

CAREL



air-conditioning controllers
programmable controllers

pcosistema⁺
Makes DC inverter technology available



integrated solutions
for high efficiency units

carel.com

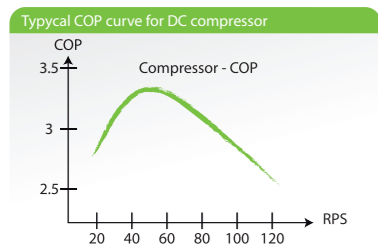
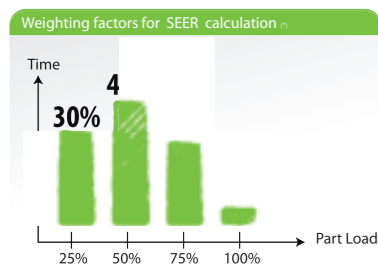
I n t e g r a t e d C o n t r o l S o l u t i o n s & E n e r g y S a v i n g s

High efficiency solutions by CAREL: a great opportunity for our customers

CAREL offers the market the highest performance solutions for maximum seasonal energy efficiency, the result of significant economic investments in research and development : 7% of consolidated R&D and 18% of personnel.

Reduce dependence on non-renewable sources

Increase seasonal energy performance



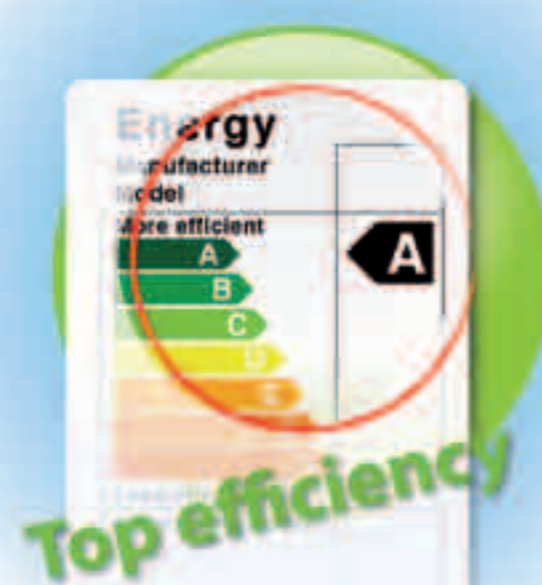
(*)The above weighting factors are defined for an average European Climate Profile and an average building load representative of residential applications. Most of the time the units are required to operate at part load conditions. (Ref. prEN 14825 for water chiller)

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 the binding national objectives for Member States, which by 30 June 2010 must present national action plans for renewable energy.

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 have weight in 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: for example, DC inverters for the control of variable speed compressors and electronic expansion valves.



Maximum energy efficiency

The most innovative technology applied to save energy and protect the environment.



