CVSTDUCAN0)

Used to access a CANbus network from a personal computer.



Programming key

(PSOPZKEY)

Used to simply export the parameter configuration from one e-drofan to another. Useful in systems with a large number of fan coils.

Version with power supply.



Konnex card on BMS

(PCOS00KXB0)

The KNX technological standard is now widely used in building automation and control for commercial and residential use.

CAREL is member of the KNX Association (www.knx.org).

The CAREL Konnex card is compatible with all KNX/EIB devices and can be installed on the FieldBus or BMS port on the pCO sistema or e-drofan controllers.

The K-Set tool (available for download from ksa.carel.com) is used to create an XML file for custom profiles.

info: konnex@carel.com




Ethernet™ interface card

(PCO1000WB0)

Used to interface pCO controllers with BACnet™ Ethernet™, IP, SNMP V1, 2, 3, FTP and HTTP protocols.

info: pcoweb@carel.com



Temperature, humidity and pressure
control solutions



Universal controllers

The “infrared universale” series is a range of instruments for controlling the temperature, pressure and humidity values in air-conditioning, refrigeration and heating units. They can however also be used in other contexts, as the voltage or current inputs can support various different types of sensors. In addition, the PT100 probes or thermocouples have an operating range up to 800 °C and can comfortably manage common oven or furnace temperature control processes. The wide range of models can satisfy all requirements:

The models are divided into two families:

- the first with **temperature only inputs**, and consequently suitable for temperature control in HVAC/R and/or generic applications that require a thermostat in the range –50T150 °C;
- the second **with universal inputs** (NTC, NTC-HT, PTC, PT1000, PT100, J/TC K, voltage and current).

The following sensors can be connected to the “temperature only” models:

- NTC with range –50T90 °C;
- NTC-HT with range –40T150 °C;
- PTC with range –50T150 °C;
- PT1000 with range –50T150 °C.

The following sensors can be connected to the “Multi-in” models:

- NTC with range –50T90 °C;
- NTC-HT with range –40T150 °C;
- PTC with range –50T150 °C;
- PT1000 with range –50T150 °C;
- PT1000 with range –199T800 °C;
- PT100 with range –199T800 °C;
- J/K TC with range –100T800 °C;
- Voltage: 0 to 1 V, -0.5 to 1.3 V, 0 to 10 V, 0 to 5 V rat;
- current: 0 to 20 mA, 4 to 20 mA.

The type of probe is selected by configuration parameter.

Main functions include::

- PID with autotuning;
- two independent control loops;
- clock management for logging alarms;
- working cycles.

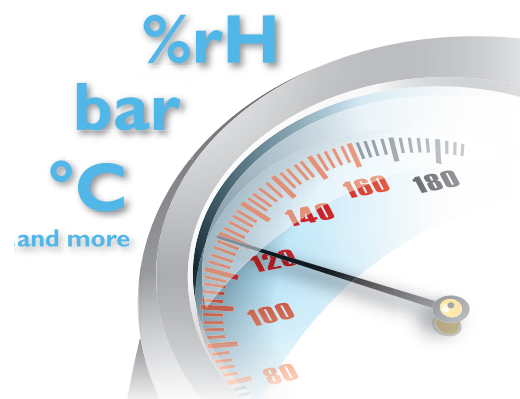
Types of outputs: relays, 0 to 10 Vdc, or control of external SSRs.

Type of power supply: models are available for mains power supply (115 to 230 Vac), or alternatively operating at 12 to 24 Vac/Vdc or 24 Vac/Vdc

Panel or DIN rail mounting: all models are available for both classic panel installation with IP65 front protection, or for DIN rail mounting (4 modules).

Backward compatibility: the list of parameters is compatible with the previous “ir32 universale” range

Other functions: 2 configurable digital inputs, IR receiver and buzzer available on all models; some versions also feature a real time clock (RTC).





IR/DN33: universal thermostats

IR33*7* and DN33*7*

This series of "universal" thermostats can connect two temperature probes (NTC, PTC, PT1000). The second probe can be used for a second control loop, independent from the first, or alternatively for temperature compensation (summer or heating), differential operation (difference between the two temperatures), or free cooling. They feature two digital inputs that can be configured to manage functions such as an immediate external or delayed alarm, and remote ON/OFF. Programming is made extremely simple by the 9 selectable operating modes (e.g.: direct, reverse, neutral zone, PWM, etc.). All controllers feature a PID algorithm with AutoTuning and some versions are available with RTC (real time clock). A low consumption switching power supply is used on both the 12/24 Vac/Vdc and 115/230 Vac versions.

Technical specifications

Power supply: 115/230 Vac -15/10% 50/60 Hz 6 VA or 12/24 Vac -10/10% 50/60 Hz 4 VA, 12/30 Vdc 300 mA max

Operating conditions: -10T60 °C, 10 to 90% RH non-condensing

Front panel degree of protection:

- panel ver.: IP65
- DIN rail ver.: IP40

Certification: CE, UL (panel ver.)

Assembly: panel or DIN rail

Number of I/Os:

- **analogue inputs:** 2 (NTC/HT, PTC, PT1000)
- **digital inputs:** 2
- **analogue outputs:** up to 2 x 0 to 10 Vdc
- **digital outputs:** 1, 2 or 4 relays

Serial ports: 1 via external option

Dimensions:

- panel version: 76x34x75 mm
- DIN version: 70x110x60 mm

Connections: plug-in terminals



IR/DN33: universal multi-input

IR33*9* and DN33*9*

This series of controllers can connect two universal probes (NTC, NTC-HT, PTC, PT1000, PT100, J/K TC, 0 to 1 V, -0.5 to 1.3 V, 0 to 10 V, 0 to 5 V rat., 0 to 20 mA, 4 to 20 mA) for managing common values in HVAC/R applications, as well as any other sensor whose output is supported by the controller. The second probe can be used for a second control loop, independent from the first, or alternatively temperature compensation, differential operation, or free cooling. They also feature two digital configurable inputs. Programming is made extremely simple by the 9 selectable operating modes (e.g.: direct, reverse, neutral zone, PWM, etc.). All controllers feature a PID algorithm with AutoTuning and some versions are available with RTC (real time clock). A low consumption switching power supply is used on both the 24 Vac/Vdc and 115/230 Vac versions.

Technical specifications

Power supply: 115/230 Vac -15/10% 50/60 Hz 9 VA or 24 Vac -10/10% 50/60 Hz 12 VA, 24 Vdc -15/15% 450 mA max.

Operating conditions: -10T50 °C, 10 to 90% RH non-condensing

Front panel degree of protection:

- panel ver.: IP65
- DIN rail ver.: IP40

Certification: CE, UL

Assembly: panel or DIN rail

Number of I/Os:

- **analogue inputs:** 2 configurable
- **digital inputs:** 2
- **analogue outputs:** up to 2 x 0 to 10 Vdc
- **digital outputs:** 1, 2 or 4 relays

Serial ports: 1 via external option

Dimensions:

- panel version: 76x34x93 mm
- DIN version: 70x110x60 mm

Connections: a morsetti estraibili



clima

ADC*

Electronic instrument for controlling ambient temperature and humidity. It can be used in various operating modes. Special attention has been focused on advanced algorithms for heating, cooling or automatic operation and for the control of underfloor heating/cooling and temperature compensation functions. Timer and RTC clock for day and night operation (optional, depending on the model). The remote control option (by purchasing accessory IROPZ48500) allows the data from the instrument to be monitored and saved using a supervisor.

Technical specifications

Power supply: 24 Vac -15/10% 50/60 Hz 1 VA, 24/32 Vdc 1 W

Operating conditions:

0T60 °C, 10 to 90% RH non-condensing

Degree of protection: IP20

Certification: CE, UL

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** room temperature and/or humidity and outside temperature
- **digital inputs:** 1
- **analogue outputs:** 1 x 0 to 10 Vdc
- **digital outputs:** 1 or 2 relays

Serial ports: 1 via external option

Dimensions: 135x86x36 mm

Connections: terminals

Accessories and options



Programming key

(IROPZKEY*)

This key allows the ir33 to be programmed quickly, even when not powered, reducing the risk of errors. The accessory reduces the number of part numbers handled, is a rapid and effective tool for service operations, allowing the controller to be programmed in just a few seconds, even during the testing phase at the end of the production line. Versions are available with battery or external power supply.



Special modules

(CONV*)

These have been developed to be connected directly to the Infrared Universale series instruments (version A). They can in any case be used with other controllers, for example with the μ chiller series.

There are two models available:

- CONV0/10A0: converts the PWM signal supplied by the instrument into a standard analogue signal (0 to 10 Vdc or 4 to 20 mA);
- CONVONOFF0: converts the PWM signal into an ON/OFF signal via relay.



Remote control

(IRTRUES000)

The remote control, which is essential for some applications, has become more powerful and compact, as well as easier to use. This accessory provides direct access to the main functions and configuration parameters, allowing ir33 to be programmed from a remote position using a group of buttons that exactly replicate the instrument keypad.



"Comtool" programming tool

(downloadable from <http://ksa.carel.com>)

With this useful tool, the controller can be programmed from any PC, saving the different configurations to files that can be loaded during the final programming stage, creating custom sets of parameters for faster programming and setting different user profiles with access protected by password.



RS485 serial connection

(IROPZ48500, IROPZ485S0)

These fit directly into the connector that normally is used for programming via key; all models available can be connected to a BMS that uses the CAREL or Modbus® protocol. Model IROPZ485S0 in particular can automatically recognise the TxRx+ and TxRx- signals.



RS485 serial card

(IROPZSER30)

The IROPZSER30 card is used to connect the DN33 universale via the RS485 serial network to a supervisory system that uses CAREL or Modbus® protocol.

Table of IR33/DN33 universale part numbers

assembly		power supply			inputs			outputs			other		
panel	DIN rail	115/230 Vac	12/24 Vac/Vdc	24 Vac/Vdc	digital	temperature	multi-input	relay	to control SSR	0 to 10V	Real Time Clock	PID - Autotuning	buzzer/IR
Universal thermostats													
IR33V7HR20	DN33V7HR20	●			2	2		1				●	●
IR33V7HB20	DN33V7HB20	●			2	2		1			●	●	●
IR33V7LR20	DN33V7LR20		●		2	2		1				●	●
IR33W7HR20	DN33W7HR20	●			2	2		2				●	●
IR33W7HB20	DN33W7HB20	●			2	2		2			●	●	●
IR33W7LR20	DN33W7LR20		●		2	2		2				●	●
IR33Z7HR20	DN33Z7HR20	●			2	2		4				●	●
IR33Z7HB20	DN33Z7HB20	●			2	2		4			●	●	●
IR33Z7LR20	DN33Z7LR20		●		2	2		4				●	●
IR33A7HR20	DN33A7HR20	●			2	2			4			●	●
IR33A7HB20	DN33A7HB20	●			2	2			4		●	●	●
IR33A7LR20	DN33A7LR20		●		2	2			4			●	●
IR33B7HR20	DN33B7HR20	●			2	2		1		1		●	●
IR33B7HB20	DN33B7HB20	●			2	2		1		1	●	●	●
IR33B7LR20	DN33B7LR20		●		2	2		1		1		●	●
IR33E7HR20	DN33E7HR20	●			2	2		2		2		●	●
IR33E7HB20	DN33E7HB20	●			2	2		2		2	●	●	●
IR33E7LR20	DN33E7LR20		●		2	2		2		2		●	●
Universal multi-input													
IR33V9HR20	DN33V9HR20	●			2		2	1				●	●
IR33V9HB20	DN33V9HB20	●			2		2	1			●	●	●
IR33V9MR20	DN33V9MR20			●	2		2	1				●	●
IR33W9HR20	DN33W9HR20	●			2		2	2				●	●
IR33W9HB20	DN33W9HB20	●			2		2	2			●	●	●
IR33W9MR20	DN33W9MR20			●	2		2	2				●	●
IR33Z9HR20	DN33Z9HR20	●			2		2	4				●	●
IR33Z9HB20	DN33Z9HB20	●			2		2	4			●	●	●
IR33Z9MR20	DN33Z9MR20			●	2		2	4				●	●
IR33A9HR20	DN33A9HR20	●			2		2		4			●	●
IR33A9HB20	DN33A9HB20	●			2		2		4		●	●	●
IR33A9MR20	DN33A9MR20			●	2		2		4			●	●
IR33B9HR20	DN33B9HR20	●			2		2	1		1		●	●
IR33B9HB20	DN33B9HB20	●			2		2	1		1	●	●	●
IR33B9MR20	DN33B9MR20			●	2		2	1		1		●	●
IR33E9HR20	DN33E9HR20	●			2		2	2		2		●	●
IR33E9HB20	DN33E9HB20	●			2		2	2		2	●	●	●
IR33E9MR20	DN33E9MR20			●	2		2	2		2		●	●

● standard



Sensors and protection devices



Sensors and protection devices

CAREL offers increasingly advanced and complete global solutions.

For this reason, CAREL has designed an entire range of probes that respond to the needs of HVAC/R installers and manufacturers, as well as for the control of CAREL's own line of humidifiers.

