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Control Systems and Components

PG5 project example for compact room controllers PCD7.L793

Radiator / cooling ceiling combination with 2 control valves in mixed operation PWM / 0-10V with dew point sensor and window contact (optional with VAV and CO_2 regulation)

Introduction

With the help of an example, this document is intended to illustrate easy implementation of a control task with the help of a compact single room controller from the PCD7.L79x series. More detailed information is contained in the PCD7.L79x room controller manual (26-868).

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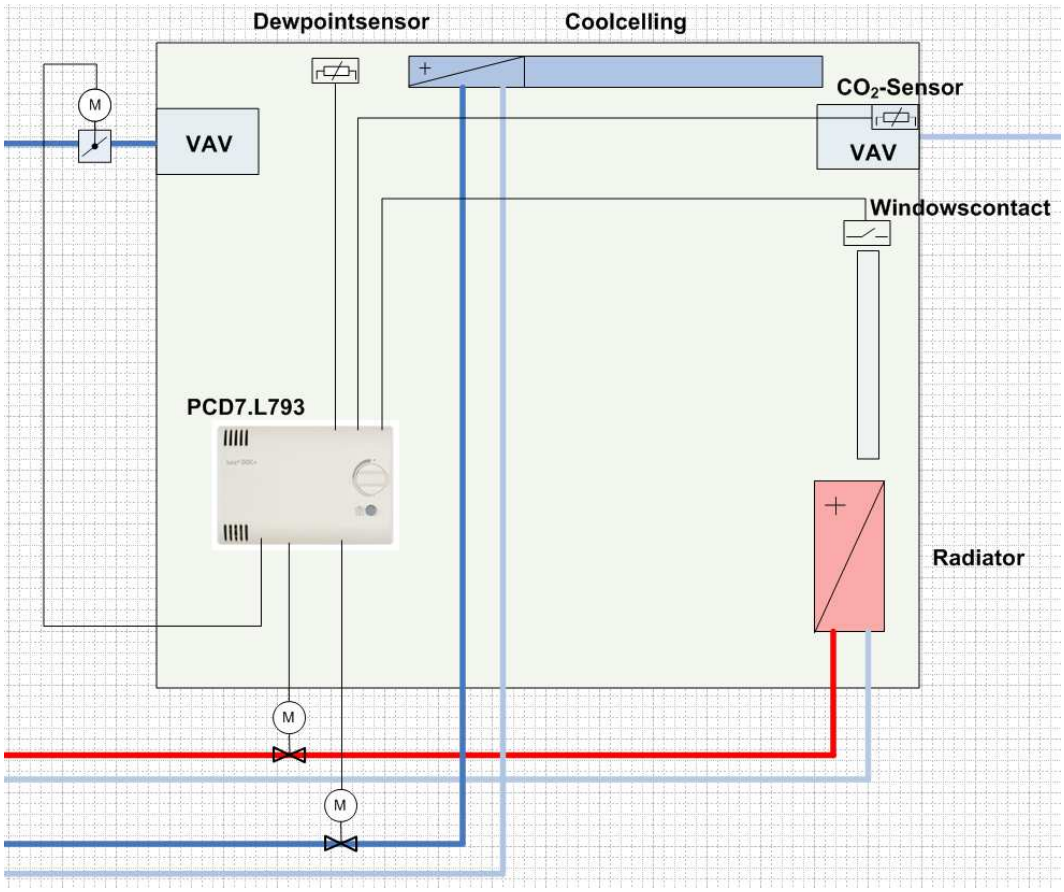
Application description:

Structure

The application example includes a radiator for heating, a cooling ceiling for cooling the room and a variable volume flow controller for fresh air supply, which can be used for additional cooling in a second stage through fresh air purification.



