Wine industry

Temperature control and supervisory solutions

An increasingly high-tech industry

Process quality and repeatability and energy efficiency make it essential to employ technology to control and monitor the main environmental variables during the winemaking process.

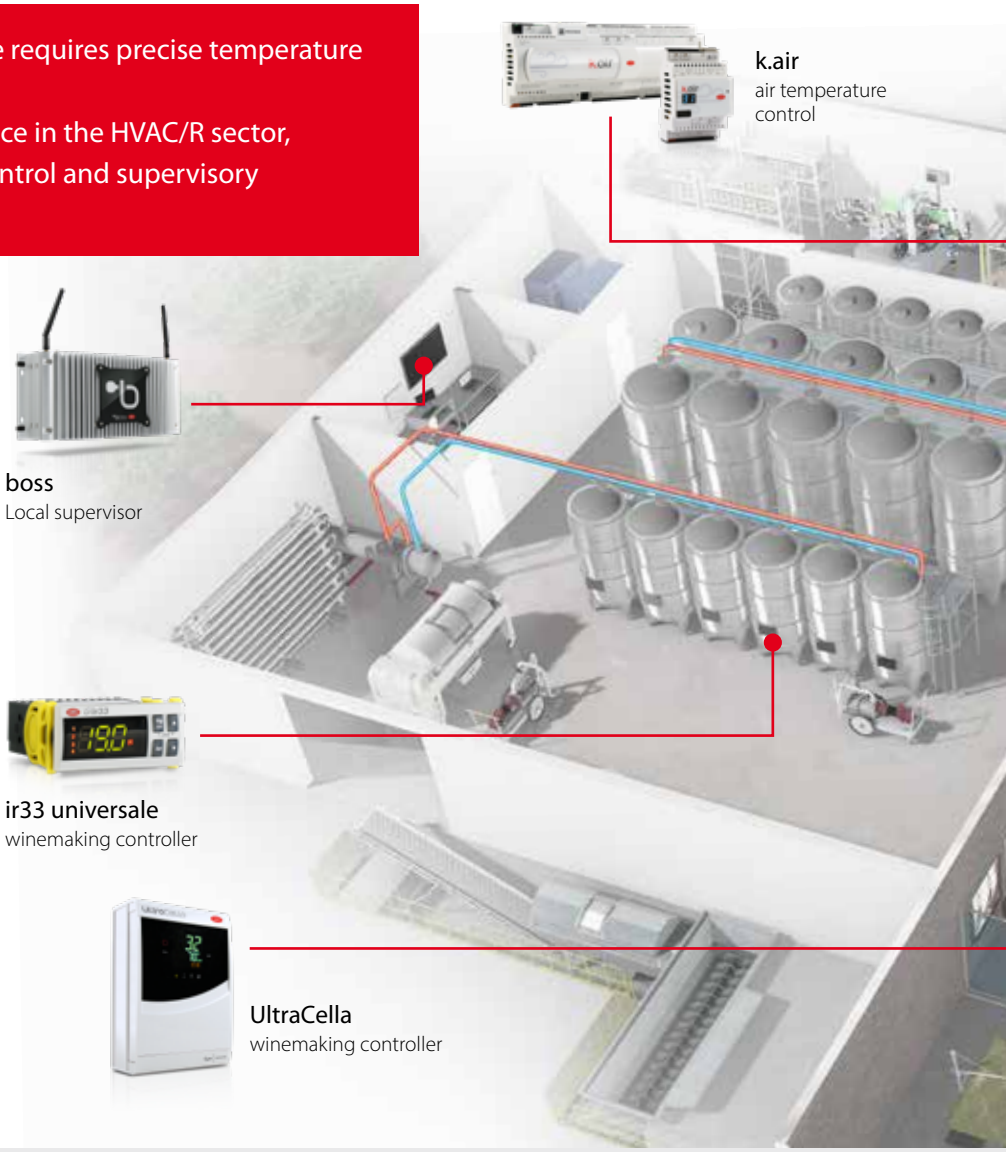
From harvesting to consumption, wine requires precise temperature and humidity control.
CAREL, backed by decades of experience in the HVAC/R sector, provides cutting-edge temperature control and supervisory solutions.

A combination of art, science and technology

The evolution of wine and the surrounding industry has always been a part of the history of mankind, however in recent years it has shaken off its traditional gradual approach to development by increasingly rapidly taking on cutting-edge technology so as to meet market trends, in which flexibility, precision and energy efficiency help effectively sustain the business. Technology has therefore become fundamental in ensuring:

- reduction in waste;
- product quality;
- process repeatability.

CAREL offers system temperature control solutions, humidifiers for the correct management of relative humidity and supervisory systems that keep the entire process under control, allowing a faster service response when needed.



Energy saving

Temperature control solutions to preserve product quality and minimise costs. Synergy and management of HVAC/R units on site so as to achieve energy efficiency.

Supervisors

Management and continuous monitoring of the cellar. Clear and immediate identification of any alarms, variable logs and remote device management.

