

PROCESS CONTROL

HUMAN CENTERED DESIGN: THE COMING REVOLUTION

HCD BREAKS FROM TRADITIONAL DEVELOPMENT WHERE MARKETING WRITES REQUIREMENTS AND ENGINEERING BUILDS SOMETHING.

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TODAY'S PROCESS control systems are capable of quickly handling enormous amounts of data in different formats and communicating with a wide variety of devices and equipment. While all of these features and technologies are allowing us to do things that may have never been imagined 20 years ago, what has been lost in the rat race is an emphasis on making it easy to set up, maintain, and operate these complex systems. After all, we have experts and trained specialists around to sort this stuff out . . . right?

Adding fuel to the fire is another important trend in our industry. Budgets are tight, and a large number of experienced workers (operators, maintenance technicians and engineers) are nearing retirement age. As they go from spending their days in the plant to dropping a worm in the local fishing hole, the knowledge that took years to accumulate, knowledge that is vital to operating and maintaining process plants and other facilities, is lost. The globalization of the world economy also results in plants being built in areas with little or no industrial history and therefore a limited pool of trained workers.

HUMAN CENTERED DESIGN

The solution to taming the complexity associated with today's technology and creating products that plant personnel can quickly learn and use efficiently lies within an approach called Human Centered Design (HCD).

HCD is an interdisciplinary and iterative approach to design focused on understanding and meeting human needs versus an exclusive focus on features and technology. Let's use the example of tax-preparation software, which facilitates quickly and easily filing your taxes. This is accomplished by designing the software in a manner that is intuitive with attention to the things that matter most like preventing errors and identifying tax credits. A typical filer would find it much easier to understand "Did you pay any interest on a mortgage?" as opposed to "Enter the value reported in box 1 of Form 1098 into line 10 Schedule A (Form 1040)."

When it comes to software user interfaces, this means using a task-based approach to better align the system with the user's mental model about the work he or she is trying to accomplish. The concept of Human Centered Design is not new; its roots lie in Human Factors and Ergonomics research and design that arose during World War II to apply knowledge of human limitations and capabilities to the design of equipment, especially with aircraft cockpit controls to prevent crashes. Carnegie-Mellon University's Human Computer Interaction Institute (HCII) pioneered research in this area and advanced the methodologies for applying Human Centered Design to computers and software user interfaces. HCII provided significant input to Emerson in developing its own Human Centered Design Institute. The Institute's primary mission is to ensure each product the company introduces is aligned with customer work practices and goals.

THE HCD PROCESS

Applying Human Centered Design boils down to three key activities:

- **Understanding the users.** Understanding the users and their goals involves interviews, contextual inquiries (observing workers going about their daily work in their workplace), researching tasks and work standards, and analyzing current solutions. The first question to be answered is how the user thinks about their work and what makes them successful at the end of the day. This information is organized into typical user or "persona" profiles, scenarios, and task maps that show the important interactions between different users.
- **Creating design solutions.** With the user-centric information providing a strong foundation, design teams then embark on ideas for new products. The design phase includes sketching and ideation followed by a series of software or hardware prototypes.

- **Testing the design.** The evaluation phase follows, with design evaluations of the prototypes and usability testing with actual users. The whole process is iterative: design prototypes, evaluate with the aid of actual users, and then improve upon the design based on user feedback. Only after several of these iterations is the product actually ready to be built.

While these activities may seem obvious and easy to implement, they break from the traditional development approach where marketing writes a set of requirements and engineering builds something based on them.

HCD RESULTS

It is important to understand that applying Human Centered Design is not the responsibility of the control system engineer or project team creating the plant specific displays and control strategies. Ideally, the control system vendor delivers a product that is not only easy to use out of the box, but facilitates customizing the system to meet plant-specific needs without requiring in-house HCD expertise. Everything from the engineering and administration tools to the operator interface are designed to prevent mistakes and promote efficiency via ease of use.

For example, it is useful to place small trend charts next to key variables in a process display; this takes advantage of the operator’s inherent pattern-recognition capability. The control system vendor can encourage this design by providing configuration building blocks that are easily incorporated into the plant-specific displays. Then consider the case of a process alarm on the operator’s display. The operator would typically click on the alarm and a faceplate would appear, showing the process value and some indication of how the

loop is performing. In a conventional (non-HCD) system, that would be the limit of the information an operator would have to quickly take corrective action. A system built on HCD principles could display a possible root cause and recommended action to resolve the problem. Even better, a note, added by a senior operator or maintenance worker in your plant and detailing valuable process specific knowledge, can also be associated with the alarm.

Now let’s consider the instrument technician, whose responsibility is ensuring the devices used by the control system are functioning properly. Say, for example, the instrument technician has received an indication that an issue exists with a pressure transmitter. He or she has a completely different mindset (or mental model) and set of common tasks and goals than the operator. The instrument technician launches a device dashboard for that transmitter, but the information could be presented in a myriad of ways. Figure 1 shows a conventional diagnostic display for a HART pressure transmitter with a problem. While the information is correct, it is not presented in a way that easily conveys the critical parameters and problem. Figure 2 shows the same device with information organized and displayed in a quickly understandable manner. Common tasks are front and center, with embedded walkthroughs to aid infrequent or inexperienced users.

Operators and maintenance technicians keep multi-million (sometimes -billion) dollar investments up and running. Human Centered Design will ultimately revolutionize this industry by bringing a focus to ease of use and implementation while leveraging the technologies of the future. 

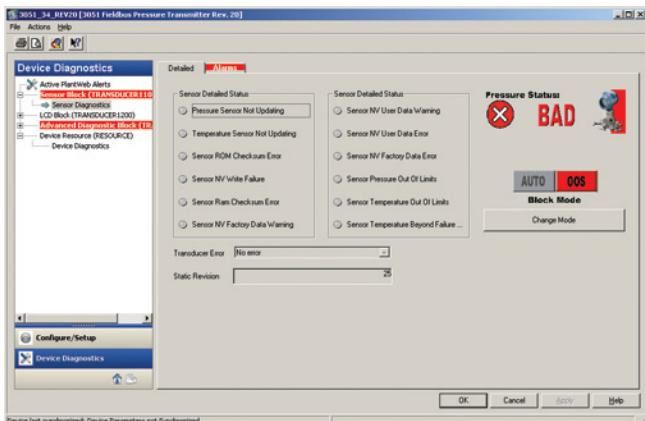


Figure 1. Conventional diagnostic display for a HART pressure transmitter with a problem

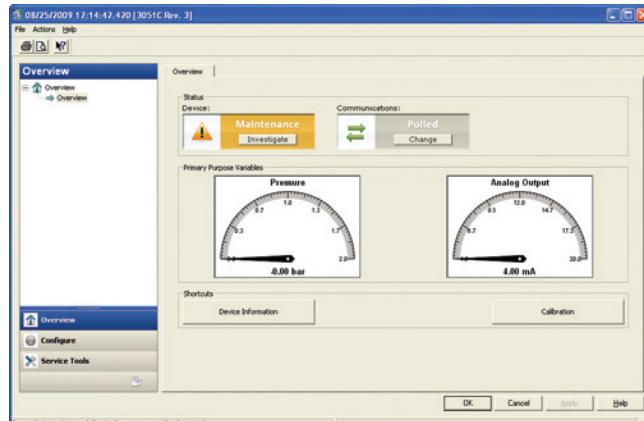


Figure 2. Reworked dashboard of the transmitter shown in Figure 1