The range envisions temperature and humidity sensors with different uses, housed in sockets, ducted, residential or industrial environment, pressure transducers, smoke, fire and flood detectors, air quality probes, gas leak detectors for refrigerant units, guaranteeing performance and compatibility with all CAREL controllers.

The range has been enhanced with the most innovative technological solutions, offering new international standards at increasingly competitive prices.

Advantages

CAREL probes, as well as being characterised by the acknowledged performance that sets them apart, are very versatile and can satisfy various market requirements.

In fact, all the probes have been especially designed to be compatible not only with all CAREL controllers, but also with the most commonly used standards worldwide.

The temperature and humidity probes, offering a great choice between active and passive technology, are available in different operating ranges and also in specific versions for corrosive or polluting environments.

The pressure transducers are available in a ratiometric version, 0 to 5 V and 4 to 20 mA, also in a sealed version (to be installed without capillary directly onto the piping) offering improved performance in terms of precision.

The air quality sensors offer a new and important accessory to installers and manufacturers of AHUs, absolutely in line with CAREL quality.

The smoke/fire and flood detectors are small devices with auto-calibration function, thus adapting to different environmental conditions without losing activation accuracy.

For the detection of CFCs, HFCs and CO₂ gas refrigerants, CAREL offers a range of sensors designed to satisfy requirements in the industrial refrigeration and air-conditioning for supermarkets, shopping centres, and other public places.



Temperature, humidity and temperature/humidity probes.

DPW*: for installation in the room
DPD*: for installation in the duct

This probes are particularly suitable for civil and commercial environments where particular attention is paid to design. They are used in heating and air conditioning systems that use ducts. The range also envisions models with RS485 connection with CAREL and Modbus® protocol.

Technical specifications

Power supply: 12/24 Vac -10/15%
9 to 30 Vdc $\pm 10\%$

Operating conditions:

- DPW*: -10T60 °C, <100% R.H. non cond.;
- DPD*: -10T60 °C, -20T70, <100% R.H. non cond.

Protection rating:

- DPW*: IP30;
- DPD*: IP55, IP40 sensor.

Assembly:

- DPW*: wall-mounted;
- DPD*: duct;

Number of I/Os:

- **analogue outputs:** -0.5 to 1 V, 0 to 1 V, 0 to 10 V, 4 to 20 mA

Serial Ports: RS485 (specific model)

Dimensions:

- DPW*: 127x80x30 mm;
- DPD*: 98x105x336 mm.

Connections: screw terminal board for cables up to 1.5 mm²



Active temperature/humidity probes

DPP*: for industrial environment

Specifically designed to measure high levels of humidity with great accuracy. The range also envisions models with RS485 connection with CAREL and Modbus® protocol.

Technical specifications

Power supply: 12/24 Vac -10/15%,
9 to 30 Vdc $\pm 10\%$

Operating conditions: -10T60 °C, -20T70,
<100% R.H. non cond.

Protection rating:

- IP55 (container);
- IP54 (sensor).

Assembly: wall-mounted

Number of I/Os:

- **analogue outputs:** -0.5 to 1 V, 0 to 1 V, 0 to 10 V, 4 to 20 mA

Serial Ports: RS485 (specific model)

Dimensions: 98x170x44

Connections: screw terminal board for cables up to 1.5 mm²



Active immersion temperature probes

ASIT*: immersion

The ASIT* immersion probes are used in cases where it is necessary to measure the temperature inside cooling and heating circuits.

They are particularly adaptable where the sensitive element must be in direct contact with the fluid being controlled.

Technical specifications

Power supply: 12/24 Vac -10/15%,
9...30 Vdc $\pm 10\%$

Operating conditions: -10T70 °C, <100%
R.H. non cond.

Protection rating:

- IP55 (container);
- IP67 (sensor).

Assembly: direct or with housing

Number of I/Os:

- **analogue outputs:** -0.5 to 1 V, 4 to 20 mA

Dimensions: 94x102x176

Connections: screw terminal board for cables up to 1.5 mm²



Active universal temperature probes

ASET*: universal

The universal temperature probes are used for many applications; in particular the ASET03* version has an electronic amplifier, protected by a container with IP55 protection rating, which allows remote control up to 200 m with 4 to 20 mA output.

Technical specifications

Power supply: 12/24 Vac -10/15%, 9...30 Vdc $\pm 10\%$

Operating conditions: -30T90 °C or 30T150 °C, <100% R.H. non cond.

Protection rating:

- IP55 (container);
- IP67 (sensor).

Assembly: directly in socket

Number of I/Os:

- **analogue outputs:** -0.5 to 1 V, 4 to 20 mA

Dimensions: 94x102x176

Connections: screw terminal board for cables up to 1.5 mm²



VOC, CO₂, CO₂+VOC air quality probes

DPWQ*: for installation in the room

DPPQ*: for installation in the duct

These analyse the quality of the air and are ideal for air ventilation and handling systems in domestic and commercial areas.

Main functions:

- measurement of air quality;
- quantitative analysis of contamination by parts of polluting gases;
- setting of a sensitivity threshold depending on that envisioned;
- for the ventilation of rooms only when necessary, contributing to a large energy saving.

Technical specifications

Power supply: 24 Vac/dc $\pm 10\%$, 50/60 Hz

Operating conditions: 0T50 °C, 10/90% R.H. non cond.

Protection rating:

- IP55 (container);
- IP67 (sensor)

Assembly:

- DPWQ: wall-mounted;
- DPPQ: duct

Number of I/Os:

- **analogue outputs:** 0 to 10 V, 4 to 20 mA

Dimensions:

- DPWQ*: 95x97x30 mm; 79x81x26 mm;
- DPPQ*: 108x70x262.5 mm; 64x72x228.4 mm.

Connections: screw terminal board for cables up to 1.5 mm²



Refrigerant gas leak detector

DPWL*

The refrigerant gas detection sensor is a device that indicates leaks of the most common gases (R22, R134a, R404a, R407c, R410a and CO₂). It can be used in stand-alone applications, integrated with Carel controllers or with third party devices. It envisions connection with the CAREL controller via the analogue, digital output or via RS485 Modbus[®] serial connection. When a leak above a certain concentration is detected, the sensor informs the controller of the alarm and locally activates an audible and visual signal and a relay (SPDT) at the same time. It offers the advantage of intervening immediately on gas leaks, thus preventing unit standstill and guaranteeing the safety of persons in the vicinity.

Its installation ensures compliance with the European F-GAS and EN378 and ASHRAE 15 standards.

Technical specifications

Power supply: 12 to 24 Vac/Vdc $\pm 20\%$ 50/60 Hz

Operating conditions:

- semicond. ver. -20T50°C;
- infrared ver. -40T50°C 80% R.H. non condensing.

Protection rating:

- semicond. ver. IP41;
- infrared ver. IP66.

Assembly: wall-mounted

Number of I/Os:

- **analogue outputs:** configurable 0 to 5 V, 1 to 5 V, 0 to 10 V, 2 to 10 V, 4 to 20 mA;
- **digital outputs:** 1 amp at 24 Vac/Vdc.

Serial Ports: RS485 Modbus[®]

Connections: disconnectable clamps, 0.5 mm² cable cross-section



Temperature probes with NTC thermistor

NTC*HP*, NTC*WP*, NTC*WH*, NTC*WF*, NTC*HF and NTC*HT, NTCINF*, NTC*PS*

CAREL offers a range of sensors with different features for the various controllers, suitable for different applications mainly in the HVAC/R market sector.

The accuracy obtained thanks to the technical solutions used in developing the sensor, the reliability as a result of the tests to which they are subjected, mean that CAREL NTC probes are reliable transducers for measuring temperature at a low cost.

Probes for socket assembly are available in strips for installation on piping for pass-through with or without pre-heater, to measure the core temperature of the product, and a sensor for estimating product temperature.

Technical specifications

Operating conditions: -50T105 °C

Protection rating: IP67 and IP68

Assembly: depending on the model

Dimensions: depending on the model



Immersion probes

TSN* and TSC*= NTC version
TST* and TSM*= Pt1000 version
TSOPZ= accessories (connectors, fittings, housing...)

CAREL offers a range of TS* series immersion probes in NTC and Pt1000 models, suitable exclusively for hydronic applications.

Quick installation, fast response of the sensor an excellent price/performance ratio are features on which this product range is based.

Connectors are available with cables, fittings and the socket as accessories.

Technical specifications

Operating conditions: -40T90 °C, -40T120 °C

Assembly: on piping

Dimensions:

- TSN* and TSC*: 1/8" GAS x 5 mm
- TST* and TSM: M14 x23 mm with 2 m cable



Temperature probes with PTC, Pt100, Pt1000 sensor

PTC*

The PTC temperature probes represent a possible solution for both cooling and heating applications, used to measure temperature within the operating range, -50T100 °C and 0T150 °C.

PT100*

The PT100 probes represent the ideal solution for all applications in which it is necessary to measure temperatures within the range from -50 to 400 °C (depending on the models).

PT1*HP*, PT1*WP*, PT1*WF*, PT1*HF*, PT1*HT*, PT1*PS; TSQ*

The Pt1000 probes (PT1* and TSQ*) are suitable for all those applications in which it is necessary to measure temperatures in a range from -50 to 250 °C (TSQ*) and from -50 to 105 °C (PT1*), maintaining accuracy also over long distances..

Probes for socket assembly are available in strips for installation on piping for pass-through with or without pre-heater, to measure the core temperature of the product, and a sensor for estimating product temperature.

Technical specifications

Operating conditions: -50T105 °C, -50T250 °C, -50T350 °C

Protection rating: IP65 and IP67

Dimensions: depending on the model



Pressure transducers 4 to 20 mA series C and D

SPKT*C*, SPK1*, SPK2*, SPK3*, SPKT*D*

The pressure transducers supply an analogue current signal (4 to 20 mA). They are used particularly in refrigeration and air conditioning to measure pressure in cooling circuits, but their high performance allows their use in almost all other applications. Compatible with all types of refrigerant. They are available with male and female connection for the C series and only female for the D series.

Technical specifications

Power supply: 8 to 28 Vdc $\pm 20\%$

Operating conditions:

- -25T80 °C (male);
- -40T135 °C (female).

Protection rating: IP65 (IP67 with built-in connector)

Number of I/Os:

- analogue outputs: 4 to 20 mA

Dimensions: depending on the model

Connections: Packard



Ratiometric pressure transducers 0 to 5 V series S

SPKT*S*

The Carel 5 V ratiometric pressure transducers (Sealing) have been developed to be used in commercial refrigeration and air conditioning applications. They are completely hermetic and can be installed directly in contact with the piping, in conditions with the refrigerant fluid lower than the dew point (it is not necessary to use the capillary positioned between piping and sensor). Available with female connection only

Technical specifications

Power supply: 5 Vdc

Operating conditions: -40T125 °C

Protection rating: IP67

Number of I/Os:

- analogue outputs: 0.5 to 4.5 V

Dimensions: $\varnothing 21 \times 51$ mm

Connections: Packard



Ratiometric pressure transducers 0 to 5 V series R

SPKT*R*

These pressure transducers supply a 0 to 5 V ratiometric signal (automotive standard). They can be used in air conditioning and refrigeration systems, with exception to those containing ammonia. Available with female connection only.

Technical specifications

Power supply: 4.5 to 5.5 Vdc

Operating conditions: -40T135 °C

Protection rating: IP65

Number of I/Os:

- analogue outputs: 0.5 to 4.5 V

Dimensions: 20x51.6 mm

Connections: Packard



Combined pressure-temperature transducer

SPKP*

The combined pressure and temperature transducer has been developed for applications in the refrigeration and air conditioning sectors. The sensor-pressure transducer is 0 to 5V ratiometric, while the temperature sensor is NTC. It offers the advantage of having a single component with a quicker and more accurate measurement. Typical use is in combination with a driver for electronic expansion valves in refrigeration and air conditioning applications.

Technical specifications

Power supply: 4.5 to 5.5 V

Operating conditions: -40T120 °C

Protection rating: IP67

Number of I/Os:

- **analogue outputs:** 0.5 to 4.5 V and NTC 10K at 25°C (non STD)

Dimensions: Ø= 23.80 x 65 mm

Connections: 4-way AMP

Micro-Quadlok System connector



Differential pressure transducers

SPKD*

The differential pressure transducers use a ceramic sensor that supplies a voltage or current signal that is calibrated and compensated by temperature. They are particularly suitable for measuring low pressure values in air conditioning systems, laboratories and clean rooms (non-corrosive air and gas)

The main features are:

- compact construction;
- easy and simple installation;
- model can be configured for 4 different pressure ranges.

Technical specifications

Power supply: 15 to 36 Vdc

Operating conditions: 0T50 °C

Protection rating: IP65

Assembly: panel

Number of I/Os:

- **analogue outputs:** 4 to 20 mA

Dimensions: 70x108x73.5 mm

Connections: screw terminal board for

cables up to 1.5 mm²



Differential pressure switch

DCPD0*0*00

Device used to control the differential pressure of the air for filters, fans, air ducts, air-conditioning and ventilation units.

The pressure switch is particularly suitable for control and safety in air-conditioning systems for indicating fan shutdown and clogging of the filters. It is applied in environments with non-aggressive and non-flammable air and gases, also in the version with assembly kit.