Optimised performance

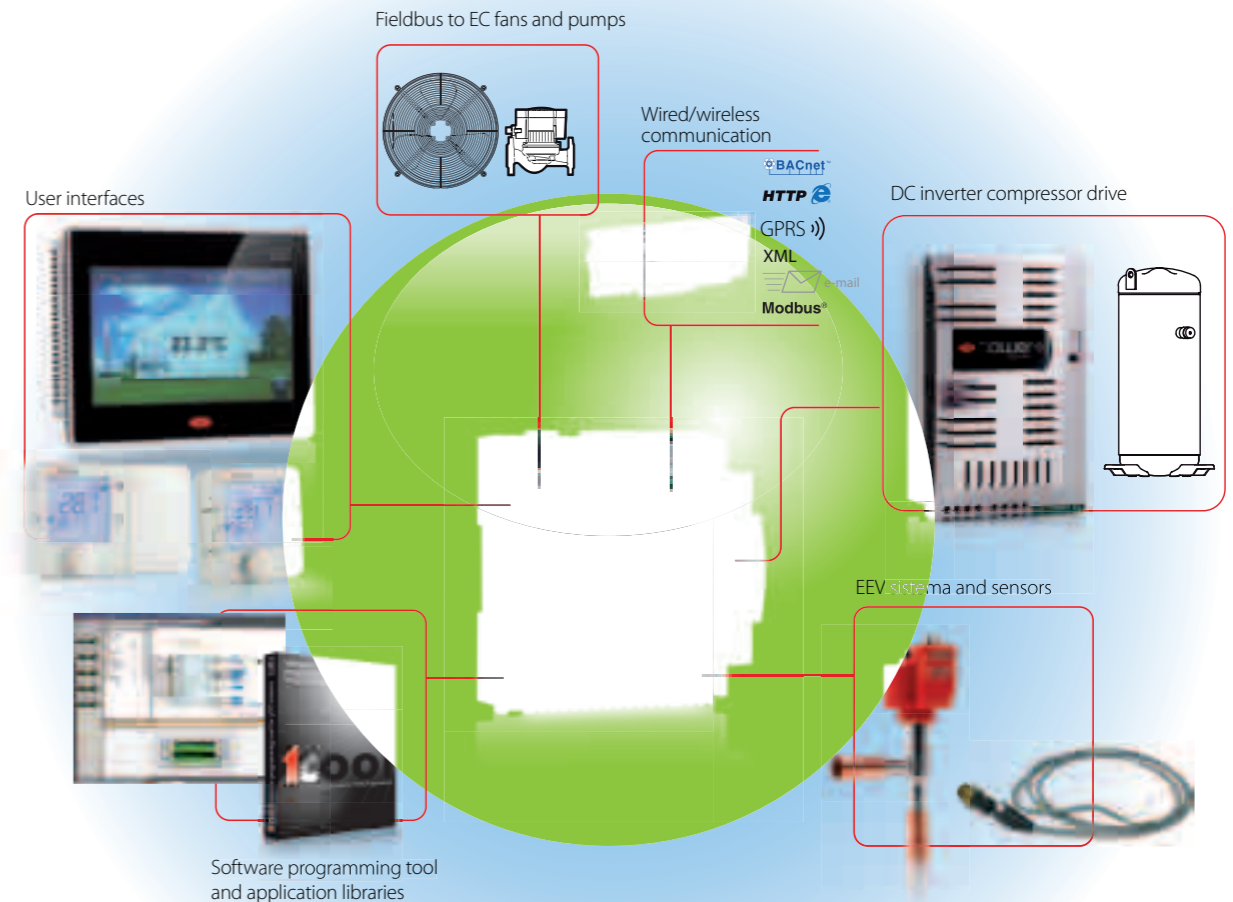
Efficient control of all unit components: compressor, EEV, fan, pump, system integration.



Connectivity

Wide range of solutions for communication, supervision and remote management.

pCO sistema+ Makes DC inverter technology available



- **pCO sistema+**: the complete solution made-to-measure for new generation high efficiency units.
- the introduction of variable capacity compressors featuring DC inverter technology allows manufacturers of refrigeration units to make that technological step forwards that current standards and market needs now dictate;
- this conviction has guided CAREL in the development of the new **power+** inverter, designed especially for residential HVAC applications;
- the use of electronic expansion valves becomes essential in order to exploit the modulation capacity of these compressors;
- integrated control of these two key components of the refrigerant circuit helps ensure an efficient and effective response to different climatic conditions

- and different thermal loads throughout the year;
- serial communication optimises operation of the new smart actuators that complete such high efficiency units (EC fans, variable flow-rate pumps, etc.) and allows integration of room comfort control, further boosting the level of performance and reliability of the system;
- **pCOsistema+** also includes a wide range of colour graphic user interfaces with touchscreen TFT technology;
- remote system accessibility (via web, GSM, etc.) allows the use of innovative remote control and maintenance services, as well as providing the end user highly effective functions.

pCOsistema+

provides manufacturers DC inverter technology to improve the performance of their units and increase integration between components, units, systems, installers, maintenance personnel and users

Solution for high efficiency heat pumps

pCO sistema+ optimises the control of heat pumps and systems in typical residential applications.