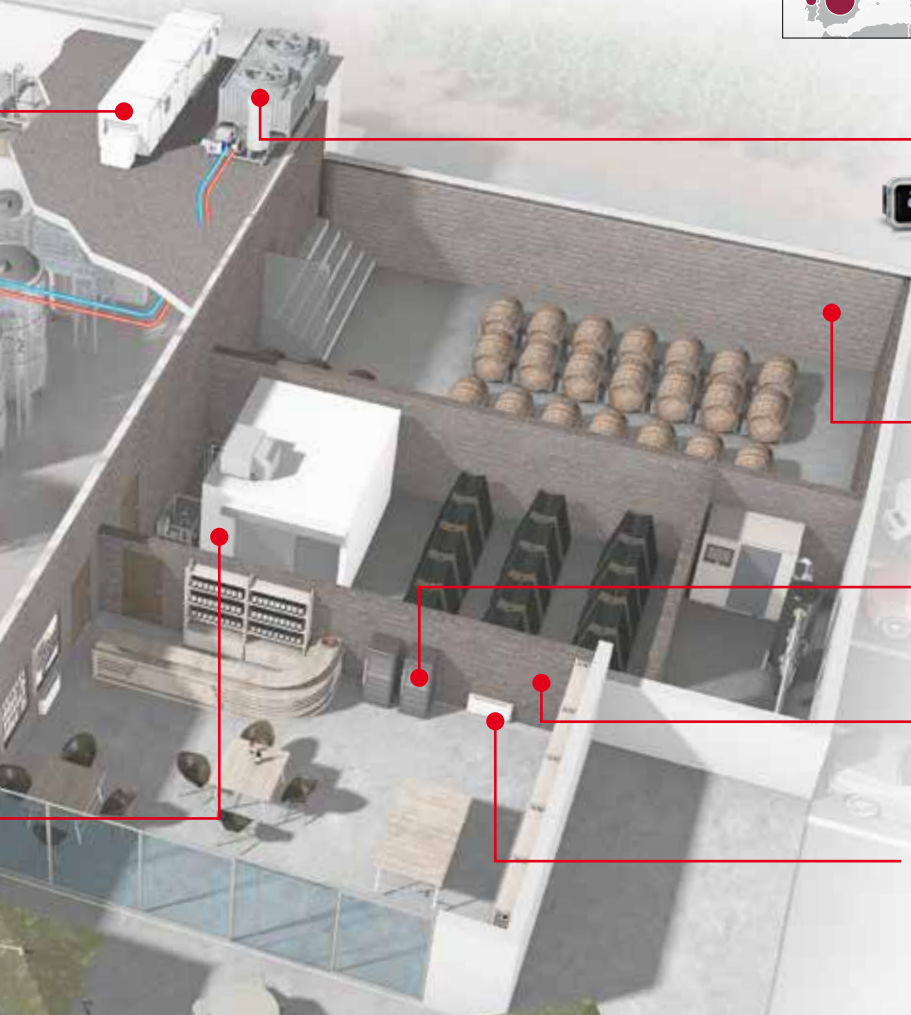
Precision

Reliable and precise control logic to guarantee the best results in relative humidity and temperature control.

Market profile

Wine production may vary slightly from year to year, mainly due to climatic conditions. However, average production remains at around 270 million hectolitres, according to OIV: the International Organisation of Vine and Wine. Italy, France, Spain and the United States are the world's main wine producers, together accounting for more than 50% of the total. Growth is especially evident in the so-called "new world" regions, such as Argentina, Chile, New Zealand and Australia.

Major wine producing countries



uchiller
chiller controller

MC
humidification

MPXone
bottle cooler controller

PGDX 7
touchscreen display

humiSonic compact
humidification for fan coils

270
Million hectolitres produced on average each year in the world

7.4
Million hectares of vineyards in the world

31.3
Billions of dollars, the value of wine exports in 2018

The winemaking process

The production of a good wine needs time and special care to all stages of the process. A winemaker combines creativity with science and uses technological tools to control the production processes.

