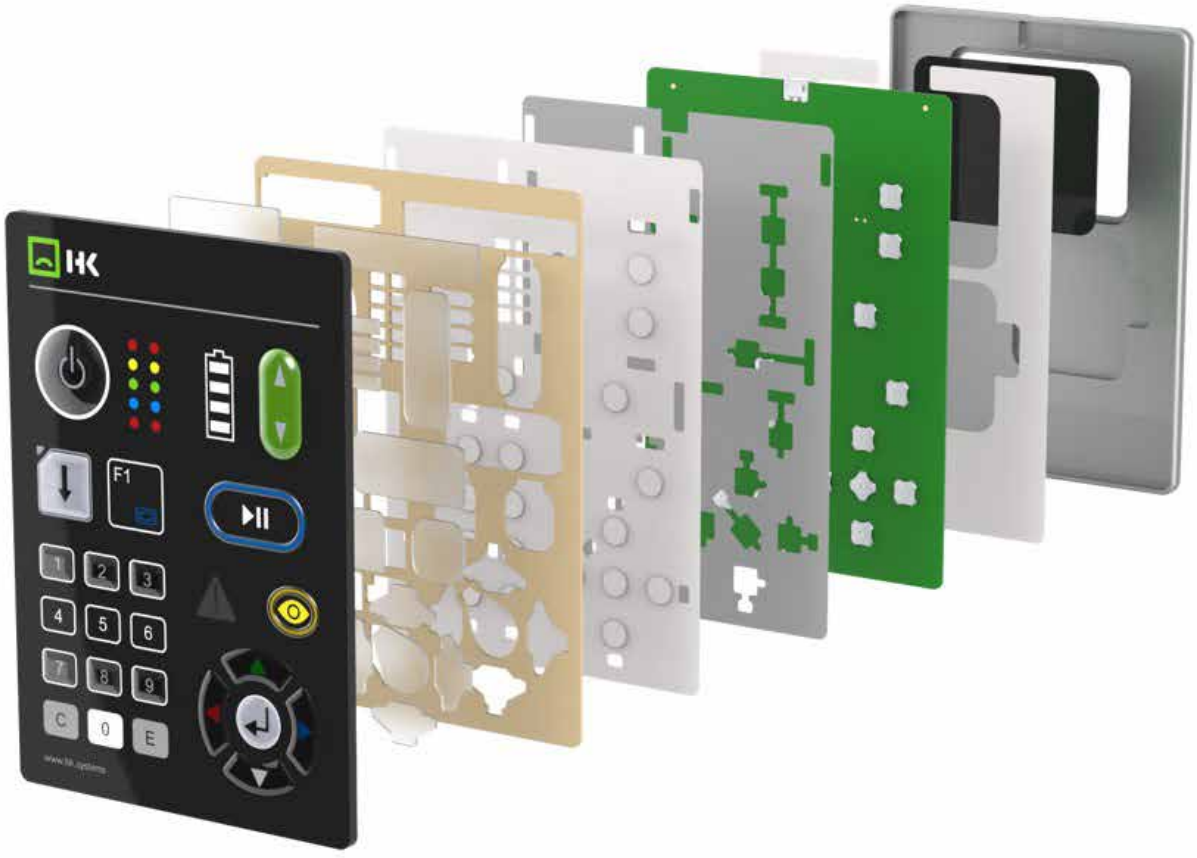
Hoffmann + Krippner

HARMONY BETWEEN MAN AND MACHINE

E-BOOK
DESIGN GUIDE BLOG SERIES 1-6



HARMONY BETWEEN MAN AND MACHINE...

Whether membrane switches, touchscreen or a combination of both, input devices and user-interfaces are about more than just functional effectiveness - they also impact user experience.

Complete user interface solutions determine how users and operators value devices and equipment. Every aspect of the user's interaction including visual, acoustic and tactile should be taken into consideration by hardware and design engineers during the early design and development phase.

Machines with aesthetically pleasing designs are more likely to be used and better rated.

