



**UL 508A and UL 916 and their relevance in building automation applications:**

## Does an HVAC controller suffice in smart buildings and smart cities?

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### Abstract

Buildings are not about HVAC alone anymore. The subject of “Smart Buildings” and “Building Internet of Things (IoT)” is frequently discussed at ASHRAE meetings, AHR Expo, IBCon, and other industry events.

The need for integration in smart and connected buildings does not stop at the buildings. A connected building is part of a campus, a campus is part of a community, and a community is part of a smart city. The importance of connectivity underscores the need for control, monitoring, and communication at a much larger spectrum than just building HVAC control. The traditional dedicated HVAC controls and communication devices do not suffice any longer. The need for high-end, scalable, and diverse means of control, supported by layer 2 and layer 3 communication, is required to meet these demands.

During the discussions with the engineering community, the question repeatedly arises about the differences between the UL 508A and UL 916. The objective of the following paper is to provide a summary of both standards and to help us understand the areas of effectiveness of each standard. We will also see the expanse, complexity, and diversity in building automation applications in the emerging IoT environment.

### INSIDE:

|   |   |
|---|---|
| Abstract .....                                | 1 |
| Introduction to UL 508A .....                 | 2 |
| Introduction to UL 916 .....                  | 2 |
| Common building automation applications ..... | 2 |
| Physical security systems .....               | 3 |
| Fire protection systems .....                 | 3 |
| Conclusion .....                              | 3 |
| References .....                              | 4 |

## Introduction to UL 508A

UL 508A defines the requirements for industrial control panels intended for general industrial use operation at 1000 volts or less. These panels are installed in accordance with ANSI/NFPA 70, in which the temperature does not exceed 40 degrees C.

UL 508A encompasses the requirements for industrial control panels intended for:

- Air conditioning and refrigeration equipment
- Load management applications
- Flame safety supervision of combustible fuel equipment
- Elevator control
- Crane and hoist control
- Service equipment
- Marine applications
- Fountain, irrigation control
- Industrial machinery including metalworking, power press, and plastic injection molding
- Aquatic playgrounds, water park rides, and other similar installations

This equipment may be intended for use in hazardous locations covered under explosion-proof and dust-ignition-proof electrical equipment, classified under UL 1203 and ANSI/NFPA 70.

UL 508A does not include guidelines for pump applications in fire safety panels. These guidelines are described in UL 218.

Since UL 508A focuses on motor control panels, it provides detailed guidelines regarding branch circuit protection using circuit breakers and fused secondary protection. The fuse-protected branch circuits must comply with UL 248. These guidelines are not mentioned in UL 916.

UL 508A also defines the requirements for utilization and sizing the load controllers.

## Introduction to UL 916

The UL 916 covers the requirements for energy management equipment and associated sensing devices rated 600 volts or less intended for installations in accordance with ANSI/NFPA 70.

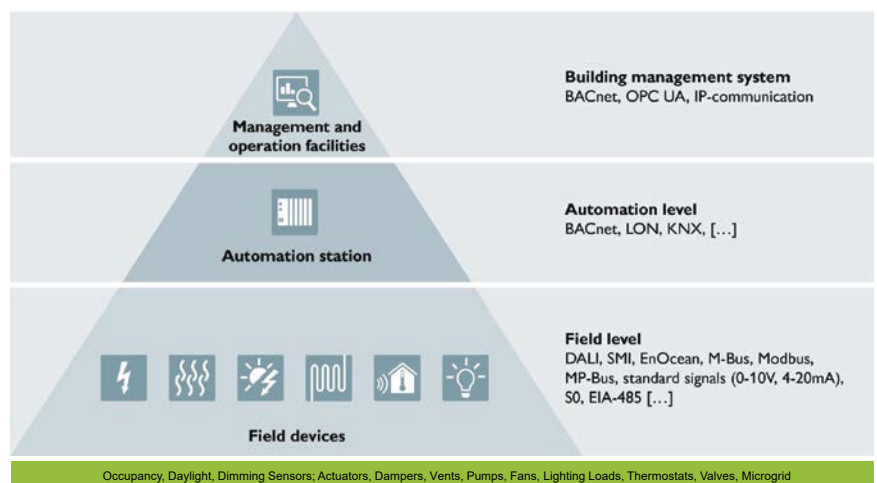
This equipment energizes or de-energizes electrical loads for use of electrical power. These loads respond to sensors of transducers monitoring power consumption through programmable devices. This equipment also monitors devices responding to signals from a utility company over power lines or as radio signals.

