

cold chain



by Epta Service and Epta Innovation Center

Epta, with the Costan trademark, has installed in the E. Leclerc Conad supermarket in Modena (Italy) an installation of a temperature monitoring system using wireless sensors in the refrigeration counters

Wireless application to refrigeration monitoring for food quality

All modern refrigerated counters have a built-in controller that makes it possible to connect up to a monitoring network, allowing remote management of alarms. Once this option was not always used, but today it is a necessity due to the need to detect any fault ever more quickly, to minimise the impact of a fault on the availability of a refrigerator cabinet for the client's sales activities.

The electronic systems used to control the refrigerator counters are therefore fitted with a classical serial communication line that creates a field bus that connects all the controllers in a sales area. The field bus is connected to a core that allows local and remote access using the most widely ranging communication technologies currently available - from the old modem on a telephone line for point-to-point connections, to intranet/internet connections using web server gateways, e-mail, sms, etc. Preset messages are used to initiate assistance action to resolve any problems that may arise.

For new-build shops or sales areas subjected to extensive redevelopment works the solution normally adopted is the lay-

ing, along with the electrical power lines and refrigeration piping, of an electric cable that constitutes the physical means of serial transmission for the field bus. For a long time electronic systems have been available that, faced with obstacles that are difficult to overcome or cable lengths that are equally inadmissible, use a radio connection between two points in the field bus. This (bridging) system is transparent for the system that therefore involves a simple section of cable replaced by a point-to-point radio communication. In this way, in a connected system, all the alarms and all the temperatures and statuses of the controllers can be viewed from anywhere, making remote monitoring or remote con-

trol possible, as well as intervention on the refrigerated counter's or compressor unit's operating parameters. These systems make it possible to manage temperature data according to the requirements of the HACCP food risk management system. Sometimes, however, the scenario becomes more complex. There are cases, in fact, in which the laying of a communication cable involves a cost that the client is not willing to pay. In other cases it is not possible to do the building work necessary to hide the cable in the floor or false ceiling. In the case of partial redevelopment of a shop the client needs to keep the refrigerator counters that are not ready for scrapping working, and they would like them included

in a monitoring system but they use old generation controllers or simply those of a different make, which are not compatible with the new instruments. What can one do, finally, if you wish to use remote monitoring for a shop whose counters do not have controllers set up for serial communication? One economically viable solution is full application of radio communication.

The ZigBee™ standard

Among the various technologies on the market for transmitting radio signals, Epta has identified the "ZigBee™" protocol as the ideal solution for applications related to monitoring refrigerator counters in order to guarantee full coverage in terms of security and continuity of the signal. This protocol is based on the IEEE 802.15.4 standard and is presided over by a group of companies that form the ZigBee Alliance (www.zigbee.org). The principal points in favour of ZigBee are the relevant long single hop communication range and the low passing band. The communication range makes it suit-

Who's epta?

Epta, European Group and worldwide partner in the commercial refrigeration sector for food retailing, owns the Costan, Bonnet Nava, Bkt, George Barker and EuroCryor brands and specialises in the manufacture installation and after-sales service of refrigeration counters for fresh and frozen products, (Plug-in) incorporated unit counters, medium and high power units, and refrigeration coldrooms.

able for even the largest commercial centres with large sales areas. The limited passing band makes it unsuitable for transmitting long strings of data to the printer or images from a PC to a TV set, but it is perfectly adequate for transmitting a dozen or so parameters every 5 or 15 minutes, which is all that is needed by a refrigerated counter. The limited amount of information transmitted compared to Bluetooth or Wi-Fi and the possibility of putting devices in stand-by mode when they are not transmitting, brings about very low energy consumption. The result, albeit secondary, is that it becomes possible to think about battery-powered objects with a lifespan of 3, 5 or more years. This brings with it the undisputable advantage of making con-

nection to a power supply simply unnecessary. Another important characteristic of ZigBee is that mesh networks can be created. When a device is unable to communicate with a core in the network, it can use other cores and reach the destination via a number of "hops". This makes communication particularly reliable and insensitive to faults in a single core. ZigBee is interesting because other markets have activated initiatives that give it a promising, rich future. These include, for example, initiatives for equipping mobile communication systems with interfaces with ZigBee networks and Telecom Italia's ZSim experimentation. This means integration of a Sim card for mobile phones in a ZigBee core. Other applications are re-

