

BEYOND

SMART CITIES

BUILDING AUTOMATION & CONTROL SYSTEM

CEM REFRESHER TRAINING

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP

ENERGY MANAGEMENT SPECIALIST CURRICULUM

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BUILDING AUTOMATION AND CONTROL SYSTEMS

FOR ENERGY PROFESSIONALS

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WHAT SHOULD YOU LEARN

Introduction

What is BAS?

Intelligent Buildings

What are the Components of BAS

Control Basic types

INTRODUCTION

Building automation is the automatic centralized control of a building's heating, ventilation and air conditioning, lighting and other systems through a building management system or building automation system (BAS)

The term building automation system, loosely used, refers to any electrical control system that is used to control a buildings heating, ventilation and air conditioning (HVAC) system. Modern BAS can also control indoor and outdoor lighting as well as security, fire alarms, and especially everything that is electrical in the building.

A building controlled by a BAS is often referred to as an intelligent building, "smart building", or (if a residence) a "smart home".

WHAT IS THE FUNCTION OF A BAS?

The primary function of a BAS is to provide control of heating, cooling, ventilation, lighting and other critical building systems.

However, it also monitors individual components to alert building managers about detected problems because it has access to a full range of building data.

For example, BAS tracks temperature data which is critical for proper climate control and occupant comfort. It can use pressure and chemical sensors to uncover air quality issues in mechanical aspects of the building.

A building's security system relays data to the BAS to indicate potential intruders.

INTELLIGENT BUILDING

"A building equipped with lighting, heating, and electronic devices that can be controlled remotely by Smartphone or computer." Most commercial products can provide only the ability to use a remote control and predefine behaviour of different engineering systems. It has been shown that there is no any intelligence in such Systems.

"Instead of being programmed to perform certain actions, the house essentially programs itself by monitoring the environment and sensing actions performed by the inhabitants"(e.g., turning lights on and off, adjusting the thermostat), observing the occupancy and behaviour patterns of the inhabitants, and learning to predict future states of the house.

WHAT ARE THE COMPONENTS OF BAS?

BAS is a structural system and generally consists of five components: sensors, controllers, output devices, communication protocols and a terminal or user interface.

1. **Sensors:** These devices track temperature, humidity, the number of people in a room, the lighting level, and other values. The sensors transmit this information to centralized controllers.

2. **Controllers:** Act as the "brain" of the BAS. They collect data from sensors and then send commands to operating systems like HVAC units, the building's lighting systems, security alarms and other connected parts.

3. **Output devices:** Once the controller sends out a command, actuators and relays go into action to follow the requirements. For example, they can reduce or increase the heating in a particular part of the building, dim lights in unused offices, or turn on the air conditioning before people come to work.

WHAT ARE THE COMPONENTS OF BAS?

4. **Communication protocols:** The BAS uses a specific language that's understood by the system's individual components to modify settings or execute commands. BACnet and Modbus are the most commonly used options in communication protocols.

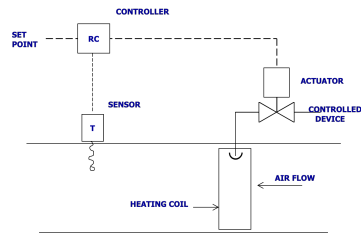
5. **Terminal interface:** Building and facility managers interact with the BAS through a terminal or user interface. It presents information in a way that a user can monitor the condition of the building and choose to override settings manually.

CONTROLS- BASIC TYPES

- ☑ **Manual - Switches - Dimmers**
- ☑ **Open Loop Automatic - Timer**
- ☑ **Closed Loop Automatic**
 - **Thermostat**
 - **Humidistat**
 - **Dimmable Ballast w/Photosensor**



BASIC FEEDBACK CONTROL SYSTEM



BASIC TYPES

☑ Two Position

- The system is either **OFF** or **ON** (gas furnace).
- Accomplished with a relay whose contacts are either open or closed, or a valve whose stem position is either open or closed.

☑ Proportional

- A variation from the set point produces a proportional movement in the actuator.
- Pneumatic controls vary the air pressure.
- Electric controls use a potentiometer (a type of variable resistor).

BASIC INPUTS & OUTPUTS

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BASIC INPUTS & OUTPUTS

✓ Digital (D)

➔ Signal with two states or positions which can be incremental (on-off, day-night, open-closed, occupied-unoccupied, series of 1's & 0's)

✓ Analog (A)

➔ Signal can be monitored or controlled through a range of positions or values (0 to 50o C, 20 to 35 kPa, 0 to 10 VDC, 4 to 20 milliamps)

INPUT EXAMPLES

Analog



Outside Air Temp. Sensor
Analog Input



Room Temperature Sensor
Analog Input

Digital



Low Temp. Detector
Digital Input



End Switch
Digital Input



High Pressure Detector
Digital Input



Duct Smoke Detector
Digital Input

INPUTS & OUTPUTS

Input Points

Temperature **AI**

Flow **AI / DI**

Status or Proof **AI / DI**

Relative Humidity **AI**

Pressure **AI**

Air Quality **AI**

Output Points

Motors for Pumps / Fans **DO**

Lights **DO**

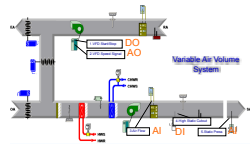
Variable Speed Drives **AO**
(or digital)

Valves **AO**

Dampers **AO**

Lighting Contactors **DO**

INPUTS & OUTPUTS +



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THANK YOU

THE WORLD'S 1ST GREEN TECHNOLOGY
MARKETPLACE

The advertisement features a person in a white lab coat interacting with a glowing digital cityscape. A circular logo in the top right corner reads 'CERTIFIED BUILDING AUTOMATION SPECIALIST' and 'CBAS+'.