



HECU sistema

The real capacity modulation for C-Stores

Hecusistema is the CAREL high-efficiency solution for convenience stores.

Refrigeration systems in small stores typically comprise a limited number of showcases, usually medium temperature, connected to one or more condensing units.

Hecusistema integrates the condensing unit equipped with DC compressor with the refrigerated units inside the store, equipped with electronic expansion valves.

The increasing attention to energy efficiency, meaning lower environmental impact and reduced running costs, makes the CAREL solution the perfect response to market needs. The strengths of the proposed solution are:

- High energy efficiency
- Extensive usability
- System reliability
- Optimum food preservation



Application Note

Hecu sistema strengths



Energy efficiency

- Lower running costs and a fast return on investment
- Total modulation and stable control of the entire system
- Compatible with the latest energy performance and refrigerant gas standards

30%
energy savings
Vs. ON/OFF units

The most technologically advanced system for acquiring data from installations, using information and creating new business opportunities

- High quality food preservation
- Stable product temperature



Quality preservation



CONDENSING UNIT



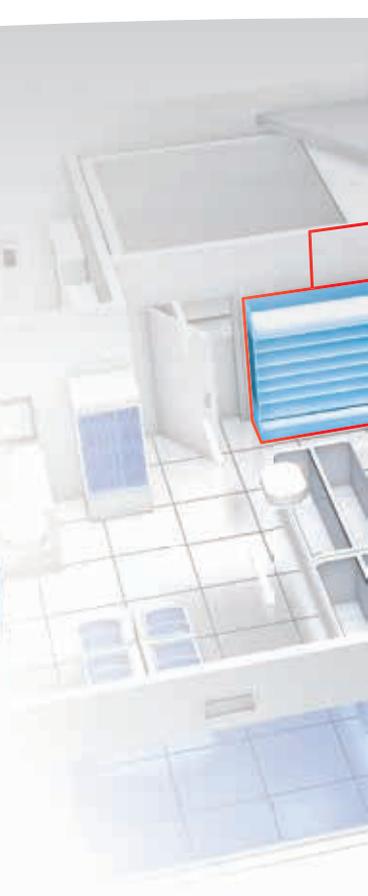
Inverter DC



pRack HECU



EEV Technology





Benchmarking
Optimisation
Data availability
Remote maintenance



Reliability

- Centralised alarm management
- High maintenance personnel service level with quick troubleshooting
- Maximised system uptime with safety procedures and preventive actions



- Access management with different levels, from manufacturer to end user
- Simple configuration and display of data, with clear and complete descriptions
- Local and remote supervision for complete monitoring of multiple systems



Usability



INDOOR REFRIGERATION UNIT



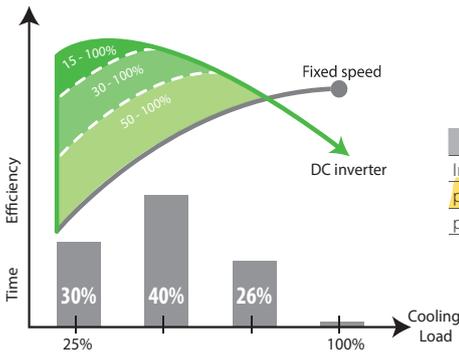
MPXPRO

High energy efficiency

Choosing Hecu sistema means cutting energy consumption and reducing running costs

DC inverter technology

The use of DC compressors guarantees higher performance in terms of energy efficiency when compared to any other technology, thanks to the wide range of cooling capacity modulation. The control system needs to continuously exchange data between the inverter and the motor. This complex operation is managed internally by pRack Hecu, ensuring simplicity and reliability for end users. DC technology also stands out for its low noise, excellent size-to-power ratio, low maintenance and long life, thanks to the low number of ON-OFF cycles. CAREL guarantees full control over the units, with many software functions designed to allow the compressor to always operate in the best conditions and fully exploit its potential



Technology	Saving
Inverter AC vs. On-Off	up to 9 %
power+ DC vs. On-Off	up to 25 %
power+ DC vs. INV AC	up to 15 %