Anti-freeze thermostat

DCTF000320

This manages heat exchanger (evaporation coils) and electric heater protection for air conditioning and refrigeration systems.

It can be used in all applications where it is necessary to control the temperature in a certain point of the system in order to prevent it dropping below a pre-established safety value. Moreover, the thermostat offers self-protection if the sensitive element should breakdown.



Airflow switch

DCFL000100

Flow switch for controlling air or non-aggressive gas flow inside the distribution ducts for air conditioning and air handling units.

It signals the lack of or excessive decrease in flow rate in the duct, thus activating the switch.



Flood detector

FLOE*

The flood sensor device can detect the presence of water in an environment. It is usually used for the protection against the flooding of datacentres, offices, laboratories, special rooms. It is made up of a detector (normally positioned on the electric control board) and a sensor (positioned on the point to be controlled).

When the water comes into contact with the sensor, the detector immediately signals an alarm, switching over relay status.



Smoke and fire detector

SFF*

The smoke and heat detectors are electronic devices that can quickly detect dangerous and sudden temperature changes or the increase in fumes. Their peculiarity lies in the self-calibration, i.e. the possibility to maintain the guarantee of activation over time, adapting perfectly to the different environmental conditions, without losing sensitivity.

Active temperature and humidity probes

Models	temper. range	temper. range	output
Active probes for rooms, power supply 9 to 30 Vdc/12 to 24 Vac			
DPWT010000	-10T60 °C		selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPWT011000	-10T60 °C		NTC 10 K at 25 °C
DPWC111000	-10T60 °C	10...90% R.H.	• NTC 10 K at 25 °C (temperature) • selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA (humidity)
DPWC110000	-10T60 °C	10...90% R.H.	selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPWC115000	-10T60 °C	10...90% R.H.	• NTC 10 K at 25 °C (temperature) • 0 to 10 Vdc (humidity)
DPWC112000	-10T60 °C	10...90% R.H.	0 to 10 Vdc
DPWC114000	-10T60 °C	10...90% R.H.	opto-isolated RS485 serial
DPWT014000	-10T60 °C		opto-isolated RS485 serial
Active probes for industrial environments, power supply 9 to 30 Vdc/12 to 24 Vac			
DPPT010000	-20T70 °C		selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPPT011000	-20T70 °C		NTC 10 K at 25 °C
DPPC111000	-10T60 °C	10...90% R.H.	• NTC 10 K at 25 °C (temperature) • selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA (humidity)
DPPC110000	-10T60 °C	10...90% R.H.	selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPPC210000	-20T70 °C	0...100% R.H.	selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPPC112000	-10T60 °C	10...90% R.H.	0 to 10 Vdc
DPPC212000	-20T70 °C	0...100% R.H.	0 to 10 Vdc
DPPT014000	-10T60 °C	10...90% R.H.	opto-isolated RS485 serial
DPPC114000	-10T60 °C	10...90% R.H.	opto-isolated RS485 serial
DPPC214000	-20T70 °C	0...100% R.H.	opto-isolated RS485 serial
Active probes for ducts, power supply 9 to 30 Vdc/12 to 24 Vac			
DPDT010000	-20T70 °C		selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPDT011000	-20T70 °C		NTC 10 K at 25 °C
DPDC111000	-10T60 °C	10...90% R.H.	• NTC 10 K at 25 °C (temperature) • selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA (humidity)
DPDC110000	-10T60 °C	10...90% R.H.	selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPDC210000	-20T70 °C	0...100% R.H.	selectable 0 to 1 V/-0.5 to 1 Vdc/4 to 20 mA
DPDC112000	-10T60 °C	10...90% R.H.	0 to 10 Vdc
DPDC212000	-20T70 °C	0...100% R.H.	0 to 10 Vdc
DPDT014000	-20T70 °C		opto-isolated RS485 serial
DPDC114000	-10T60 °C	10...90% R.H.	opto-isolated RS485 serial
DPDC214000	-20T70 °C	0...100% R.H.	opto-isolated RS485 serial
Container protection rating:	IP55 for DPD, DPP		for duct and technical environment)
	IP30 for DPW		(wall-mounted)
Sensitive element protection rating	IP30		for DPW
	IP40		for DPD
	IP54		for DPP
Time constant, temperature	in still air		300 s
	in ventilated air (3 m/s)		60 s
Time constant, humidity	in still air		60 s
	in ventilated air (3 m/s)		20 s
Models	temperature range		output
Active probes for immersion and power supply environment 9 to 30 Vdc/12 to 24 Vac			
ASIT030000	-30T90 °C		selectable -0.5 to 1 Vdc/4 to 20 mA
Active probes for universal power supply use 9 to 30 Vdc/12 to 24 Vac			
ASET030000	-30T90 °C		selectable -0.5 to 1 Vdc/4 to 20 mA
ASET030001	-30T90 °C		selectable -0.5 to 1 Vdc/4 to 20 mA
ASET030002	-30T150 °C		selectable -0.5 to 1 Vdc/4 to 20 mA

Passive temperature probes

Models	range	accuracy	constants (time) in fluid	IP
NTC*				
NTCI*HP**	-50T105 °C	25 °C: ±1%	25 s	IP67
NTCI*WF**	-50T105 °C	25 °C: ±1%	10 s	IP67
NTCI*WP**	-50T105 °C	25 °C: ±1%	30 s	IP68 limited
NT*WG**	-50T105 °C	25 °C: ±1%	20 s	IP67
NT*HT**	0T150 °C	±0.5 °C; -10T50 °C - 25 °C: ±1.0 °C; -50T85 °C ±1.6 °C; +85T120 °C - ±2.1 °C; +120T150 °C	30 s	IP55
NT*HF**	-50T90 °C	±0.5...25 °C; ±1.0 °C from -50T90 °C	50 s	IP55
NT*WH*	-50T105 °C	25 °C; ±1%	30 s	IP68 permanent
NTC*PS*	-50T105 °C	25 °C: ±1%	50 m	IP67
NTCINF	-50T110 °C	25 °C: ±1%	45 s	IP67
TSN*	-40T120 °C	25 °C: ±1%	30 s	IP68
TSC*	-40T90 °C	25 °C: ±1%	45 s	IP68
PT100*				
PT100000A1	-50T250 °C	IEC 751 class B	20 s	IP65
PT100000A2	-50T400 °C	IEC 751 class B	20 s	IP65
PT1000				
PT1*HP*	-50T105 °C	IEC 751 class B	10 s	IP67
PT1*WF*	-50T105 °C	IEC 751 class B	15 s	IP67
PT1*WP*	-50T105 °C	IEC 751 class B	25 s	IP68 limited
PT1*HF*	-50T105 °C	IEC 751 class B	15 s	IP67
PT1*HT*	-50T250 °C	IEC 751 class B	20 s	IP67
PT1*PS*	-50T105 °C	IEC751 class B	50 m	IP67
TSQ15MAB00	-50T250 °C	IEC 751 class B	10 s	IP65
TST*	-40T120 °C	IEC 751 class B	10 s	IP68
TSM*	-40T90 °C	IEC 751 class B	10 s	IP68
PTC				
PTCO*0000	0T150 °C	±2 °C; 0T50 °C - ±3 °C; -50T90 °C - ±4 °C; 90T120 °C	15 s	IP65
PTCO*W*	-50T100 °C	±2 °C; 0T50 °C - ±3 °C; -50T90 °C - ±4 °C; 90T120 °C	15 s	IP67
PTCO3000*1	-50T120 °C	±2 °C; 0T50 °C - ±3 °C; -50T90 °C - ±4 °C; 90T120 °C	15 s	IP67

Air quality probes

Models	type	output
For rooms, 24 Vac/15 to 36 Vdc		
DPWQ306000	V.O.C.	0 to 10 Vdc or 4 to 20 mA
DPWQ402000	CO2	0 to 10 Vdc
DPWQ502000	V.O.C. and CO2	0 to 10 Vdc
For ducts, 24 Vac/15 to 36 Vdc		
DPDQ306000	V.O.C.	0 to 10 Vdc or 4 to 20 mA
DPDQ402000	CO2	0 to 10 Vdc
DPDQ502000	V.O.C. and CO2	0 to 10 Vdc

Pressure transducers

Models	power supply:	operating temperature	range	accuracy	output signal	constants (time)	IP
SPKT00-R0: 0 to 5 V ratiometric - female series R							
53	4.5 to 5.5 Vdc	-40T135 °C	4.2 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
13	4.5 to 5.5 Vdc	-40T135 °C	9.3 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
33	4.5 to 5.5 Vdc	-40T135 °C	34.5 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
43	4.5 to 5.5 Vdc	-40T135 °C	17.3 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
B6	4.5 to 5.5 Vdc	-40T135 °C	45.0 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
F3	0.5 to 5.5 Vdc	-40T135 °C	20 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
E3	0.5 to 5.5 Vdc	-40T135 °C	12.8 relative bar	±1,2%	0.5 to 4.5 V	10 ms	IP65 ¹
SPK*: 4 to 20 mA - male series C							
*1000000	8 to 28 Vdc	-25T80 °C	-0.5 to 7 bar	±1% fs	4 to 20 mA	-	IP67
*240000	8 to 28 Vdc	-25T80 °C	-1 to 24 bar	±1% fs	4 to 20 mA	-	IP67
*2500000	8 to 28 Vdc	-25T80 °C	0 to 25 bar	±1% fs	4 to 20 mA	-	IP67
*3000000	8 to 28 Vdc	-25T80 °C	0 to 30 bar	±1% fs	4 to 20 mA	-	IP67
SPK*C*: 4 to 20 mA - female series C							
*T0021C0	8 to 28 Vdc	-40T135 °C	-0.5 to 7 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T0011C0	8 to 28 Vdc	-40T135 °C	0 to 10 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T0031C0	8 to 28 Vdc	-40T135 °C	0 to 30 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T0041C0	8 to 28 Vdc	-40T135 °C	0 to 18.2 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T00B1C0	8 to 28 Vdc	-40T135 °C	0 to 44.8 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T00G1C0	8 to 28 Vdc	-40T135 °C	0 to 60 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
*T00D8C0	8 to 28 Vdc	-40T100 °C	0 to 150 bar	±1% fs; 0T50 °C	4 to 20 mA	<10 ms	IP65 ¹
SPK*: 4 to 20 mA - female series D							
*T0021D0	8 to 28 Vdc	-40T135 °C	-0.5 to 7 bar	±1% fs; 0T40 °C	4 to 20 mA	<10 ms	IP65
*T0011D0	8 to 28 Vdc	-40T135 °C	0 to 10 bar	±1% fs; 0T40 °C	4 to 20 mA	<10 ms	IP65
*T0041D0	8 to 28 Vdc	-40T135 °C	0 to 18.2 bar	±1% fs; 0T40 °C	4 to 20 mA	<10 ms	IP65
*T0031D0	8 to 28 Vdc	-40T135 °C	0 to 30 bar	±1% fs; 0T40 °C	4 to 20 mA	<10 ms	IP65
*T00B1D0	8 to 28 Vdc	-40T135 °C	0 to 44.8 bar	±1% fs; 0T40 °C	4 to 20 mA	<10 ms	IP65
SPK*: 0 to 5 V - female series S							
*T0051S0	0.5 to 4.5 Vdc	-40T125 °C	-1 to 4.2 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T0011S0	0.5 to 4.5 Vdc	-40T125 °C	-1 to 9.3 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T00E1S0	0.5 to 4.5 Vdc	-40T125 °C	-1 to 12.8 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T0041S0	0.5 to 4.5 Vdc	-40T125 °C	0 to 17.3 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T00F1S0	0.5 to 4.5 Vdc	-40T125 °C	0 to 20.7 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T0031S0	0.5 to 4.5 Vdc	-40T125 °C	0 to 34.5 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67
*T00B1S0	0.5 to 4.5 Vdc	-40T125 °C	0 to 45 bar	±1% fs; 0T50 °C	0.5 to 4.5 V	<10 ms	IP67

¹ with built-in IP67 connector

Differential air pressure transducers

Models	power supply:	input current	differential pressure range	differential pressure accuracy full scale	output signal	filtered signal	IP
SPKD00C5N0	15 to 30 Vdc	≥20 mA	-50 to 50 Pa -100 to 100 Pa 0 to 50 Pa 0 to 100 Pa	±3%	4 to 20 mA	selectable 1 or 10 s	IP65
SPKTD00U5N0	15 to 30 Vdc	≥20 mA	0 to 1000 Pa 0 to 2000 Pa 0 to 3000 Pa 0 to 5000 Pa	±3%	4 to 20 mA	selectable 1 or 10 s	IP65

Pressure switches and flow switches

Operating conditions	sensor	range	accuracy	maximum current	output signal	contacts	IP
DCPD0*0100: pressure switch for duct							
-25T85 °C max 50 mbar	silicone membrane	0.5 to 5 mbar	0.2 ± 15% mbar	1.5 (A) 25 Vac 0.1 A 24 Vac	NO...NC voltage-free contact	AgCdO contacts watertight switch	IP54
DCPD0*1100: pressure switch for duct							
-20T85 °C max 50 mbar	silicone membrane	0.2 to 2 mbar	0.2 ± 15% mbar	1.5 (A) 25 Vac 0.1 A 24 Vac	NO...NC voltage-free contact	AgCdO contacts watertight switch	IP54
DCFL000100: flow switches							
-40T85 °C	silicone membrane	2.5 to 9.2 m/s (start) 1 to 8 m/s (stop)		15 (8) A 24/250 Vac	NO...NC voltage-free contact	watertight switch	IP65

*: "1" with assembly kit



Wireless devices for monitoring temperature, humidity, light and energy

The CAREL rTM monitoring system, is used to monitor temperature, humidity, light intensity and pulse counters from energy meter modules, in combination with CAREL supervisory systems or programmable controllers with special software.

