HIXSON
ARCHITECTURE ENGINEERING INTERIORS

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From Experience

Understanding Basic Human Machine Interface (HMI) Design

It is common in industrial settings for operators and maintenance crews to need quick and easy access to detailed process information. At Hixson, we commonly specify any number of buttons, beacons, and horns to communicate with our clients' crews. At times however, more detailed information needs to be readily available from the production floor. This is when we specify the installation of a Human Machine Interface (HMI), either in a control panel or as a standalone device. An HMI is a durable touchscreen monitor that long predates the handheld tablet, and at first glance, you might think it is antiquated. The screens that are loaded into an HMI are very simple. This is intentional...to make sure critical information can be easily found and read. We use HMIs to visually display relevant data, track trends, display detailed alarm information, and access controls to individual pieces of equipment. So what considerations make for good HMI design?

1. A display hierarchy that defines the structure of the screens included with the HMI:
   - **Level 1:** Overview Display – A single display that contains a summary of all the critical parameters, alarms, and devices contained within the system.
   - **Level 2:** Process Unit Control Display – Displays that contain more detailed information of a specific section of functionality that is typically task-based.
   - **Level 3:** Process Unit Detail Display – Further detailed displays that are intended for either simple, non-routine tasks, or complex routine tasks.
   - **Level 4:** Process Unit Support Display – Diagnostic displays, commonly setup as pop-up screens, to edit the configuration of a piece of equipment.

2. Displays should be designed for the primary users, typically the operators of the process, while still supporting secondary users, such as maintenance staff.
3. Screens should have as little visual clutter as possible by displaying only the information necessary to complete the task.
4. Use a consistent font size and style for different types of elements, across all screens, so users can quickly navigate the system.

5. Include a standard header bar that allows for common navigation actions to be found on every screen.
6. Users should be able to intuitively navigate through the screens, requiring no prior familiarity with the system.
7. Reserve the use of bright, intense colors for alarms. Use a neutral solid color as a background, such as light grey, to reduce interference with items the users need to see, and use a secondary differentiator, such as shape, to mitigate color blindness.
8. Display refresh rate should be at least twice as fast as the cycle time of the system's processes. Feedback to users' interactions with the HMI should be no more than two seconds, but no less than a half a second.

Additional information on HMI development can be found in the ANSI/ISA-101.01-2015 standard and Rockwell Automation publications PROCES-WP016A-EN-E, dated January 2016, and PROCES-WP023A-EN-P, dated May 2019.

Experience in Brief

HMI design would not be complete without the use of alarms. Alarms should attract attention to notify users of an abnormal condition that requires a response, with an alarm banner used for the highest priority alarms. An unacknowledged alarm should use a blinking animation, requiring acknowledgement, and users should be able to see and filter all alarms in an alarm summary screen.

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