Dew point sensor:

If the water temperature of the cooling ceiling is below the dew point of air in the room, condensation water forms and the room controller's cooling signal must be switched off. For this purpose a dew point sensor must be mounted near the cooling ceiling and connected to the controller.
Any restart of the cooling signal after quitting the dew point can be prevented by configuring a delay time in the controller, so that the output is not constantly switched on and off.
There are subsequently two ways of avoiding renewed condensation:

- By dehumidifying primary air purification
- By raising the feed temperature of cooling water (=> cooling power will be reduced)

Window contact:

To allow energy savings, sensoring is necessary of whether windows (or balcony doors) are closed. For this purpose a window contact sensor must be connected to the controller, which checks window position.
If the window is open, all heating, cooling and air functions are deactivated and only frost protection mode remains active.

Use
This combination can be used for large office spaces and therefore also allows air quality to be regulated in addition.

Basically, VAV systems are suitable for meeting rooms, cinemas, concert halls, theatres, etc. (VAV cooling can only be used for small scale cooling of room temperature by max. 2-3 ℃).

The 0-10V output for VAV and CO_2 regulation can be programmed in the PG5 and driven using S-Bus communications through an output that is not used by the application.

Variations
This example can also be used in a modified form without VAV or cooling ceiling, or else with underfloor heating instead of a radiator.

If CO_2 regulation is not needed, the VAV part can be left out and cooling/heating handled with just the cooling ceiling/radiator combination.
However, this makes the reaction time for cooling significantly more sluggish (which would offer less comfort when heat develops due to insolation) and the cooling performance of the cooling ceiling can be restricted by atmospheric humidity within the room (see dew point sensor).

It is however also possible to operate the cooling/heating application without a cooling ceiling, by using the VAV system alone for cooling.
But this limits the maximum cooling output, because the inlet cooling air should be no more than 4 Kelvins cooler than room air – otherwise loss of comfort results.

Advantages
- Cooling ceiling together with VAV system => more energy saving if primary VAV feed air can be used for cooling
- With cooling ceiling each zone can be individually cooled to a specific temperature
- With the use of radiators beneath windows, cooled and falling air can be reduced, which prevents any unpleasant draught for the user
- Compared with a straight cooling ceiling system, the temperature can be cooled down more quickly with an additional VAV system, which can be an advantage when insolation is variable.

Hardware and software required

Hardware
This project has been configured for the following hardware arrangement:

- PCD3.M5540
  The controller is connected via serial S-Net with the single room controller.
- PCD7.L793
  The compact room controller with 2 TRIAC and 2x 0...10VDC outputs, temperature sensor, occupancy button and setpoint potentiometer. After configuration it can also work autonomously.

Software
The following software, including a valid licence, is required for programming:

- PG5.20

This project can also be operated with other hardware. If so, the corresponding parameters must be adjusted in hardware and software configurations.

Preparation of the project example

The project must be imported in PG5 and the PCD must be configured. To select the Fupla file "Example radiator cooling ceiling mix.fup", set the check-mark at Linked/Build (key combination Ctrl+L). This check-mark must be removed from the other example files.
After compilation, the project is transferred to the controller.
The single room controller is connected via serial S-Bus to the PCD.

Terminals on the single room controller are configured as follows:

Input E1	: window contact
Input E2	: dew point contact
Input E3	: free analogue input (0-10V)
Output Y1	: heating valve
Input Y3	: free analogue output (0-10V) e.g. to drive VAV
Output Y4	: cooling valve

Do not forget the power supply!

Configuration of controller in program example:
- Issue enable for L79x_Setup and L79x_Conf. F-Box.
- Open L79x_Setup, operate service pin on connected controller
- With "Setup" key, write new address in the controller
- Open L79x_Conf
- With "Write" key, write adjusted parameters in the controller

Parameters modified from factory setting:

From station address	: 10 (freely selectable, value for this demo-application)
To station address	: 10 (freely selectable, value for this demo-application)
Application selection	: 4pipe H/C
Choice of temperature sensor	: L79x
Contact terminal E2	: dew point
Drive valves Hz-Kh	: H-Y1 / C-Y4
Dew point (x20 seconds)	: 15

After configuration, cancel the enable for L79x_Setup and L79x_Conf. F-Box!

