



## rTM SE wireless sensors

(Remote Temperature Monitoring)

### where

- sensors are installed inside the showcases and on the units configured for temperature monitoring.
- the Access Point is usually installed near the supervisory system to reduce wiring.
- when the distance between the Sensors and the Access Point exceeds 50 m, a Router needs to be installed

### what

- acquisition of the main operating parameters for each individual refrigeration unit in the field, with the data available to the supervisory system.

### why

- significant reduction in installation costs, by eliminating the need for wiring;
- simple to install;
- versatile and flexible;
- reliability of data transmission ensured by the ZigBee data transmission protocol;
- up to 2 analogue inputs and 2 digital inputs used;
- no need to replace the existing electronics (even if not supplied by CAREL).

## Combined with supervisory systems for temperature monitoring

For the retrofitting existing systems, CAREL proposes a showcase temperature monitoring solution using the rTM SE (Remote Temperature Monitoring) wireless system, combined with a CAREL supervisor.

The system comprises:

- battery powered wireless sensors, available in four versions: BP - EP - SA - SI, which measure the status of the inputs (temperature, humidity and light intensity, digital inputs) and send the data wirelessly to the Access Point.
- Access Point: RS485/ZigBee™ gateway configured to acquire information from the sensors. Communicates with the supervisor over RS485 using the Modbus® RTU protocol;
- Router: ZigBee™ to ZigBee™ device that repeats the wireless signals so as to cover greater distances. Available in the following versions:
  - EP1 Router-Sensor (same functions as the EP sensor);
  - Router-Bridge used to extend a wired RS485 serial network;
  - Router-Actuator to manage I/Os from the supervisor (includes thermostat function);
- Modbus® supervisory system: CAREL PlantVisorPRO or PlantWatchPRO.

The retrofit of existing systems is closely related to compliance with HACCP regulations (hazard analysis and critical control points), which require all food industries and small businesses to implement a program of checks so as to prevent the risks relating to the safety and conservation of food for human consumption.

With the rTM SE system, CAREL ensures the security of continuous and detailed monitoring of the installation.

The main advantages of the CAREL system for retrofit installations are:

- low installation costs;
- flexible installation and operation.



## Objective

To retrofit an existing installation for the purpose of implementing continuous and detailed monitoring in compliance with the HACCP regulations, keeping account of the following factors:

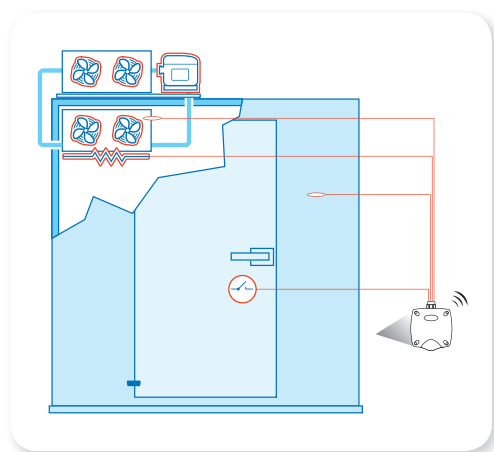
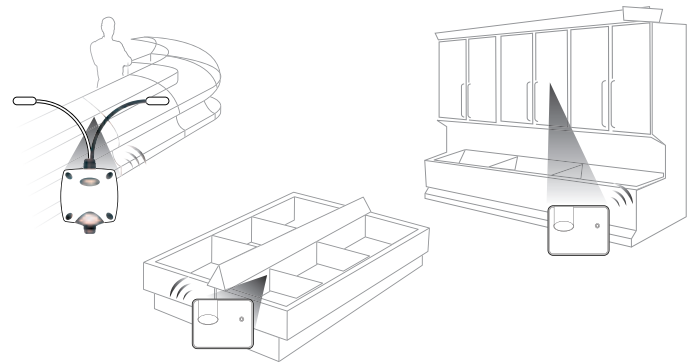
- control the temperature of existing refrigeration units using a low-impact system;
- avoid having to replace the electronics installed on such units;
- limit the wiring required by exploiting the advantages of wireless technology, at the same time significantly reducing installation costs;
- simplify data recording procedures;
- record and monitor system data;
- prevent and/or identify possible critical events and automatically notify the installation supervisor by email, SMS or fax, so as to allow corrective actions to be taken;
- automatically process reports, tables and graphs on system data, preserved and filed in compliance with the HACCP regulations, reducing the time required to complete the required forms;
- allow the system to be monitored via a remote connection;
- use just one supplier for all the components in the installation.

The supplier thus becomes a "ONE STOP SHOP", providing and servicing all the components required for the retrofit.

