

University of Hong Kong
Department of Mechanical Engineering

Laboratory for MECH3023 Building Energy Management and Control Systems

Title:

HVAC System Configuration in BEMCS and Building Emulation

Objectives:

1. To study the specification and configuration of typical HVAC systems in commercial BEMCS.
2. To study the performance of a computer model of a 4-zone VAV system and to analyse its use for building emulation with the BEMCS.

Apparatus:

For Objective 1, the apparatus consists of a Landis & Gyr System 600 BEMCS comprising a Pentium PC operating in Insight under MS Windows 2000 as the central station and an outstation fitted with a number of input and output modules.

For Objective 2, the apparatus consists of a computer simulation model of a 4-zone VAV system developed using the MATLAB language for execution under MS Windows in a Pentium PC.

Experiment:

(A) HVAC system specification and configuration

Figure A1 shows a typical arrangement for the control of multiple water chillers in a variable volume flow system.

Figure A2 shows a VAV heating and cooling air handling unit with economizer control.

1. For the above two cases, identify all input and output points in the system and list them in a table, distinguishing whether they are digital or analog point.
2. Start up the Insight software.
3. Configure the systems in the BEMCS, making reference to the instructions for the Insight software and associating the input and output points with the input and output modules in the outstation. Make use of the Point Editor and Point Commander as required.
4. Save the configuration details in files.

(B) Building Emulation

Figure B1 shows the block diagram of a 4-zone VAV air conditioning system for simulation study in the MATLAB environment.

This component-based computer model can be used to obtain the performance characteristics of the air conditioning system under specified operating conditions.

1. Execute the simulation software using the specified input files for occupancy, solar gain and weather data to obtain the air flow rates and room air temperatures for one day.
2. Save the output variables in files.
3. Plot the output files on the computer screen.

Report:

(A)

1. Briefly explain your point tables and your choice of configuration parameters.
2. State your expected sequence of control operation for the two systems.
3. Identify the required sensors and actuators for the two systems.

(B)

1. Briefly explain how you can modify the given simulation setup in order to be able to obtain a building emulator.
2. Plot the output variables of the simulation to check the general patterns.
3. Identify the component(s) which should be replaced by the BEMCS for testing of the BEMCS performance using the building emulator.