

WHITE PAPER

Tough outdoor cameras

i-PRO Video surveillance systems



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1. Introduction

With the growing concern over physical security, surveillance cameras have been installed outdoors more and more in every industry sector and public space from towns, airports and railroad stations to offices, retailers, healthcare providers and more. Installing cameras under the open sky with expensive outdoor housings became required. Today outdoor-ready cameras offer high-waterproof performance. External housings are no longer required but other points need to be considered when installing cameras outdoors. i-PRO has shipped the largest number of outdoor vandal resistant cameras in the security camera industry. This paper describes the considerations and latest technologies for outdoor surveillance cameras.

2. Vandal resistant and tampering alarms

If surveillance cameras are vandalized or severely damaged, surveillance will stop. Outdoor surveillance cameras are usually installed over a broad area and recovering from these interruptions requires significant time and work. Cameras are also at a greater risk of vandalism when they are placed at easy-to-find locations for deterrence. Choosing the tough camera allows you to minimize vandalism damage and to save time and money when recovering from damage. i-PRO outdoor vandal resistant cameras are optimally- designed for outdoor use.

-IK10 compliant

The IK code is an international numeric classification for the degree of protection enclosures provide for electrical equipment against external mechanical impact. IK10 is the top grade. i-PRO provides IK10-compliant vandal resistant cameras.

-Physical strength

The Impact-resistant polycarbonate camera dome and aluminum die-cast body bring toughness. The Built-in shock absorber protects the optical mechanism and electrical circuit from impact.

-Shockproof focusing

The focusing mechanism in the camera is designed to avoid images deteriorating from external mechanical shocks. Auto Back Focus (ABF) enables readjusting the focus remotely from an operation center if the camera becomes out-of-focus.

Tampering also interrupts surveillance. Interruptions such as spray-painting on the camera dome, changing the camera direction and covering the camera with something are often



Figure 1. Tough camera protected with built-in shock absorber.

overlooked because people pay little attention to motionless pictures. Operators take a long time before becoming aware of such interruptions. Scene Change Detection, an intelligent i-PRO camera feature, detects tampering and immediately sends an alarm to the operator.

3. Waterproof and dehumidification

Outdoor cameras preventing water and moisture from penetrating inside the camera is essential, keeping outdoor cameras in good running order for many years. The two keys are the waterproofing to prevent water ingress and the dehumidification to remove water and moisture from inside the housing.

The International Electrotechnical Commission (IEC) defines the waterproof performance rating. The Ingress Protection (IP) rating classifies and rates the degree of protection mechanical casings and electrical enclosures provide against the intrusion of solid objects including body parts such as hands and fingers, dust, accidental contact and water. i-PRO outdoor cameras meet IP66, which indicates powerful performance: No dust ingress. The enclosure protects the camera against harmful effects from powerful water jets projected from any direction.



Figure 2. Water resistance test.

In addition to IP66-compliance testing, i-PRO conducts the following tests to ensure long lasting waterproof performance.

1. The endurance test is an accelerated deterioration test and confirms that the camera maintains waterproof performance for years. The camera is alternately exposed to hot fine weather of 60 degrees Celsius and rainy weather of 25 degrees Celsius every 12 hours for 30 days.
2. The cooling test confirms no ingress of moisture, verifying that the camera is condensation-free inside when it cools.
3. The submergence test also confirms no ingress of water. The camera is completely submerged in water and the housing remaining water-free is verified.
4. The air tightness test confirms the housing seal performance by applying pressure to inside the camera.

The second is dehumidification. Cameras cannot completely prevent moisture from penetrating inside. The camera breathes moisture-containing air in and out with changes in atmospheric pressure. i-PRO was first company in the industry to introduce moisture control technology. A small electric anti-humidity device keeps the camera dry inside. The device first uses electrolysis to decompose the moisture in the camera into hydrogen and oxygen ions. Then, the hydrogen ions are carried outside the camera and returned to water by combining them with other oxygen ions outside. Oxygen ions in the camera also leave the

camera after binding together into stable molecular oxygen. This anti-humidity technology is safe and green thanks to low power consumption because heaters and mechanical fans are not used.