Red wine making

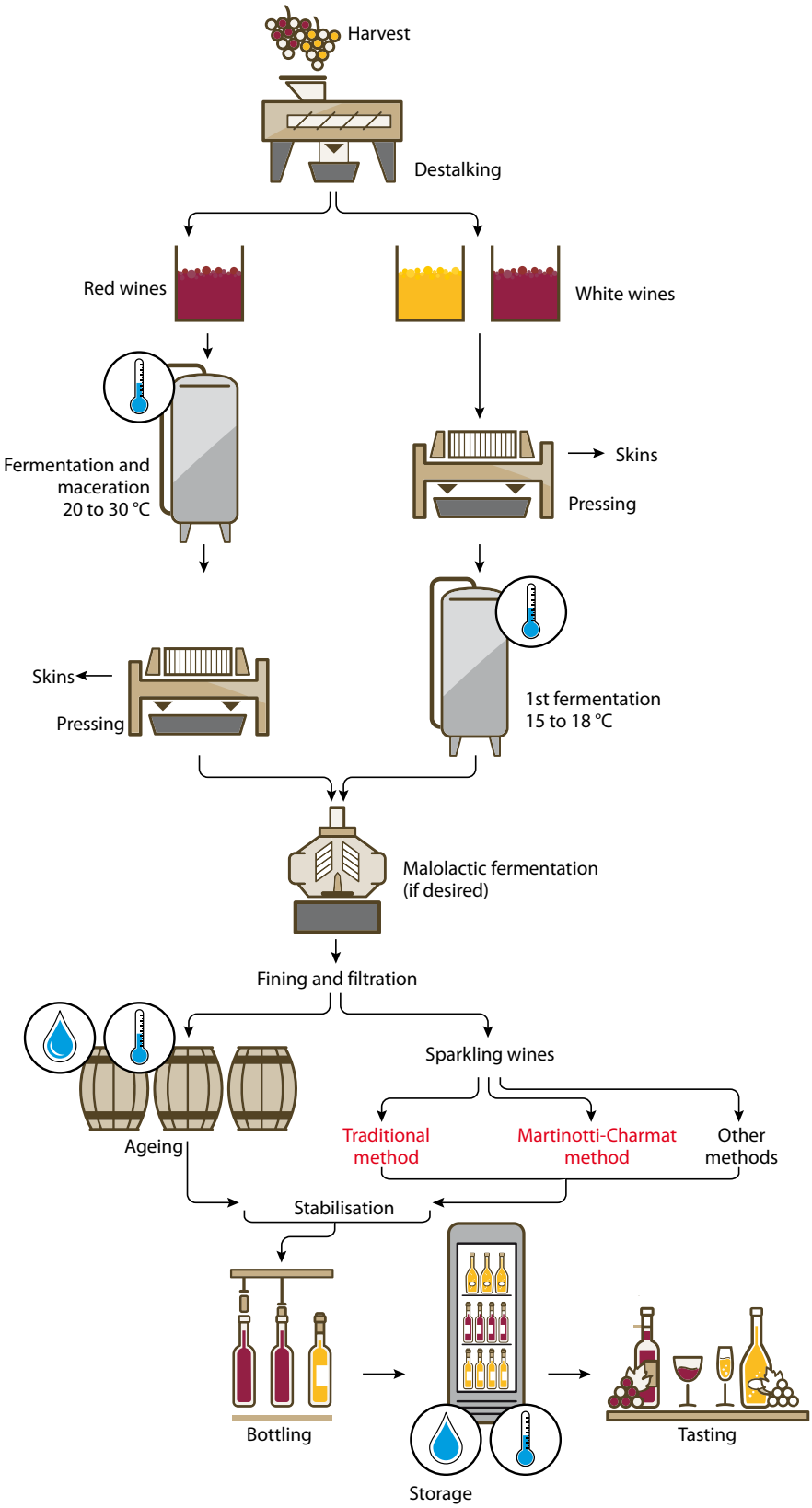
Red wines usually undergo alcoholic fermentation in stainless steel vats. The addition of sulphur dioxide (SO2) is important to prevent oxidation and as a disinfectant; it also avoids premature fermentation of the must.

The fermentation temperature is usually between 20 and 30°C, depending on the type of wine, and is kept constant over time. Fresh, aromatic red wines are taken from the vats at the end of fermentation or just before. Full-bodied wines intended to be aged in wooden barrels undergo extended maceration, well beyond the completion of fermentation.

White wine making

The first fermentation of white wine usually occurs at a temperature between 15 and 18°C, without contact with the skins. This means white wines can even be made from red grapes.
After the first fermentation, the wine can be processed to obtain still white wines or transformed into sparkling wine, using a number of common methods. The traditional method and the Martinotti-Charmat method are the most widely used natural processes for making sparkling wines.

These involve several stages, with a number of choices available to the winemaker. Consequently, there is no standard procedure, which enriches the variety of wine making excellence on the market.

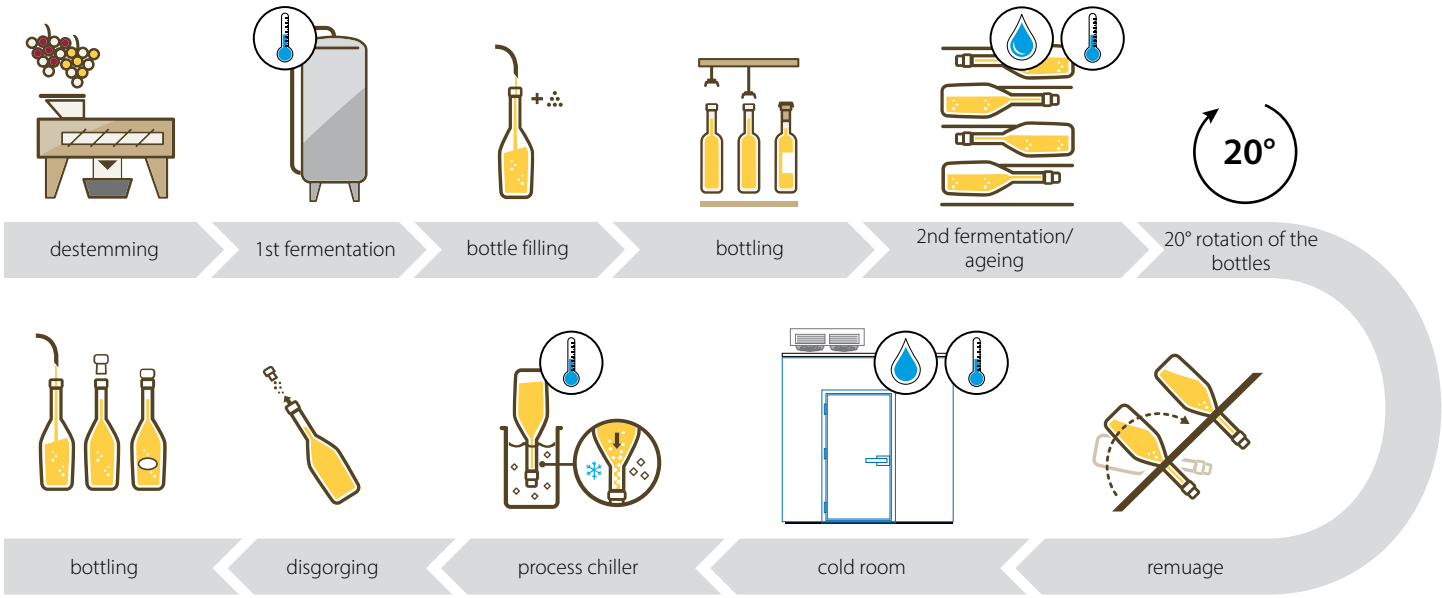


Sparkling wines

Traditional method

The Traditional Method historically stems from the French region of production of Champagne and for this reason it is also called the champenois method. At the end of the cuvèe, selected yeasts are added to the wine, which is then bottled using crown caps and left to ferment for a period that depends on the maintenance temperature (e.g. 50 days at 11°C for Champagne).

This is followed by ageing which lasts from a minimum of 9 months to 3 years in a horizontal position with controlled temperature and humidity. The bottles are then gradually placed vertically (upside down) in a process called Remuage. At the end of this process, all the yeasts and solid compounds generated during fermentation have settled in the neck of the bottle. At this point, after passing through a climatic chamber, the necks of the bottles are chilled by means of process chillers to -25°C. This is followed by disgorging to eliminate the solid deposits, filling the bottles with the missing part of the wine and bottling with corks.

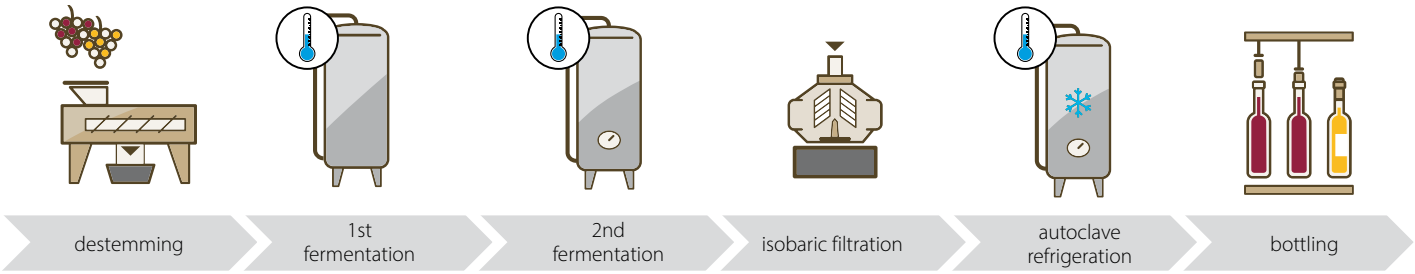


Martinotti-Charmat Method

The Martinotti-Charmat method dates back to the beginning of the 20th century and is characterised by the second fermentation of the wine in an autoclave, greatly reducing the process time compared to the Traditional Method.

It is therefore a second fermentation consisting of large quantities of wine stored in a single stainless steel container at controlled temperature and pressure.

The method is particularly suitable for fruity wines such as Muscat, since it enhances the aromatic fragrances of the grapes.



CAREL temperature control solutions

Contribution of the necessary technology to achieve excellent results and ensure competitiveness of the product in a globalised market.

