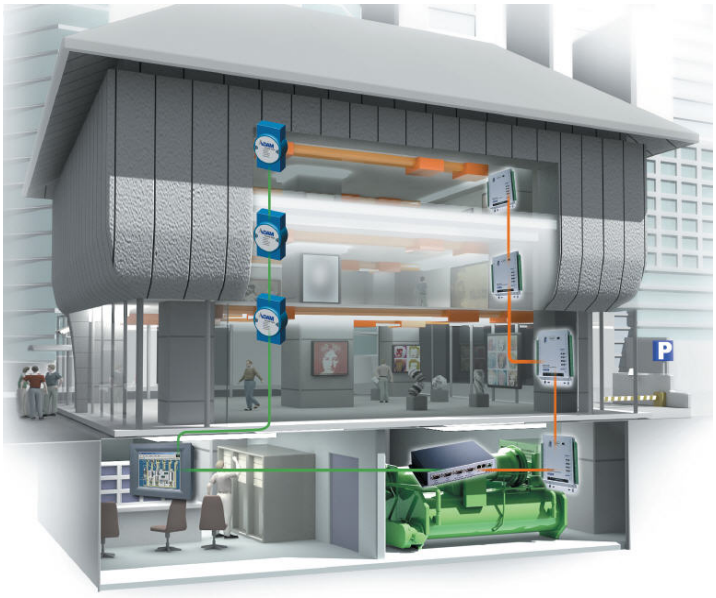
The Advantages of Small Form Factor HMI

Written by: Hector Lin, Advantech Corporation, Industrial Automation Group

As embedded computers have become ubiquitous, so too the need for human machine interfaces has grown. Once found in only complex control systems, like distributed control systems in refineries and other process plants, HMI systems are now found in many guises and many locations, from games to industrial machines and tooling systems, with many stops in between.

HMIs have mutated and changed with new requirements, and they have become more flexible and capable. And while they've been doing that, they've become smaller and more useful.

So what is an HMI anyway?
Strictly speaking, any way for a human being to "interface" with a machine is an HMI. The touch-panel on your microwave is an HMI, the dial on your washing machine, and the cable remote-operated software selection guide on your TV is an HMI.



Transmitters and sensors originally had no HMI, and many didn't even have as simple an HMI as a display. Many were blind, with just an output signal. Some had a rudimentary HMI: a single or dual line ASCII display with a set of arrows for programming, or a 10 key pad. Very few field instruments, sensors and analyzers ever had HMI panels that could actually provide good graphics, have a simple, easy to understand way to enter data and commands, and provide a high resolution window into the process.

HMIs that used full computers and full display screens were limited to control rooms because of the fragility of early computer circuitry, screens and disk drives. Enclosures were developed that would allow a computer-based HMI to be located out on the plant floor, but these were very large, bulky and prone to failure from heat, moisture, wash-down, and other plant floor perils.

Early computer-based HMIs also ran hot and were significant power consumers. A typical "desktop" computer in the 1980s required as much as 200 W.

Helping operators work
As plant floor processes become more automated, the operator needs to have more information on the process at his fingertips, and the requirements for local display and control have become more complex. One of the first advances in this area was the early touchscreen display. This enabled the operator to simply press the portion of the display that had a "virtual button" on it, to force an action or recipe to occur. This eliminated the need for keyboards, mice and joysticks, except for unusual or complex programming tasks that could be done during shutdowns.

Another major advance was the LCD display. It took up much less space, and was far less fragile than a CRT display, and could therefore be used in much smaller spaces.

The biggest advance was in small form factor embedded computers that made it possible to replace the 2-line display on a typical tool or transmitter with a full featured HMI.
Operators work in very limited space on the plant floor. Sometimes there is simply no place for the operator, tools, parts, and a large-form HMI. Sometimes operators need a completely portable HMI.

The Small Form Factor HMI
Small form factor HMIs coupled with small form factor embedded computers have revolutionized the use of HMIs on the plant floor. But what features should a modern HMI have?

