

Human Machine Interfaces (HMIs): How to choose the right type of HMI for your project

Developing the ideal human machine interface (HMI) for any given application is about creating the desired experience based on the end user's requirements. That means product developers need to think about things like tactile response, cleanability, lighting (ambient and backlighting), actuation force, component flexibility and much more. Boyd helps manufacturers across industries design, develop and optimize HMI solutions. We can help you identify the right type of HMI for your application to create the ideal user experience.



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3 Types of HMI

There are three main types of HMIs to choose from: membrane switches with graphic overlays, elastomer keypads and capacitive touch switches. Each has its own advantages, disadvantages and customization options.

ELASTOMER KEYPADS

[Elastomer keypads](#) are flexible components with raised buttons that are an ideal choice when you need a switch with high-tactile feel and customizable feedback. Also known as rubber keypads or silicon keypads, these products can be customized to require different amounts of force to actuate buttons and can be produced with multiple durometers in the same piece. Elastomer keypads are lightweight and extremely durable and provide excellent weatherability in ruggedized environments. They are resistant to moisture and chemicals, and can endure temperatures ranging between -30°C to +80°C. Because of their durability and versatility, elastomer keypads are used in [aerospace applications](#), [defense vehicles](#), [medical devices](#) and equipment, and [eMobility](#) applications.



FEATURES

- **Optimal light diffusion and backlighting** – Raw silicone has a milky white color that's ideal for backlighting and dispersion of light. Boyd provides a wide range of [backlighting solutions](#) for full color, and our processes create a crisp legend with a variety of illumination options for varied user experiences in different lighting conditions.
- **One-piece, sealed surface construction** – Molded elastomer keypad products come as a single piece with a sealed surface to [prevent ingress](#) from dust, dirt, debris or other contaminants. This is ideal for outdoor environments or applications where ingress protection and ease of cleaning are important.
- **Design flexibility** – Boyd offers several design options to fit your needs, including plastic or metal bezels, display windows, multicolor and custom colors, durometer variance, printed, laser etched and/or backlit legends and icons.



MEMBRANE SWITCHES AND GRAPHIC OVERLAYS

[Membrane switches](#) are typically screen-printed on thin polyester using silver or carbon conductive ink. They are often combined with printed [graphic overlays](#) to create aesthetically pleasing HMIs. This creates an extremely thin stackup that is easy to clean and resistant to moisture, chemicals and abrasion. Boyd offers a wide range of design configurations including custom colors, textures, backlighting and tactile response options. Membrane switches are versatile, typically low-cost products, which is why they are used across nearly every industry for applications such as medical devices, control panels in aerospace and industrial equipment, consumer electronics and more.



FEATURES

- **Tactile feedback options** – Boyd creates membrane switches with tactile responses in a range of actuation forces and switch heights, or we can add fully embossed keys so users can easily distinguish individual buttons and feel each actuation.
- **Limitless graphics options** – Graphic overlays can be screen, flexographic or digitally printed to display nearly any color or graphics. Boyd provides color matching to create the ideal branded experience. This design flexibility makes this type of HMI ideal for applications that require complex graphics or unique designs.
- **Display windows and backlighting** – Boyd can create membrane switches with windows for digital displays, as well as integrate backlighting systems using LEDs or other types of illumination. These design options make membrane switches well suited for low-light environments and applications that require both digital displays and tactile user controls.



CAPACITIVE TOUCH SWITCHES

[Capacitive touch HMIs](#) can be produced with several different options. The first option is assembling an LCD display with a touchscreen. For the most durable solution, the touchscreen and LCD are assembled using an optically clear adhesive. Many times, a decorative piece of glass will also be assembled to the top surface to give the user a higher end experience. This capacitive touch solution gives you a more rigid display that can be mounted on a variety of pieces of equipment or products.