Fermentation

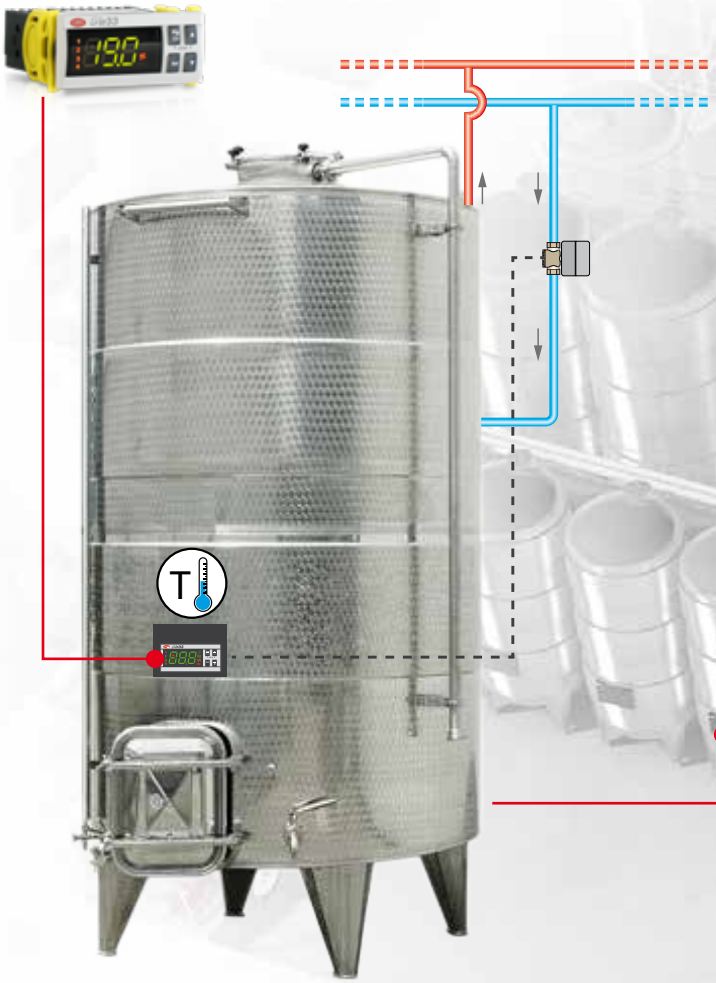
Alcoholic fermentation is characterised by an exothermic reaction in which the yeasts transform the sugar into ethyl alcohol, carbon dioxide and heat.

The heat generated by the reaction must be appropriately removed to keep the fermentation temperature constant. For this reason, winemakers use specific cooling "jackets". Alternatively, specific immersion heat exchangers are used.

$$C_6H_{12}O_6 \longrightarrow 2CH_3CH_2OH + 2CO_2 + Heat$$

Solution for winemakers

CAREL's IR33 universale parametric controller provides complete management of fermentation tanks: temperature monitoring, refrigerated line control and easy connection to a centralised supervisory system.
The IR33 can be combined with a Wi-Fi gateway to transmit data to a centralised supervisory system without the need for multiple cables.



Ultracella

Modular three-phase solution for cold rooms that provides complete load management, ensuring simplicity and lower installation costs compared to standard solutions.

Air temperature control

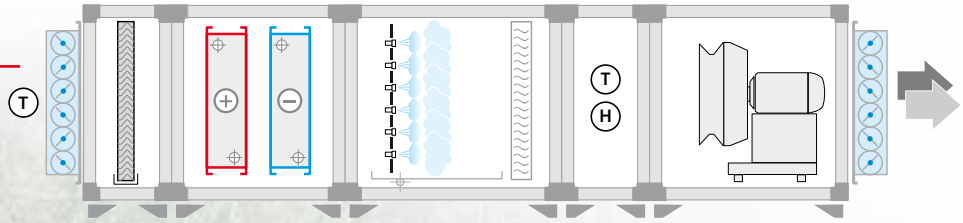
The air handling units can manage several rooms of the plant and make a significant contribution to the energy balance of a cellar. The efficiency and performance of the components used is only a first step towards reducing consumption. The control and management logic make it possible to reap maximum energy benefits.

k.air

k.Air is the CAREL solution for air handling units and ventilation. k.Air stands out for its easy commissioning, application flexibility, advanced connectivity and usability, thanks to the following features:

- pre-loaded air handling unit configurations, configuration tool or manual configuration procedure;
- application of energy saving and adiabatic humidification management algorithms;
- modular concept for additional configuration management
- management of high-efficiency direct expansion units.

Example of AHU configuration



CAREL offers solutions for the complete management of air/water and water/water chillers with the aim of reducing energy consumption.
An example of a solution with µchiller is shown in the photo above.

Wine ageing

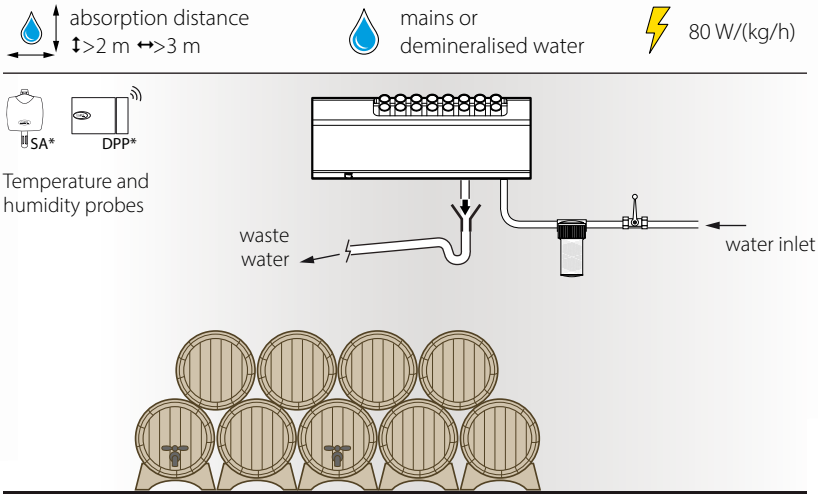
The ageing and maturation of wine in wooden barrels requires careful control not only of the temperature, but also relative humidity.