Benefits

Ideal for retrofits on existing systems, being easy to install:

- no electrical connections required;
- flexible layout in the event of structural modifications;
- simple installation and maintenance;
- existing controllers do not need to be replaced, as the system is completely independent and can be integrated into any installation;
- simplifies monitoring of the installation (including over remote connections). In the event of alarms, operating status can be notified via SMS, email, FAX;
- supervisory systems can be used to process and send customised reports and data log files;

Composition

- Battery or mains powered sensors for measuring the temperature of cabinets and cold rooms (°C). Available in versions with built-in sensors (BP) and external sensors (EP);
- Battery powered sensors for measuring temperature, humidity, light intensity in

rooms, type SA (°C - RH%) or SI (°C - r.H.% - Lux).

- Pulse counter from energy meter modules for monitoring electricity, water and gas consumption, battery powered (CI) or mains powered (RC).
- RA (Router-Actuator) I/O module, to measure the status of the inputs and activate general loads. Can be configured as a thermostat with direct/reverse logic.
- RB (Router-Bridge) to connect instruments locally over Modbus® RS485 that are not accessible to cabled lines.

The devices use a 2.4 GHz wireless connection (16 channels, 2405 to 2480 MHz) with ZigBee communication protocol and MESH networks with up to 7 hops, automatic adaptation of communication between devices, optimising wireless communication routes when the devices are not directly reachable from the Access Point, so as to guarantee continuous communication. Battery or mains powered sensors. The battery powered sensors require no electrical connection and typical battery life is 5/8 years; mains powered devices require no routine maintenance. All wireless sensors send the data measured to the Access Point via radio; this acquires information from the sensors and then forwards it to the CAREL supervisory system or controller, over the Modbus® RTU RS485 serial network.

The system can be easily extended and modified following installation.

Handheld configuration devices are available for simple configuration and installation.

To increase wireless coverage, Routers are available that extend the area of transmission. These devices are available as Router only, RO, or combined with other functions:

- EP1 Router-Sensor (same functions as the EP sensor);
- RB Router-Bridge type (to extend the RS485 wired network);
- RA Router-Actuator, to manage I/Os via a remote connection or used as a local thermostat monitored via the wireless network.



BP - temperature sensor

WS01U01M0*

Sensor suitable for installation in refrigeration cabinets. The local button disables the high temperature signal alarm when the cabinet is off or being cleaned. The sensor is ready to be installed directly inside the cabinet with its own fastening bracket. The rear wall has metal shielding that, combined with thermal insulation inside the shell, offers better heat insulation, eliminating the influence of the surface of the refrigerated cabinet.

Functions implemented

- instant temperature;
- product simulation temperature;
- monitoring of temperature thresholds for high temperature (HACCP) or low temperature alarm signals (to prevent products from freezing);
- disable high temperature alarm from local "Clean" button;
- battery level control in mV and residual charge in mAh;
- wireless signal level control.

Technical specifications

Power supply: 3.6 V lithium battery 2500 mAh, "AA" size

Operating conditions: -40T50 °C 80% r.H. non-condensing

Degree of protection: IP65

Assembly: wall-mounted on bracket

Dimensions: 83.9x71.6x34 mm



EP - temperature sensor

WS01W02M00

The EP sensor (External Probe) is used inside cabinets or cold rooms to monitor temperature in combination with supervisory systems. It transmits temperature data measured by the two NTC probes, and the status of two digital inputs, configurable as "door status" and "defrost status" or for generic use.

Functions implemented

- instant temperature read by the two sensors;
- monitoring of temperature thresholds for high temperature (HACCP) or low temperature alarm signals;
- battery level control in mV;
- wireless signal level control;

Technical specifications

Power supply: 3.6 V lithium battery 2500 mAh, "AA" size

Operating conditions: 0T50°C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** 2 NTC 10 K at 25°C
- **digital inputs:** 2 (voltage-free contact)

Dimensions: 94x102x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



SA - room temperature and humidity sensor

WS01G01M00

The SA wireless room sensor is battery-powered and is installed inside rooms to monitor temperature and humidity.

Functions implemented

- instant temperature;
- instant humidity;
- monitoring of temperature and humidity thresholds;
- battery level control in mV;
- wireless signal level control.

Technical specifications

Power supply: 3.6 V lithium battery 2500 mAh, "AA" size

Operating conditions: -10T60°C 80% r.H. non-condensing

Degree of protection: IP30

Assembly: wall-mounted

Dimensions: 127x80x30 mm



SI - temperature, humidity and light sensor

WS01F01M00

The SI wireless industrial sensor is battery-powered and is installed inside rooms to monitor temperature, humidity and light intensity.

Functions implemented

- instant temperature;
- instant humidity;
- instant light intensity;
- monitoring of temperature, humidity and light intensity thresholds;
- battery level control in mV;
- wireless signal level control.

Technical specifications

Power supply: 3.6 V lithium battery 2500 mAh, "AA" size

Operating conditions: -20T70°C 80% r.H. non-condensing

Degree of protection: IP55 case, IP40 sensor cap

Assembly: wall-mounted

Dimensions: 94x153x40 mm



CI - pulse counter

WS01E02M00

The CI battery-powered wireless pulse counter is a device used together with energy meters to measure electricity, gas, or water consumption, without the need to install electrical cables.

It can manage two energy meters using two digital inputs, and is ready for connection of two external NTC temperature probes. Closing of the contacts on the digital inputs activates two separate pulse counters.

The number of pulses is converted to an energy value (KW, m³) by the CAREL supervisor or controller with special software, so as to total and monitor energy utility consumption. It can manage up to two energy meters configured to send pulse signals.

Functions implemented

- two separate pulse counters;
- battery level control in mV;
- wireless signal level control;
- instant temperature read by two NTC probes;
- temperature difference between NTC probes.

Technical specifications

Power supply: 3.6 V lithium battery 2500 mAh, "AA" size

Operating conditions: 0T50°C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** 2 NTC 10 K at 25°C;
- **digital inputs:** 2 (voltage-free contact)

Dimensions: 94x108x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



Access Point

WS01AB2M20

This device acquires data via the wireless signals sent by the sensors or Routers over the ZigBee™ network, and then forwards these over a Modbus® RTU RS485 serial line. A CAREL supervisor (PlantVisorPRO or PlantWatchPRO) or controller can be used to manage the rTM system variables. Up to 30 sensors can be bound to each Access Point, and a maximum of 60 when adding one or more Routers. Up to 7 Access Points can be connected to the same Modbus RS485 serial network, for a total of 111 sensors on each serial line.

Technical specifications

Power supply: 12/24 Vac/Vdc ±10%;

Operating conditions: 0T50°C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Serial ports: RS485 Modbus®

Dimensions: 94x300x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



RO - router

WS01RC1M20

This device is used when the distance between sensor and Access Point exceeds 30 m, or alternatively the number of network nodes (sensors) exceeds a total of 30. A maximum of 60 Routers can be installed in the wireless network, 48 of which can be accessed by the supervisor. The Access Point automatically assigns the serial address in the order in which these are "bound" (from 200 to 247).

Technical specifications

Power supply: 230 Vac -20/+10 %;

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Dimensions: 98x300x44 mm

Connections: plug-in terminals, wire size 0.5 mm²



RB - router bridge

WS01RB2M20

This device is used to connect Modbus® RS485 instruments via radio when these are not accessible using cabled lines, using a wireless connection to send data from the instruments to the supervisor.

The instruments are connected locally on the serial line, which acquires data and forwards them to the Access Point.

The Access Point is physically connected to the supervisor, and the instruments connected locally to the Router-Bridge devices are logically assigned to the main network (where the Access Point is physically connected).

This is an excellent solution for all refrigeration and air-conditioning applications and others with similar needs.

The device is a solution for binding all wired devices that require wireless communicate.

It also includes the Router function.

Technical specifications

Power supply: 12/24 Vac/Vdc ±10%;

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Serial ports: RS485 Modbus®

Dimensions: 94x300x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



EP1 - router sensor

WS01VB2M10

This integrates the same functions as the EP battery-powered sensor and the RO Router, and features two network addresses (one for the sensor and one for the router).

Functions implemented

- instant temperature read by the two sensors;
- monitoring of temperature thresholds for high temperature (HACCP) or low temperature alarm signals;
- wireless signal level control;

Technical specifications

Power supply: 12/24 Vac/Vdc ±10%;

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** 2 NTC 10 K at 25°C;
- **digital inputs:** 2 (voltage-free contact)

Dimensions: 94x300x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



RC - router/pulse counter

WS01N02M20

This integrates the same functions as the CI pulse counter and the RO Router, and features two network addresses (one for the pulse counter and one for the router).

Functions implemented

- management of two separate pulse counters;
- wireless signal level control;
- instant temperature measurement by two NTC probes;
- temperature difference between NTC probes.

Technical specifications

Power supply: 12/24 Vac/Vdc $\pm 10\%$;

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** 2 NTC 10 K at 25°C;
- **digital inputs:** 2 (voltage-free contact)

Dimensions: 94x300x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



RA - router actuator

WS01H02M20

This module can be configured as a wireless I/O actuator for managing loads and reading generic inputs. It can be configured as a thermostat with heat-cool operating logic. When used as an I/O module, the outputs are managed directly by Modbus variables (via CAREL supervisor or controller with special software). When used as a thermostat, it sends the I/O status to the supervisor for monitoring. It also integrates the Router function and features two network addresses (one for the I/O module - thermostat and one for the router).

Configured as an I/O module it manages:

- 2 digital inputs;
- 2 digital outputs, 1 A/24 Vac;
- 1 analogue inputs (NTC 10 K at 25°C)

Functions implemented

- management of remote loads, reading analogue and digital inputs;
- activation of digital outputs from digital input;
- thermostat management (heat – cool);
- wireless signal level control;

Technical specifications

Power supply: 12/24 Vac/Vdc $\pm 10\%$;

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP55

Assembly: wall-mounted

Number of I/Os:

- **analogue inputs:** 1 NTC 10 K at 25°C
- **digital inputs:** 2 (voltage-free contact)
- **digital outputs:** 2 (1 A, 24 Vac)

Dimensions: 118x300x40 mm

Connections: plug-in terminals, wire size 0.5 mm²



Handheld configuration device

WS01L01M00

The rTM handheld is a useful device for installation, commissioning and service of CAREL ZigBee™ wireless networks for the rTM system.

Functions implemented

- reading of wireless channels occupied, performed before wireless system installation (in the field);
- measurement of wireless signal intensity from Access Point or Router;
- simplified opening and closing of the wireless network during commissioning;
- reset default parameters on Access Point and Router;
- assign serial address (ID) to the BP Sensor.

Technical specifications

Power supply: 1.5V "AAA" size batteries

Operating conditions: 0T50 °C 80% r.H. non-condensing

Degree of protection: IP40

Dimensions: 72,5x167,5x28 mm



Remote management and communication solutions



Connectivity

Connectivity is the result of CAREL's years of experience in the design and production of serial devices for controlling HVAC/R units. CAREL is continuously engaged in technological evolution in the communications industry, paying attention to certain fundamental concepts.

Connectivity

Interfaceability and compatibility with the most widespread BMS (Building Management Systems): BACnet™, LonWorks®, Modbus®, Konnex, SNMP. It thus becomes easy to:

- manage the unit remotely via modem and Internet, even with a simple browser;
- inform authorised personnel, wherever they might be, of any alarm situations, even via SMS and email;
- construct alarm logs and graphs for prompt unit diagnostics.

Interoperability

The ability to work in distributed intelligence and with integrated solutions, acquiring and sharing information to and from third party devices for:

- better unit management;
- a higher degree of efficiency of the system (energy savings).