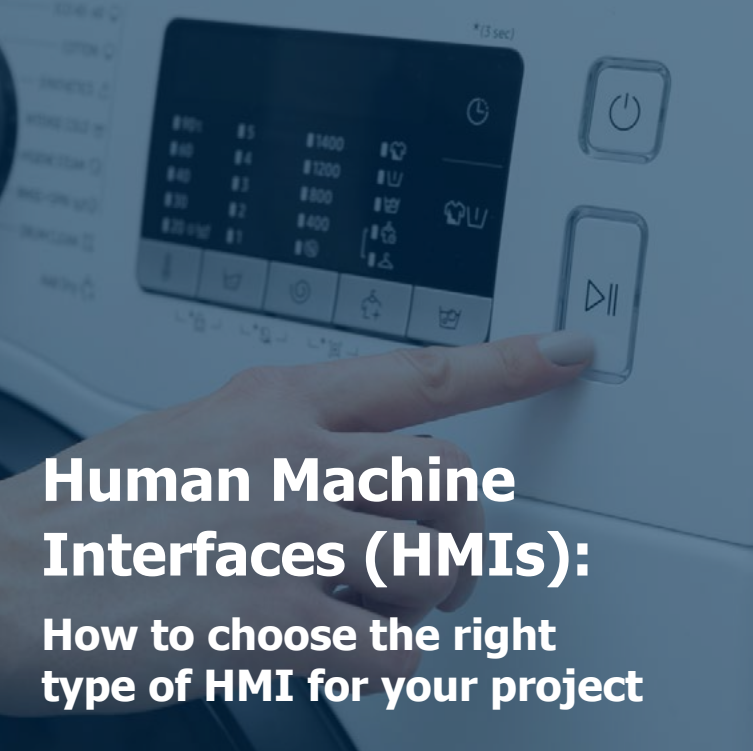


The second capacitive touch solution is a flexible circuit. Like a membrane switch, except there are no moving parts. There are many benefits to a flexible capacitive touch HMI including excellent durability, sleek, modern design options, easy cleanability and more. Creating these solutions involves printing a graphic overlay and then attaching that with a 3M adhesive layer to a capacitive touch circuit. The result is an extremely thin stack-up construction of capacitive sensors that is well suited for consumer electronics like tablets, medical devices such as monitoring devices, and many other applications.



FEATURES

- **Long switch life** – Because there are no moving parts in a capacitive touch HMI, the switch life is essentially infinite. By eliminating any metal domes, embossed buttons, or other parts that need to move to create the tactile response, the mean time between failure (MTBF) is basically infinite, making these solutions ideal for products with a long lifespan.
- **Easy cleanability** – The finished product appears as a single flat surface without cavities that can trap dust, dirt or other contaminants. The materials typically used for the top layer are also chemical resistant. This makes capacitive touch HMIs well suited for applications that require frequent, thorough cleaning, such as medical devices.
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ELASTOMER KEYPAD MATERIALS

- Silicone
- Silicone inks
- Silicone adhesives
- Differential adhesives
- Printed circuit board assembly
- Printed silver circuit assembly
- Polyimide circuits