UL 916 also defines requirements for controls intended to be installed in air handling and environmental air space. Note that UL 916 does not cover requirements for devices operated by mechanical or electromechanical clock mechanism to energize and de-energize loads.

Generally, devices tested to UL 916 Standard for Energy Management Equipment are not suitable for use as lighting contactors. UL 916 energy management equipment is intended primarily for control panels used with energy management equipment fed by power-limited circuits.

## Common building automation applications

**Building automation and control systems by product and hierarchy (see Figure 1 below)**



**Figure 1:** Common building automation and control systems

## Physical security systems

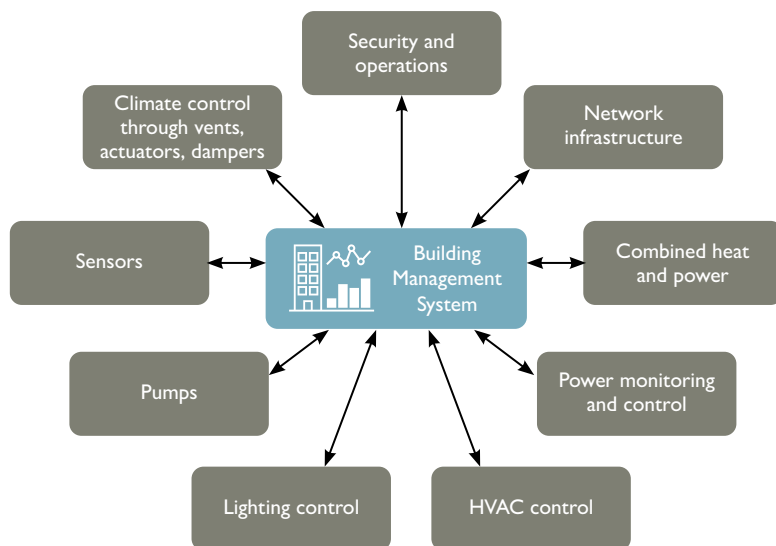
Security in buildings entails two major areas: a physical security system and network security.

The physical security system in a building includes video surveillance, access control, emergency lighting, and fire protection systems. These systems depend on cameras, monitors, fire protection systems, data storage servers, secure networks, and access control systems supported by hardware and software platforms. The data security requires the networks, data servers, control systems, and database to be protected from internal and external pilferage.

## Fire protection systems

The fire protection systems require sensors and detectors, alarms, emergency lighting, evacuation systems, and sprinklers. Requirements for these systems are defined in UL 864.

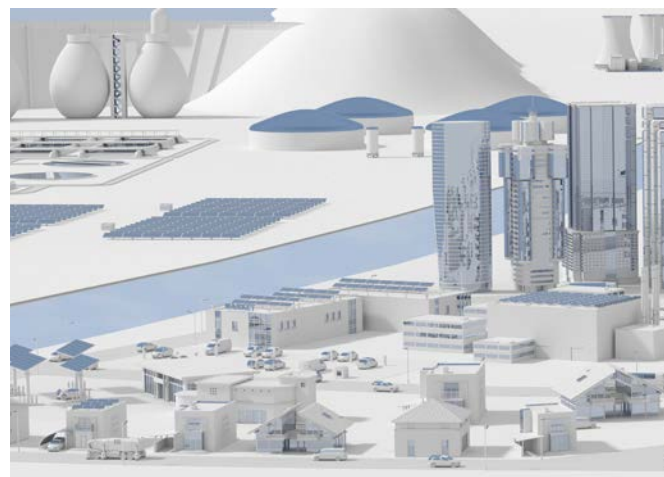
**Figure 2 below summarizes the application areas in a Building Management solution.**



**Figure 2:** Building Management System

A close review of sections C-1 and C-2 above reveals that UL 916 requirements might not address today's building automation needs. Neither UL 508A nor UL 916 covers the fire system requirements in section C-3.

