



# Building Management System (BMS and HVAC Controls)

An Online Continuing Education Course for Engineers

**Course Number: HV-5017**

**Credit: 5 Hours / 5 PDH / 5 CPD**

# Building Management System (BMS and HVAC Controls)

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## Introduction

A Building Management System (BMS) is an integrated monitoring and control of building functions via an intelligent microprocessor-based system. The core functions of a BMS system is to control and monitor utility equipment such as Lighting, Heating, Ventilation & Air conditioning (HVAC) systems, Fire Alarm Panels, Water Tank Monitoring, Elevator Operations, CCTV, Access Control, Vehicle Management, Perimeter Security, Generators, STP, WTP and many more of the sub-systems that are employed within a building. A BMS system will include sensors, controllers, output devices, host computers, workstations; graphical web interfaces, and communications networks with embedded control to provide the primary interface for the building operation.

They are also referred to as building automation systems (BAS) and building automation and control systems (BACS).

BMS can generate the following benefits:

- Integrate multiple systems onto one operating platform.
- Minimize human manual intervention in daily operations.
- Keep the building's environment within a specified range.
- Monitor and correct system performance remotely.
- Ensure compliance with OH&S and essential services regulations.
- Monitor benchmarking energy efficiency, security, and scheduling maintenance.
- Alert or sound alarms in the event of a malfunction.
- Reduce building operator time and costs and enable remote monitoring and access.

## Terminology Terms

You may hear any of the following terms to describe the control or automation of buildings.

These terms are often used interchangeably, but there are subtle differences.

- **Direct digital control (DDC)**
  - Direct Digital Control (DDC)—describes the communication method used in modern devices (hardware and software). Collectively, DDC products control various building systems and form the automation system. A DDC is similar in function to a small PLC. It has the capabilities of handling a limited number of digital and analog inputs/outputs and is dedicated to HVAC systems.
- **Building automation system (BAS)**
  - Building Automation Systems (BAS) are centralized, interlinked, networks of hardware and software, which monitor and control the building's environment. While managing various building systems, the automation system ensures the operational performance of the facility as well as the comfort and safety of building occupants. A BAS is necessarily a subset function of the BMS.
- **Building management system (BMS) /Building management and control system (BMCS)**
  - Building management systems (BMS) could be referred to as a networked BAS system, which allows different automation subsystems to combine into one through a PC workstation or over the internet. BMS provides an opportunity for detailed analysis of controlled processes and their optimization.
- **Energy management system (EMS)and Energy management control system (EMCS)**
  - Energy Management System (EMS)—generally understood to be the same as a Building Automation System but may have a particular emphasis on energy metering/monitoring

- **Smart (Intelligent) Building**

- A smart, intelligent building is one that is equipped with a data-rich BMS.

For the sake of this course, we will stick with the most common industry term – "The BMS."

### **How do BMS work?**

Basic BMS has five essential elements:

- **Input Devices**

- Input devices *measure* physical information such as temperature, pressure, CO<sub>2</sub> concentration, and pressure sensors.

- **Controllers and I/O Module**

- Controllers *interpret* data from input devices, compare it with a set of instructions, and issue logical control commands to output devices.

- **Output Devices**

- Output devices carry out *changes* based on the controller action.

- **Dashboard or User Interface**

- PC workstation where building information is reported. Day to day operation is usually displayed via graphical user interfaces and alarm management features. Operators use the workstation to monitor and interact with various controllers. It is also called the **Human Machine Interface (HMI)**.

- **Communication Protocols**

- The communication protocol is a language spoken among the components of the BMS. The most widely accepted framework for the BMS is a three-tier distributed architecture for monitoring, processing, and carrying the designated instructions. All major BMS manufacturers and many HVAC plant suppliers have standardized on BACnet - A Data Communication Protocol for Building Automation and Control Networks developed under the auspices of the

American Society of Heating, Refrigerating and Air-Conditioning Engineers  
(ASHRAE).

### **Future trends in BMS – changing expectations**

When the subject is automation and intelligent buildings, you know that things don't stand still.

Here are a few trends influencing BMS:

- Until recently, the building controls were restricted to HVAC systems. Building HVAC controls are now being increasingly integrated with other building functions, such as lighting, physical security, and access control, etc.
- The HVAC control system has to migrate from the traditional use of serial networks to more robust interfaces such as Ethernet, fiber, and wireless technology. The current generation BMS systems are now commonly based on open communications protocols that are WEB enabled. Administrators and system operators can use the web interface for remote command and control with extensive database reporting and analysis.
- The next significant shift is the "Internet of things (IoT)." Big data, automated analytics, pervasive wireless sensing, and cloud services. These are together radically changing the quality of information that can be collected, processed, and analyzed in a real-time basis for better services provision. Manufacturers are now offering direct Bluetooth Low Energy (BLE) interaction with the HVAC, lighting, CCTV, and other controls, and app developers are creating customized Smartphone apps for a specific building with a host of additional functions such as wayfinding, meeting room booking, and status, car park booking, restaurant menus, transport information, and so on.

In this course, you will learn the fundamentals and applications of control systems, DDC, and BMS with a central focus on the HVAC systems.

The course is divided into 8 Chapters:

CHAPTER 1: Control System Basics

CHAPTER 2: Sensors

CHAPTER 3: Controllers

CHAPTER 4:	The Output Devices
CHAPTER 5:	Types Of Control Systems
CHAPTER 6:	Building Management Systems (BMS)
CHAPTER 7:	BMS Communication Network & Protocols
CHAPTER 8:	Building Management Systems Capabilities

## CHAPTER 1: Control System Basics

A control system is a combination of components that act together to control equipment or processes. A fundamental control system consists of three elements: 1) Sensor, 2) Controller, and 3) Controlled Device.

- **Sensors**

- Devices that measure the building conditions such as:

- + Temperature (space, duct, outside air, mixed air, and return air)
- + Humidity (space, return, and outside)
- + Pressure (in ductwork, piping, and the building)
- + Flow (liquid flow, airflow)
- + Carbon dioxide concentration (indoors and outdoors)
- + Differential pressure (filters, fans, etc.)
- + Daylight

- **Controllers**

- A controller receives input data from the sensor and performs appropriate logical action.

- + Different types of controllers are used for different applications.

- **Controlled Devices**

- These components are used to control the building equipment. You need to distinguish between sensors and controlled devices.