Hygroscopic materials such as wood and cork are heavily influenced by the relative humidity of the air, which must be adequately managed.
The different partial pressures between the water content in the wine and that in the air tend to balance each other according to the principles of physics. In dry environments, the water content of the wine tends to evaporate through wood and cork into the air, resulting in degradation and reduction of the saleable product. The slats of wooden barrels may undergo dimensional changes that in the long term may result in oxidation of the wine they contain. For this reason, the relative humidity must be kept above 75%.

humiSonic Direct

Ultrasonic humidifier

Ideal for environments where compactness, low noise and short absorption distance are key requirements. Energy efficiency is guaranteed thanks to an operating consumption of only 80 W/(kg/h).

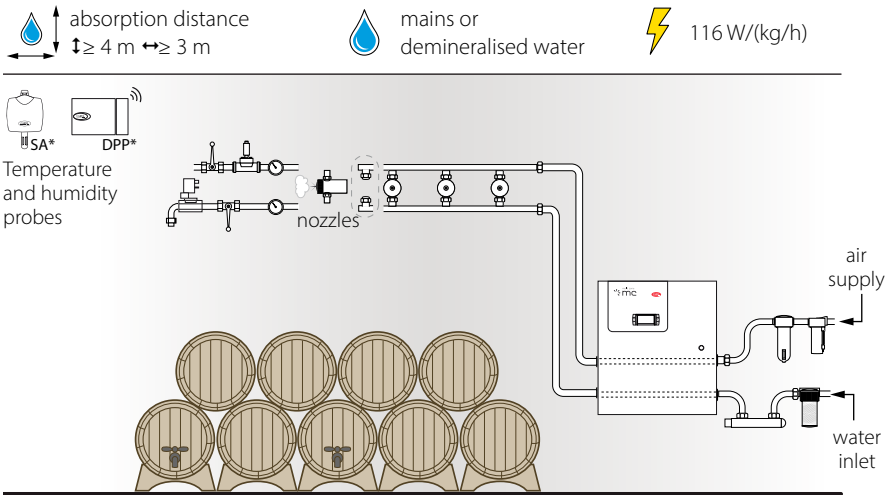


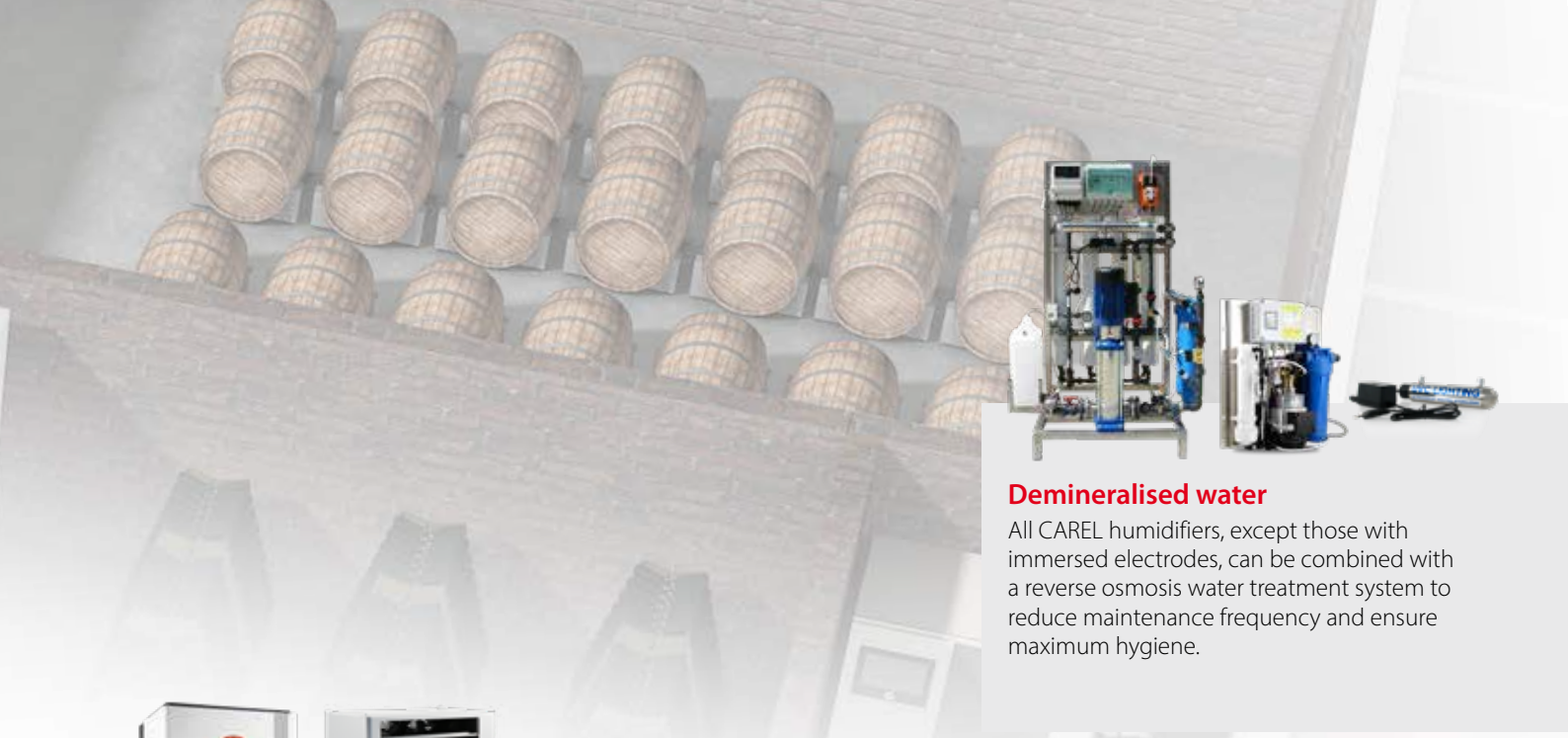
Any microorganisms present in the environment where humiSonic operates can affect both the frequency of maintenance operations and the hygiene of the humidifier itself.

