



# Z-Wave Wireless Control Technology, System and Applications

An overview for companies seeking to use Z-Wave technology for controlling their home and office from anywhere in the world.

When it comes to controlling Home, offices, convention facilities, large restaurants, and educational facilities the predominant technology is Z-Wave. Historically wireless methods have been complex and costly, but with the use of Z-Wave wireless technologies, a simple and effective wireless control method has been implemented by Musewerx.

In commercial buildings, homes and in offices energy management, security and lighting control are the major issues. Overcoming these issues has become a major goal for building owners, governments, utilities and many other stakeholders. It's no secret that replacing existing equipment, with more efficient sources is one of the ways to reduce these issues, but efficiency is only the start. Improving system-wide control over energy consumption, lighting and security is the best way to ensure that energy consumption is less, lighting energy is automatically reduced as much as possible and homes, offices or any other facilities are well monitored, Wireless Control solutions (based on a variety of technologies) have been proven to reduce energy and lighting consumption in commercial and industrial buildings by up to 70%. Wireless control solutions also provide home and office monitoring from anywhere. These solutions have been limited in the past by cost, complexity and applicability, but new wireless technologies are providing ways to expand the capabilities of Wireless Control and offer them to a wider set of customers.

Wireless control may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. Wireless control for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

Wireless control is one of the most exciting frontiers in lighting control, energy management and security management offering significant potential benefits for residential and nonresidential systems, large and small buildings, and both existing buildings and new construction. New technologies are now being commercialized that will redefine wireless control by dramatically expanding its utility.

## ***Introduction to Z-Wave Technology***

Z-Wave is a proprietary wireless communications protocol designed for home automation, specifically to remote control applications in residential and light commercial environments. The technology uses a low-power RF radio embedded into home electronics devices and systems, such as lighting, home access control, entertainment systems and household appliances.

Z-Wave is a next-generation wireless ecosystem that lets all your home electronics talk to each other, and to you, via remote control. It uses simple, reliable, low-power radio waves that easily travel through walls, floors and cabinets. Z-Wave control can be added to almost any electronic device in your house, offices and hospitals even devices that you wouldn't ordinarily think of as "intelligent," such as appliances, window shades, thermostats and home lighting.



**Z-Wave Wireless Technology**

Z-Wave unifies all your home electronics into an integrated wireless network, with no complicated programming and no new cables to run. Any Z-Wave enabled device can be effortlessly added to this network, and many non-Z-Wave devices can be made compatible by simply plugging them into a Z-Wave accessory module. In seconds, your device gets joined to the network and can communicate wirelessly with other Z-Wave modules and controllers.



### Z-Wave Chips

And Z-Wave lets you control these devices in ways that give you complete command even when you're not at home yourself. You can control your Z-Wave household remotely from a PC and the Internet from anywhere in the world...even through your cell phone!

### *Z-Wave Wireless Control Benefits*

---

Use of Z-Wave technology can increase business productivity and reduce associated costs. To ensure that companies benefit from the advantages Z-Wave provides it is important to understand how to adopt this technology. The business benefits that have been derived in a number of sectors including but not limited to:

- Life style and Convenience
- Home Entertainment
- Energy Conservation
- Safety and Security
- Home Health Care

By analyzing current practices and procedures 6 main benefit can be identified.

• **Z-Wave Is Simple** – Z-Wave control is easily added to almost any device in minutes. Simply plug the device you want to control into a Z-Wave module, and "join" it to your Z-Wave network!

- **Z-Wave Is Modular** – With Z-Wave, you can add as much or as little home control as you want over time. You can add Z-Wave to a device, a room, a floor or the entire home, according to your needs and desires.
- **Z-Wave Is Affordable** – Unlike costly whole-home control systems that need special wiring and professional installation, Z-Wave is accessible and easy for the do-it-yourselfer.
- **Z-Wave Is Powerful** – Z-Wave's intelligent mesh networking 'understands' the present status of any enabled device, and gives you confirmation that your devices have received the automatic or manual control commands you want.
- **Z-Wave Is Versatile** – Z-Wave can be added to almost anything in your home that uses electricity, and gives you the power to control or monitor them from your home or away from home.
- **Z-Wave Is Intelligent** – Z-Wave enabled devices can work together as a team. Have your garage door turn on your house lights when you come home. Have your door locks notify you when your children arrive home from school. Turn your downstairs lights off from upstairs. Create your own intelligent control "scenes" with Z-Wave!