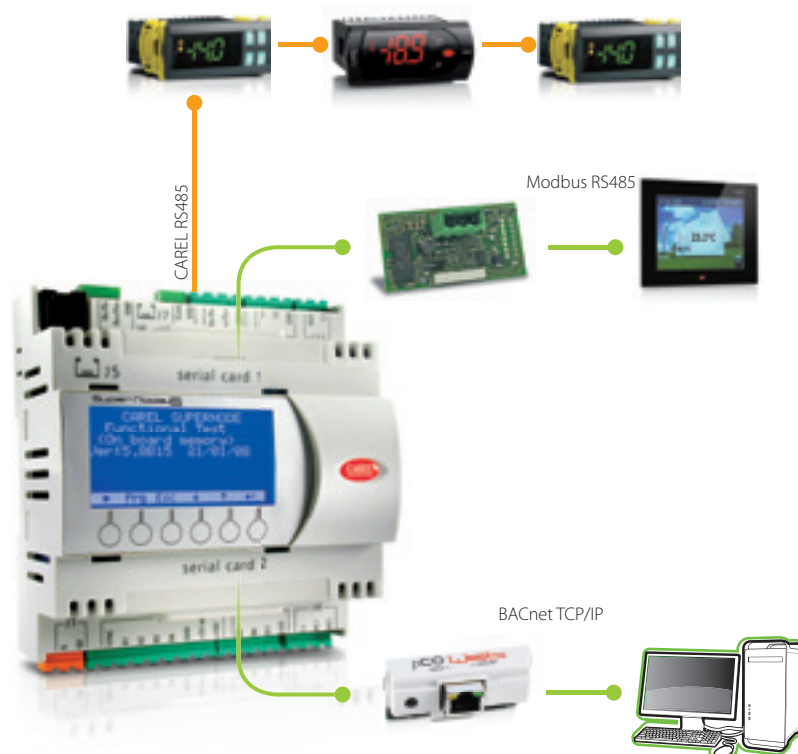
Security

Absence of risks in transmitting information and exchanging important data, especially across networks that can be accessed by everyone.

CAREL devices, through the supervisory systems, can be equipped with:

- differentiated access to the unit according to whether the person is authorised for maintenance or supervision;
- secure access via internet or VPN (virtual private network).

Application example





Supernode

SN*

Supernode, the programmable controller for managing a large flow of information. Compact (6 DIN modules) with built-in 132x64, pixel blue negative display. The keypad, located horizontally under the display and without screen printing, allows customisation of the functions for each key (shown in the last row on the display) differentiating them from screen to screen.

Supernode has 6 serial ports:

- 2 integrated RS485, one of which is opto-isolated;
- 2 slots for BMS plug-in cards;
- 2 USB ports (Master and Slave).

The fast digital input that is standard on all versions allows direct reading of energy meters.

Ideal as a system coordinator, access for two supervisory systems at the same time and masters with several serials ports makes it adaptable to all types of applications and needs.

Technical characteristics

Power supply: 24 Vac -15/10%, 50/60 Hz o 48 Vdc (36 Vmin to 72 Vmax)

Operating conditions: -10T60 °C, 90% RH non condensing

Protection rating: IP20 –Front IP40

Certification: CE / UL

Assembly: DIN rail

I/O Number:

- **analogue inputs:** from 6 to 8
- **digital inputs:** from 4 to 6
- **analogue outputs:** 2
- **digital outputs:** 2

Serial Ports: pLAN, 2BMS, 1FieldBus

Dimensions: 6 DIN (105x110x60)

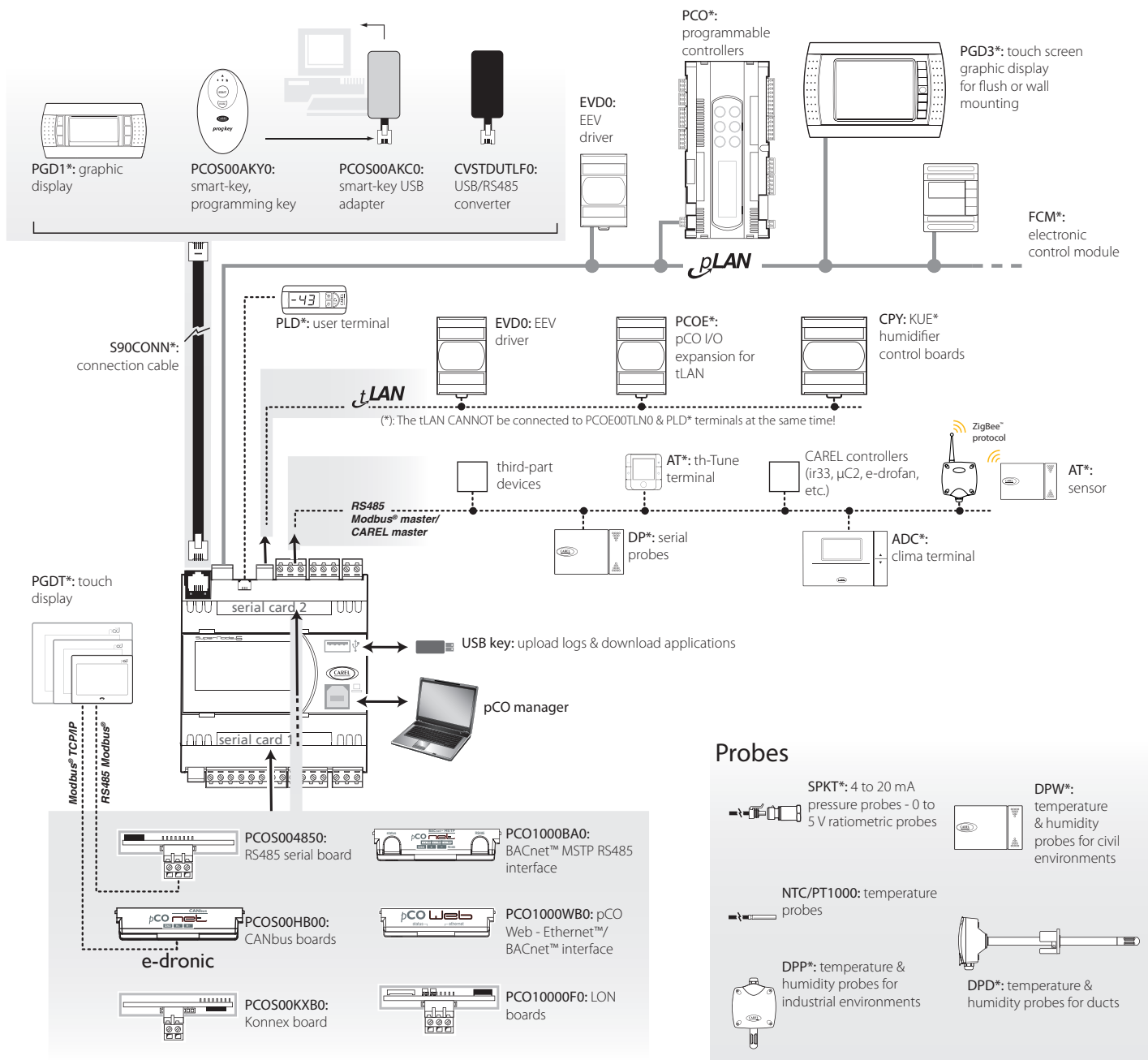
Connections: plug-in terminals

Features	SNS*M
Flash Memory 4 Mb	●
Ram 512 kb	●
Nand Flash 32 Mb	●
Real Time Clock	●
Max no. serial ports	6
pLAN	●
RS485 opto-isolated/tLAN/PST-PLD	●
Serial 1 card connector	●
Serial 2 card connector	●
USB Master Port	□
USB Slave Port	□
Preset programming key	●
Built-in 132x64 pixel blue negative display	□
Built-in 6 LED + 1 key user interface	□
Black box	●
Maximum no. inputs	7
PT1000 inputs	2
Inputs 0 to 10V	6
Inputs 0 to 1V	6
Inputs 4 to 20mA or 0 to 20mA	2
NTC inputs	6
Inputs 0 to 5 Vdc, ratiometric	6
Voltage-free contact digital inputs	3
Fast digital inputs for pulse counter	1
Input selection via software	●
Max no. analogue outputs	2
0 to 10 Vdc outputs	1
PWM outputs (cut-off)	1
Max no. digital outputs	2
SPST relay outputs	1
SPDT relay outputs	1
Max no. SSR outputs	2
Power supply 48 Vdc	●
Power supply 24 Vdc	●

● standard

□ optional

OVERVIEW DRAWING Supernode



pCOWeb/Net

LONWORKS

Konnex®

RS485



SNMP

Modbus® TCP/IP

remotepro



Modbus® RTU



RS485
CAREL

RS485 Modbus®



tLAN

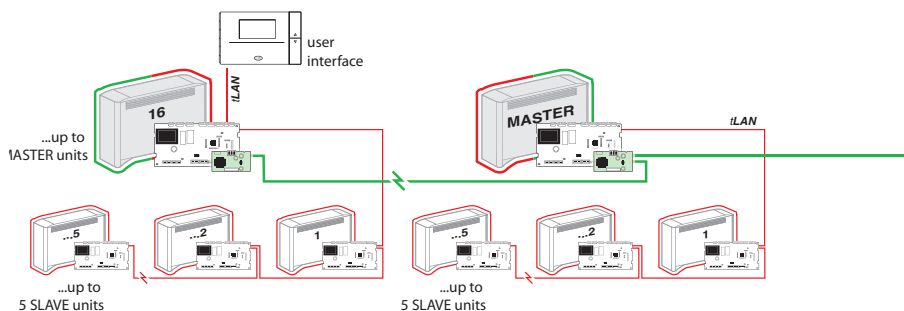
MP BUS
TECHNOLOGY BY BELIMO



FieldBus connectivity

For the purpose of communication between controllers from different manufacturers, CAREL offers a wide variety of solutions that allow pCO controllers to interface with devices in the field such as valves, VFDs, serial

sensors, Belimo actuators, etc. In this way, the pCO sistema controller manages not only the individual unit but also the entire air conditioning/cooling system.

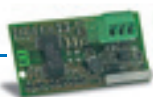


CANbus

(BMS: PCOS00HB0, FieldBus: PCOS00HBF0)

With the CANbus option, pCO controllers can be connected to the CAREL system to manage fan coils (e-drofan), thus allowing easy management of the system and optimising comfort and operating costs through synergy between controllers.

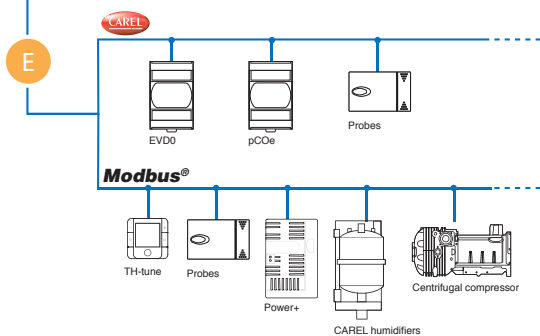
Available for both FieldBus and BMS.



RS485

(PCO100FD10)

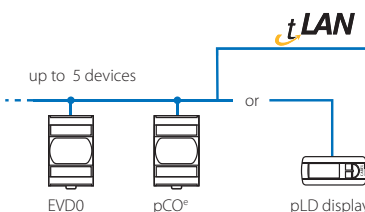
The RS485 serial option on the FieldBus serial device can be used with the Modbus® Master or CAREL Master protocol to manage intelligent devices.



MP BUS

(PCO100MPB0)

With the MP-BUS® protocol, a maximum of 6 Belimo servocontrols can be managed via a single 2-wire cable.



tLAN

(PCO100TLN0)

The tLAN options allows connection with CAREL devices such as the I/O expansions (pCOe) or driver for managing the electronic valve (EVD0), up to a maximum of 5. Alternative PLD display

BMS connectivity

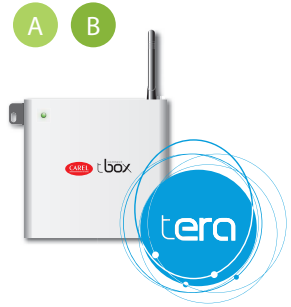
Connecting CAREL controllers with the BMS can be done as follows:

- directly, thanks to the capacities of the pCO series system for selecting the protocol to use (CAREL, Modbus®);
- through the connection with a serial

card that communicates with the protocol used by the BMS (BACnet™, SNMP, LON...);

- by integrating the drivers for managing the CAREL proprietary protocol (OP® server) in the BMS.

Modbus®



RS485
(PCOS004850)

The RS485 for serial BMS interfaces with the supervisor system through the CAREL slave or Modbus® RTU slave protocols.



The CAREL slave protocol is for interfacing with PlantVisorPRO, PlantWatchPRO or OPC server supervisor systems.



LONWORKS®

LON
(PCO10000F0)

LonWorks is a digital communication technology developed by Echelon following rapid distribution in building automation systems. The LonWorks technology was later established in the industrial sector and is now even used in home automation. The electrical standard supported by CAREL is FTT10. The LONset tool (which can be downloaded from ksa.carel.com) allows the creation of LON files (NXE and XIF) for customised profiles. For info: lon@carel.com.



Konnex®
(BMS: PCOS00KXB0, FieldBus: PCOS00KXF0)

Konnex is a standard communication protocol designed for domotics and automation applications inside buildings.

CAREL is a member of the KNX Association (www.knx.org).

The Konnex CAREL card is compatible with all KNX/EIB devices and can be installed on ports:

- BMS of the pCO sistema or e-drofan controllers;
- FieldBus for pCO sistema controllers.

The K-Set tool (which can be downloaded from ksa.CAREL.com) allows the creation of an XML file for customised profiles.

For info: konnex@carel.com



It is an industrial standard created by a consortium of companies in collaboration with Microsoft® for standardising drivers towards proprietary devices. Using the CAREL OPC server (which can be downloaded from ksa.CAREL.com), any Windows® OPC client application can communicate with all CAREL devices.

Modbus®

A B



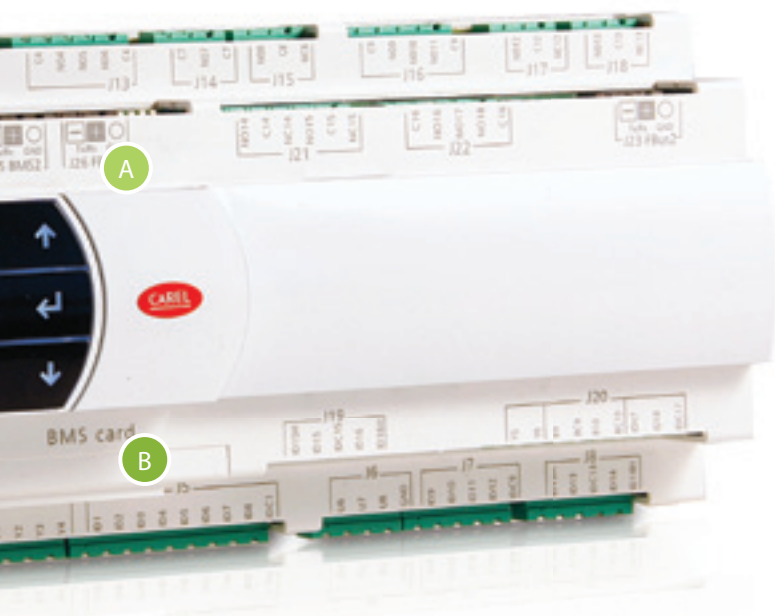
Modbus®

A B





A B



A

B



pCOWeb
(PCO1000WB0)

Based on the physical Ethernet™ standard, it allows connection to the following networks:

- SNMP v1,v2, with TRAP;
- BACnet™ Ethernet, BACnet™ /IP;
- Modbus® TCP/IP
- local LANs or Internet.

With pCOWeb's Web-Server capacity, the user can manage the system through a browser. The embedded LINUX™ operating system allows applications (plug-ins) to be added that can be developed by the user to meet their own requirements. It is currently possible, with maximum security, to download the pCO application from a remote location through the Ethernet network. It also has an internal logger to create data logs and graphs and send them via email.

For info: pcoweb@carel.com.



B

BACnet is a standard protocol designated in 1995 according to the ASHRAE, ANSI and ISO standards. BACnet was designed to allow communications between different devices for heating, air conditioning, ventilation, lighting and security systems that are found inside buildings.

Versions supported by CAREL:

- BACnet™ Ethernet™ ISO8802-2 over 8802-3 (pCOWeb);
- BACnet™/IP (pCOWeb);
- BACnet™ MS/TP; EIA-485 (pCOnet) communication standard.

The BACset tool (which can be downloaded from ksa.carel.com) allows cards to be configured and tested. pCOWeb and pCOnet have obtained approval from BTL laboratories with the B-AAC profile (BACnet Advanced Application Controllers). www.bacnetinternational.net/btl (BACnet Test Laboratory)

SNMP

B

Simple Network Management Protocol (SNMP) is a network protocol that belongs to the family of Internet protocols defined by the IETF (Internet Engineering Task Force). The protocol allows for the management and supervision of devices connected to an Ethernet network.

pCOnet

(PCO1000BA0)

Interface with the BACnet™ MS/TP protocol based on the EIA-485 physical standard. For info: pcoweb@carel.com



B

Connectivity of parameter controls

All CAREL controllers offer the possibility of connecting to CAREL or third party monitoring systems via the CAREL and Modbus® RTU protocols.



 CAREL
 Modbus®

Supernode: to create gateway solutions between CAREL or Modbus® RTU and more advanced protocols or area control units.

PlantVisorPRO: to monitor CAREL controllers and/or with third party Modbus® RTU.

Third party BMS: to integrate controllers from different protocols and functions in a single monitoring system.

Webgate: Gateway between the CAREL protocol and a local TCP/IP network with SNMP v1 protocol or Webserver, with the possibility of customising the HTML page.



Solutions for system monitoring and supervision

The use of a global monitoring and supervision system is always more essential, due to the necessity to manage alarms quicker and more efficiently and to optimise the routine and special maintenance of systems.

In addition, standards in force and the trend towards energy saving make these systems a key to success and differentiation.

CAREL solves these requirements by offering field instruments fitted with RS485 interface for connection to local and centralised supervision systems.

Depending on the various types of system and requirements, CAREL offers:

- PlantWatchPRO: compact embedded solution for small refrigeration and air conditioning systems up to a maximum of 30 devices.
- PlantVisorPRO: embedded solution for medium and large systems up to a maximum of 300 devices.
- RemotePRO: software solution for centralised server in order to manage the system installed quicker and in an optimised manner.

Advantages

The CAREL supervision systems use modern WEB technology, making remote access always much quicker and more secure at the same time.

The data is memorised inside a database, thus guaranteeing integrity and reliability of the information.

The embedded plug&play solution and the software made to measure for the user, greatly reduce installation and configuration times in the system.

The user-friendliness, the complete control of the systems, the sophisticated configuration for the notification of alarms and the tools for analysis are all features that make CAREL supervision a winning solution.

Certification

EN12830

PlantVisorPRO and PlantWatchPRO are compliant, as required by EC regulation 37/2005 of 12 January 2005, with standard EN 12380 on temperature recorders for the transport, storage and distribution of refrigerated, frozen and deep-frozen food and ice cream.

Underwriters Laboratories®

PlantVisorPRO complies with the UL Standard, which guarantees product certification for the North American Market.



PlantVisorPRO

PP2ST*

PlantVisorPRO is the CAREL monitoring and supervision system that allows complete control and optimisation of refrigeration and air conditioning systems.

It offers an intuitive and customisable interface for the display and configuration of the system.

PlantVisorPRO guarantees remote access to all devices connected to it via the LAN or MODEM connection.

The system is available as a complete all-in-one solution: the product integrates all field connections, digital inputs and output relays.

The installation formats are defined as follows:

Version	No. of Instruments	Variable log
STANDARD	90	1400
HYPER	300	3500

Energy Saving

Optimisation and monitoring of system performance: specific functions for the increase in installation efficiency and for the analysis of energy consumption trends.

Floating Suction Pressure Control

Automated modification of the refrigeration unit set point depending on the cooling request from the refrigerated counters it serves.

Dew Point Broadcast

Propagation of the information relative to room temperature and humidity in order to calculate the dew point and modulate the use of antisweat heaters.

Parameter Control

Recording and notification of the unauthorised modifications on critical system parameters in order to preserve optimum operating configuration.

Data analysis and optimisation

Manual and scheduled creation of graphs

and detailed reports, relating to system variables.

KPI – Key Performance Indicator

Control of the effective controlling capacity of a device depending on the operating set point, the differential and any defrosting performed.

Energy

Analysis of CO₂ emissions, power consumption and the cost of energy per pricing zone in order to identify energy optimisation areas.

Simplified commissioning

Reduction of installation times in the system and control of the installation.

Thermodynamic debug

Analysis of the thermodynamic behaviour of the refrigerated counters.

Configuration propagation

Propagation of system configurations from one to "n" devices.

Alarm management

Detection and signalling of every alarm situation, with remote interaction for efficient management of maintenance and after-sales service operations.

PlantVisorPRO packets

PP2ST*P*

PlantVisorPRO is a scalable solution that offers the user the possibility to activate specific function packages according to requirements.

Below is the offering of packages for the solution and the relative functions activated:

GREENRETAIL	Floating Suction
	Dew Point Broadcast
	Parameter control
	KPI
	Energy
SAFETY	Parameter control
	RemotePRO connection
	ModbusSlave
EXTENDED	Logical devices
	Custom algorithm
ENERGY	KPI
	Energy
SAVING	Floating Suction
	Dewpoint Broadcast





PlantWatchPRO

PWPRO*

PlantWatchPRO is a CAREL solution developed for the supervision of small-medium systems.

Complete possibility of network and alarm configuration, easy to navigate and attractive design are some of the characteristics that make PlantWatchPRO the state-of-the-art product in its category. A colour LCD, touch screen and the use of practical menus guide the user easily and intuitively, thus supplying an easy solution. Other innovative features of PlantWatchPRO are:

- possibility of connecting and controlling up to 30 devices;
- use of CAREL or Modbus® protocols for connection;
- recording of 100 variables sampled every 15 minutes, for over one year;
- IP65 protection rating;
- 3 output relays, for signalling alarms or activation of lights and defrost;
- graphical displays;
- possibility to access system management by several users, with different control privileges;
- tool suitable for technical environments, no moving parts are present;
- remote access via LAN or PSTN modem.

PlantWatchPRO is also available in a version with internal modem.

Accessories



PC-Gate

(CVSTD00000)

The PC-Gate converter is used as hub for Y-connections or amplifier to extend the length of the line beyond a kilometre.



USB converter

(CVSTDUMORO)

Where necessary, the USB/RS485 converter can increase the number of lines connected to the PlantVisorPRO.

GSM Modem

(PLW0PGSM00)

GSM modem for the notification of alarms via SMS.



I/O management module

IOM*

This can be connected in parallel to controllers made by other manufacturers or to electro-mechanical controllers in order to acquire the main operating parameters from refrigeration units, air conditioning systems and condensing units. It manages:

up to 4 NTC temperature probes, or 2 NTC probes and 2 x 4 to 20 mA or 0 to 5 Vdc transducers;
digital contacts: 2 opto-isolated, 2 voltage-free contacts (or one NTC);
a relay output to activate actuators or manage a local alarm.

It can be connected to PlantVisor, PlantWatch and Web-GATE.

Technical specifications

Power supply:

- IOM*230*: 230 Vac;
- IOM*115*: 115 Vac;
- IOM*024*: 24 Vac ±10%, 50/60 Hz

Operating conditions: 0T50 °C, 20/80% R.H. non cond.

Protection rating: IP20 for device not incorporated in electric control board

CE UL, certification:

Assembly: DIN rail

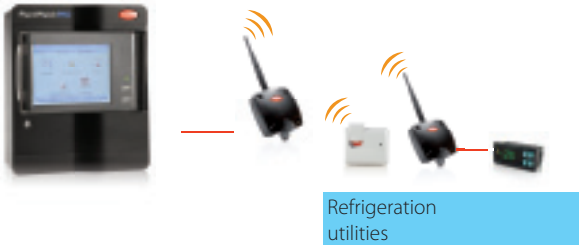
Number of I/Os:

- analogue inputs: 2 (4);
- digital inputs: 2 (4);
- digital outputs: 1

Serial Ports: RS485, CAREL protocol

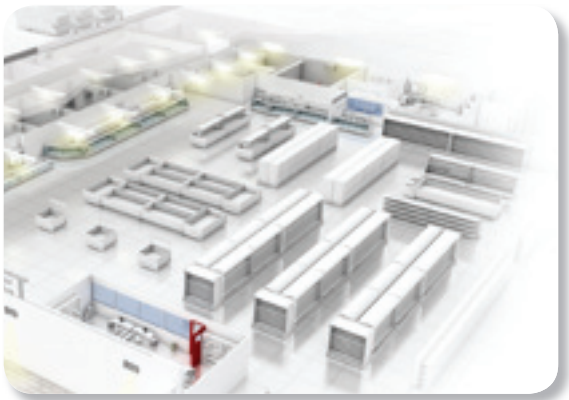
Dimensions: 72x88x70max mm

Connections: clamps



retrofit

For monitoring of refrigerated counters, CAREL offers a battery-powered radio sensor, to be installed on the counter in order to record the temperature and coupled to a CAREL supervisor system. Ideal for retrofit applications, being easy to install and connect.



convenience store service area

PlantWatchPRO is the ideal solution for monitoring temperatures and managing refrigeration unit alarms present in small installations such as service areas or small supermarkets, where the demand for control is the same as large areas. Thanks to the GSM modem connection, it is possible to send notifications to the service network via SMS.

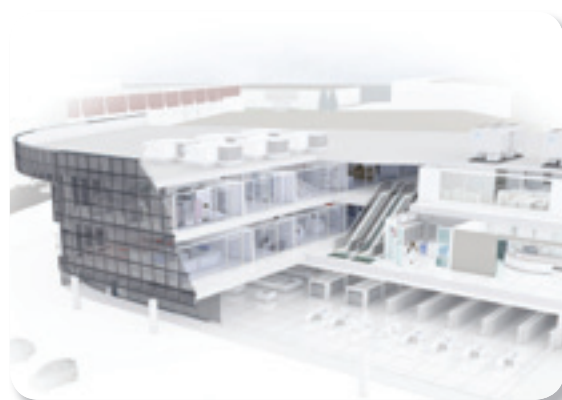




Air-conditioning

building

PlantVisorPRO, thanks to its easy customisation and integration, is the idea solution for centralised control of air conditioning in a building.



hypermarket

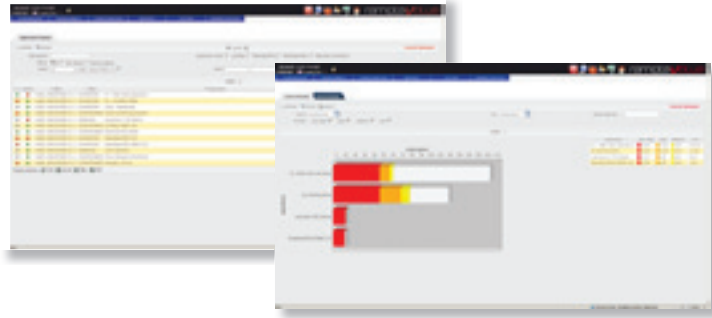
PlantVisorPRO is the ideal solution for large areas where there are a large number of units and advanced control and management are required.