Installation is also easy. i-PRO outdoor cameras are installed in the field without any additional work such as caulking. Outdoor cameras deliver their full waterproof performance fully without depending on installer skills.

4. Fog, smog and sandstorms

Small particles drifting in fog, smog and sandstorms scatter light and make images white and blurred. This negatively affects surveillance because it becomes harder for operators to watch people and/or cars through the cameras. If cameras are deployed based on this shorter visual range, more cameras are required and costs increase.

i-PRO Fog and Sandstorm compensation feature, an image processing technology, reduces the impact of fog, smog and sandstorms, delivering clear color images to the operators.



Figures 3 and 4. Outdoor gate. Left: the image is an example without fog compensation. Right: the image is an example with fog compensation running, which reduces the fog impact.

5. Water droplets, dirt and dust

Water droplets on the camera dome distort light and reduce visibility. Dirt and dust attached on the dome also block the light and lower image quality. Although frequent cleaning can keep the dome clear, maintenance costs increase.

i-PRO developed the newly-patented Rain-wash coating technology. The hydrophilic coating sheets water off instead of forming droplets that scatter light; camera image distortion is reduced. i-PRO technology helps operators conduct surveillance with clear images, even in rainy weather.

The hydrophilic coating also offers self-cleaning as water washes away the dirt on the dome. The coating keeps the dome clean, simplifies cleaning work and saves maintenance costs.



Figure 5. Airport on a rainy day. The left half of the dome is coated with Rain-Wash coating and the image is clear. For comparison, the right half is not coated.

6. Light

Strong light such as headlight glare causes the darker part to be buried in black and the brighter part to be buried in white. Surveillance operators cannot monitor such places on the screen and blind spots occur.

i-PRO developed the industry's first Super Dynamic technology and improved it to Mega Super Dynamic technology, dramatically expanding the dynamic luminance range. The technology measures the luminance of each pixel on the image, adjusts the brightness of parts that are too bright or too dark to the appropriate brightness and produces a clear image. Electrical sensitivity enhancement keeps color images clear, even in dim light.



Figures 6 and 7. Left: the image is an example when Super Dynamic technology is turned off. Right: the image is an example when Super Dynamic technology is turned on.

The day/night feature of the camera ensures 24-hour surveillance. When darkness sets in, the camera automatically switches to night mode. The camera captures the images in black and white and uses infrared (IR) light to start enhancing the image clarity. During the day a built-in IR cut filter eliminates IR light because it changes the image color. When the camera switches to the night black-and-white mode, it removes the IR-cut filter and increases the luminous sensitivity. Every time the camera changes the mode between day and night, it gets slightly out of focus with or without the IR-cut filter. The i-PRO patented Auto Back Focus (ABF) automatically readjusts the focus so the camera delivers clear images to operators, even in the dark of night.



Figures 8 and 9. Parking at night. Left: camera runs in day-mode. Right: camera switches to night mode and infrared light (IR) enhances the image.

7. Coverage area

The PTZ camera, which offers panning, tilting and Zooming, enables conducting surveillance over a large area and zooming in to check details. i-PRO provides a wide range of cameras: endless 360-degree pan cameras, 240-degree (from -30° to +210°) wide tilt angle cameras, 90x extra zoom cameras and software-based 360-degree PTZ cameras free of moving parts.

With the conventional PTZ dome the image blurred when it tilted above the horizontal position. Suppose the camera was installed on the ground at the airport and you wanted to monitor the control tower positioned higher than the camera. As it tilted upward, the image blurred due to the small curvature difference between the lower spherical part and upper cylindrical part of the camera dome. They behaved as differently-focused lenses and reduced the image quality.

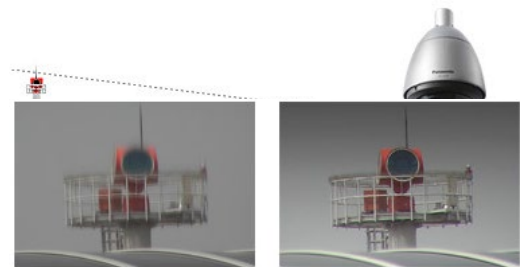


Figure 10. Control tower at the airport.
Left: the image is captured without AEM.
Right: AEM is running and the image is clear.