MATERIALS

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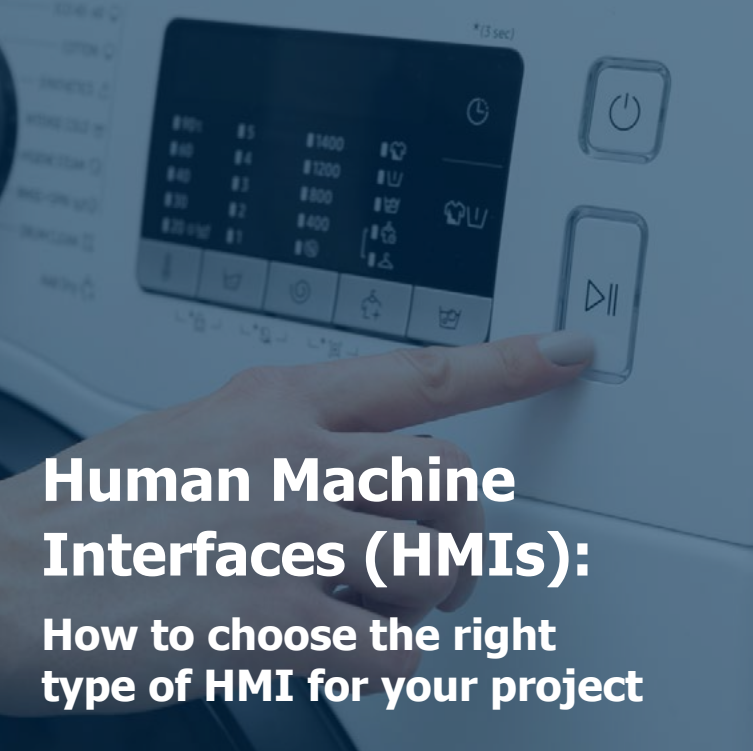
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MATERIALS

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- Military vehicles
- Construction equipment
- Industrial controllers
- Instrumentation products
- Medical products



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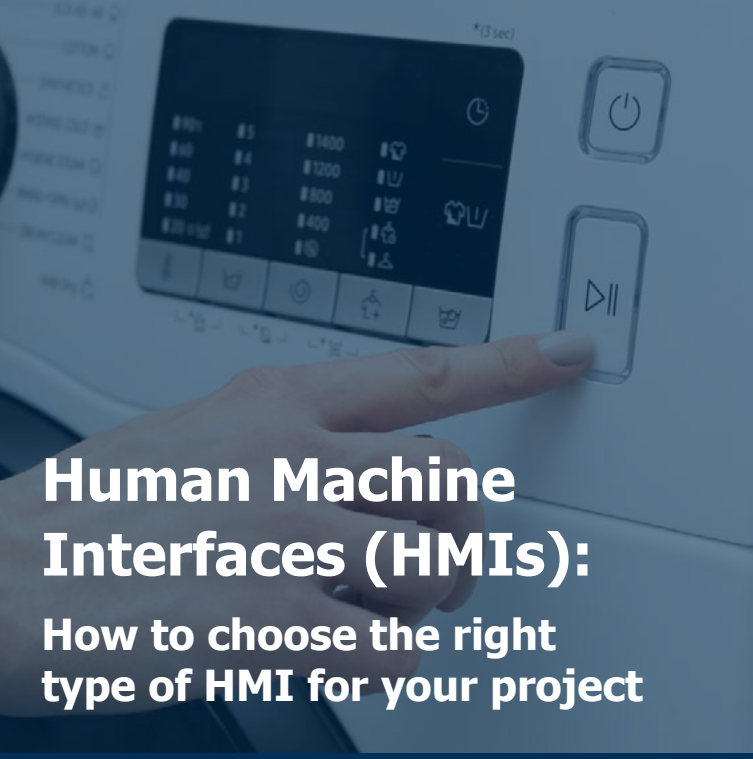
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MEMBRANE SWITCHES AND GRAPHIC OVERLAYS

MATERIALS

- Polyester (PET)
- Silver and carbon conductive inks
- Dielectric inks
- Thin plastic films
- Structural adhesives
- Metal domes