Refrigeration utilities

Refrigeration units

Air-conditioning



remotePRO

RVSTD*

The remote supervision system allows analysis and comparison of the data collected by local supervisors on each installation, using just one interface. Whatever your application, CAREL remote is a secure and reliable tool for keeping systems installed in different locations under control. All local supervision products offered by CAREL can be connected to the remote supervisor:

- PlantVisorPRO;
- PlantWatchPRO;
- pCOWEB.

via LAN or modem connection.

Maintenance

Centralised control of all systems in order to reduce management costs of the sites and guarantee the level of security

required by the customer. Centralised notification of alarms and comparative analysis between the systems.

Data analysis

KPI comparisons for evaluation of system operation: alarms, energy, temperature report. Offline reports without having to connect to the individual sites.

Call Centre

Advanced tool for the management of routine and special system maintenance.

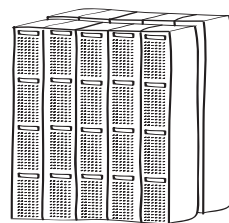
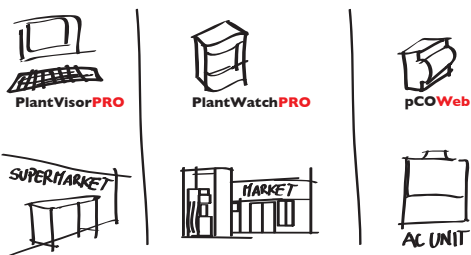
Versions

- RVSTDDS000 – Remote Control Maintenance Technician: dedicated to the persons in charge of maintenance on sites where correct operation must always

be guaranteed. It offers the possibility to be notified immediately regarding any malfunctions and includes all tools necessary for solving problems in the field directly from the office;

- RVSTDDM000 – Centralised data management: dedicated to whoever wants to support their customers with comparative analyses of the different system data. Offers reports, graphs and statistical calculations on the variables transferred from the local supervisors.

Version	No. of sites	Variables
RVSTDDS000	50	---
RVSTDDM000 plugin to activate on RVSTDDS000	50	7.000



remotepro

If it is necessary to control the numerous installations from remote, CARELA offers dedicated instruments for centralised management. PlantWatchPRO allows the automatic synchronisation of data and alarms with RemotePRO and RemoteValue in order to keep the situation of all systems under control on a unique interface.





E^xV sistema



E^XV sistema - electronic expansion valves and drivers

Technology

The E^XV family valves manage refrigerant expansion through a variable valve port, created by a fixed calibrated opening and a conical movable element.

The linear movement of the closing element is achieved through the combined action of a stepper motor and a worm screw transmission, which produces precise and regular movement by minimising friction.

Control precision and stability are ensured by rotating elements supported by stainless steel ball bearings. The entire mechanism is very robust, thanks to the motor block suspended on harmonic steel springs, and a technopolymer chassis that guarantees high mechanical performance and light weight.

All this is made possible by careful construction, the use of quality materials, and a production process with final testing on each and every product, in accordance with the highest quality standards.

Performance

The care paid to the design and production of our valves ensure market-leading performance:

- high maximum operating pressure (Ps):
 - 45 barg on entire E^XV range;
 - 140 barg on models for CO₂ (R744) ;
- extended operating temperature range:

- 40T65 °C (-40T149 °F) for the refrigerant;
- -30T50 °C (-22T122 °F) for the system;
- operation guaranteed in both directions so as to simplify refrigerant circuit layout on reverse-cycle heat pumps and reduce installation costs: just the one valve is required, without needing to install non-return valves.

In addition, thanks to the effect combined of:

- Teflon gasket for perfect tightness;
- calibrated spring and extra closing steps to ensure tightness seal even with high pressure differentials;
- ultracap to guarantee closing even in the event of blackouts.

E^XV sistema is the only solution available on the market that can fully carry out the function of solenoid valve.

Energy saving and precision

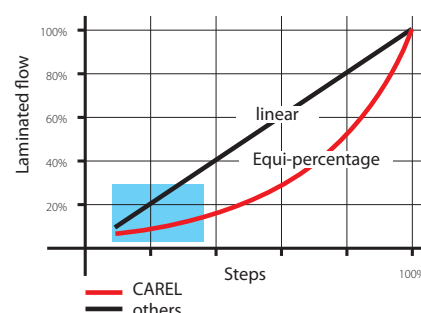
The extended range of operation and precision in terms of control (from 10 to 100% of rated capacity) allow significant energy savings.

The extended control range of the E^XV allows refrigeration unit operation with floating condensing pressure, significantly increasing compressor COP at medium and low room temperatures. This special function - only available with electronic expansion valves - brings considerable energy savings in all refrigeration

applications.

E^XV sistema provides excellent control performance, with a typical control curve that ensures high control precision in all applications, even at low flow-rates. This feature is very useful in circuits featuring compressors managed by inverters, and in general on circuits with variable flow-rates.

E^XV typical control curve





E²V smart

E2V*

The CAREL E²V smart series electronic expansion valves bring together the renowned reliability of the CAREL E³V and the versatility of a removable cartridge, plus the option of a convenient integrated sight glass.

The motor block can be dismantled to simplify welding, thus preventing the risk of overheating and damage.

A movable element with Teflon gasket, plus a calibrated spring seal mechanism, are the heart of the CAREL system that ensures unrivalled tightness, meaning the valves can work with very high pressure differentials.

E²V smart also offers a removable metal filter to trap solid residues that may damage the valve or cause a decline in efficiency.

The family of E²V smart valves comes in 8 sizes and covers a wide range of capacities:

- air-conditioning: 0.3 to 58 kW (R410A, tev= 4.4 °C, tcond= 38 °C, sc= 1K)
- refrigeration: 0.15 to 38 kW (R404A, tev= -12 °C, tcond= 45 °C, sc= 3 K).

Technical specifications

Limit pressure values:

- maximum working pressure (MWP): 45 bars (653 psi)
- maximum operating pressure differential (MOPD): 35 bars (508 psi)
- PED: not applicable, group 2 fluids, art. 3, par. 3

Operating conditions:

- refrigerant side: -40T65 °C (-40T149 °F)
- installation environment: -30T50 °C (-22T122 °F)

Closing steps: 550

Control steps: 480



E³V and E⁴V

E3V*, E4V*

Two families of valves with similar architecture, covering a consecutive range of capacities, with elbow connectors, usable indifferently on the inlet or outlet. Complete installation freedom is further supported by that fact that the various components, stator, motor block and liquid sight glass, can be fully dismantled.

As well as on the E⁴V, the liquid sight glass is now also available on the E³V. Fitted with moisture indicator, this is very useful for verifying correct refrigerant flow and valve operating conditions.

Both E³V and E⁴V can operate in both directions, representing the ideal solution for reverse-cycle applications by ensuring simple installation and saving on installation of a solenoid valve and liquid indicator.

E³V and E⁴V offer solutions for all needs in the following applications:

- air-conditioning: 12 to 290 kW (R410A, tev= 4.4 °C, tcond= 38 °C, sc= 1K)
- refrigeration: 8 to 260 kW (R404A, tev= -12 °C, tcond= 45 °C, sc= 3 K).

Technical specifications

Limit pressure values:

- maximum working pressure (MWP): 45 bars (653 psi)
- maximum operating pressure differential (MOPD): 35 bars (508 psi)
- E⁴V95= 24 bars (349 psi)
- PED: E³V= not applicable, group 2 fluids, art. 3, par. 3; E⁴V= group 2 fluids, Category 1

Operating conditions:

- refrigerant side: -40T65 °C (-40T149 °F)
- installation environment: -30T50 °C (-22T122 °F)

Closing steps: 550

Control steps: 480



E⁵V, E⁶V and E⁷V

E5V*, E6V*, E7V*

CAREL also offers a complete range of high capacity valves, where energy efficiency is essential and precision control is one of the best ways to ensure this.

Unrivalled tightness in closing and the built-in sight glass mean separate solenoid valves and liquid indicators are not required, while the possibility to completely dismantle the parts ensures accurate welding without the risk of damage.

On chillers and large air-conditioning units having a valve that can be dismantled means only the valve body needs to be handled when installing the piping, and the motor and stator can be fitted later when the unit is being completed.

Three models of valves with inline fittings and copper connectors, each with an extended operating range:

- E⁵V: Ø35/35mm, up to 530 kW*
 - E⁶V: Ø42/42mm, up to 890 kW*
 - E⁷V: Ø54/54mm, up to 1850 kW*
- (*) R134a, tev=2 °C; tcond= 45.0 °C; sc= 3

Technical specifications

Limit pressure values:

- maximum working pressure (MWP): 45 bars (653 psi)
- maximum operating pressure differential (MOPD): E⁵V= 35 bars (508 psi), E⁶V, E⁷V= 28 bars (406 psi)
- PED: group 2 fluids, Category 1

Operating conditions:

- refrigerant side: -40T65 °C (-40T149 °F)
- installation environment: -30T50 °C (-22T122 °F)

Closing steps: 550

Control steps: 480



E²V for CO₂

E²V**C

The E²V (amily (which can comfortably handle operating pressures up to 45 barg) has been further extended to include a product developed specifically for use with transcritical CO₂ systems.

A powerful motor, thicker walls and highly resistant materials are just some of the reasons why these valves have achieved record levels of performance, with operating pressures and differentials that are hard to find in products made by other manufacturers.

Designed for transcritical CO₂ applications, these can naturally also be used for subcritical cycles, where higher pressure resistance - exceeding 45 barg - and very precise control are required.

Complete tightness guaranteed by a Teflon gasket, and continuous and regular movement are the outstanding features of the E²V platform that are also available in this E²V for high operating pressures.

E²V**C comes in five sizes, covering subcritical cycle cooling capacities up to 20 kW (R744, tev= -10 °C, tcond= 20 °C, sc= 5 K.

Technical specifications

Limit pressure values:

- maximum working pressure (MWP): 140 bars (2030 psi)
- maximum operating pressure differential (MOPD): 120 bars (1740 psi)
- PED: not applicable, group 2 fluids, art. 3, par. 3

Operating conditions:

- refrigerant side: -40T65 °C (-40T149 °F)
- installation environment: -30T50 °C (-22T122 °F)

Closing steps: 550

Control steps: 480



EVD evolution

EVD*

Based on CAREL's extensive experience in electronic valve drivers, EVD evolution is available as a "single" and "twin" driver, the latter able to control two valves independently, with the most commonly-used refrigerants (see the instruction sheet). Simple graphics and a series of LEDs offer an immediate overview of operating status and the main driver functions.

A powerful removable graphic display (EVDIS**0) can be used to configure the driver, providing clear and immediate information on operating status and allowing the controller to be started the first time after selecting just four parameters:

- refrigerant used;
 - valve model;
 - type of pressure probe;
 - application (chiller, cabinet, etc.).
- EVD evolution can operate in stand-alone mode, or connected to a pCO or the PlantVisorPRO supervisor.

EVD evolution can also manage other functions in addition to superheat control, such as hot gas bypass, evaporation pressure control (EPR), valve control for gas coolers in transcritical CO₂ circuits.

Technical specifications

Power supply: 24 Vac 50/60 Hz, 24 Vdc (±15%)

Operating conditions: -10T60 °C, 90% RH non-condensing

Degree of protection: IP20

Assembly: DIN rail

Number of I/Os:

- **inputs:** 2 digital
- **outputs:** 2 voltage-free contacts

Serial ports: 1

Dimensions: 70x110x60 mm (4 modules DIN)



Ultracap for EVD evolution

EVD0000UC0

Ultracap is the new emergency power supply device for electronic valves, the natural completion of the EVDEvo, both single and twin versions, ensuring complete closing of the valves even when there are sudden mains power failures. Exploiting ELDC (Electric Double Layer Capacitor) technology, Ultracap can supply immediate, reliable and clean emergency energy, representing a major step forwards compared to conventional battery-based systems, including as regards disposal of used materials.

Ultracap has been designed to give 10 years' trouble-free silent operation, without requiring periodical checks or having to replace batteries.

Ultracap means immediate energy: just 5 minutes (4 minutes for CAREL valves) after power is restored, the system is already recharged and active (in practical terms the same time the compressor takes to restart...).

The extreme reliability of Ultracap combined with the exceptional tightness of CAREL valves, eliminates the need for solenoid valves even in the most critical applications.