Z-Wave delivers on all the promises of the wired home, and opens up exciting new possibilities for the home of the future. And that future is here now, because hundreds of Z-Wave enabled products are already widely available.

## ***Spectrum support***

---

Z-Wave is a low-power wireless technology designed specifically for remote control applications. Unlike Wi-Fi and other IEEE 802.11-based wireless LAN systems that are designed primarily for high-bandwidth data flow, the Z-Wave RF system operates in the sub Giga hertz frequency range and is optimized for low-overhead commands such as on-off (as in a light switch or an appliance) and raise-lower (as in a thermostat or volume control), with the ability to include device metadata in the communications.

Because Z-Wave operates apart from the crowded 2.4 GHz frequency, it is largely unaffected by interference from common household wireless electronics that operate in this range. Z-Wave does share a range (900MHz) used by some cell-phones and would be susceptible to interference from such devices. However, this freedom from normal household interference allows for a standardized low-bandwidth control medium that can be reliable alongside common wireless devices.

As a result of its low power consumption and low cost of manufacture, Z-Wave is easily embedded in consumer electronics products, including battery operated devices such as remote controls, smoke alarms and security sensors. Z-Wave is currently supported by over 200 manufacturers worldwide and appears in a broad range of consumer products in the U.S. and Europe.

## ***Setting up Z-Wave Network***

---

Z-Wave mesh networks can begin with a single controllable device and a controller. Additional devices can be added at any time, as can multiple controllers, including traditional hand-held controllers, key-fob controllers, wall-switch controllers and PC applications designed for management and control of a Z-Wave network.

A device must be "included" to the Z-Wave network before it can be controlled via Z-Wave. This process (also known as "pairing" and "adding") is usually achieved by pressing a sequence of buttons on the controller and the device being added to the network. This sequence only needs to be performed once, after which the device is always recognized by the controller. Devices can be removed from the Z-Wave network by a similar process of button strokes.

This inclusion process is repeated for each device in the system. Because the controller is learning the signal strength between the devices during the inclusion process, the devices themselves should be in their intended final location before they are added to the system.

However, once a device has been introduced into a network, it can become troublesome to remove the unit without actually having the functional unit present. A number of Z-Wave users have complained that a Z-Wave controller can be functionally destroyed by the bulb that it controls blowing and any controlling units then report errors every time a command that would affect that unit is sent, i.e., group commands / scene commands / all-on / all-off, etc. The only way to restore the service to a non-error reporting state is to factory reset all controllers and then relearn all Z-Wave devices.



**Z-Wave Controllers**

---

## ***Musewerx's Z-Wave Wireless Control Product***

---

### ***Application Overview***

If you tired of turning on and off the switches in your house? Would you want to monitor your home or office when you are travelling? Would you want to practice energy conservation? Would you want to create a high tech automation system that interfaces a PC and microcontroller? Then Musewerx Z-Wave wireless control product is the best choice for you.

With this smart automation system, you can easily control the facility thermostat, turn on a sprinkler from anywhere you want, and it can react with the motion detector floodlight automatically, Lights can automatically turn on, off or dim at set times or under set conditions. This wireless controlling system will help you to practice the energy conservation. This means more money can be saved and less carbon dioxide to be emitted into the Earth!

### ***Features***

Multiple options exist to control your home or facility, whether you're inside or outside. Check and adjust lighting, temperature, security, audio, and more from Musewerx wireless control Interface.

- Z-Wave wireless devices fully supported (including lighting and HVAC).
- Can be run directly from the PC/Smart phones on the network.

### **Remote Access**

The entire system can be monitored and controlled from the web. Users can check on their homes, offices or facility when they are away at work , on vacation or when travelling.

### **Powerful Event Mechanism**

Trigger event actions based on any of the following:

- Any Condition
- Status change of any device
- Specific Time
- Notification

## Event Actions

In response to event triggers, these actions (and more) may be performed:

- Send light control signals
  - ON
  - OFF
  - DIMM
- Send thermostat and volumn control Signals
  - Raise
  - Lower
- Trigger another event
- Send notification
- Operate any Z-Wave supported device.

## Advantages

Organizations are adopting wireless solutions to improve their competitiveness. Benefit of using wireless technology are,

- Wireless solutions can provide users with access to real-time information from more places in their organization.
- Companies can generate revenue in less time through the deployment of wireless solutions than with comparable access technologies because a wireless system can be assembled and brought online in as little as two to three hours.
- Wireless solutions offer productivity, convenience, and cost advantages over traditional wired networks.



