IP Rated Guide

Helping you Choose the Right Level of Protection

At Crystal Display Systems, we understand that reliability matters—especially in demanding environments. Ingress Protection Rating (IP rating) is a globally recognised standard that defines how well electronic displays are protected against dust and water.

Whether used in industrial settings, outdoor installations, or high-traffic public spaces, IP-rated displays are designed to perform consistently where standard screens may fail.

This guide will help you understand IP ratings, their real-world applications, and how to select the right level of protection to ensure long-lasting performance and durability for your display solutions.

Industrial display systems are often deployed in environments that challenge the limits of electronic equipment. From factory floors filled with airborne dust to outdoor installations exposed to rain, temperature swings, and direct washdown, these environments introduce risks that can compromise performance and longevity. To ensure reliability, manufacturers and buyers rely on standardised enclosure protection classifications—most commonly IP (Ingress Protection) and NEMA ratings. Understanding these standards is essential when specifying display enclosures that must perform consistently under demanding conditions.

IP ratings, defined by the International Electrotechnical Commission (IEC), provide a globally recognised system for classifying how well an enclosure protects against the intrusion of solid objects and liquids. The rating is expressed as “IP” followed by two digits. The first digit refers to protection against solid particles such as dust, while the second digit indicates resistance to moisture or water ingress. This structured approach allows engineers and buyers to quickly assess whether a display enclosure is suitable for a given environment.

The first digit in an IP rating ranges from 0 to 6. A rating of 0 indicates no protection, while 6 represents complete protection against dust ingress. For example, an enclosure rated IP5X offers limited protection against dust—enough to prevent harmful deposits but not entirely dust-tight. By contrast, IP6X enclosures are fully sealed against dust, making them suitable for environments such as cement plants or woodworking facilities where fine particulate matter is prevalent. For industrial displays, dust protection is critical because particles can infiltrate internal components, leading to overheating, reduced visibility, or eventual system failure.

The second digit in an IP rating ranges from 0 to 9, addressing water resistance. Lower ratings indicate minimal protection, such as IPX1, which guards against vertically falling droplets. At higher levels, the protection becomes more robust. An IPX5 rating ensures resistance to water jets from any direction, while IPX6 withstands more powerful jets. IPX7 and IPX8 go further, indicating protection against temporary or continuous immersion in water, respectively. The highest commonly referenced level, IPX9 (or IP69K in certain standards), is designed for high-pressure, high temperature washdown environments.

When combined, these digits create a comprehensive classification. For example, an IP65-rated enclosure is dust-tight and protected against water jets, making it suitable for many industrial applications. An IP67-rated display can survive temporary immersion, which may be necessary in outdoor or flood-prone environments. These distinctions become highly relevant when selecting display systems for real-world use.

NEMA ratings, established by the National Electrical Manufacturers Association in the United States, provide a broader framework for enclosure performance. While IP ratings focus specifically on ingress protection, NEMA standards encompass additional factors such as corrosion resistance, construction integrity, and protection against environmental hazards like ice formation. As a result, NEMA ratings are often used in North American industrial specifications and may be required for compliance in certain sectors.

NEMA enclosures are categorised using numeric designations, each corresponding to a defined set of environmental protections. For example, NEMA 1 enclosures are intended for indoor use and provide basic protection against accidental contact with internal components. NEMA 4 enclosures, on the other hand, are designed for indoor or outdoor use and offer protection against windblown dust, rain, splashing water, and hose-directed water. This makes them suitable for many industrial display installations where exposure to moisture is a concern.

For more demanding environments, NEMA 4X enclosures build upon the capabilities of NEMA 4 by adding corrosion resistance. This is particularly important in industries such as food processing, pharmaceuticals, and marine applications, where exposure to cleaning chemicals or saltwater can degrade standard materials. Stainless steel construction is often used in conjunction with NEMA 4X ratings to ensure long-term durability.

NEMA 12 enclosures are commonly specified for indoor industrial environments where dust, dirt, and dripping non-corrosive liquids are present. These enclosures are frequently used on manufacturing lines, where displays must be protected from oil mist or airborne debris without requiring full waterproofing. Meanwhile, NEMA 6 and 6P ratings indicate protection against temporary or prolonged submersion, making them suitable for applications where equipment may be exposed to flooding or heavy washdown.