Ultracap can be connected to the EVDEvo as well as all the pCO⁵ family controllers, with extremely simple installation, just like connecting a battery module.

Technical specifications

Power supply: 24 Vac 50/60 Hz, 24 Vdc (±15%)

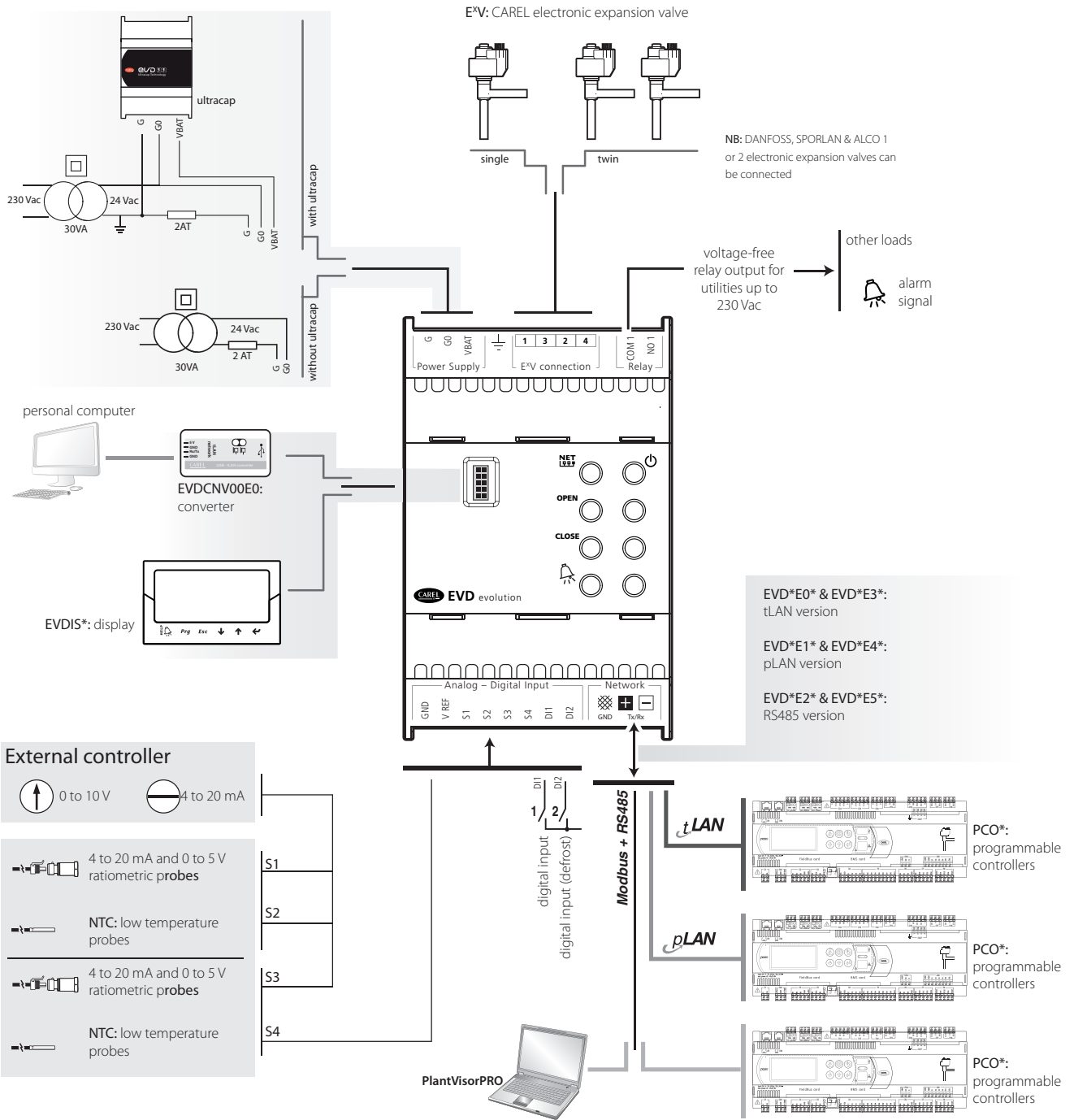
Operating conditions: -25T50 °C, 90% RH non-condensing

Degree of protection: IP20

Assembly: DIN rail

Dimensions: 70x110x60mm (4 modules DIN)

OVERVIEW DRAWING EVD evolution





Condenser controller and inverters



Speed controllers and inverters

To complete its range of products, CAREL offers a series of modules suitable to satisfy different particular applications of HVAC/R units, for fan, pump and compressor speed control.

In fact, optional modules are available that have been specially designed, and therefore optimised, for increasingly important functions in today's air conditioning and refrigeration units.

As regards condensing pressure control, the fcs range of controllers is available, allowing the possibility to be used in stand-alone configuration or connected to a controller in the pCO sistema range. This range of controllers is available for all requirements: single and three-phase versions exist.

Regarding parametric controllers, such as the μ chiller range, CAREL offers a range of controllers with single phase power supply in the MCHRTF range, which are more suitable for this type of controller. This speed controllers are also compatible with programmable pCO sistema controllers. They can manage single phase 230 Vac fans with 8, 10 and 12 A current.

The inverter represents one of the state-of-the-art solutions regarding energy saving. The CAREL inverter offer can boast two product families: The VFD NXL range, suitable for driving fans,

pumps and compressors fitted with asynchronous three phase motors and the innovative power+, it can control BLDC/BLAC brushless motors with permanent magnets, which are used in new generation compressors.

In particular, compressor modulation allows significant results in terms of energy saving and at the same time optimise operation of all unit components. Modulation of flow rate of the refrigerant and primary fluids exploits the full capacity of heat exchangers at reduced load and decreases compression ratio at the same time. To exploit the modulation capacities of these compressors in full, the use of the latest generation electronic expansion valve is essential. For this reason, pCO sistema represents the complete system made-to-measure for the new generation of high efficiency units.

The range of VFD, NXL series variable frequency drives, is developed specifically for applications with:

- variable flow rate on air handling unit fans;
- modulation of compressor speed;
- variable flow rate on system supply pumps and evaporator pumps on the chillers;
- control of condensing pressures on ventilation units.

The use of inverters with electric motors applied on the water pumps or on fans allows modulation of load and accurate and efficient process control from an energy point of view.



DC inverter: power+

PSD*

power+ is an inverter that can control compressors with BLDC/BLAC brushless motors with permanent magnets without the aid of a position sensor, thanks to the use of "sensorless" technology. The integrated functions of Power+ are focused on controlling the compressors:

- the acceleration ramp, programmable in steps, respects the requirements of every application;
- a PTC input guarantees heat protection of the compressor.

power+ also has an STO input (Safe Torque Off), which can be used to cut-off the compressor power supply in the event of an emergency, for example following activation of a high pressure switch. Moreover, power+ can manage the compressor in an intelligent manner in extreme conditions: algorithms are available for automatic reduction of the switch-over frequency or rotation speed in order to prevent the compressor stopping in high temperature conditions. In household use, noise is limited to a high frequency switch-over, up to 8 kHz. The electromagnetic compatibility (EMC), is such to allow use in the home, also respecting the strictest standards regarding harmonic emissions.

Product installation is made easier by the flat design of the electronics, as well as availability of removable brackets for fixing. In this way, the heat sink necessary to dispose of the heat up to 60°C in the environment, can be positioned behind the control board, thus greatly reducing the space occupied inside the control board. The IP protection rating and the protection gasket guarantee a protection rating of IP44 on the heat sink side.

power+ has also been tested with most BLDC compressors available on the market: SCI (Siam Compressor Industries), Samsung, Hitachi, Toshiba.

The configuration of power+ for a BLDC

compressor tested by CAREL can be completed with a click, if used with the controllers of the pCO sistema. The CAREL controller not only manages the electric parameterisation of power+ but also the complete thermodynamic control of the compressor according to the requirements of the compressor manufacturer.

Technical specifications

Power supply:

- single-phase: 200 to 240 V 12 A or 16 A;
- three-phase: 380 to 480 V 14/18 A (50 °C) or 22.5 A;

Operating conditions: 60 °C 95% R.H. non condensing

Protection rating: IP20/IP44

CE UL, certification:

Assembly: panel or semi-builtin

Number of I/Os:

- **digital inputs:** 1 STO (Safe Torque Off) and 1 PTC;
- **digital outputs:** 1 voltage-free contact configurable relay up to 240 Vac 5 A

Serial Ports: RS485/Modbus®

Dimensions: 164x183x265 mm max.

Connections: screw clamps



AC inverter: NXL

NXL*

The NXL range is available in power ratings from 0.37 to 30 kW, with single-three phase power supply and three phase output, protection rating up to IP54, for all applications with variable capacities. Control is via 0 to 10V or 4 to 20 mA analogue signal or via Modbus® serial communication, which can integrate the device functions with the pCO range controllers management software or the PlantvisorPRO supervisor.

Other advantages are: wide operating range, easy installation and use, low noise emissions, high protection rating against electromagnetic interference and particularly compact book-like" design. The NXL range is the ideal solution for all operating environments, for completion and integration of the range of CAREL products in order to obtain maximum efficiency and energy saving in HVAC/R systems.

Technical specifications

Power supply:

- single-phase: 208 to 240 V from 0.37 kW to 1.5 kW;
- three-phase: 380 to 500 V from 0.55 kW to 30 kW;

Operating conditions: -10T50°C 95% R.H. non condensing

Protection rating: IP20, IP21, IP54

CE UL, certification:

Assembly: panel

Number of I/Os:

- **analogue inputs:** 2 x 0 to 10 V or 0 to 20 mA
- **digital inputs:** 3 programmable
- **analogue outputs:** 1 x 4 to 20 mA
- **digital outputs:** 1 NO/NC relay

Serial Ports: RS485/Modbus®

Dimensions: 195x519x237 mm max.

Connections: screw clamps



Stand-alone speed controllers

FCP*

FCP is a speed controller for single phase fans on stand-alone units with up to 2 circuits. It manages the fan depending on the pressure variation in the condenser circuit, in order to maintain the set point value, using a 0 to 5 V signal from the ratiometric pressure transducer (SPKT*R0) positioned in the water circuit. It is used on condensing units. It can manage asynchronous axial motors (specific for the phase cut controller), on loads up to 8 A/230 Vac. Available in the master/slave version or power device (as current MCHRTF80A0, in IP54 version).

Technical specifications

Power supply: 230 Vac -15/10%, 50/60 Hz with autosensing

Operating conditions: -20T50 °C, <85% R.H. non condensing

Protection rating: IP54

Assembly: panel

Number of I/Os:

- **analogue inputs:** 2 ratiometric
0 to 5 Vdc, 1 NTC 10 K at 25 °C
- **digital inputs:** 1 configurable
- **analogue outputs:** PWM

Serial Ports: RS485 (with additional optional board)

Dimensions: 139.8x134.8x89 mm

Connections: spring clamps for cables with cross-section of 1.5 mm²



Single phase 4, 8, 10 and 12 A speed controllers

FCSM*, MCHRTF*

The range of FCS and MCHRTF single phase controllers has been developed to control fan speed on condensing units depending on the signal sent from the controllers. In particular, the FCS range, receives a 0 to 10 V signal, while the MCHRTF, pCO, µchiller, ir33 universal and pRack range controllers, receive a PWM signal.

Technical specifications

Power supply: 4, 8, 10 and 12 A/230 Vac

Operating conditions: -10T50 °C

Protection rating: IP00

Assembly: panel

Number of I/Os:

- **analogue inputs:** 0 to 10 V or PWM

Dimensions: 82x107x58 mm max.

Connections: screw clamps for cables with cross-section of 1.5 mm²



FCS: IP55 three phase speed controllers

FCS3*00

The IP55 three phase range, suitable for outdoor environments, can be controlled by a 0 to 10 Vdc analogue signal or with PWM signal (phase width modulation). The range, which envisions the control of motors with current draw of 6 to 40 A, is fitted with a control board, able to supply power to the load, in linear or square mode, with cut off, threshold, minimum and maximum speed functions, using the trimmer on the board.

Technical specifications

Power supply: 400 Vac -15/10%, 50/60 Hz

Operating conditions: -10T50 °C

Protection rating: IP55

Assembly: panel

Number of I/Os:

- **analogue inputs:** 0 to 10 V or PWM

Dimensions: 198x265x178 mm max.

Connections: screw clamps for cables with cross-section of 1.5 mm²



FCS: IP20 three phase speed controllers

FCS3*10

The IP20 range, suitable for installation on the control board, can be managed by controllers with 0 to 10 Vdc analogue signal or PWM signal (phase width modulation). This envisions the control of motors with current draw of 9 to 40 A, and a control board, which supplies power to the load, in linear or square mode, with cut off, threshold, minimum and maximum speed functions, using the trimmer on the board.

Technical specifications

Power supply: 400 Vac -15/10%, 50/60 Hz

Operating conditions: -10T50 °C

Protection rating: IP20

Assembly: panel

Number of I/Os:

- **analogue inputs:** 0 to 10 V or PWM

Dimensions: 245x340x200 mm max.

Connections: screw clamps for cables with cross-section of 1.5 mm²

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