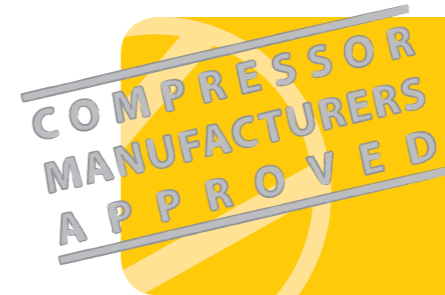
The CAREL solution for the control of high efficiency ground source heat pumps ensures significant energy savings in the entire system, guaranteeing a high degree of adaptability and integration between heat generator and system.

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 heat pumps.

-30%
ENERGY SAVING

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



The library of standard software modules continues to grow in terms of both size and reliability, thanks to collaboration with leading compressor manufacturers.

Connectivity and supervisory systems

CAREL's integrated solutions are designed and developed to interact with a variety of different supervisors and communication systems. The wide availability of protocols over many types of networks means the CAREL offering for heat pumps ensures a communication system that is open to the world.

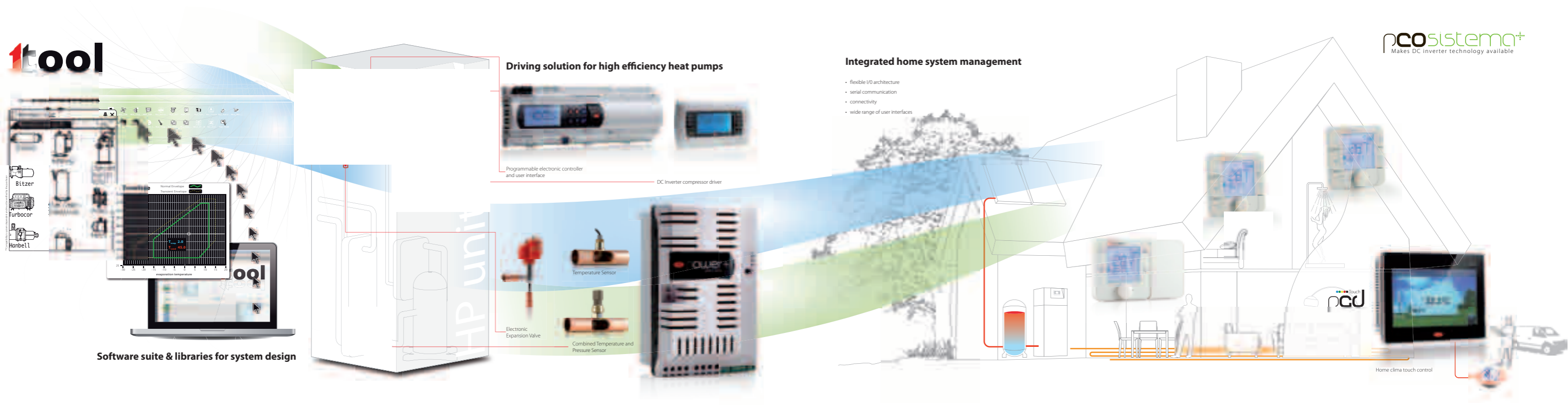
Programmability: research and protection of knowledge

The CAREL solution is based on programmable controllers using the 1tool development environment. This on one hand guarantees the possibility to continually improve the technological aspects of the heat pumps, keeping up-to-date with advances in the state-of-the-art, while on the other ensures maximum protection of company know-how.