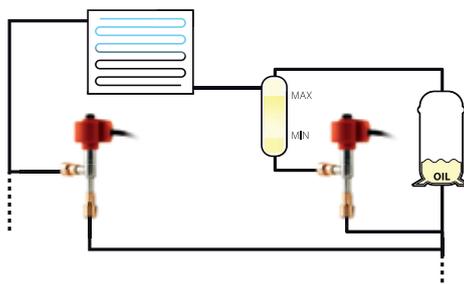
The graph highlights the change in energy efficiency based on required cooling capacity, from solutions with fixed-speed compressors to the maximum possible modulation with DC inverter technology (15%-100%). Between these limits lie variable flow-rate solutions with a reduced range of modulation.

Calibrated oil and liquid injection with CAREL E²V expansion valves

Hecusistema operates in widely variable conditions, thanks to the extended range of cooling capacity modulation. The possibility to calibrate both oil and liquid injection based on actual system requirements increases overall efficiency.



Liquid injection by electronic valve reduces the amount of refrigerant needed to lower the discharge temperature



By installing an advanced oil separator with dual level sensor, an algorithm controls the E2V valve so as to inject the exact amount of oil required by the system.

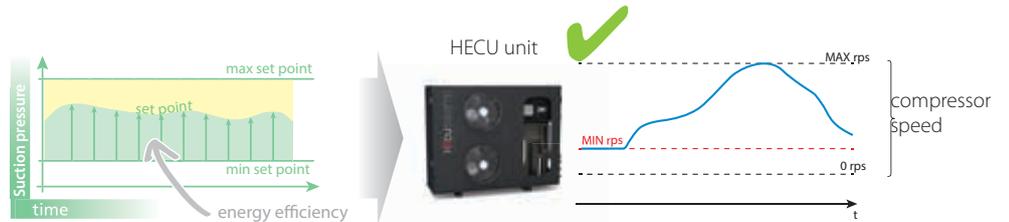
Only pure oil is injected, preventing mixtures with hot gas that cause energy inefficiencies.

Energy optimisation in real time through the continuous exchange of data with the showcases

A major contribution to system energy efficiency is made by the serial connection between pRack Hecu and the MPXPRO controllers fitted on the showcases. Real-time knowledge of individual showcase operating conditions means the condensing unit can implement advanced energy saving algorithms and at the same time increase the performance of the entire system.

Floating suction

- Continuous suction pressure set point modulation
- ON-OFF cycles reduced to the minimum
- High efficiency and stability with CAREL power+



CAREL E²V electronic expansion valves

The refrigeration units inside the store, equipped with CAREL MPXPRO controllers, may be showcases or cold rooms. The CAREL E²V electronic expansion valve modulates refrigerant flow in the evaporator, thus maximising heat exchange efficiency.

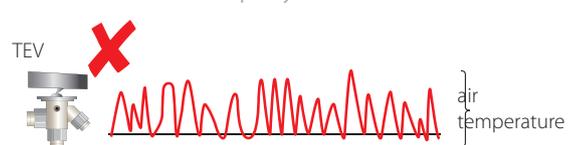
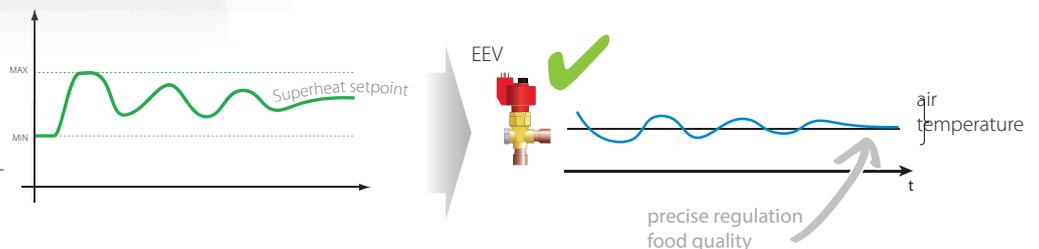
The use of these valves moreover drastically reduces the number of ON-OFF cycles, an aspect that is typical of traditional thermostatic valves.

Each transient in fact means loss of energy.

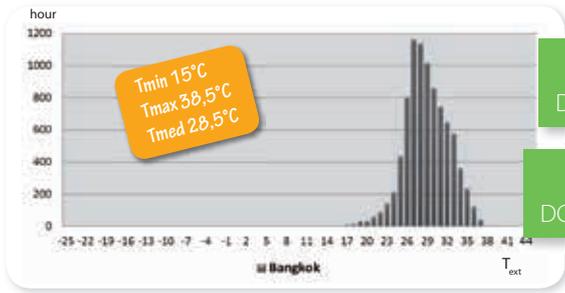
The MPXPRO controller implements the Smooth Lines function that modulates the superheat set point with the objective of further closing or opening the valve, rather than switching off the unit.

Smooth lines

- Continuous superheat set point modulation
- Stable product temperature
- High efficiency and stability with CAREL electronic expansion valves

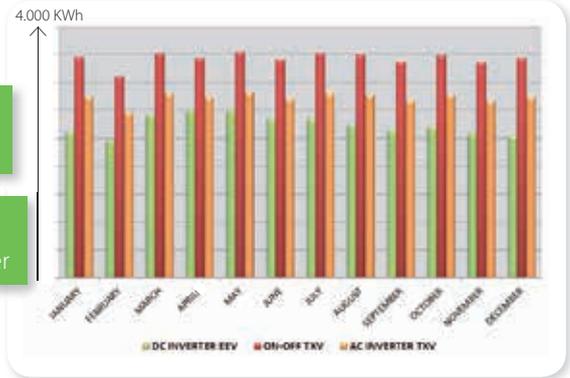


BANGKOK

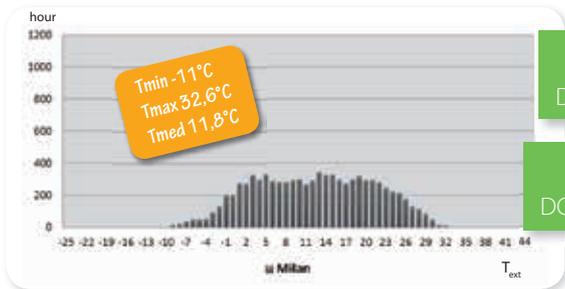


30% Saving
DC versus ON-OFF

15% Saving
DC versus AC inverter

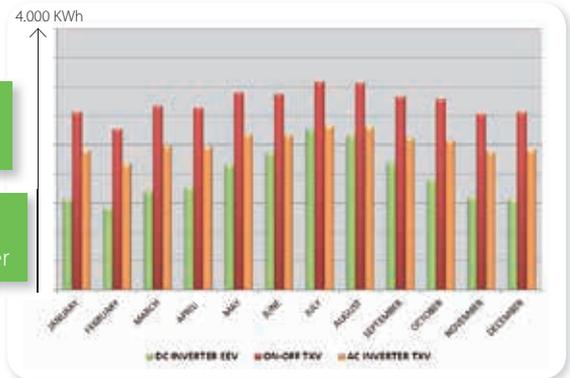


MILAN

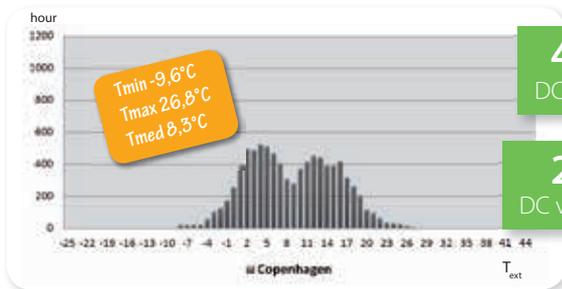


38% Saving
DC versus ON-OFF

22% Saving
DC versus AC inverter

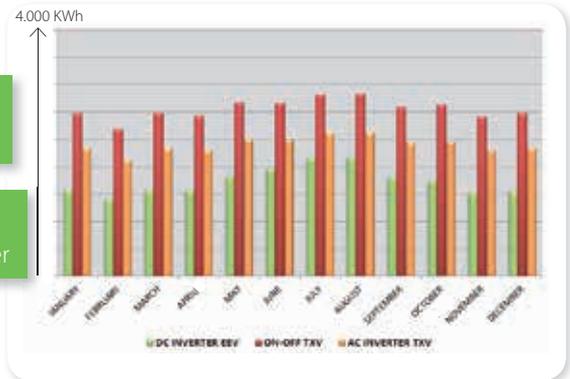


COPENHAGEN

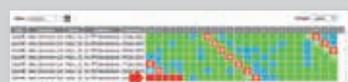
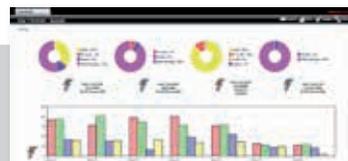


42% Saving
DC versus ON-OFF

27% Saving
DC versus AC inverter



*Up to 10% energy savings
thanks to real-time communication between the indoor
refrigeration units and the condensing unit that allows
implementation of floating suction pressure*



Energy dashboard with comparative analysis

- System optimisation
- Identify the best configurations
- Pinpoint energy-hungry devices

ENERGY EFFICIENCY STANDARDS

EUROPE: Directive 2009/125/EC (Energy Related Product, ERP) of the European Parliament and Commission, also called "Ecodesign", defines:

- a minimum COP (coefficient of performance) for units with a capacity of less than 5 kW,
- a minimum SEPR (seasonal energy performance ratio) for units between 5 and 50 kW.

These limits will come into force as of June 2016 and stricter limits will apply as of June 2018.

USA: DOE CFR 2015 Title 10 Part 431 Energy efficiency program for certain commercial and industrial equipment

The energy efficiency limits in this case are applied to the entire system: condensing unit and refrigeration units. Different minimum requirements are defined according to the type of refrigeration unit.

- Subpart C—Commercial Refrigerators, Freezers and Refrigerator-Freezers: limits in kWh/day.
- Subpart R—Walk-in Coolers and Walk-in Freezers: limits in BTU/(Wh) also called AWEF (Annual Walk-in Energy Factor).



Optimum food preservation

Hecu sistema combines high energy efficiency with the highest quality of food preservation

Highest quality food preservation

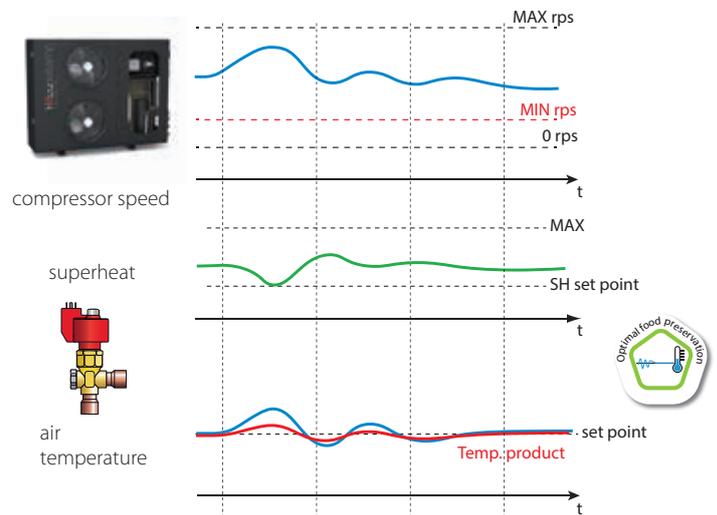
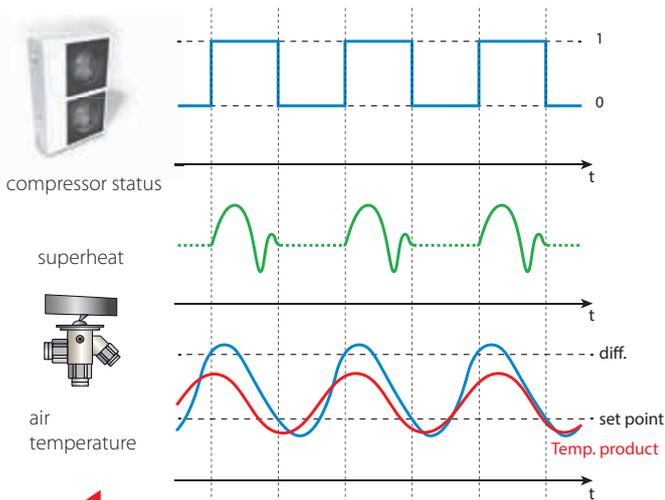
thanks to advanced algorithms and close synchronisation between system components

On a traditional condensing unit

the suction temperature is fixed at the required value by the unit with the highest cooling demand. Consequently, the system as a whole and the evaporators always work at a lower temperature than would actually be necessary, at higher costs. The air is thus cooled excessively, and each cooling cycle is followed by an interval in which the unit is off, allowing the temperature to return to the set point. The products therefore undergo heat-cool cycles ranging several degrees around the average optimum value.

With Hecu sistema

The condensing unit constantly responds to the cooling demand of each connected unit, dynamically adapting to current conditions (floating suction and floating condensing), while the E2V valves on each unit control the flow of refrigerant, and the MPXPRO controllers minimise temperature fluctuations (smooth line thermostat) even in the most critical stages, such as defrost cycles or variations in load.



Analysis of food preservation quality

- HACCP reports
- Device performance analysis
- Evidence of asset malfunctions



System reliability

Centralised alarm management, advanced safety procedures and preventive actions.

Thanks to the serial connection between the condensing units and the indoor refrigeration units, alarms can be managed centrally, providing maintenance personnel with accurate information that can be used to quickly identify the problem and thus reduce service times.

pRack Hecu in fact manages a whole series of functions on just one controller: the main system pressure and temperature values, compressor and fan speed management, defrosts and calibrated oil and liquid injection, offering a high level of protection that meets current requirements in the retail market.

Centralised monitoring

- Alarm management
- Call center support
- Assess maintenance personnel performance



Hecu sistema improves oil return to DC compressors even at low operating speeds

Oil return and recovery procedure

with the Speed Boost function

This software function makes the compressor work at a sufficiently high speed to assist oil return.

by washing the showcases using CAREL E²V expansion valves

This software function exploits communication with the showcases to lower the valve superheat set point and thus recover the oil that deposits on the evaporators, through periodical washing cycles.

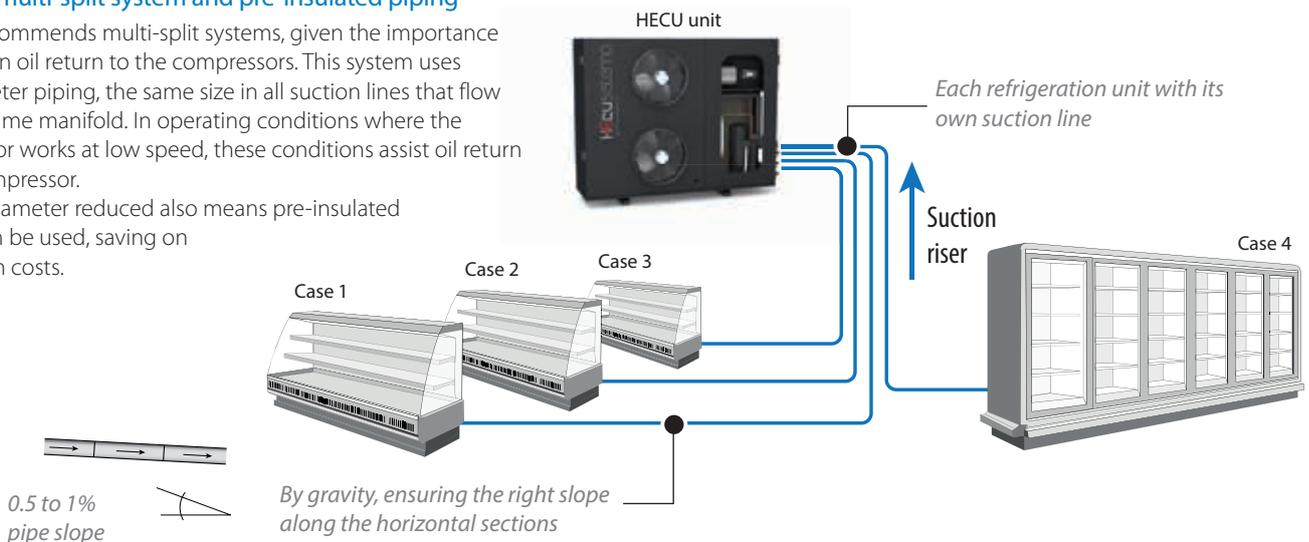


Better oil return flow and simple installation

with the multi-split system and pre-insulated piping

CAREL recommends multi-split systems, given the importance of piping in oil return to the compressors. This system uses low diameter piping, the same size in all suction lines that flow into the same manifold. In operating conditions where the compressor works at low speed, these conditions assist oil return to the compressor.

The low diameter reduced also means pre-insulated piping can be used, saving on installation costs.



R410A MEDIUM temperature application Imperial System

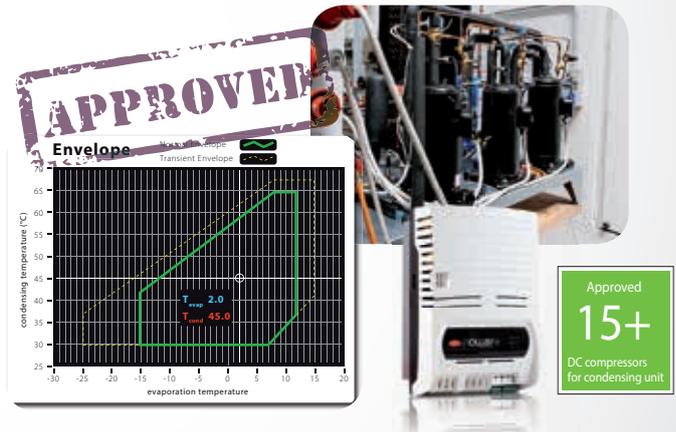
		Evaporator maximum cooling capacity						
		1,0kW	1,5kW	2,0kW	2,5kW	3,0kW	3,5kW	4,0kW
condensing temperature	40°C	5/16"	3/8"	3/8"	1/2"	1/2"	1/2"	1/2"
	45°C	5/16"	3/8"	3/8"	1/2"	1/2"	1/2"	1/2"
	50°C	5/16"	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"
	55°C	3/8"	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"

Narrow pipes are the best option to allow the oil to flow up through vertical sections, due to the faster refrigerant speed. Nonetheless, pipes that are too narrow would cause a pressure drop that reduces system efficiency. CAREL provides tables for sizing the piping based on the maximum capacity of each unit for multi-split configurations.

Optimum compressor control with the CAREL power+ inverter

Thanks to a detailed testing process

The combination between compressor and DC inverter technology is fundamental in fully satisfying the requirements of each application. The CAREL testing process approves the use of its inverter with different models of compressors, so as to ensure completely safe operation in the best possible conditions. Many compressor manufacturers have already approved CAREL as certified partners for controlling their motors. In fact, 15 different models of compressors can now be used with CAREL power+ inverter for condensing unit application.



Extensive usability

Fast configuration, easy commissioning and an advanced user interface are the strengths of Hecu sistema.

