Why Buy Industrial Computers?

WHITE PAPER

A report for OEMs and manufacturers who use computers in their manufacturing equipment and processes.

Rugged, high-performance industrial computers are designed and hardened for the plant floor. Industrial personal computer (IPC) technology is used in ever increasing volume in the manufacturing environment. Applications close to the manufacturing process, from PC-based control systems and HMI systems to computers interfaced with the enterprise computing environment, are becoming increasingly popular. Manufacturing environments vary widely among different industry types. Appropriate levels of PC industrialization are necessary for optimal performance in these harsh environments.

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Appropriate Levels of "Industrialization" Are Required for Optimal Machine Operation

What Is "Industrialization" or What Is "Industrialized Equipment"?

The manufacturing environment contains severe operating environments in which all types of equipment must perform. "Industrialization" in this context means that equipment used in the manufacturing process is expressly designed to meet the challenges posed by the manufacturing environment and operating parameters.

It should be noted that the manufacturing environment varies widely among industry types. For discussion purposes it may be useful to categorize these environments based on both environmental and operational characteristics. The National Electrical Manufacturers Association (NEMA) has developed some standards that help define these characteristics.Chart A describes some of the differences among representative types of industry applications.

Chart A.

Industry/Application	Environment Factors	Operational Characteristics
Electronics Assembly	Clean and climate controlled for personnel comfort as well as to minimize static electricity	Personnel generally have clean hands and do not wear gloves. Machinery ranges from manual operations to fully automated. Weight is generally not a factor in handling product.
Metal Forming (Pressing/Forging Operations)	Heated in winter but not cooled in summer. Heat, vibration (from press operation), and oil mist exists.	Operators are typically gloved; safety is extremely important
Automotive Assembly	Heated in winter but not cooled in summer. Heat and vibration are the key factors.	Operators may or may not be gloved
Forest Products (Paper Production, Sawmills)	Very harsh environments consisting of solvent based mist in air, no climate control, outside operations.	Operators are gloved
Steel Manufacturing (Primary, Rolling, Finishing)	Very harsh environments consisting of heat, vibration, outside operations.	Operators are gloved, products being manufactured are large in mass and require heavy equipment for transport
Metal Cutting/Machine Tool	Heated in winter but not cooled in summer. Heat, vibration, and oil mist exists.	Operators are gloved

Rating Systems Commonly Used within the Manufacturing Environment

Mechanical Protection

The National Electrical Manufacturers Association has developed standards that are useful in defining the types of environments along with a rating system for determining the degree of protection provided by a given electrical enclosure. Similarly, the International Electrotechnical Committee (IEC) has developed standards. These IEC standards typically are applied outside of North America.

Because most industrial computer applications are associated with other electrical devices, the NEMA and IEC rating systems apply to the protection offered by a given computer when included as an integral part of an electrical enclosure.

Hazardous Location Protection (Explosive Atmosphere Protection)

Underwriters Laboratories (UL) has developed a series of explosion resistance tests, against which manufacturers of industrial equipment can test their equipment. This can be important if you are applying a computer in an area where an explosive atmosphere may or does exist. In general these explosive atmospheres consist of dusts, (flour, for example) or gases (hydrogen for example). In evaluating computer equipment for use in an industrial environment it is important to take into account the potential for a hazardous situation and assure that the computer has been tested in accordance with UL standards.

How Does a Computer fit into the Industrial Environment?

In order to accurately assess the requirements that may be applied to a computer to be used in the industrial environment, several factors must be taken into account.

- What functions will the computer perform?
  - Human Machine Interface (HMI)
  - Control of a process
  - Interface between process controllers (PLC) and enterprise system host computer)
  - Data acquisition/reduction (Product quality—SPC/SQC)
  - Data entry point (machine operator/supervisor)
  - Materials management (stock requests, machine production results, recipe management)
- On what control/information/network architectures will the computer depend in order to service its required functions?
  - Connection to machine level I/O
  - Connection to PLC
  - Connection to enterprise system or host computer
  - The local environment of the specific area where the computer must be deployed.

Required functions will, in most cases, help determine the required architecture that the computer must reside in. As with most situations, determining the best equipment for a given application is usually a series of tradeoffs. The net result of the tradeoffs should be a system that provides all of the necessary functions at the least possible price with some reasonable reliability implied.

