

Delivering the ISA 101 Standard HMI

Where Kaizen Meets Kanso In Advanced Manufacturing

Kaizen. A guiding principle used frequently in the Japanese culture that literally means “constantly improving” – in our lives and our processes. Kaizen is based on the principles of gradual, constant improvements that often, individually, are small but when taken together are impactful.

Zen Buddhists practice the art of kanso. Simplicity. Clearing our space to allow us to think clearly, raising awareness, and being better. Albert Einstein stated, “If you can’t explain it simply you don’t understand it enough” and Leonardo da Vinci said, “Simplicity is the ultimate sophistication”. In that same vein, Apple’s Steve Job’s was an exceptional communicator and was best known for being able to announce new products mapped simply into user feelings and benefits. Simply communicating complex solutions is an artform, often misunderstood or discounted, but can be developed with proper focus.

As advanced manufacturing technologies are being delivered at warp speed, mere mortals are being bombarded with increased complexity and noise. Billions of sensing devices are being deployed in the world – in our toasters and on our plant floors. Data rates are doubling every 11 months. And don’t forget. Our children need to be picked up at car pool. So, as technologists and designers, it’s even more critical now to be reminded of kaizen and kanso – focusing to deliver technical solutions with great impact, simply for greatest user impact and use.

Cloud computing and cloud-based technologies address both kaizen and kanso – offering both efficiency and simplicity at the architectural level. Cloud computing offers fewer boxes on the plant floor reducing both CapEx and OpEx. And, Programming software-as-a-service solutions in the cloud can be customized, designed and delivered rapidly at often substantially lower costs. Cloud computing almost takes on an ethereal, angelic resonance compared with common descriptions of today’s plant environments of “smokestacks of data orphaned on the plant floor”. Hardware gateways provide the necessary connection – bridging the OT and IT domains and across the DMZ. Architecturally, as we deliver the IIoT, the industry has made great strides in kaizen, and we continue to do so as we build software as a service rapidly in the cloud.

World-class designers understand it is easy to create a different thing but it's very hard to create an impactful thing. As we continue to focus on delivering "constantly improving" solutions that advance manufacturing, perhaps nowhere does the concept of kanso ("simplicity") become more pronounced and imperative to understand than at the human-machine interface (HMI). Why? Because if we are unable to visualize data in a format that is recognizable, pleasing to the eye and in a format that the average human can reliably and repeatedly interpret and act on, then we have failed to deliver value from that data. So, creating a simple, easy to navigate and use HMI is critical to achieving kaizen.

Humans must be reminded of certain truisms. For example, neuroscientists know there are 100 billion neurons in the human brain and we can place about 30,000 of them on the head of a pin. Placed end to end the neurons in just one person's cortex would stretch 100,000 miles, enough to circle the earth over 4 times. And our brains are capable of processing upwards of 30 billion bits of information per second, using effectively 6,000 miles of the wiring and cabling that supports our brains. So, the hardware and wiring in our brains is absolutely amazing.

Yet, cognitively, most agree that the maximum number of items we can store in our conscious, working memory, brain is limited at 3-4. We often lose attention after 10 minutes of listening to a verbal presentation – seeking instead to find pleasure – seeking to find the nearest exit or create a convenient excuse to leave. Difficult to operate processes often leave us frustrated, particularly when simultaneously bombarded with other competing tasks, priorities and deadlines. In such cases, mere mortals might seek to reduce the pain. Turn the computer off. Defer critical plant maintenance tasks.

But yet presenters often deliver dissertation-length, bullet-point laden PowerPoint presentations believing the audience actually wants to read the eye charts and not actively engage with the presenter. And many HMI designers continue to try to impress plant floor operators with displaying too much information in techie eye-charts without concern for the user experience. Have we accomplished kaizen and kanso in either case? No. Most likely the listener will seek to reduce the pain – and not use the system.

The gentleman who brought us the Theory of Relativity said, "If you can't explain it simply you don't understand it enough". Further, if we can't represent critical plant floor data in a recognizable, easy to use format, then chances are the designer lacked either the understanding

of the user or the understanding of the context of the data. Understanding user needs/wants/behaviors as well as the context of the data is therefore critical to proper HMI design.

The ISA 101 HMI standard committee has taken great care and effort to address the design, implementation, operation, and maintenance of HMIs for process automation systems including multiple work processes. Starting in 2015, the initial working groups focused on delivering the HMI philosophy, style guide and design guide; addressing HMI usability and performance, and; HMI for mobile platforms concerns important for designers, integrators and operators. The ISA 101 standard, recently adopted by ANSI, has addressed human factor engineering factors such as the use of consistent colors, and process objects from a common toolkit and context of data.

Taking a more holistic perspective, the ISA 101 committee included a discussion of an HMI lifecycle approach much like the work done in ISA 84 for safety systems and ISA 18.2 for alarm management. Very kaizen-like in approach, the HMI style guide focuses on small changes that increase HMI effectiveness, such as color usage, navigation, and object animation, to name a few. For example, it is recommended to use a gray background that both minimizes glare as well as provides a low-contrast depiction of the data. Or, as suggested, bright colors should be used only to highlight alarm and abnormal conditions.

As the industry designs and delivers the next generation HMI, we must do so thoughtfully and remind ourselves of the principles kaizen and kanso – focusing on how we can make continuous improvements that are often technically challenging while at the same time representing and communicating these solutions simply.

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*Perspective: Delivering the ISA 101 Standard HMI -
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