MC multizone

Compressed air and water humidifier

This is the ideal humidifier when a compressed air system already used for other purposes is available. The distribution system is flexible and easily adapts to the specific layout of the cellar.





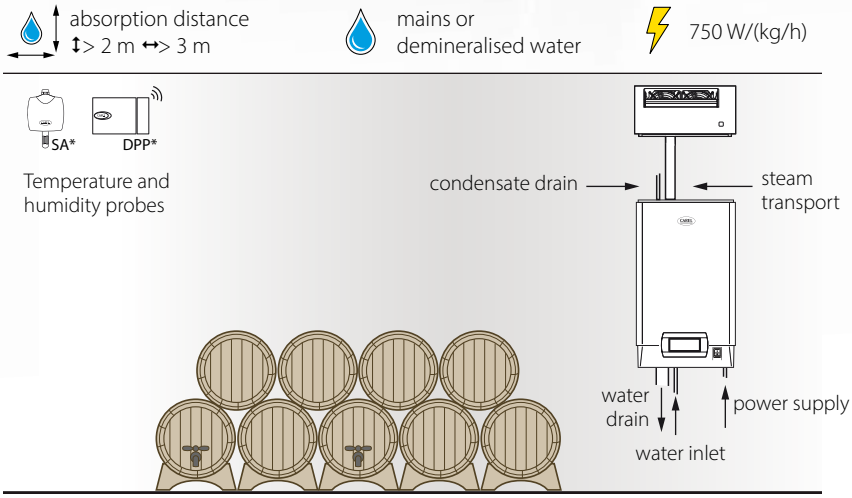
Demineralised water

All CAREL humidifiers, except those with immersed electrodes, can be combined with a reverse osmosis water treatment system to reduce maintenance frequency and ensure maximum hygiene.

heaterSteam

Resistance humidifier

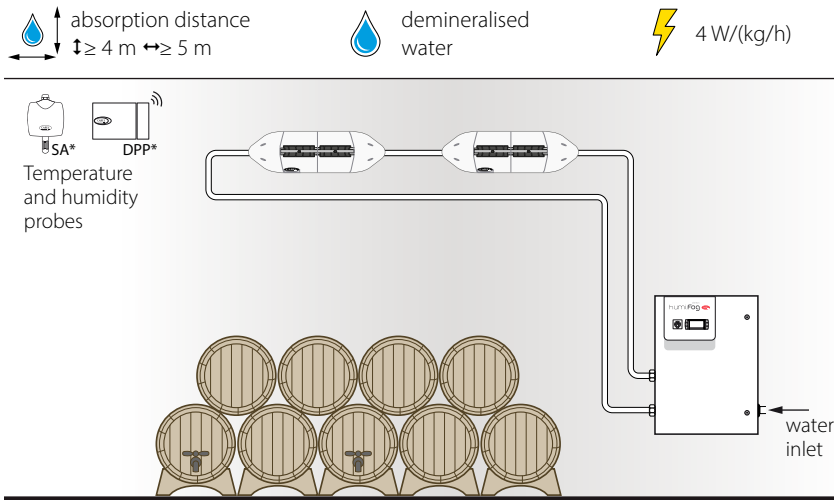
Suitable for environments with little free space where precision, reliability, low maintenance and hygiene are required. The humidifier has a state-of-the-art user interface that simplifies its use and clearly highlights the most important information.



humiFog direct

High pressure adiabatic humidifier

Designed for medium and large wine ageing and storage spaces. Characterised by low energy consumption and distribution system flexibility for installation of the fan heads in the places of greatest interest.



