How to Protect Indoor Wi-Fi Access Points  
In Below Zero Environments

With today's increased reliance on wireless communications, even workplaces such as cold storage warehouses, freezers, and refrigerated rooms found in food, pharmaceutical, and bio-tech industries are demanding Wi-Fi connectivity. However, these environments pose unique challenges for reliable Wi-Fi networks. Thick walls and insulation interfere with RF coverage and can make wiring for AC power expensive, time-consuming, causing delays and downtime. In addition, condensation, frost, and continuous exposure to moist, cold air cause operation-limiting effects.

Deploying indoor access points in heated enclosure systems is a solution that enables companies to quickly and seamlessly extend Wi-Fi coverage in these challenging environments and has several benefits. First, adding indoor access points to an installed base on an existing WLAN ensures interoperability with the other devices and decreases time spent bringing them up onto the network. Second, the heated enclosure system provides a simple, plug-and-play deployment solution that can be used in these cold environments and situations where there is no AC power. Third, the system includes important components such as antennas, lightning and surge protectors, and automatic heating elements to protect against harsh environmental conditions. Finally, the enclosures include door locks to protect against theft and tampering, and feature a waterproof design, protecting them from wash-downs.

How does the enclosure system work in cold environments?

Access points generate heat on their own, which is beneficial when deployed in cold environments. When housed in a 12” x 10” x 6” polycarbonate enclosure, Ventev engineers found that the access point and the other electronics raised the internal temperature of the enclosure by 18 degrees F and that there was little difference between “Standby” and “Active” mode when fully operational and sending data. The engineers factored the 18-degree F temperature rise due to the access point into their temperature study and then extrapolated the external temperature criteria in which the enclosures can be safely deployed. The result was that environmental or external temperatures as low as minus 22 degrees F could be realized and the enclosed access point would maintain a temperature above minus 4 degrees F.

According to the National Climatic Data Center, 43 states in the U.S. have recorded temperatures below minus 22 degrees F. While certainly a rare occurrence, the addition of a heating element to the enclosure acts as insurance to safeguard against temperature extremes. Adding a heating element to the enclosure system further extends the outdoor temperature range down to minus 40 degrees F while keeping the access point above its minimum-rated operational temperature. The enclosure engages the heating element when the internal temperature of the enclosure drops below 37 degrees F. The element will be disengaged when the internal temperature goes above 53 degrees F.

Are indoor access points safe in cold environments?

Maintaining indoor access points within a normal operating range is critical to indoor access point functionality and long-term product reliability. External factors such as moisture from rain, ice, sleet and snow, as well as extreme temperatures, can be detrimental to indoor access points:

- Moisture can cause destructive corrosion and rust, leading to component structural failure and in turn, access point failure.
- While typical indoor Wi-Fi access points have an operational temperature range of approximately minus 4 degrees F to 131 degrees F (Ref: Cisco 3602E access points), the addition of heat generated by the access point in the enclosure (18 degrees F) and solar loading (5 to 15 degrees F) can cause the indoor access point inside an enclosure to exceed the manufacturer’s operating guidelines in an outdoor environment.

<table>
<thead>
<tr>
<th>Temperatures</th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>Manufacturer’s Indoor Access Point Operating Temperature</td>
<td>-4 degrees F</td>
<td>131 degrees F</td>
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<tr>
<td>United States Temperature Range</td>
<td>-40 degrees F</td>
<td>121 degrees F</td>
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<td>---------------------------------</td>
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<tr>
<td>Heat Generated by Access Point in Enclosure</td>
<td>18 degrees F</td>
<td>18 degrees F</td>
</tr>
<tr>
<td>Extreme Temperature Range</td>
<td>-17 to -10 degrees F</td>
<td>144 to 154 degrees F</td>
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</table>

When housed in an enclosure system that protects from environmental factors, indoor access points can be maintained well within the manufacturer's operating specifications and are safe and reliable in any environmental conditions. Enclosure systems for indoor access points are designed and fabricated with a robust environmental control system that ensures that all active equipment, such as access points, are within their rated values and safely protected from harsh environmental conditions. The enclosures are constructed of 100-percent non-metallic, polycarbonate material (with the exception of stainless steel latches) and meet high NEMA/IP ratings. The enclosures carry a NEMA 3RX rating, making them appropriate for the harshest of environments. Heating elements are added to the enclosure systems to eliminate the potential for external temperature shocks and to maintain the ambient temperature of the enclosure within manufacturer-specified operating temperatures.

**Summary**

When encased in weatherproof, NEMA-rated enclosures, indoor access points are as reliable on a WLAN in any condition. Indoor access points in an outdoor enclosure provide the following benefits:

<table>
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<tr>
<th>Environmental Protection Benefits</th>
<th>Price / Performance Benefits</th>
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<tr>
<td>Allows indoor access points to withstand extreme environments.</td>
<td>Reliable, reasonably priced outdoor coverage for 2.4 GHz and 5 GHz Wi-Fi / WLAN deployment.</td>
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<tr>
<td>Provides protection from water, wind, ice, snow, and other environmental conditions that can limit access point lifespan.</td>
<td>Ensures interoperability with other devices and decreases time bringing them up on network.</td>
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<td>Protects against corrosion and rust which can lead to component structural failure and, in turn, access point failure.</td>
<td>Per-unit cost of indoor access point plus enclosure is less than outdoor access point.</td>
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<tr>
<td>Protects from theft and tampering.</td>
<td>Simple, preconfigured deployment solution includes components such as antennas, lightning and surge protectors, heating and cooling elements.</td>
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**Ventev Wireless Infrastructure’s Enclosure System portfolio:**
- Freezer Room Enclosure System- a simple solution for providing Freezer Room connectivity
- PoE-Only Outdoor System- uses Power-over-Ethernet only making it the ideal solution for outdoor locations where there is no AC power

Learn more about the Ventev PoE Enclosure System by visiting [www.terra-wave.com/APsystems](http://www.terra-wave.com/APsystems).
References

Ventev Wireless Infrastructure “Takes Wi-Fi Outside” at CTIA 2013

TMC News
http://www.tmcnet.com/usubmit/2013/06/06/7185657.htm

Whitepapers

Indestructible Network: Wireless LANs for Industrial and Outdoor Applications

802.11ac: The Fifth Generation of Wi-Fi Technical White Paper

Web site

Temperature extremes: http://ggweather.com/climate/extremes_us.htm

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