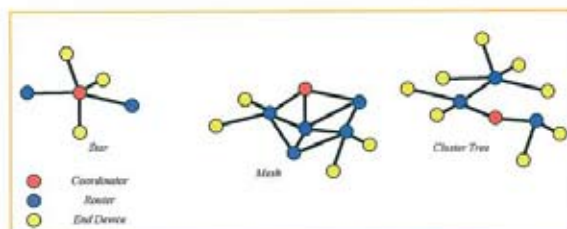


Figure 1



Epta

Advanced Solutions
for your Store

cold chain

tached to the refrigerated counter using velcro. The NTC sensor is attached to the inside of the refrigerated counter and positioned at the point at which the temperature must be monitored. The End Devices manage the temperature of even two counters due to the characteristics of the product that is able to read two NTC type sensors. The sensor measures the temperature of the refrigerator counter at sampling intervals determined by the parameter and activates a radio connection with the Access Point.

The greater the sampling interval the longer the battery lifespan. Subsequently the Access Point transmits the data gathered from the sensors in the field, to the supervisor via RS485 serial, using a ModBus protocol. This in turn makes the data available via the company LAN. The PlantvisorPRO supervisor is connected to the supermarket's Ethernet network, which makes it possible for all local users to access the plant supervisor provided they have access passwords. A VPN connection makes remote access to the sys-

tem via the web possible, which allows Epta-Costan and Carel to monitor each individual device in the plant. The system described provides fully free transmission, lowers installation costs and, at the same time, improves communication reliability. With the system proposed, momentary interruption of communication, in a worst case scenario may create problems for a single instrument but does not affect the entire transmission system. Traditional wiring systems, on the other hand, present a number of limi-

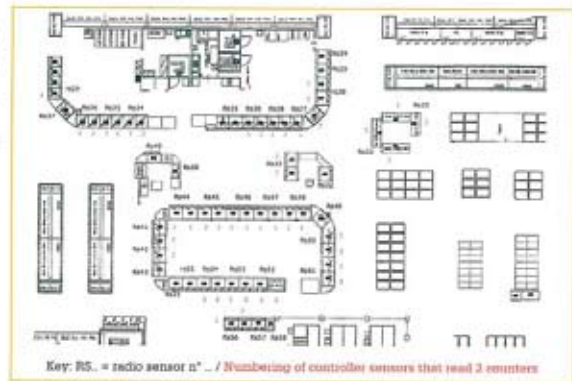


Figure 3

tations, possible interruption or noise related to the earth currents that may disturb or end communication. This can be very harmful if it fails to transmit an alarm. As has been said, this is in addition to the obvious disadvantage of installation costs and time associated with the need for serial cable wiring and a power supply source. (Figure 2)

Installation times

One decisive element in favour of the solution proposed is undoubtedly the installation time. Work carried out around the refrigerator counters has been reduced to a few minutes for each counter. This means that sales do not have to be interrupted. It is not even necessary to stop refrigeration of plug-ins. The simplicity of using the configuration and "plug&play" installation of the Wireless Sensor and PlantvisorPro system made it possible to complete installation in one working day.

This compared to installation of a classical wired solution that takes 10 or 20 times as long with an incomparable increase in costs and the need to cordon off areas of the supermarket for works and the related loss of sales for the store.

The last phase of the installation was configuration of the PlantvisorPRO system to memorise the temperatures according to the HACCP standard requirements, display graphs of the same, and generate daily reports in pdf format.

System users were pro-

grammed with differing access and password rights. Next a list was prepared of the persons that are to receive alarm indications, which can be sent by e-mail, fax, or sms, thanks to the system's potential. The system allows Epta-Costan to monitor the plant whenever they wish, allowing them to connect via the web and determine any assistance works required.

This solution made it possible to achieve the following advantages:

- Maintain existing regulation of refrigerator users.
- Guaranteeing supervision using a system other than the control system, which brings added security.
- Monitoring system in compliance with the standard with management of high/low temperature alarms and sending of alarm indications by e-mail, sms, fax, or HACCP report.
- Not closing sales areas to carry out work (Figure 3). //

Recommended readings

AEIT July /August 2008 - ZigBee Standard di trasmissione emergente: una rivoluzione in atto? - Elisa Alessio, Maura Turolla Telecom Italia spa

Epta wishes to thank E. Leclerc Conad and Carel's R&D and MKT staff for their valuable assistance in running the field test described and with this article