Application Note

# How to Protect Indoor Access Points in Tough Environmental Conditions

College and corporate campuses, government and military installations, city centers, industrial work zones, and hospitality environments such as hotels and cruise ships, face the challenges associated with extending their networks to meet the demand for continuous Wi-Fi coverage. Many network owners have already built out indoor WLANs and are now exploring how best to move their connectivity outdoors. One option is to purchase and install a new system of outdoor access points from the manufacturer. The second option is to use existing indoor access points and enclose them in durable, weather-resistant, outdoor enclosure systems.

Using indoor access points outdoors is an option that is gaining widespread popularity for a number of reasons. 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 on the network. Second, the per-unit cost of the indoor access point and its enclosure is less than that of an outdoor access point, which makes for significant savings when planning a large WLAN extension with multiple units. Third, the outdoor enclosure system provides a simple, plug-and-play deployment solution for indoor access points that can be used in situations where there is no AC power. The system includes important components such as antennas, lightning and surge protectors, and automatic heating and cooling elements to protect against harsh environmental conditions. Finally, enclosures conceal operating lights, and they include door locks to protect against theft and tampering.

**Are indoor access points safe in hot and cold outdoor environments?**
Maintaining indoor access points within a normal operating range is critical to indoor access point functionality and long-term product reliability. Outdoor environmental 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.

| **Temperatures** | **Low** | **High** |
|---|---|---|
| Manufacturer's Indoor Access Point Operating Temperature | -4 degrees F | 131 degrees F |
| United States Temperature Range | -40 degrees F | 121 degrees F |
| Heat Generated by Access Point in Enclosure | 18 degrees F | 18 degrees F |
| Solar Loading | 5 to 15 degrees F | 5 to 15 degrees F |
| Extreme Temperature Range | -17 to -10 degrees F | 144 to 154 degrees F |

When housed in an outdoor 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 outdoors even in the most extreme environmental conditions. Outdoor enclosure systems for indoor access points are designed and fabricated with a robust environmental control system that ensures that all active equipment, such as radios, are within their rated values and safely protected from harsh environmental conditions. Enclosures are constructed of 100-percent non-metallic, polycarbonate material and meet high NEMA/IP protection ratings; NEMA 3R for vented enclosures and NEMA 4 for non-vented models. NEMA 4X-rated enclosures are appropriate for the harshest of environments. Heating and cooling elements are added to outdoor enclosure systems to eliminate the potential for external temperature shocks and to maintain the ambient temperature of the enclosure within manufacturer-specified operating temperatures.

**How does the enclosure system work in hot environments?**
Heat poses a significant threat to sensitive indoor access points. The maximum operating temperature of the indoor access point is 131 degrees F. While it seems unlikely that temperatures will spike to that extreme, temperatures exceeding 110 degrees F have been recorded in 39 states in the U.S. Add to that temperature, the 18 degrees F generated by the access point and a solar loading range of between 5 to 15 degrees F, and the maximum operating temperature is easily surpassed. A cost-effective way to minimize the impact of heat is to add a fan and vent. The enclosure's thermostat is preset to engage the fan. The selection of the fan set point is determined by the heat that the access point generates with an added engineering margin to account for other environmental variables such as solar loading.

With the expectation that the temperatures external to the box are cooler than the temperatures inside the enclosure, the fan is designed to bring in the cooler, outdoor air and force the hotter, indoor air out through the vent. When the internal temperature of the enclosure exceeds 104 degrees F, the fan operates by pulling outside air into the enclosure. It redistributes the cooler air around the access point and expels the warmer, internal air out of the vent. The fan will stop operating when the temperature goes below 89 degrees F inside the enclosure.

An engineering analysis was performed to establish the correct fan size, ensuring that it would exchange the air volume inside the enclosure fast enough so that the heat would not build up inside the enclosure and allow the electronics to surpass their typical upward limits of 131 degrees F. While the fan is not an air conditioner and cannot lower the temperature inside the enclosure below that of the outdoor temperature, it is able to keep the interior temperature within 10 degrees F of the outdoor temperature and the access point well within manufacturer-specified operating temperatures.

**How does the enclosure system work in cold environments?**
The access point generates heat which is beneficial 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.

**Cold Storage, Freezer and Refrigeration Rooms**
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. Heated enclosure systems with PoE power can be a simple solution to overcoming the unique challenges in these environments such as lack of AC power, and continuously moist, cold air that exposes sensitive electronics to the operation-limiting effects of condensation and frost. The heated, non-vented 12" x 10" x 6" NEMA 4X-rated enclosure features a waterproof design, protecting it from wash-downs, with a clear door with a locking mechanism that safeguards against tampering and theft.

**Summary**
When encased in outdoor NEMA-rated enclosures, indoor access points are as reliable on a WLAN and are more cost effective than outdoor access points. Indoor access points in an outdoor enclosure provide the following benefits:

| Environmental Protection Benefits |
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| Allows indoor access points to withstand extreme environments. |
| Provides protection from water, wind, ice, snow, and other environmental conditions that can limit access point lifespan. |
| Protects against corrosion and rust which can lead to component structural failure and, in turn, access point failure. |
| Protects from theft and tampering. |

| Price / Performance Benefits |
| --- |
| Reliable, reasonably priced outdoor coverage for 2.4 GHz and 5 GHz Wi-Fi / WLAN deployment. |
| Ensures interoperability with other devices and decreases time bringing them up on network. |
| Per-unit cost of indoor access point plus enclosure is less than outdoor access point. |
| Simple, preconfigured deployment solution includes components such as antennas, lightning and surge protectors, heating and cooling elements. |

**Ventev Wireless Infrastructure's Outdoor Enclosure System portfolio:**

- PoE-Only System- uses Power-over-Ethernet only making it the ideal solution for locations where there is no AC power
- Non-Powered System- a cost-effective enclosure with integrated grounding
- PoE & AC System- a heated and/or cooled solution perfect for sites where AC already exists
- Freezer Room Enclosure System- a simple solution for providing Freezer Room connectivity

Learn more about the Ventev PoE Power Enclosure System by visiting www.terra-wave.com/APsystems/poe-only-system.php.

## References


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