

This system allows the study of refrigeration systems and the implementation of the thermodynamic calculations applied to refrigeration

.
Its uniqueness is that it is fully controllable via the Internet directly from a web browser like Internet Explorer or Firefox

.
It consists of two cold rooms, each with their own evaporator but sharing the same cooling fluid R134a system (compressor, condenser ...).

The control and configuration of this system can be done in two ways:

- a classic console coupled to a regulator
- [PLC](#) type industrial PAC (programmable automation controller) Compact [Fieldpoint](#)

The Compact [Fieldpoint](#) adds the possibility of remote control via the Internet, viewing the evolution

lution curves
of
temperature,
air and
refrigerant
fluid,
pressure
and
power
at various
points

.
This
allows
calculating
the
required
cooling
system features
such as
enthalpy
,
entropy,
Mollier diagram
and performance coefficients



Refrigeration system with control panel and circuit fluid

Hardware

The software is embedded in a Compact [Fieldpoint](#) controller from National Instruments. It includes a RJ45 Ethernet connector that allows to connect to the network in aim of uploading the executable on the controller module to the embedded FTP and publish shared variables on the network

. We use Compact [Fieldpoint](#) module inputs / outputs , analog and relays for sending commands (start / stop , compressor speed , refrigerant solenoid valves ,

condenser
and
evaporator
fans

,
lights
and
heaters
for
cold rooms

)
a
nd
collect measurements

.
We
measure
the
power
consumed
by
the
compressor
with
the
power meter
included
in
the
regulator

.
This
regulator
communicates only
by
Jbus protocol

. So we
use
the RS

-
232
Compact
[Fieldpoint](#)
controller
and connect to it
an RS

-
232
<
-
>
RS
-485
converter.
Jbus
communication
functions
are
programmed into
the
controller
based
on
the Modbus protocol
that
is compatible for
our
use
.
An
Ethernet
8
relays
card
is
added
to increase
the number
of relays
.



The refrigeration system with Compact [Fieldpoint](#) modules in blue embedding [LabVIEW](#) real

-time

software.

Also shown on the right side doors of the two cold rooms.

Software

- [LabVIEW](#) for programming and compiling the program embedded in the controller Compact Fieldpoint

- [LabVIEW](#) RT Module for programming in [LabVIEW](#) embedded targets with real-time constraints

- Operating system of the Compact [Fieldpoint](#) controller: Phar Lap ETS IntervalZero (Group Citrix)

- HTTP server embedded in the Compact [Fieldpoint](#) controller to display directly in a web browser

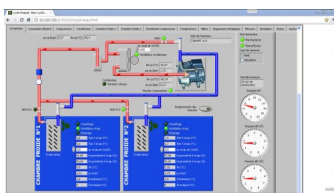
(Firefox

, Internet Explorer

...

) the GUI controls and graphs

- FTP server embedded in the Compact [Fieldpoint](#) controller to download the executable and configuration files and data



Screenshot of the GUI software programmed with [LabVIEW](#), embedded in the controller module of the Compact Fieldpoint controller from National Instruments

You can access this interface from the Internet via a web browser like Google Chrome here.

How does it work?

The user has the option to choose, by a switch, using the bench in local mode with the classical control panel or using it in remote mode for examination and regulation a

by the Compact [Fieldpoint](#)

If the remote mode is selected,

it is possible to visualize all the features,

curves and calculations (entropy, enthalpy,

Mollier diagram,

performance coefficients) by connecting,

via a

web browser,
to the controller

.

An
LED
lights
when
a
remote user
requests
the
control
to
change
temperature settings
or
sending commands

.

A
function
allows
the
measurements
recording
for
export
to Excel

.

It
is
thus
possible
to reload
these
recordings
to
simulate
the cooling system
without
making it work

.

Can be viewed
simultaneously
from
multiple
remote station

but only one
can
get the
control
of the bench
.