### Application Overview



## ***Musewerx Z-Wave Wireless Control Applications Areas***

---

Wireless remote controlling with Z-Wave is a new idea. It can offer all the same benefits of a powerful, custom control system, but it can also offer any of them individually. User can use Z-Wave to control any specific control task around your house, office or facility, without having to invest in an elaborate, all-encompassing wireless control system. With Z-Wave, you can easily and inexpensively create customized control solutions for any room or situation, and add new ones to your home over time.

Some of the main application areas of Z-Wave Wireless Cotrolling System.

### ***Life Style and Convenience***

For all the advances in today's digital electronics, one very basic idea has always been sorely missing ,the ability to have your electronics work together as a team. With Z-Wave, you can finally have the convenience of unified control over all your home electronics, and customize their operation to your preferences and your lifestyle.

Think of all the individual electronics you have to set for even the most basic daily activities. How many buttons on how many remote controls do you push just to watch a DVD movie? How many lights and appliances on laundry day? How many doors and lights to check before you leave for an evening out? What if you could control all of these with a single unified action? Muserwerx Z-Wave wireless control system gives you the power wirelessly.



### **Life Style and Convenience**



## *Home Entertainment*

All conventional remotes typically only control only one component at a time. The second big limitation of typical remote controls is that they work with infrared (IR) signals. These are essentially light beams that are too low in frequency for your eyes. Like any light wave, they're directional, one has to aim these remotes directly at the component to control them. And IR beams are not only short-range (typically only 10-20 feet), but they are blocked from working by any obstruction. With Z-Wave these kinds of one-touch conveniences are not only possible, they're simple. And Z-Wave doesn't stop there. Unlike IR signals, Z-Wave wireless signals are radio waves. These easily travel through walls, floors, ceilings and cabinets. This effectively makes a Z-Wave remote control into a whole-house controller.



### **Home Entertainment**

## *Energy Conservation*

Z-Wave wireless control allows you to automate home's, offices' or facility's illumination so that you get the lighting you want when you're at home, and the savings one wants when you aren't. And adding Z-Wave to existing lighting is a snap. Simply plug floor, table and standing lamps into Z-Wave modules, pair them to Musewerx wireless control system and one is up and running. Beyond lighting control, Z-Wave further economizes your energy usage by regulating your HVAC (heating, ventilation and air conditioning) and Thermostat.



### **Energy Conservation**

## *Safety and Security*

Z-Wave wireless control opens up a world of new possibilities in safety and security. Z-Wave enabled devices can send alerts and triggers to other Z-Wave devices, or to an entire Z-Wave network, even when you're not at your facility. With Z-Wave, a smoke detector in the garage can trigger another near your bedroom. A security camera can turn on a backyard light. Musewerx Z-Wave wireless control makes your home safer and more secure.



## **Safety and Security**

## *Health Care*

Z-Wave is such a portable, affordable technology, it will have an intriguing part to play in one of the major growth areas in today's societal landscape, Health care. Z-Wave will be the enabling technology that makes all this healthcare communication possible. It's inexpensive and "light" enough to be built into virtually personal technology, such as blood pressure monitors and weight scales. At the same time, it's powerful and reliable enough for critical healthcare applications. Imagine a Z-Wave enabled defibrillator that alerts a nurse when a heart patient needs assistance. When the nurse's console reacts to the communication, Z-Wave can also send an alert to the doctor, or trigger an indicator that would send a medic to check on the patient.



**Health Care**

Application Areas	Questions to Musewerx Applications
<p><b>Life Style and Convenience</b></p>	<p>How many buttons on? How many remote controls do you push just to watch a DVD movie? How many lights and appliances on laundry day? How many doors and lights to check before you leave for an evening out?</p>
<p><b>Home Entertainment</b></p>	<p>In which room DVD players on? It's sleeping time of your child switch OFF the TV.</p>
<p><b>Energy Conservation</b></p>	<p>In which room temperature increases? Turn ON AC. It's too cold in the room? Turn ON heater.</p>
<p><b>Safety and Security</b></p>	<p>When something activates the security system? Z-Wave, a doorbell can send your cell phone an alert, and a security camera can tell you who's at your door? When you're away on a trip. A Z-Wave enabled intercom can let you talk to whoever's there perhaps it's an unexpected parcel delivery. With Z-Wave, you could even open the vestibule door, and lock it again remotely when the courier leaves.</p>
<p><b>Health Care</b></p>	<p>Reading is abnormal in the Glucose monitoring device for diabetic patient? Glucose monitor signals the family member. Or the patient has an arrhythmia? Heart monitor automatically triggers phone calls to the doctor or hospital.</p>

## *Application Architecture And Design Requirement*

---

### *Software Component*

The solution consists of both hardware and software. These two categories need to be able to properly interface with each other.