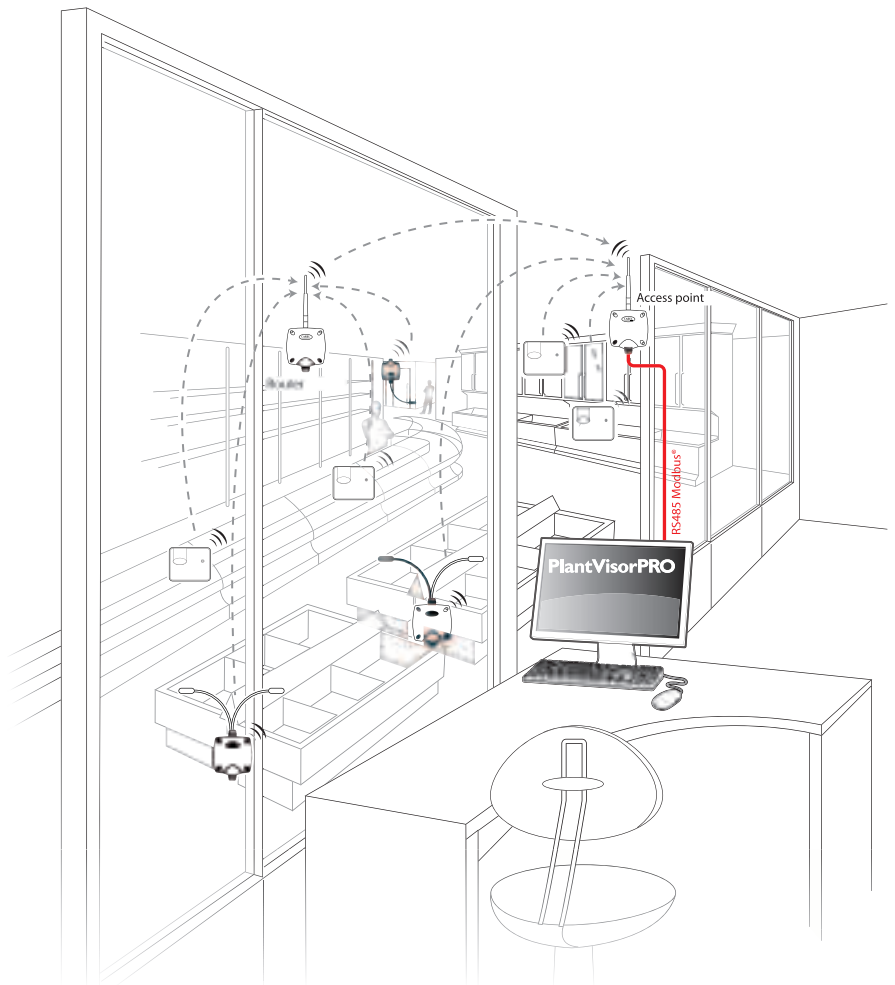
## Reliability and flexibility

The system diagram shown below illustrates how CAREL offers highly technological products within an integrated solution framework, made up of:

- wireless sensors;
- Access Point;
- Router;
- supervisory system.



*example of cold room installation*



*example of connection between devices and supervisor*

Overall, the installation requires very few connections (wiring is reduced by exploiting wireless technology, maintaining the existing controllers on the refrigeration units).

Data is exchanged between the sensors using ZigBee, a high-performance and innovative wireless protocol. Specifically, this supports "Mesh" networks, in which each node interacts with the others in the network. This creates a highly reliable and flexible system, based on the principle of "redundancy" that allows reach individual node to communicate either directly or via one or more intermediate nodes to reach the receiver or; this means alternative channels can be found for sending and receiving data.

All this gives clear benefits when changing the layout of the showcases. Graphs and reports on the system data can be created simply and efficiently using the PlantVisor or PlantWatch supervisory system, which can furthermore manage and supervise several installations situated in different places from one position.



*BP Sensor installed in a display case*

It's important to verify the best position for the Access Point and Router in every installation by studying the layout and taking into account any fixed or moving obstacles.

The installation should include a sufficient number of Routers to cover the area where the sensors are installed, making sure each sensor can reach at least two devices (Access Point and Router or two Routers). Wireless technology is not like a wired connection, which always guarantees delivery of the data sent. Indeed, the operation of wireless devices depends considerably on the environmental conditions, which may easily change (people in transit, metal trolleys, shelves with food inside the supermarkets, metal doors that open and close, low or high humidity levels, other obstacles in general), and consequently each sensor must always be able to see at least two devices to ensure greater certainty that the data will be delivered to the Access Point.

Two accessories are available to monitor the wireless signal level, providing the installer useful support in establishing the wireless connections between devices and monitoring wireless signal quality.

## Solution

Its profound knowledge of HVAC/R applications and extensive experience have allowed CAREL to develop an INNOVATIVE SOLUTION for supervision and monitoring applications, combining technology and aesthetics. The solution proposed by CAREL is made up of rTM SE wireless sensors combined with the PlantVisorPRO or PlantWatchPRO supervisory system.

### Wireless sensors

#### BP wireless sensor (Built-in Probe)

The sensor measures the temperature inside the refrigerated showcase, and sends the data to the supervisor. The data transmission interval is set by parameter. The high temperature alarm can be disabled locally using the CLEN button, for restocking the products and cleaning the showcase.