Although IP and NEMA ratings serve similar purposes, they are not directly interchangeable. An IP rating provides a precise, two-digit code that separately defines protection against solids and liquids. NEMA ratings, by contrast, describe overall enclosure performance under specific environmental conditions, including factors not covered by IP standards. For instance, corrosion resistance and gasket ageing are considered in NEMA classifications but not explicitly addressed in IP ratings.

There are general equivalencies that can guide comparisons. For example, a NEMA 4 enclosure is often considered roughly equivalent to an IP65 rating in terms of ingress protection. However, this comparison does not capture the full scope of NEMA requirements, particularly regarding durability and environmental resilience. As such, it is important to evaluate both standards in context rather than relying on one-to-one conversions.

In practical terms, these ratings play a critical role in display system design and deployment. Consider an outdoor digital signage installation exposed to rain, dust, and temperature fluctuations. An enclosure with at least an IP65 or NEMA 4 rating would be necessary to ensure protection against the elements. If the installation is located in a coastal area, where salt exposure can accelerate corrosion, a NEMA 4X enclosure would be more appropriate.

In food and beverage processing facilities, hygiene requirements introduce additional considerations. Equipment must withstand frequent washdowns using high-pressure water and cleaning agents. In this context, IP69K-rated enclosures or NEMA 4X designs are commonly specified. These ratings ensure that displays can endure rigorous sanitation processes without compromising internal components or creating contamination risks.

Manufacturing environments present a different set of challenges. Displays mounted on production lines may be exposed to oil, coolant, metal shavings, and vibration. An IP54 or IP65 rating may be sufficient, depending on the level of exposure. NEMA 12 enclosures are often chosen for these applications, providing protection against dust and dripping fluids while maintaining accessibility for maintenance.

Transportation and logistics hubs may require displays that can operate reliably in semi-outdoor conditions, such as loading docks. Here, enclosures must handle temperature variations, humidity, and occasional water exposure. An IP65 or NEMA 4-rated enclosure typically meets these requirements, ensuring that displays remain operational despite environmental fluctuations.

Mounting configuration also influences the choice of enclosure rating. Panel-mounted displays integrated into sealed cabinets may rely on the cabinet's rating for overall protection, while standalone or open-frame displays must incorporate their own sealing measures. Touchscreen interfaces, cable entry points, and ventilation systems all represent potential ingress paths, and their design must align with the intended protection level.

It is also important to consider thermal management when specifying high-protection enclosures. As sealing increases, heat dissipation becomes more challenging. Industrial displays must balance ingress protection with effective cooling, often using heat sinks, sealed fans, or advanced materials. This interplay underscores the importance of selecting solutions engineered with both environmental protection and performance in mind.

Selecting the appropriate IP or NEMA rating begins with a thorough assessment of the operating environment. Key factors include the presence of dust or particulates, exposure to water or chemicals, temperature extremes, and the frequency of cleaning processes. It is equally important to consider the consequences of failure.

In mission-critical applications, such as control systems or safety monitoring, higher protection ratings may be justified to ensure uninterrupted operation.

Over-specifying protection can increase costs and introduce design complexities, while under-specifying can lead to premature equipment failure and downtime. The goal is to match the enclosure rating precisely to the application's demands. This requires not only familiarity with the standards but also practical experience in how they apply to real-world conditions.

For organisations deploying industrial display systems, working with a partner that understands these nuances is essential. Properly applied IP and NEMA ratings ensure that displays perform reliably, maintain visual clarity, and withstand the environmental challenges they encounter. By aligning enclosure design with operational requirements, businesses can protect their investment and achieve consistent performance across even the most demanding installations.

Ultimately, IP and NEMA ratings are more than just technical specifications—they are tools for risk management. They translate complex environmental factors into clear, actionable criteria, enabling informed decisions about equipment selection. For industrial buyers and system integrators, mastering these standards is a critical step in delivering robust, dependable display solutions.

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IP65 Front-Faced Monitor

IP66 OutdoorVUE

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CONTACT US:

Crystal Display Systems Ltd
Unit 6 M2M Park, Fort Bridgewood
Maidstone Road, Rochester,
Kent. ME1 3DQ

T : +44(0) 1634 791600
E : info@crystal-display.com
W : crystal-display.com

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