MATERIALS

EXAMPLES



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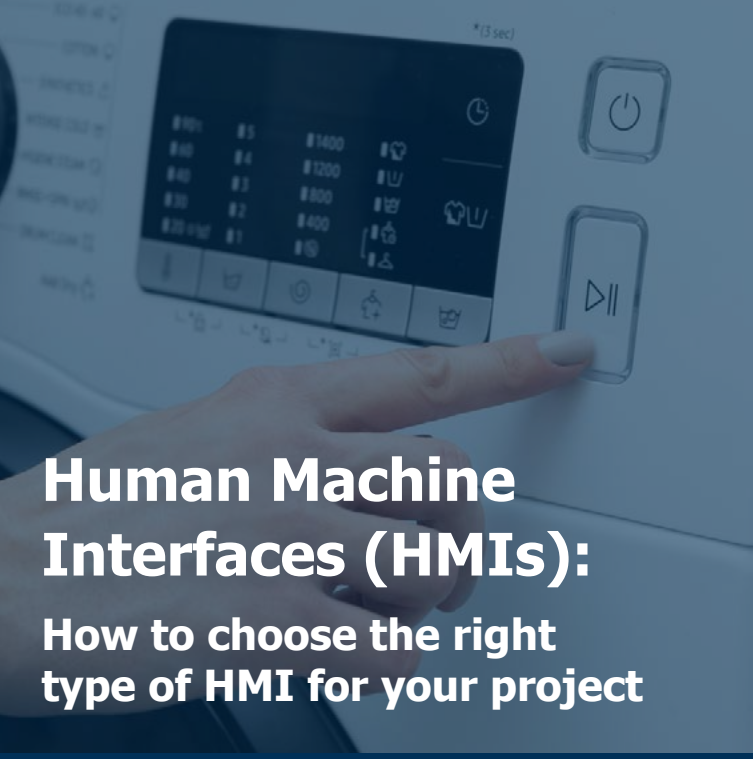
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EXAMPLES

- Home appliances
- Gym equipment
- Door access panels
- Industrial controllers
- Medical devices
- Outdoor control panels

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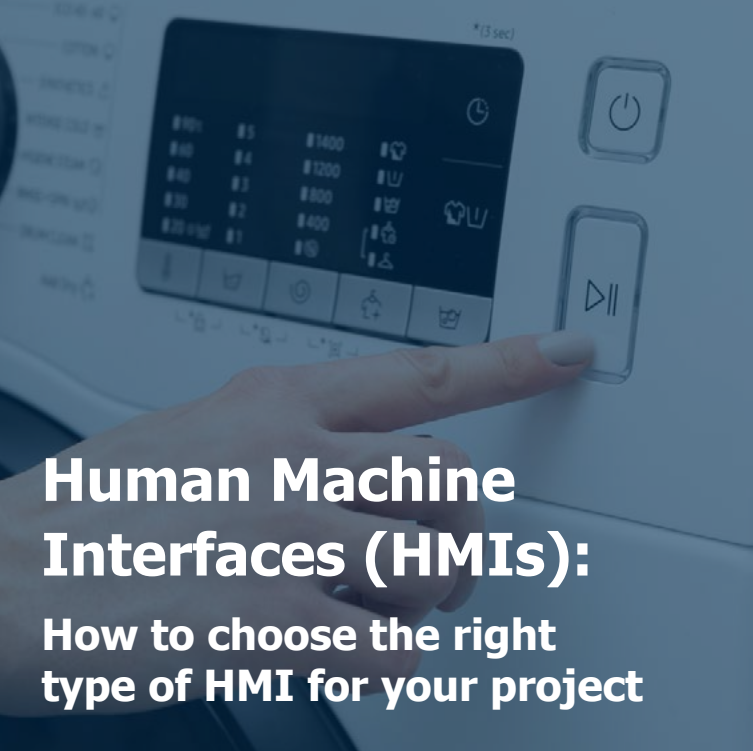
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MATERIALS

- Carbon ink, silver ink, and/or polymer conductive transparent inks
- Dielectric inks
- Polyester
- Polycarbonate
- Glass
- Acrylics
- Optically clear adhesives
- Pressure-sensitive adhesives
- Capacitive touch circuits
- PCBA circuits