Can be used in space-limited areas
More and more PCs and embedded PCs are being used in manufacturing applications for networking and shop or plant floor controls. Many of these devices are of limited utility unless accompanied by some sort of HMI. A small form factor HMI provides increased capability for operator interface for recipe management, alarm management and operational control. Small form factor HMIs can be installed on a wide variety of devices and tools, in addition to the traditional control desk or panel mounting.

In fact, HMIs can now be so small that they can be installed in the same space that would have previously consumed by a single push button and a single indicator light. So in less space than a typical Hand-Off-Auto station would have required in the panel, the operator can have a fully featured small form factor HMI, with an infinite number of push buttons and indicators.

In addition, the modern small form factor HMI has common programming languages and operating systems.

Thin Client or Embedded PC
The modern equivalent of a dumb terminal, thin clients are used in many distributed networking applications where either the program and operating system are loaded from a network server, or a “light OS” such as Windows CE or Windows XP-Embedded is provided in flash memory for a specific purpose computing system.

Thin clients can often be used instead of full PCs for embedded computing applications. Thin clients are often combined with an HMI, and when the HMI has a small form factor, the entire product, HMI and thin client processor, may be physically only as large as the HMI display itself. This of course makes it possible to use an integrated thin client/small form factor HMI in locations where a traditional HMI and associated PC would not fit or be functional.

While a traditional PLC operator station has a proprietary operating system, the use of Windows CE, or Windows XP-embedded, or even Linux as HMI operating systems means that required operator training is less, and, even more importantly, the number of available programmers who can work in that common commercial environment is much larger, making embedded PC HMIs easier and less costly to use than traditional operator stations.

Lower power consumption – green
Increased power usage worldwide has given rise to the need for computing devices with much lower power requirements. Typical traditional HMI products, including CRT displays and even LCD displays, along with PCs with cooling fans, hard drives and other moving parts are known to be power intensive.

A small form factor HMI built to be used with a fanless embedded PC or thin client requires significantly less power than a traditional HMI/PC combination. For example, the power consumption of Advantech's newly released 3.5" QVGA TFT LCD Xscale PXA270 Touch Panel Computer is only 8W.

The use of lower power consumption HMIs and embedded PCs and thin clients permits the use of more devices for the same power load, or, conversely, overall lower power consumption and thus lower cost of ownership than previous generations of HMIs and computers provided. Plus, lower power consumption small form factor HMIs and embedded computers are a contribution to the "greening" of manufacturing technology wherever they are used.

Portability when required

One of the greatest benefits of the lower power consumption necessary to run small form factor HMIs is the ability to operate on small batteries. This, plus the very size of the small form factor HMI has made it possible to produce industrial grade portable HMI devices that are far superior to commercial grade laptops and touch-pads.

In some cases, these portable devices can be entirely wireless, providing an HMI, computing capability, and data acquisition capacity that is able to roam wherever the operator wishes or needs to go in the plant.

Increased reliability

Lower power devices like small form factor HMIs are also designed with very high levels of component integration and VLSI circuit boards. Fewer components and lower power requirements improve the overall reliability of the computer. Mean times between failures (MTBF) are lengthened when this combination of lower component counts running at lower power levels is extended to small form factor HMIs.

Reduced cost

High level integration and small form factor makes the modern HMI less costly, both to manufacture and to purchase. Higher reliability makes the total cost of ownership (TCOS) lower than older designs, as well.

Better cost-benefit ratio

A modern small form factor HMI can be purchased for about the same cost as a dozen push buttons and indicator lights, providing better control, easier operator interaction, easier maintenance and support, and much greater operational utility for the same cost.

Fits a broad range of vertical markets

Small Form Factor HMIs can be found in a wide variety of applications in a large number of vertical markets, not only in industrial automation. They can be found in commercial applications; HVAC applications such as zone controllers and data acquisition systems; machine control applications; environmental monitoring applications; telecom applications; automotive applications; and many

more. Because the small form factor HMI is a fully functional PC, not just a PLC operator terminal, this inherent flexibility and universality greatly increases the small form factory HMI's applicability in multiple vertical markets.

Small form factor HMIs appear headed for inclusion in nearly every part of human existence from medical devices to industrial automation.

###