#### EP wireless sensor (External Probe)

The sensor is installed on the showcases, and can accommodate two external temperature probes, NTC 10K@25°C  $\beta=3435$ .

The typical application is showcases with one sensor on the evaporator, plus one inside the compartment, together with two digital inputs to check the door and defrost status (alternatively it can be used to monitor two showcases).



#### SA room sensors

Used to measure temperature and humidity in the room.



#### SI industrial sensors

For light industrial applications, to measure temperature, humidity and light intensity.



#### Access Point

Device that receives the signals from the wireless sensors and forwards these to the supervisor over the Modbus® RTU RS485 serial line.



#### Router

- used when the distance between Sensor and Router exceeds 30 m;
  - when there are more than 30 sensors for each Access Point;
- Also available in combined versions:
- Router-Sensor -> same functions as the EP sensor;
  - Router-Bridge -> to extend the local Modbus RTU RS485 network;
  - Router-Actuator -> to activate loads or read input status. Also acts as a local thermostat



## Monitoring systems

### Why

- innovative monitoring and supervision systems;
- PlantVisorPRO and PlantWatchPRO can be used to monitor the system, based on the values read in the field, saving and processing such values to generate alarms.

### Benefits

- continuous monitoring of the system with alarm signals sent by SMS, email, fax;
- highly reliable system management, creation of graphs and reports in compliance with the HACCP regulations;
- overall cost reduction (maintenance, component selection, software installation).



PlantWatchPRO



PlantVisorPRO

### Simplified HACCP management

The supervisory systems can produce temperature and alarm reports for all the instruments connected to the supervisors. The temperature data are saved on the supervisor in compliance with the standards in force.

### Simple and clear alarm management

Each alarm event is detected and saved by the supervisor. In response, an e-mail, fax or SMS can be sent immediately to notify the service centre of the problem, so as to optimise the action taken.

Each alarm can be assigned a different level of importance and the information can be sent to different recipients, based on time bands.

### Effective service

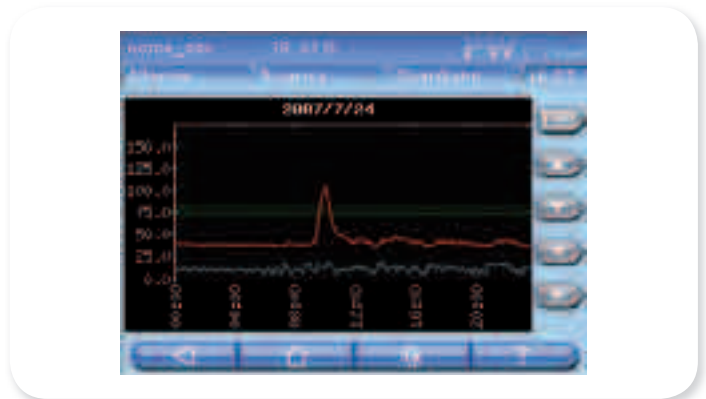
Being informed instantly is a major advantage. The sites are thus under control at all times, and accessible with a simple "click". The remote system can be used to resolve many problems immediately, without having to physically go on site.

### Graphs

The supervisors produce detailed and complete graphs, with the possibility to represent a series of temperature or operating status values at the same time. These are fundamental tools for analysis and diagnostics in the event of incorrect operation of the controlled units.



PlantVisorPRO



PlantWatchPRO

### 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

CAREL Asia - [www.carel.com](http://www.carel.com)  
CAREL Australia - [www.carel.com.au](http://www.carel.com.au)  
CAREL China - [www.carel-china.com](http://www.carel-china.com)  
CAREL Deutschland - [www.carel.de](http://www.carel.de)  
CAREL France - [www.carelfrence.fr](http://www.carelfrence.fr)  
CAREL Iberica - [www.carel.es](http://www.carel.es)  
CAREL India - [www.carel.in](http://www.carel.in)

### Affiliates

CAREL HVAC/R Korea - [www.carel.com](http://www.carel.com)  
CAREL Russia - [www.carelrussia.com](http://www.carelrussia.com)  
CAREL South Africa - [www.carelcontrols.co.za](http://www.carelcontrols.co.za)  
CAREL Sud America - [www.carel.com.br](http://www.carel.com.br)  
CAREL U.K. - [www.careluk.co.uk](http://www.careluk.co.uk)  
CAREL U.S.A. - [www.carelusa.com](http://www.carelusa.com)

CAREL Czech & Slovakia - [www.carel-cz.cz](http://www.carel-cz.cz)  
CAREL Korea (for retail market) - [www.carel.co.kr](http://www.carel.co.kr)  
CAREL Ireland - [www.carel.com](http://www.carel.com)  
CAREL Thailand - [www.carel.co.th](http://www.carel.co.th)  
CAREL Turkey - [www.carel.com.tr](http://www.carel.com.tr)