Examination of Tradeoffs

As it relates to "Industrial Computing", the easiest way to control the environmental impact on the computer is to remove it from the "harsh environmental zone". In other words, the computer itself is relegated to a control room or other climate-controlled area where contamination, vibration and heat are held to prescribed levels. Often, however, this proves quite difficult to achieve. The reasons are manifold but some common causes are:

- Communication networks between the computer and other equipment are necessarily extended (above the distance required when the computer is on the machine). This may lead to undesirable effects on reliability and uptime due to network failures. In many cases the networks have distance limitations which may preclude a remote location for the computer (e.g., RS-232 can probably not be run further than 200 feet, and that with specially rated cable).
- Cost of building a control room is excessive. Especially in situations where cable length constraints dictate multiple control rooms be constructed in order to assure that cable runs are kept within acceptable limits.
- Cost of running multiple networks from machine to control room is quite high.

Based on the these issues, in most cases it is more cost effective to locate the actual computing equipment in near proximity to the machine; the evaluation of the computer hardware becomes germane.

Chart B. Computer Configuration and the Advantages of an "Industrialized Grade" of Computer Equipment.

Computer Configuration	Installation Method	Available as Office Grade Equipment	Advantages of Industrialized Unit
Integrated	Cutout in electrical panel (pendant or floor-mount panel)	No	Provide operator display and computer functions in one integrated package. Industrialized packaging and material selection to assure longevity and machine uptime.
Discrete components	Computer located in electrical panel or control room. Monitor placed in cutout of electrical panel (pendant or floor mount panel)	Yes	**Computer:** built in a form factor that facilitates easy mounting in an electrical panel or rack. **Monitor:** NEMA-rated to assure adherence to standards for foreign object penetration resistance. Industrialized packaging and material selection to assure longevity and machine uptime.
Computer only	Computer located in electrical panel or control room	Yes	**Computer:** built in a form factor that facilitates easy mounting in an electrical panel or rack. Industrialized packaging and material selection to assure longevity and machine uptime.

Computer Installation Considerations

In general, computer equipment may be configured in one of the following ways (also see chart B):

- **Integrated:** Computer and monitor integrated in a single unit. In the past these units were quite large, due to CRT technology. Today, however, with flat panel technology dropping in price, these units are becoming much smaller and more easily adapted to electrical enclosures.
- **Discrete Components:** Computer and monitor are separate. As above, the flat-panel display technology is providing users with a lighter, smaller alternative to CRT technology.
- **Computer Only:** Computer is necessary but no monitor is required.

(Note: In all of the previous cases, a keyboard/mouse may or may not be required. The addition of a keyboard/mouse may significantly affect the installation requirements.) It is the installation of computer equipment in close proximity to the machine that has driven much of the development of the industrial computer equipment.

It is an interesting phenomenon in the area of computer equipment that office or commercial grade equipment is even considered for use in an industrial environment. No one would consider using a commercial-grade light switch to turn on a pump on a machine. The switch could do the job, but why is it not selected?

Two main reasons:

- It is not rated for the application and would most likely fail prematurely
- Although it performs the same function as its industrial cousin, it doesn't have the right fit and form for the application at hand.

In the same way, the industrial computer provides fit and form more appropriate to the industrial application than its commercial-grade cousin.

Key Components of a Truly Industrial Computer

Industrialization begins in the design phase of a computer, not by adding onto an already designed commercial computer.Chart C on the following pages denotes key requirements of the manufacturing process and the respective design features of an industrial computer necessary to meet these requirements.

Chart C.

Industrial Requirements for a Computer Platform	Xycom Industrialized Computer Response
Packaging and Design	
Display Resistance to Foreign Contaminants Penetration	NEMA-rated screens (4/4X and 12). NEMA 12 - Indoor use, protection against: • Incidental contact with enclosed equipment • Falling dirt & rust • Circulating dust, lint, fibers, and flyings (nonexplosive) • Falling liquids and light splashing • Oil and coolant seepageNEMA 4/4X Indoor & outdoor use, protection against: • Incidental contact with enclosed equipment • Falling dirt & rust· Circulating or windblown dust, lint, fibers (non explosive) • Falling liquids and light splashing • Oil and coolant seepage • Rain, snow, and sleet • Hosedown and splashing water • Corrosive Agents
Use in Hazardous Locations (Explosion Protection)	UL listed for hazardous locations: • Class I, Division 2, Groups A, B, C, and D • Class II Division 2, Groups F and G • Temperature Code T6
Interference with other Electrical Equipment (RF radiation)	Meets FCC 47 CFR, Part 15, Class A
Reliable Operation of Operator Input (Typically Operator Fingers, Gloved or Not) Components	Membrane keypad units: Integrated keypad unit with display. Keypad buttons will exceed 1 million cycles without failure. Designed for use with gloved hands. Touchscreen units: Rugged resistive touchscreen tested for compatibility with many industrial chemicals. Designed for use with gloved hands.
One-Touch Operator Input Capability	Relegendable membrane keypads
Low Voltage Power Sources Required in Some Applications (CE Low Voltage Directive)	Computer may be driven by 24 VDC power (typically an option)
High Ambient Temperature Operating Environment	Computer designed so that at ambient temperatures up to 50° C all components in the unit remain below maximum temperature specifications. Additionally, electrical components are de-rated to assure long life as well as a guard band when temperatures temporarily exceed 50° C.
Corrosive Atmosphere	Gold plated connectors