Ready-to-use technology

With Smart HP, CAREL offers ready-to-use application software that integrates all the options provided by pCOsistema+, including:

- water and room set point control
- residential heating and domestic hot water (DHW)
- outside temperature compensation
- management of inverter-driven compressors
- management of CAREL electronic expansion valves (CAREL EXV sistema)
- dedicated room terminal.



pCOsistema+
Makes DC inverter technology available

pCO⁵: the heart of the system

The new CAREL programmable controller designed for multiple air-conditioning and refrigeration applications

pCOsistema+ has been developed around to the new range of pCO⁵ programmable controllers, increasingly powerful and enhanced with specific new functions for improving the efficiency of HVAC/R systems, such as:

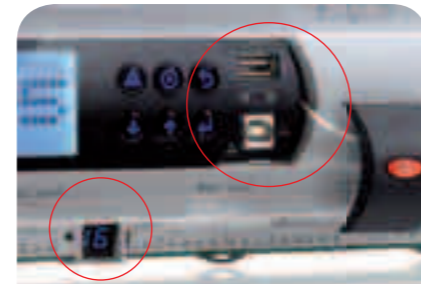
- integration of electronic expansion valve drivers;
- integration of ultra cap technology, used to close the electronic expansion valve in the event of power failures;
- 5 serial lines;
- "Host" and "Device" USB ports;
- special interface for setting the network address.

These features increase the possibility of serial connection with the actuators on the unit, at the same time simplifying installation in the field.

All in addition to the rationalisation of costs and spaces in the electrical panel, incorporating into the controller several important functions that were previously managed by external devices.

Special attention has also been paid to developing a new range of latest generation user interfaces.

Finally pCO⁵ guarantees perfect hardware and software compatibility with the pCO³ range of controllers, so as to protect and guarantee the investments of CAREL customers.



USB CONNECTION

Direct accessibility to the controller.



EASY ADDRESS SETTING

Dedicated interface for setting the network address.



One single development suite for designing the complete application, from control of the unit to interaction with the environment.

New completely programmable touchscreen TFT displays

All the displays in the new CAREL range can be programmed using 1tool. This allows development of interfaces that are increasingly easy to use, intuitive and attractive. The range of touchscreen TFT displays allows the combination of several colours and layers using Alpha Blending technology.



Specific libraries for HVAC/R applications

CAREL's know how, acquired in more than 35 years of specific experience in HVAC/R, is synthesised in a complete library of functions, from the simplest to the most complex, and ready to use.

Compressor Manufacturer Approved: technology available

Collaboration between CAREL and the leading international compressor manufacturers guarantees high quality of the control solutions and optimum management of the compressor throughout the life of the unit.

1tool HVAC/R library
Software drivers for the fastest implementation, the best performance, the highest reliability, the longest life of your compressors.

COMPRESSOR MANUFACTURERS APPROVED

Logos include: Bitzer, Digital Scroll, Stam Compr. Industries, Frascold, Ref comp, Hanbell, Danfoss, HITACHI, Copeland Scroll digital, and SAMSUNG.

All trademarks hereby referenced are the property of their respective owners.

Inverters for DC compressors

power+ is a special inverter that can control compressors with permanent magnet brushless motors (BLDC/BLAC)

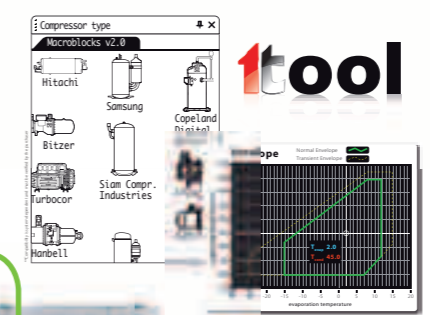
Integrated into pCOsistema+, it brings significant energy savings by modulating compressor speed and consequently the cooling capacity of the unit. Variations in load are managed precisely and with constant control of the compressor envelope. This makes significant increases in unit COP possible during operation at part load, giving higher seasonal performance factor values (SPF).