Intuitive programming

with the advanced PGD and pLD PRO user terminals

- Different access profiles make it possible to quickly find the parameters for each type of user.
- Navigation is simplified thanks to the menu divided by function and type of parameters
- Availability with both PGD and pLD PRO terminal

Easy setup and optimisation

with the wizard procedure

- Fast condensing unit configuration using the wizard start-up procedure.
- Pre-setting of the main unit parameters, such as set point and alarm thresholds, based on the selected type of refrigerant.
- Pre-setting of the probes that are essential for control in each type of application

Fast commissioning

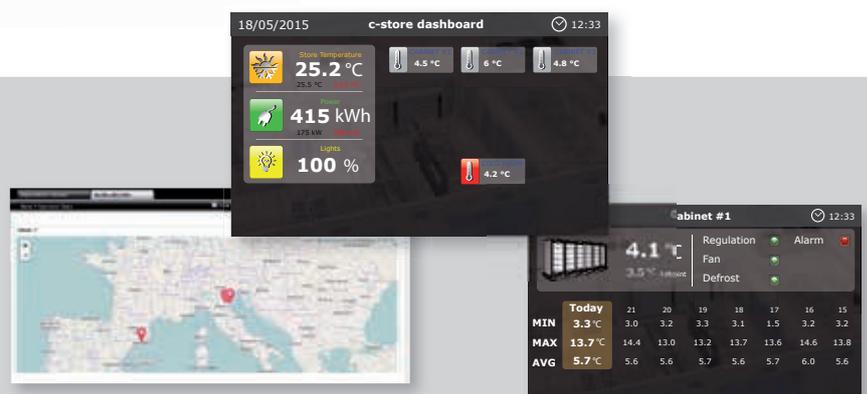
thanks to automatic pre-configurations and simplified service menu

- Fast commissioning with default configuration for connection between condensing unit and showcases.
- Automatic pre-configuration of Floating Suction and Oil Recovery Washing functions.
- Optimised and extensively modifiable default values.
- Control parameters optimised for showcases fitted with MPXPRO controllers.



Remote interface

- Geolocation
- Customised system mapping
- Profiled user management



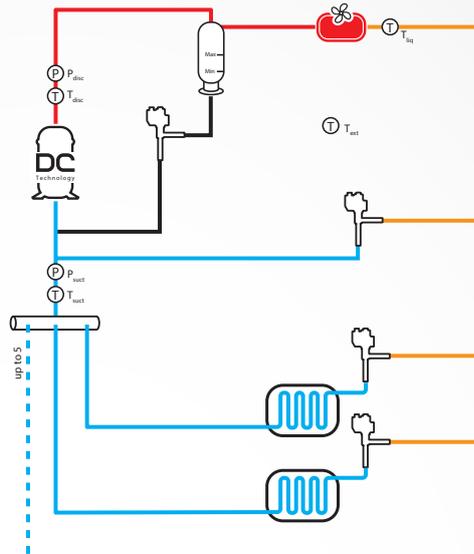
Application diagram

Medium temperature diagram

A medium temperature system can be managed as shown in the diagram alongside.

pRack Hecu can control:

- 1 DC compressor
- 1 optional backup compressor
- EEV, solenoid or capillary oil injection valve
- EEV or solenoid liquid injection valve
- Up to 2 fans
- Serial communication with up to 5 MPXPRO controllers

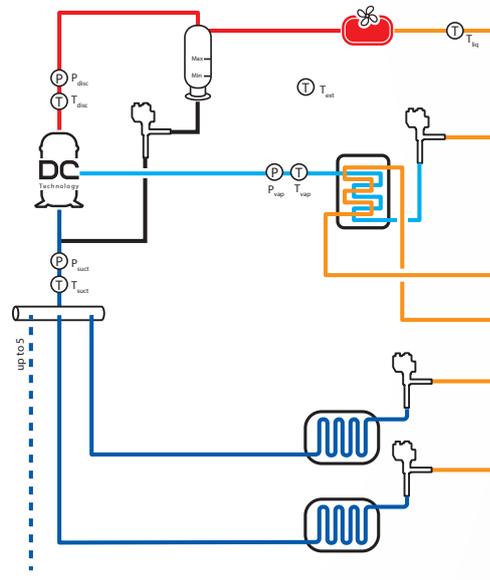


Low temperature diagram

A low temperature system can be managed as shown in the diagram alongside.