## Conclusion



**Figure 3:** Smart cities will include many types of applications, including the power generation, water/wastewater, traffic management, and more.

The above review shows that UL 508A encompasses a much wider range of applications, including the air-conditioning and refrigeration applications. UL 916, on the other hand, focuses on equipment that energizes and de-energizes the electrical loads.

As smart building applications emerge from local air handler and HVAC systems to a much wider, integrated, and IoT environment, the controls are multifaceted. A UL 916 Listed controller does not suffice for examples such as smart grid, pump control, elevator control, water treatment plants, power monitoring, and charging infrastructure applications.

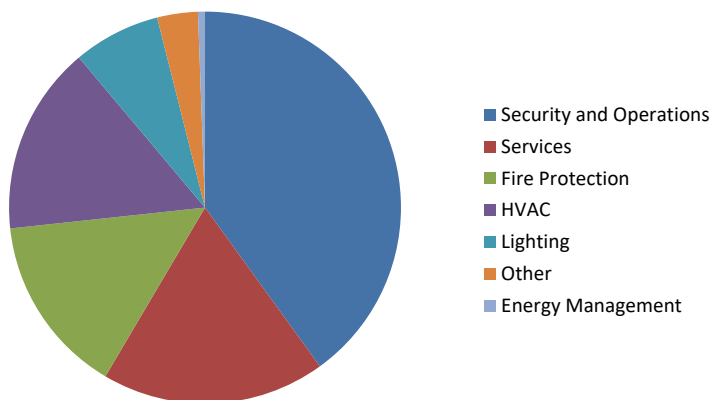
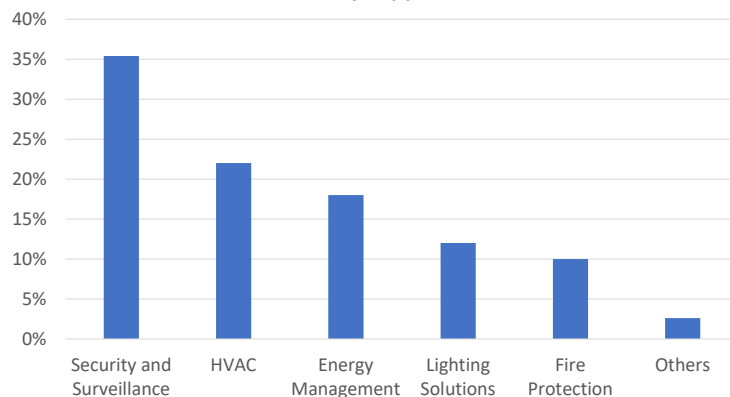
Out of the \$141 billion expected global sales by the year 2026, the largest application areas and potential opportunities are security and surveillance followed by HVAC, energy management, lighting control and others such as fire systems, and access controls, according to an article on FMlink.com. The traditional HVAC applications in building automation are no longer the largest application area. In building IoT, networking, security, and energy management applications play a vital role in maintaining security and efficiency. We can conclude that:

- UL 508A-compliant control panels cater to a much wider application area in a smart building and the building IoT environment.
- We should not only focus on HVAC applications in building automation. We should focus on networking,

security, and energy management applications, and new business applications which enter the building management world and integrate them into building IoT. These applications include:

- E-mobility, EV charging infrastructure
- ERP and billing systems for optimization of operating cost. This includes energy-efficiency initiatives
- Services on demand (such as cleaning, catering, etc.)
- Improved efficiency through occupancy sensing
- Net Zero energy facilities

BMS Market by Application Area



**Figure 4:** BMS Market by Application Area (Global Building Automation Systems Market Share by Systems – Transparency Market Research)

According to multiple reports, security and operations applications make up almost 36 percent of the building automation market. This surpasses the traditional HVAC applications, which used to be the largest sub-segment prior to the advent of IoT in the building automation.

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