DC INVERTER technology also allows:

- more precise control of water temperature even in response to peaks in request, reducing or avoiding the use of water storage tanks;
- higher heat exchanger efficiency at part load, allowing operation at higher suction pressure and lower condensing pressure. As well as the undeniably positive effect on COP, this also means the outdoor coil ices up less, reducing the need for defrosts on air/water HPs.

Main features

- sensorless motor control technology;
- custom acceleration ramp;
- wide operating range, up to 60 °C ambient;
- low noise due to the high switching frequency, up to 8 kHz;
- safety torque off input;
- compact design
- pass-through assembly (heat sink outside the electrical panel) or wall mounted.



power+ is easy to install: thanks to the gasket and intelligent bracket system. The heat sink can be located outside the electrical panel.

power+ is currently being approval tested by:

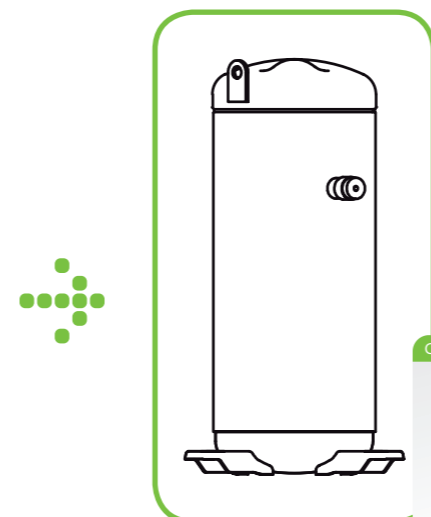
- Hitachi
- Samsung
- Siam Compressor Ind.

For information please contact your local distributor.



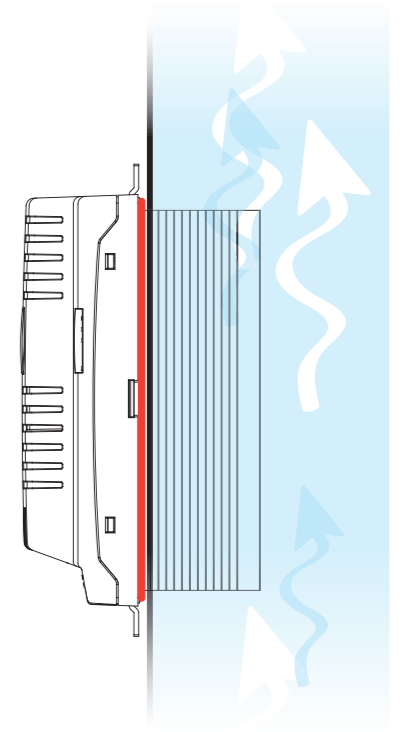
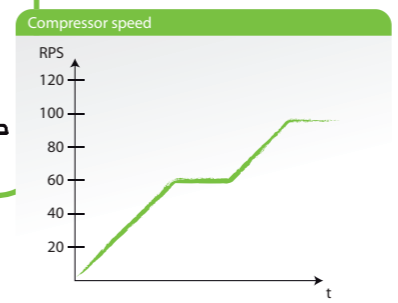
230 Vac 10.5 A - 16A single-phase

400 Vac 18 A - 22 A three-phase



Complete integration in pCOsistema+

- envelope control;
- integrated electronic valve management;
- quick inverter setup using preloaded table of parameters based on compressor type.



The most complete range of electronic valves

EXV sistema is the advanced and versatile solution for optimum superheat control that maximises the performance of air-conditioning and refrigeration units.

EXV sistema, thanks to the wide range that covers cooling capacities up to 2000 kW, guarantees maximum precision in the modulation of refrigerant flow in all HVAC/R applications.