To solve this problem, i-PRO developed the industry's first Auto Eyelid Mechanism (AEM), similar to the human eye. The AEM keeps the image clear while tilting. As the camera tilts upward, a built-in light shield cuts the unwanted light accordingly and reduces the image degradation. The AEM looks like a person narrowing their eyes to see something better.

8. Zoom

A zoom is a good solution to surveil a broad outdoor area. The mechanical PTZ accuracy and the focusing speed are important when selecting a zoom camera. The i-PRO high-accuracy positioning mechanism and its mature software control the high-power 90x Extra zoom quickly and comfortably.

9. Vibration

Vibrations sometimes blur images. When large heavy trailers or trains pass by, they may cause vibrations that travel through the ground to cameras on poles and negatively affect image quality. Machinery such as pressing machines, strong winds and storms also cause vibrations and pole swinging. Building poles completely unaffected by these vibrations and swinging costs.

i-PRO Auto Image Stabilizer, an image processing technology, reduces the negative impact of vibrations and delivers clear images to surveillance operators.



Figure 11. Free-way. Left: Vibration from the road affects the Image. Right: The Auto Image Stabilizer eliminates the vibration effects.

10. Air temperature

Cameras are exposed to severe outdoor environments from baking summer heat to bitter winter cold. Cameras should be placed within the range of their operational temperature so that they are in good running condition. Placing cameras out of the range of their operating temperature requires a cooling unit or heater, leading to an increase in initial and maintenance costs.

i-PRO provides the industry top-class outdoor cameras from minus 50 degrees Celsius to 55 degrees Celsius (minus 58 degrees Fahrenheit to 131 degrees Fahrenheit). i-PRO achieves this with built-in 45 thousand-hour long-life cooling fans, built-in power-saving heaters, well-designed mechanisms to cancel out effects from thermal expansion and shrinkage, temperature-resistant grease and more.

11. Audio monitoring

While audio is not widely used in video surveillance, i-PRO recommends considering audio when a video surveillance system is newly built or replaced. Sounds can make it easier for operators to grasp what suspicious motion is. Operators can then understand quickly what is going on and respond accordingly.

i-PRO provides outdoor cameras with built-in microphones and IP66-compliant waterproof performance. The cameras are easy to install in the field because both audio and video are sent on a single IP network. Additional cabling isn't required.

Some countries and areas restrict using audio in video surveillance. i-PRO suggests checking the relevant laws and regulations before using audio.

12. Continuity of image recording

Edge-recording temporarily stores captured images on the camera, which is the network edge. This ensures video recording continuity even when the network between the surveillance center and cameras is down. Edge-recording makes surveillance systems more reliable as the redundant design of networks, switches, routers and servers does too.

Edge-recording uses SD memory cards. i-PRO provides durable SD memory cards that are waterproof, temperature resistant, impact resistant, static electric resistant, antimagnetic and X-ray resistant.



Figure 12. Panasonic SD memory cards.

13. Conclusion

Being tough is crucial for outdoor surveillance cameras that are exposed to the severe outdoor environment. i-PRO continues improving camera durability, reliability, ease of installation and serviceability so that our valued customers can build flexible, scalable and cost-effective surveillance systems and protect their investments. i-PRO's broad range of tough outdoor cameras covers customer needs from small to large surveillance systems.

14. i-PRO network camera on YouTube

1. i-PRO Vandal Resistant Camera Impact Test
<http://www.youtube.com/watch?v=AwxeOS0tLU>
2. Waterproof Performance and High Durability of IP66/IP55 i-PRO
http://www.youtube.com/watch?feature=player_embedded&v=KK5HV66kkoQ
3. i-PRO Smart HD "Rain-wash coating"
<http://www.youtube.com/watch?v=LvKIHwJJvus>
4. 72x Extra Zoom to Car License Plate WV-SW396 of i-PRO 2[HD]
http://www.youtube.com/watch?v=opxvy-9GmS8&feature=player_embedded



For more information, visit the i-PRO Security Camera site at <https://i-pro.com/global/en/surveillance>.

You can also visit us on Facebook at <https://facebook.com/i-PRONetworkcamera>.



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