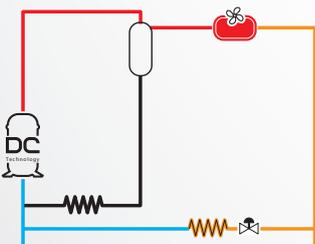
pRack Hecu can control:

- 1 DC compressor
- 1 optional backup compressor
- EEV, solenoid or capillary oil injection valve
- EEV vapour injection valve
- Up to 2 fans
- Four-way valve for defrosting by reversing the cycle
- Serial communication with up to 5 MPXPRO controllers



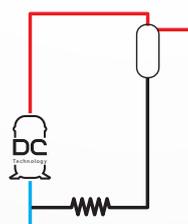
Alternatives to the proposed solution

Medium temperature only



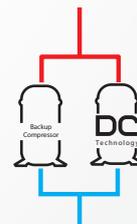
pRack Hecu can manage a solenoid valve as an alternative to the EEV valve for liquid injection.

Medium and low temperature



pRack Hecu can manage capillary valves as alternatives to the electronic expansion valve for oil injection.

Medium and low temperature



High service level with backup compressor activated only in the event of alarms or malfunctions on the main compressor. The system continues operating and service response times are less critical.

CAREL products making up Hecu sistema

The very high performance of the individual components reach the highest levels as a result of the tight synchronisation ensured by Hecu sistema



pRack Hecu

pRack Hecu is the main controller that manages the logic of the Hecu sistema. It provides complete management of a condensing unit with DC compressor for low or medium temperatures, with advanced control functions, oil return, defrost and liquid or vapour injection. Serial connection to showcases fitted with MPXPRO controllers is a significant extra feature, due to advanced optimisation algorithms this ensures.



power+

power+ is a special inverter for controlling compressors with brushless permanent magnet motors (BLDC/BLAC). Integrated into Hecu sistema, this device can achieve significant energy saving by modulating compressor speed and consequently unit cooling capacity. Variations in load are managed precisely and with constant control of compressor envelope.



E^V Sistema

The Carel E^V electronic expansion valves stand out above all for their excellent flow control, even at very low flow-rates. Carel expansion valves have three main strengths: reliability over time, extremely precise control, perfect refrigerant tightness.



MPXPRO

MPXPRO is the complete control device for multiplexed showcases or cold rooms. Compact and flexible, with special focus on energy saving and user simplicity, this device can manage CAREL electronic expansion valves using ultracap technology to ensure closing in the event of power failures.



e-meter

Energy meter measures the main electrical and power parameters of the connected loads. Power consumption data is saved for complete and detailed analysis, allowing operators to identify when and where consumption occurs, any inadequate behaviour and incorrect use, faults and abnormal consumption, as well as evaluate the effects of the energy saving actions implemented.



pwpro

PlantWatchPRO now has a new design, to better respond to the needs of small-medium systems. The new hardware allows different users, such as installers, maintenance personnel and store managers, to check and optimise their refrigeration and air-conditioning systems in a simple and intuitive way.



remotePRO

RemotePRO is the Enterprise solution for increasingly centralised control of systems, with the possibility to compare operation and thus identify the areas where optimisation actions can be taken.

C-Store total solution

remote**pro**



Optimised
maintenance



Better energy
performance



High-level
data analysis

Remote monitoring



pChrono-CS

Compact **entry-level** solution

- One controller for all areas
- Ethernet interface for remote monitoring
- Configuration wizard
- Wireless options

pwpro

High-level monitoring solution

- More system functions
- Alarm notifications
- Store data analysis
- HACCP reports

Air-conditioning

Management and comfort now
for smaller stores too

Lights

Integrated optimisation thanks to
significant expertise in LED technology

arianna
a CAREL company

Refrigeration

Exceptional food preservation and energy saving
using scalable and integrated solutions

HECUsistema

Energy & environment

"You can't manage what can't be measured..."

Headquarters ITALY

CAREL INDUSTRIES HQs
Via dell'Industria, 11
35020 Brugine - Padova (Italy)
Tel. (+39) 0499 716611
Fax (+39) 0499 716600
carel@carel.com

Sales organization

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