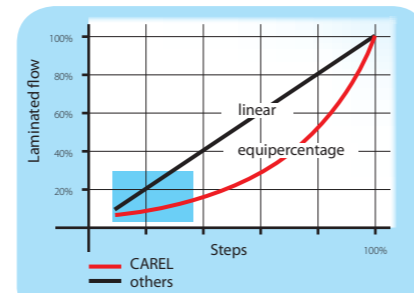
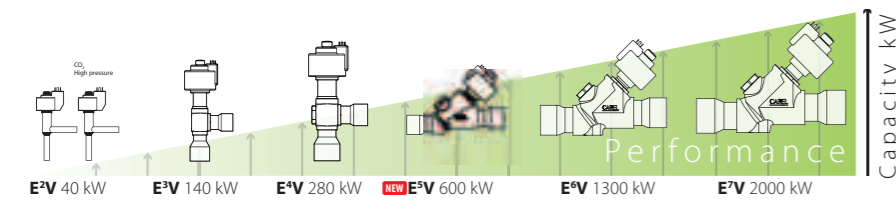
Main features

- external stator replaceable without dismantling the valve;
- removable motor mechanism (except for E²V) to simplify installation and replacement without unsoldering the valve;

- integrated flow sight glass (except for E²V and E³V);
- efficient and gearless motor;
- movement on stainless steel ball bearings;
- tight when valve closed thanks to Teflon gasket and compression spring;
- flow in both directions;
- equipercetile variation of refrigerant flow-rate.

exv sistema

Electronic Expansion Valve



EQUIPERCENTILE PROFILE

The equipercetile profile, thanks to fine control of refrigerant flow at part loads, is ideal for operation with variable capacity compressors.



Solutions for supervision and remote maintenance and control centres

pCO Web, PlantVisorPRO, remotepro, & remoteValue solutions for remote management and communication

The CAREL solution for local and remote monitoring and supervision of units using pCO sistema+ is complete and reliable at all levels, and is a secure and reliable tool for controlling sites in different locations.

For example, remotepro "Remote maintenance manager" offers the opportunity to be immediately alerted of any unit malfunctions and provides all the tools required to resolve problems in the field directly from the service centre. remotepro "Centralised data management" acquires reports, graphs and statistical calculations on the information sent by the local supervisors.

remoteValue

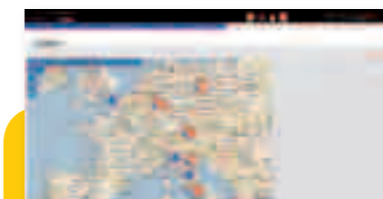
remoteValue responds to the need for advanced functions to manage a vast network of systems or to operate call centers, enhancing the tried-and-tested remotepro platform with new standard or custom functions. A team of experts is available to help, from configuration to support for customised remoteValue solutions.



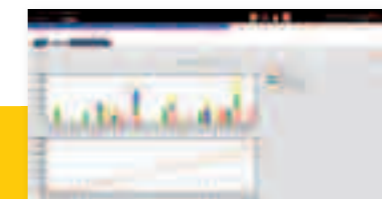
ETHERNET INTERFACE for pCOsistema+:

- BACNet™;
- SNMP v1, v2, con TRAP;
- Modbus® networks over IP;
- Embedded WEB server;
- Embedded FTP server;
- Data log acquisition;
- E-mail management;
- Update pCO via Ethernet.

remoteValue
Software for remote centre management



Geolocalization



Statistical analysis



Cost KPIs

Demo unit equipped with pCO Sistema +



The demo unit is used to analyse the performance of a Scroll compressor with brushless-sensorless permanent magnet DC motor controlled by the CAREL Power+ inverter.

By exploiting the possibility to modulate the compressor speed, the increase in performance (COP) of a hypothetical heat pump with similar control technology can be estimated.

It also highlights the optimum operation of the CAREL system made up of:

- pCO sistema+ controller to manage and coordinate the various components,

as well as controlling modulation, safety functions and the compressor envelope

- DC Power+ inverter: compressor driver
- E2V expansion valve: electronic expansion valve with stepper motor.
- temperature and pressure sensors to measure the related variables.



Control of compressor operating conditions (pressure envelope).



Real time control of the refrigeration cycle



Modulation of cooling capacity and monitoring of related values

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