WHITE PAPER

The Washdown Dilemma

Consider IT Lifecycle in Plant-floor PC Deployment

Over the past several decades, most every field of human endeavor has been revolutionized by the application of computers. Industry is no exception and today relies heavily on computer-based control systems and human-machine interfaces (HMIs) to fully automate manufacturing and other industrial processes when possible and practical, and to communicate with human operators when their judgment and intervention are required.

In some cases, operators can interact with their processes from the relative comfort and safety of a centralized climate-controlled operator console. But in many others, the human operators--and the computers they rely on--must be placed out in the plant itself, exposed to the particular vagaries of the industrial environment in question.

From the tar sands of Alberta to the gas fields of Qatar, sometimes Mother Nature dictates the environmental extremes (mostly temperature, wind and precipitation) against which local computer equipment must be protected. Other times, such as in the manufacture of food, beverages and pharmaceuticals, processing equipment is located indoors but periodically subjected to high-pressure sprays of harsh and abrasive cleaning solutions to protect against biological contamination of the end product.

The deployment of computer equipment in such washdown environments presents a particular set of options and trade-offs to the system designer. One key issue is whether to specify a sealed, industrially hardened computer that's ready to deploy in a washdown environment, or to specify an appropriately sealed industrial enclosure into which a more general-purpose computer can be placed. Either approach can perform admirably when it comes to the basics of routine operation: meeting the process's sanitation requirements while protecting electronic equipment from water sprays and temperature extremes. Over the long term, however, the choice between the two is an investment decision that must balance lifecycle costs, operational continuity and the accelerating pace of information technology.

A Washdown Backgrounder

The common protective requirements for electronic equipment deployed in industrial environments have given rise to classification methodologies developed by a number of industry organizations, notably the National Electrical Manufacturers Assn. (NEMA) in the United States and the International Electrotechnical Commission (IEC). The enclosure classifications of specific relevance to washdown environments are NEMA 4X and IEC IP (ingress protection) 66 as summarized in Table I. The operative descriptors for NEMA 4X/IP 66 are protection against hose-directed water and resistance to corrosion. Corrosion resistance normally dictates stainless steel construction.

Further, NSF International, a U.S.-based certifying agency with a particular focus on equipment used in the manufacture of human consumables, has codified the essential characteristics of

enclosures used in washdown environments in its NSF/ANSI (American National Standards Institute) standard 169 covering "Special Purpose Food Equipment and Devices."

Essential aspects relevant to the enclosure's ability to be thoroughly cleaned (and not harbor microbial contaminants) include lift-off hinges with removable pins; leg stands or easily cleaned casters with a minimum 6-in. unobstructed clearance; sloped surfaces to facilitate runoff; welded and deburred joints and seams; easily-cleanable fasteners, including slot-head quarter-turn latches; and no exposed threads, projecting screws or studs.

NEMA Classification	Comparable IEC Classification	Description
4	IP 66	For indoor or outdoor use, providing "a degree of protection" to personnel against access to hazardous parts as well as a degree of protection of the equipment inside from solid foreign objects (falling dirt and windblown dust); ingress of water (rain, sleet, snow, splashing water, and hose directed water), and external formation of ice.
4X	**IP 66**	**Similar to NEMA 4, with added protection against corrosion**
6	IP 67	Similar to NEMA 4, with added protection against water ingress when temporarily submerged
12	IP 55	For indoor use, with protective measures oriented toward dripping and light splashing of water.
13	IP 65	Similar to NEMA 12, with added protection against splashing and spraying of oil and non-corrosive coolants.

Table I. While not strictly equivalent, these NEMA and IEC IP (ingress protection) ratings commonly are used for HMI panels and enclosures intended for industrial applications. NEMA 4X is particular relevant to plant-floor food, beverage and pharmaceutical applications.

Adequate thermal management, too, is a fundamental design consideration--whether a sealed industrial computer assembly is used or whether the enclosure and computer are specified separately. After water, excessive heat in particular is a computer's worst enemy. Some sealed industrial computers are designed to work without active cooling; this is intended to improve system reliability because no moving parts are involved, but may limit the unit's ability to dissipate heat at higher ambient temperatures. Other industrial computer assemblies employ the same cooling technologies as "standalone" enclosures, including fans and heat exchangers, air conditioners and vortex coolers. Heaters, too, sometimes are dictated in order to deal with refrigerated processes and to avoid condensation within the enclosure.

Lifecycle Considerations

From a design and nominal performance perspective, there's generally little to differentiate a NEMA 4X industrial computer from a general-purpose computer in a separately specified NEMA 4X enclosure. In general, the higher initial purchase price of the industrial computer will offset the costs of a less expensive, general-purpose computer and enclosure. If specified properly, either option will capably

perform the task at hand. Indeed, the differences between the two approaches typically come into play only well after the system has gone into production.

The first big difference rears its head in the case of computer hardware failure. While an industrially hardened computer should last longer (after all, that's a big part of the initial price premium), hardware failures do happen--sometimes six months down the road, sometimes six years.

Industrial computers, on the one hand, are often relatively inflexible when it comes to repair, and their sealed design may require a visit from the supplier's service technician or, in some cases, shipment back to the manufacturer. In either case, the user faces extended downtime and may need to hold an expensive replacement unit in inventory. While it may be judged necessary for operational continuity, an aging inventory of expensive IT equipment that grows more outdated with each passing day is a high price to pay by any measure.

On the other hand, by separating one's investment in a NEMA 4X enclosure from the computer hardware that it protects, the user can effectively decouple the lifecycle of the hardware that should last a long time (the enclosure) from the hardware that seldom stands the test of time (the computer). This also means that in the case of computer failure, operational continuity can be assured by holding a far cheaper back-up in inventory.

Most importantly, this investment decoupling truly shines when the user wishes to take advantage of new advances in computing and software technology that didn't exist three years ago. Simply swap out an older general-purpose computer for a state-of-the-art one that does far more--and likely costs less--than the original. That may well be when the decision to separate enclosure and computer investments proves sweetest.