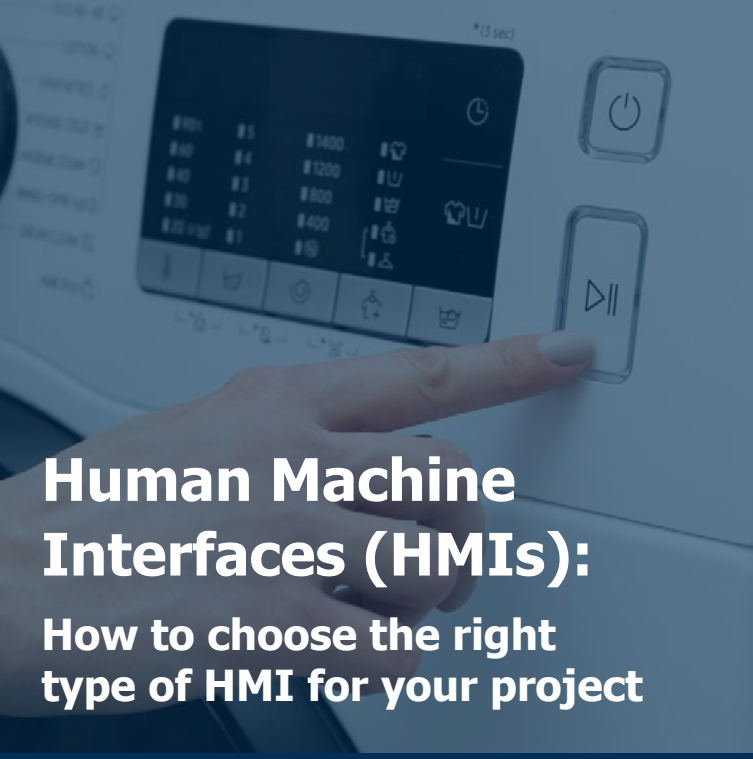
MATERIALS

EXAMPLES

FEATURES

- **Long switch life** – Because there are no moving parts in a capacitive touch HMI, the switch life is essentially infinite. By eliminating any metal domes, embossed buttons, or other parts that need to move to create the tactile response, the mean time between failure (MTBF) is basically infinite, making these solutions ideal for products with a long lifespan.
- **Easy cleanability** – The finished product appears as a single flat surface without cavities that can trap dust, dirt or other contaminants. The materials typically used for the top layer are also chemical resistant. This makes capacitive touch HMIs well suited for applications that require frequent, thorough cleaning, such as medical devices.
- **Diverse feedback options** – Capacitive touch switches can be customized to provide visual, auditory or haptic feedback when actuating controls. Boyd also offers backlighting and dead front options for optimal user experiences in all types of ambient lighting.





Human Machine Interfaces (HMIs): How to choose the right type of HMI for your project

Developing the ideal human machine interface (HMI) for any given application is about creating the desired experience based on the end user's requirements. That means product developers need to think about things like tactile response, cleanability, lighting (ambient and backlighting), actuation force, component flexibility and much more. Boyd helps manufacturers across industries design, develop and optimize HMI solutions. We can help you identify the right type of HMI for your application to create the ideal user experience.



Work with Boyd to develop the ideal HMI solution and optimize the user experience.

Contact us to start your next project today.

www.boydcorp.com

3 Types of HMI

There are three main types of HMIs to choose from: membrane switches with graphic overlays, elastomer keypads and capacitive touch switches. Each has its own advantages, disadvantages and customization options.

ELASTOMER KEYPADS

[Elastomer keypads](#) are flexible components with raised buttons that are an ideal choice when you need a switch with high-tactile feel and customizable feedback. Also known as rubber keypads or silicon keypads, these products can be customized to require different amounts of force to actuate buttons and can be produced with multiple durometers in the same piece. Elastomer keypads are lightweight and extremely durable and provide excellent weatherability in ruggedized environments. They are resistant to moisture and chemicals, and can endure temperatures ranging between -30°C to +80°C. Because of their durability and versatility, elastomer keypads are used in [aerospace applications](#), [defense vehicles](#), [medical devices](#) and equipment, and [eMobility](#) applications.



MATERIALS

EXAMPLES

FEATURES

- **Optimal light diffusion and backlighting** – Raw silicone has a milky white color that's ideal for backlighting and dispersion of light. Boyd provides a wide range of [backlighting solutions](#) for full color, and our processes create a crisp legend with a variety of illumination options for varied user experiences in different lighting conditions.
- **One-piece, sealed surface construction** – Molded elastomer keypad products come as a single piece with a sealed surface to [prevent ingress](#) from dust, dirt, debris or other contaminants. This is ideal for outdoor environments or applications where ingress protection and ease of cleaning are important.
- **Design flexibility** – Boyd offers several design options to fit your needs, including plastic or metal bezels, display windows, multicolor and custom colors, durometer variance, printed, laser etched and/or backlit legends and icons.



MEMBRANE SWITCHES AND GRAPHIC OVERLAYS

[Membrane switches](#) are typically screen-printed on thin polyester using silver or carbon conductive ink. They are often combined with printed [graphic overlays](#) to create aesthetically pleasing HMIs. This creates an extremely thin stackup that is easy to clean and resistant to moisture, chemicals and abrasion. Boyd offers a wide range of design configurations including custom colors, textures, backlighting and tactile response options. Membrane switches are versatile, typically low-cost products, which is why they are used across nearly every industry for applications such as medical devices, control panels in aerospace and industrial equipment, consumer electronics and more.



MATERIALS

EXAMPLES

FEATURES

- **Tactile feedback options** – Boyd creates membrane switches with tactile responses in a range of actuation forces and switch heights, or we can add fully embossed keys so users can easily distinguish individual buttons and feel each actuation.
- **Limitless graphics options** – Graphic overlays can be screen, flexographic or digitally printed to display nearly any color or graphics. Boyd provides color matching to create the ideal branded experience. This design flexibility makes this type of HMI ideal for applications that require complex graphics or unique designs.
- **Display windows and backlighting** – Boyd can create membrane switches with windows for digital displays, as well as integrate backlighting systems using LEDs or other types of illumination. These design options make membrane switches well suited for low-light environments and applications that require both digital displays and tactile user controls.



CAPACITIVE TOUCH SWITCHES

[Capacitive touch HMIs](#) can be produced with several different options. The first option is assembling an LCD display with a touchscreen. For the most durable solution, the touchscreen and LCD are assembled using an optically clear adhesive. Many times, a decorative piece of glass will also be assembled to the top surface to give the user a higher end experience. This capacitive touch solution gives you a more rigid display that can be mounted on a variety of pieces of equipment or products.



The second capacitive touch solution is a flexible circuit. Like a membrane switch, except there are no moving parts. There are many benefits to a flexible capacitive touch HMI including excellent durability, sleek, modern design options, easy cleanability and more. Creating these solutions involves printing a graphic overlay and then attaching that with a 3M adhesive layer to a capacitive touch circuit. The result is an extremely thin stack-up construction of capacitive sensors that is well suited for consumer electronics like tablets, medical devices such as monitoring devices, and many other applications.

MATERIALS

EXAMPLES

FEATURES

- **Long switch life** – Because there are no moving parts in a capacitive touch HMI, the switch life is essentially infinite.
- **Easy cleanability** – The smooth surface without cavities or recessed areas makes the materials typically used in capacitive touch HMIs resistant. This makes them ideal for applications that require frequent, thorough cleaning.
- **Diverse feedback options** – Capacitive touch switches can be customized to provide visual, auditory or haptic feedback when actuating controls. Boyd also offers backlighting and dead front options for optimal user experiences in all types of ambient lighting.

EXAMPLES

- [Medical devices](#)
- [ATMs](#)
- [Tablets](#)
- [Industrial controllers](#)
- [Instrumentation products](#)
- [Automotive applications](#)