Industrial Requirements for a Computer Platform	Xycom Industrialized Computer Response
High Incidence of Vibration and Shock Loading	Locking cables. Unit designed and tested to meet industrial shock and vibration requirements. Maximum shock and vibration values are typical published specs (no rotating media): **Operating:** Shock - 15g peak acceleration, 11 msec duration Vibration - 5 to 2000 Hz (.006" peak to peak displacement) 1 g max accel. **Nonoperating:** Shock - 30g peak Acceleration, 11 msec duration Vibration - 5 to 2000 Hz (.006" peak to peak displacement) 1 g max accel. **Note:** Rotating media (disk drives) reduce the tolerance of the unit to shock and vibration. For this reason, many industrial users may opt for diskless operating systems. Industrial computer product manufacturers will focus heavily on this technology as commercial diskless products, such as Windows CE become prominent.
Minimize Panel Size and Cooling Requirements	Careful attention is paid to providing the amount of power needed for computer and peripheral application without excess power consumption. For example, the 3510 unit carries an 80 watt power supply, while comparably equipped commercial grade equipment may require a 200 watt supply. Components are selected to provide maximum performance at lowest power consumption.
Removal and Reinstallation Complexity (Machine Downtime, Wiring, Panel Assembly)	High percentages of electronic failures will occur in the first 48 hours of operation. To minimize "infant mortality" each unit is burned in at the factory (under load and at maximum ambient temperature) for 48 hours.
Quality & Reliability	
Maximize Uptime of Manufacturing Equipment	ISO 9001 certified. Internal design and manufacturing of critical components to assure temperature and vibration specifications are met. All products are subjected to lifetime burn in tests. These tests may be years long, data is gathered and fed into the design/manufacturing process to continuously improve designs. Xycom units average 3% failures in factory environments, some reports show failure rates as high as 30% among office grade computers, in office environments.
Migration Path	
Mechanical Compatibility with Legacy Product	Units mechanically designed to be backward compatible. Allows panel cut-outs to be the same within product families. Modular hardware (passive backplane with engineered ground planes) allow for easy upgrade of motherboard without removing the entire computer.
Software Compatibility of New Equipment with Old Equipment. (How Can I Be Sure That the Computer I Order Today Will Work with the Software I Wrote Yesterday?)	Source code for the BIOS (Basic Input Output System) is licensed from Phoenix. Xycom then creates, and owns rights to its own BIOS. These BIOS versions are shipped with the Xycom computer hardware. Versions are controlled to assure customers that new equipment can be configured to be compatible with legacy software and hardware. **No midproject BIOS changes.**

Industrial Requirements for a Computer Platform	Xycom Industrialized Computer Response
Service and Support	
After Hours Support	24 hour a day, 7 day week phone support - 800 AT XYCOM
International Support	Offices in Europe and Asia
Compatibility and Compliance	
Compatibility	Hardware and BIOS tested with leading industrial software and hardware products. In many cases, Xycom bundles an industrial computer with software and hardware interface to assure a working package for the customer. An example of this is our OpenHMI™ offering, where we bundle industry leading Wonderware® software and the customer's choice of an I/O interface with any of our industrial computers.
Compliance	UL, CE, and CSA approvals on all Xycom hardware

Future

Xycom Automation is committed to providing the latest in computer hardware and software. As computing and machine control applications continue to migrate together, it will be critical that your computer supplier provide solutions across a wide range of operating systems and hardware platforms. Xycom Automation is committed to the application of suitable new technology. For example, the latest released unit runs the Windows® CE operating system and may be operated in a mode that requires no rotating media. When choosing a supplier of computer equipment, make sure that you have fully explored their ability to provide you with a scalable architecture. Scalability should range from real-time operating systems on very low-cost reliable hardware to high-end server-based computer equipment running Windows NT® (or other operating systems).

Summary

Industrialized computers are not necessary for every application. Clean noncritical applications may receive acceptable performance from office grade computer equipment. For those applications that may have severe environments, critical applications (Up-time requirement), or combinations of these two factors, an industrial computer will serve as an excellent choice.

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WP-PC-007(C). 7-01.

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