Wine storage

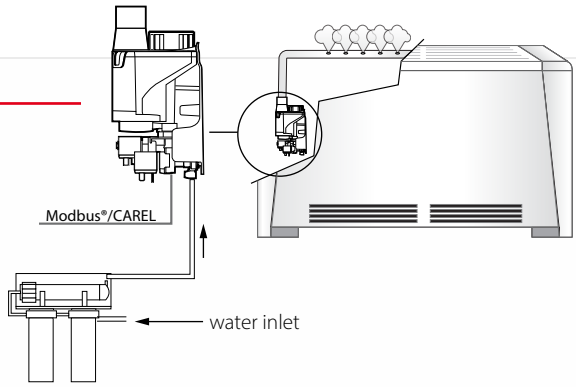
Wine needs to be stored in places with controlled temperature and humidity to preserve its initial qualities and improve them over time.

humiSonic compact

Ultrasonic humidifier

Suitable for regulating relative humidity in refrigerated cellars and for installation in fan coils, ensuring:

- minimum noise;
- compact design;
- easy installation even in the case of retrofitting;
- reduced maintenance with the use of demineralised water.



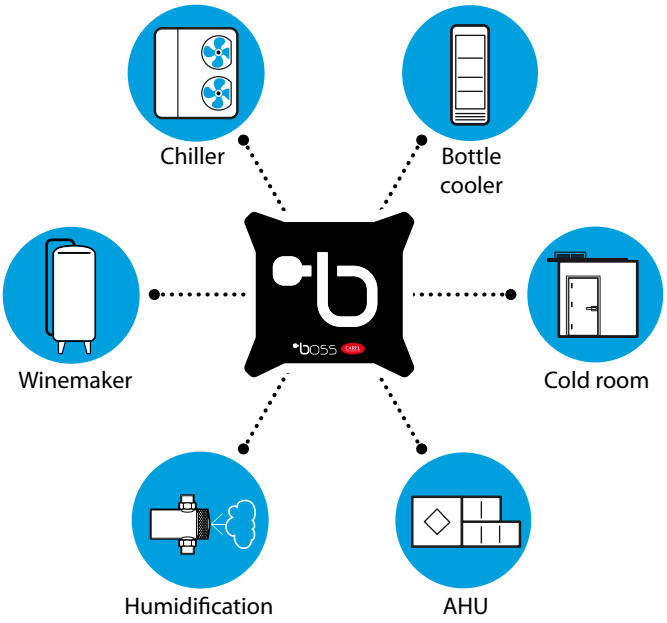
CAREL offers solutions for precise and stable temperature maintenance in refrigerated cellars and bottle coolers, ensuring:

- energy efficiency;
- ease of use;
- easy integration with supervisory systems.

An example of a solution with MPXone is shown in the photo above.

Everything under control: CAREL supervisor solutions

From destemming to wine bottle storage, the CAREL supervisory system provides continuous information monitoring from a centralised control room.



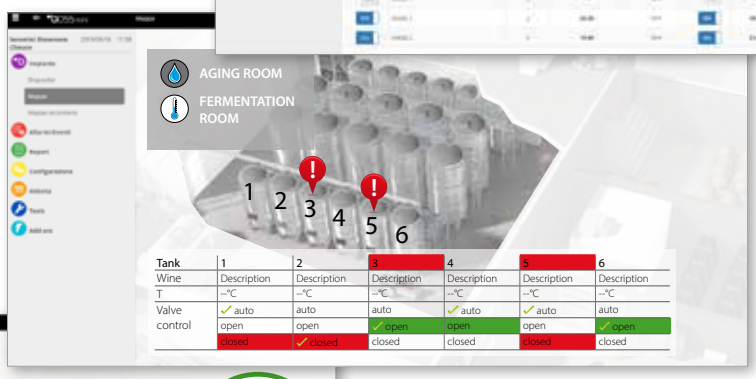
Boss range

Local supervision

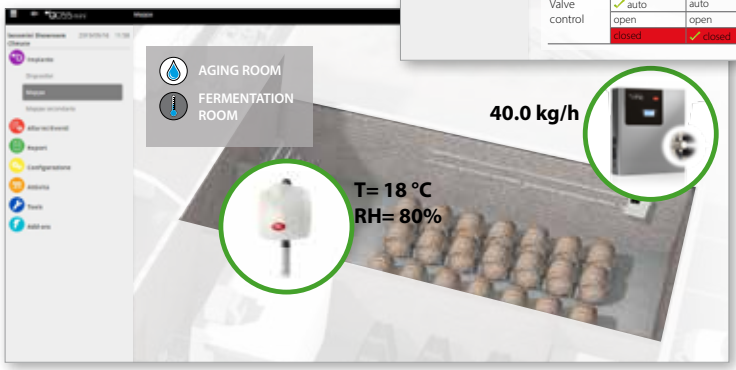
Boss is the CAREL local supervisor. The ample configuration flexibility, graphics customisation and Bacnet, Modbus and LonWorks protocol integration ensure ease of use and continuous monitoring of the thermohygrometric variables.
Any alarms are shown on the monitor for prompt action.
Wine fermentation, one of the most delicate phases of the process, is easily monitored for each tank with information on temperature, pressure and the possibility of displaying graphs of the variables of interest.

The product can be used to manage CAREL and/or third-party devices and have all the information available for each device.
The main interface can be customised according to the cellar layout and the customer's needs.

Variable log



Fermentation area supervisor



Ageing area supervisor

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