### *Software Component*

The software side requires a database that is able to store all the required data. This data is handled with Microsoft SQL Server and any other database management softwares are also supported. Web application has to be developed that would allow users of the product to see their account activity. This application has three main software components.

- Web Application
- Database Server
- Web Service

### *Hardware Component*

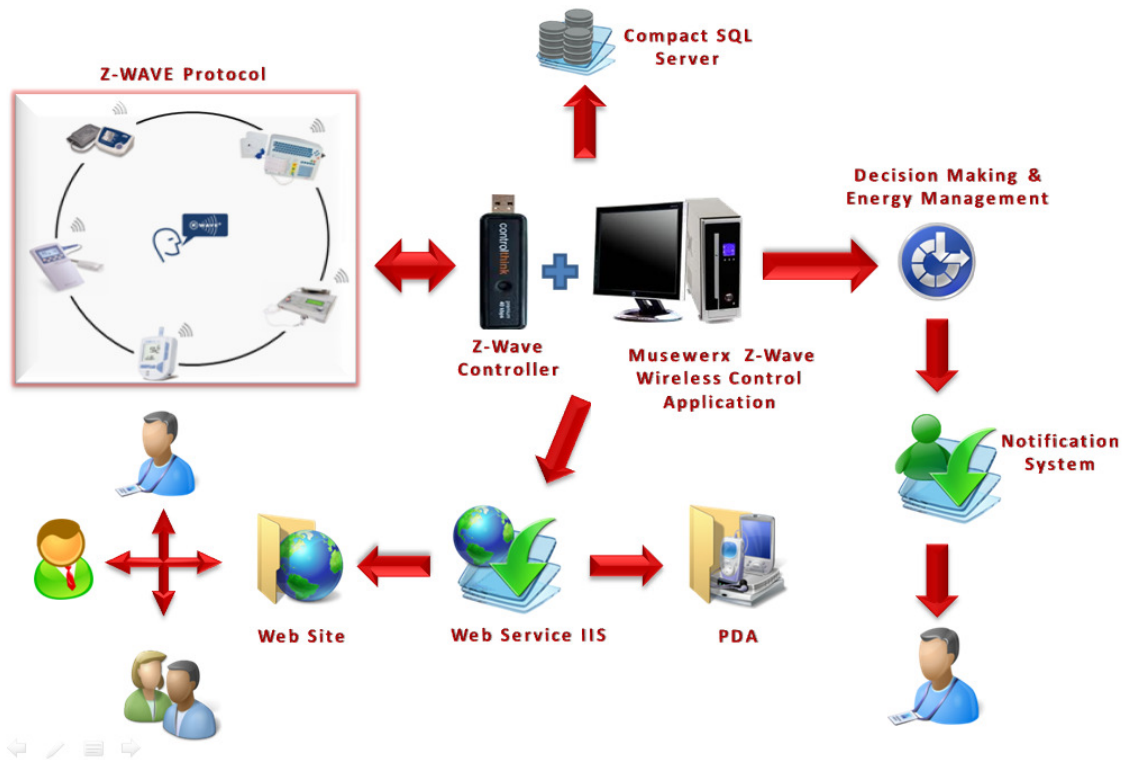
The second major category affecting the design of the system is the hardware components. A key factor in the hardware design is that everything has to be able to interface with the other components. The solution consist of two major components:

- Z-Wave Controller: Similar to how a Wi-Fi USB adapter connects your computer to the Internet wirelessly, Similarly Z-Wave controller used in conjunction with software this makes it possible for your computer to control and monitor lighting, climate control, entertainment and other devices wirelessly.
- Z-Wave Device: Devices in which a Z-wave two way wireless mesh networking technology chips embedded.

The entire hardware and software component have to be able to interface with the each other. The final stage in the system design is the connection between the Web Application and the Database.

### *Notification*

Z-Wave wireless control can send notification alert when something activates the security system, when room temperature increases or decreases, when light is not turned OFF for long period of time. Z-Wave wireless also alerts a nurse, doctor or a family member when a patient needs assistance.



(Architecture Diagram)



***References:***

---

- [http:// www.z-wave.com](http://www.z-wave.com)
- <http://www.ieee-centennial.org>
- <http://www.homeauto.com>