The address should be entered in the F-Box of the compact room controller (in this demo: 10). All remaining settings correspond to the default.

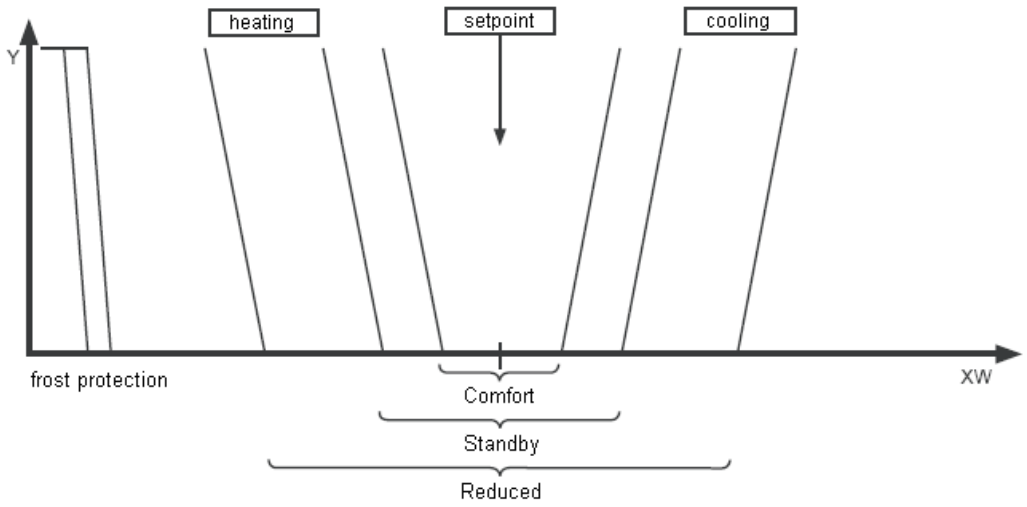
Operation of single room control

To query the current values of the compact single room controller, communication must first be enabled (set enable comm to "1").

The controller has four **operating modes**:

Comfort mode (OccMode=0) :
The controller works permanently in comfort mode. The occupancy function on the control panel is ignored.
Reduced (OccMode=1) :
The controller works in reduced mode. Through an occupancy signal, the controller switches to comfort mode for an adjustable period. This time is adjusted in the configuration F-Box under "Running comfort mode x10min".
Standby (OccMode=2) :
The controller works in standby mode and switches to comfort mode in case of occupancy. If occupancy is no longer detected, the controller switches back to standby mode.

Permanently reduced (OccMode=5) :
The controller is permanently in reduced mode. Occupancy detection is disabled.



The basic setpoint defines the room setpoint. This can be adapted within the prescribed limits via the setpoint potentiometer. The current control setpoint is the value "Soll_Temp" (SetPt). Depending on the choice of operating mode, room temperature is adjusted according to the control set point. At the same time, the maximum deviations (dead band in the Config F-Box) set for the current operating mode are taken into account.
Opening the window contact switches off normal control function and activates frost protection. Opening the dew point contact at input E2 causes cooling operation to be blocked and, when the dew point contact has been closed, cooling operation will only be reactivated once the re-closure delay “dew point (x20 seconds)” has expired.

In order to use the free analogue input (0-10V), in F-Box "L79x Room" a register has been assigned to the data point "analogue input terminal E3". This allows the input (like any other assigned data point) also to be used outside the F-Box for any purposes required. (AIClampE3 in symbol editor).
In this project it can be used as an input for a CO_2 sensor.

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In PG5 Fupla, VAV/CO_2 control can be freely programmed, parameterized and written via the F-Box "L79x AO" to 0-10V output Y3.

Connection diagram: