

TECHNOLOGY FIRST

JOURNAL VI

SAFETY

IMEMS
CONNECTORS
MOTOR CONTROL
H BRIDGE DRIVERS
DEVELOPMENT KITS
ENGINE MANAGEMENT
MOSFETS
MCUS
POWERTRAIN
SENSORS
CONTROLLERS

Transportation

Takes off

NETWORKING

FLEXRAY
CAN
LIN
MOST
INFOTAINMENT
DISPLAYS
AUDIO
LIGHTING
HB LEDS
DRIVERS
BODY & CHASSIS
SENSORS
ACTUATORS
SECURITY
TRANSMITTERS
RECEIVERS
COMMUNICATIONS
GPS
ANTENNAS

LIVEWIRE | MARKETWATCH | EMBEDDED CORNER
WORLDVIEW | ROADTEST | TECHTRENDS | GET TECH



Human-Machine Interface components for transportation

Source: EAO Switch Corporation

As transportation systems grow more complex, issues of end-product equipment safety, ease of operation and reducing the risk of human error are becoming extremely important. Designers today know that operational performance, efficiency and safety of public transport systems are closely related to the interaction between humans and machines, the human-machine interface (HMI).

The key drivers for the public transportation sector are reliability, longevity, safety, compliance with fire regulations and adherence to standards. Because these vehicles are constantly exposed to extreme weather conditions, vibration, high volume of passengers and vandalism, HMI solutions must fulfill the ergonomic and aesthetic requirements of the end users as well as the technical and economic value requirements of vehicle manufacturers.

Industry standards

The starting point for HMI solutions is a thorough knowledge of technical ergonomic design and manufacturing standards. These include human engineering standards, as well as HMI guidelines from industry organizations such as, ANSI, IEEE, ISO and others.

Industry criteria are also important, and include placement of components, legend size and color, emergency stop switch configuration, protection guards and other ergonomic factors that improve usability, efficiency and safety.

Working with an HMI supplier

The future development of HMI systems and products necessitates an end-application, solutions-orientated approach. Designing and integrating HMI control systems is a task often undertaken by specialized suppliers to complement the core capabilities of end-product manufacturers. Some manufacturers use an HMI supplier as an extension of their design team. For example, EAO is working with many transit-related manufacturers and transit authorities to achieve these goals.



The role of the HMI supplier is to develop products and solutions that align equipment and task, to assure that the end user and the technology work in complete symmetry. For the user, the benefit is clearly defined functionality and comfort of use, a critical key to reducing the likelihood of errors in operation and the dangers associated with poorly designed controls. Overall, it is the quality and the reliability of people, products and processes that combine to deliver the “human touch” that satisfies the demands of modern transportation ergonomics.

At the consultation stage, the HMI supplier should be tasked to include full concept, design and feasibility studies in any proposal. During application engineering, the HMI team will help the product manufacturer verify concepts and create prototypes by using the latest technologies.

HMI suppliers cannot work in isolation. An important consideration in the selection of an HMI supplier is the strength of the relationships that it has with its own suppliers, including plastics vendors, toolmakers, electrical and electronics engineers, industrial designers and ergonomics experts. All designs must be tested for quality and certification according to applicable standards.

Upon completion of a project, it is important that the HMI supplier fully records details of the project to ensure easy upgrading and remodeling of components for future projects. It is highly desirable to utilize a standard framework, each with a unique configuration for a given program.

Application considerations

For human engineering purposes, HMI specialists like EAO, encourage the consideration of several key areas: ergonomics, health and safety, performance and the presentation of information. It is essential to look beyond purely ergonomic requirements of an application and consider any environmental demands that are likely to be placed upon the end product.

To address the ergonomic risks associated with environmentally harsh applications, it is wise to consider stainless steel and durable polymer-based products that operate reliably under demanding conditions.

Where required, control products fabricated from these materials offer protection up to IP67 as well as resistance to heat, shock, vibration and vandalism. They are designed for minimal maintenance and deliver long-term value in terms of lifecycle cost benefit.

For example, EAO's Series 56 pushbuttons, commonly found as passenger access pushbuttons on light rail, buses and commuter rail vehicles, feature a bright front bezel, LED "halo" illumination and a large touch surface that can be supplied with Braille text for the partially sighted. The pushbutton immediately focuses user attention on the control. Pushbuttons featuring large actuation areas are also ideal for operators wearing large gloves. Materials utilized in this series are also resistant to the harshest graffiti cleaners available today.

In terms of safety and security, crew key switches protect against unauthorized access and act as additional safety controls. Each switch actuator is comprised of a unique rotor shape identified by the transit authority. Such special purpose keylock switches are ideal for harsh commuter and light rail environments and can be supplied in flush-mount designs for increased protection against vandalism. Passenger access is a major requirement as well; switches for doors and in toilet areas must be reliable, visible and easily operated. Wheelchair access requires that pushbuttons are fitted at certain heights and operable by palm.

The latest laser engraving technology makes it possible to incorporate intricate designs, such as symbols and fonts, into products. One of the main advantages of laser engraving over traditional molding and mechanical engraving methods is the precision and positional control afforded by the laser beam. Characters are resistant to wear, a significant benefit in applications subject to harsh



environments that require service life on the order of 15 to 30 years.

Integrating HMI components

Once specifications have been approved by both the HMI supplier and the client, they will form the basis for the production and supply of the right solution. Detailed drawings, parts lists, circuit diagrams and assembly instructions are then completed and production schedules agreed upon before manufacturing commences. Companies that employ modern design-to-manufacturing methods, such as CAD/CAM and concurrent engineering, can shorten product development cycles and cut production time to market.

The selection and seamless integration of HMI components, such as switch controls and indicators, are critical to the success of equipment designed for human operation. Utilizing a philosophy of control panel modularity with intermediate connector termination reduces end-product assembly costs and extends service life. Design engineers who develop HMI solutions with this in mind will deliver applications with additional transportation market advantage and greater sales potential.

Stringent regulations within the public transportation industry require HMI components meet the highest standards of safety, durability and functionality. Generally, components must:

- Comply with industry standards for shock, vibration, fire, smoke and toxicity emissions
- Provide highly visible illumination with dimming control and long life LED sources that can handle a wide operation voltage tolerance
- Have large touch surfaces suited for text, symbols and Braille
- Meet the needs of disabled users
- Be attractive and functional while vandal

resistant, with a positive tactile feedback tailored to specific transportation needs

Retrofits and half life projects

HMI "plug-and-play" products, used primarily in retrofits, provide functional versatility and time savings in these applications. HMI switch controls, rotary & linear actuators and indicators in modular designs can fulfill most requirements. Products can be flush mounted, providing protection against accidental operation, or raised for viewing from all sides.

Time is critical for retrofit projects. Replacing rocker switches with modern flush-mounted pushbuttons in the operator control console is a quick HMI solution with significant advantages. Pushbuttons are less susceptible to accidental actuation, improving operational safety. Their large, illuminated lens area has room for more legible markings and clearer indication of status to reduce operator error. In the passenger compartment, new LED information displays add safety and value to many retrofits.

Additional lens protection can be achieved with extended or sealed rings and lens caps. Lenses are available in a variety of colors together with film inserts for legends or symbols, and can be illuminated with high-intensity LEDs or incandescent lamps. A wide operating voltage tolerance of +25% to -30% ensures reliable performance.

Summary

The development of a successful HMI solution relies to some extent on a balancing act. Front-end consideration must be given to the engineering and financial constraints placed on a project, while the cost rewards to be gained from the investment also must be assessed. Employing high-quality design, best practices and proven techniques results in reliable HMI systems. ■