Our design guide blog series in a downloadable e-book

In addition to our **"Design Guide To Your Perfect User-Interface"**, the blog series guides readers through a comprehensive overview of the design elements that need to be considered when designing the perfect HMI. We have combined the blog series in this easy accessible and downloadable e-book.

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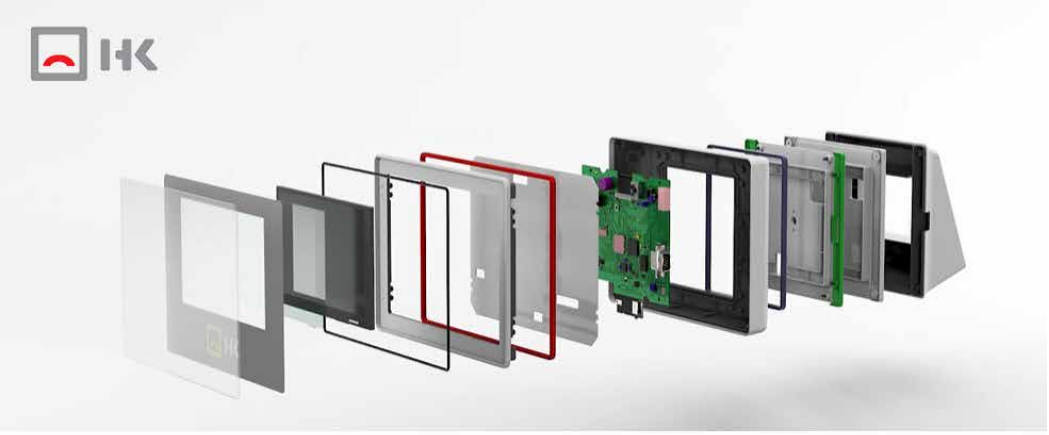
DOWNLOAD THE COMPREHENSIVE DESIGN GUIDE HERE:
>>https://www.hoffmann-krippner.com/membrane-switch-design-guide/



>>> DESIGN GUIDE SERIES #1

A BIG PICTURE LOOK AT WHAT'S NEEDED TO DESIGN A SUCCESSFUL HUMAN-MACHINE INTERFACE

Building a new product or machine is a nontrivial undertaking. If the manufacturer wants to be successful, they have to consider a dizzying array of factors and make countless design decisions. Then, each and every one of those decisions must support the underlying function of the machine.

This is doubly true when it comes to the point of interface between the product and its human user. Every element of the user's interaction with the machine – including visual, acoustic, tactile, and other sensory modes of input and output – must be weighed by both mechanical and design engineers during the early design and development phase. Otherwise, the manufacturer risks creating a product that is less functional, less pleasing, and less successful.

Because there are so many different factors to consider, and many of those design elements are aesthetic or stylistic (particularly when it comes to the human-machine interface, or HMI), it's easy to overlook or underestimate many of them. For that reason, in this new design guide series, we're going to provide a comprehensive overview of the design elements that need to be considered when designing your perfect input solution.

- In Part 2 (the next article in the series), we'll start by looking at the relationship between product design and how the HMI facilitates (or fails to facilitate) the manufacturer's ultimate goals.
- In Part 3, we'll step back and consider the machine's human operators in more detail. What do they need from the machine from a design perspective? The issue is that design decisions can impact everything from safety to accuracy to productivity to usability.
- In Part 4, we'll look at aesthetic and stylistic considerations. This is more important than merely deciding "how it looks." It's about the impression the machine makes on users, how well it communicates with them, and how easy it makes their lives.
- In Part 5, we'll start getting into the nitty-gritty of the design with a look at the guts of the machine: its electronics. It's critical to answer fundamental questions about the electronics to ensure it can fulfill its function and meet the designer's goals.
- Finally, in Part 6, we'll look at the operating environment. For example, does the machine need to be able to weather outdoor conditions? What kind of application environments have design implications that need to be addressed during the design process?

In short, this series will run readers through the same basic process through which we'd walk any customer who wants to build a new product. We'll look at the relevant questions step by step until we have a clear vision and solid design guidelines for that product. In the meantime, if you'd like an additional in-depth guide into the various components and specifications that should be considered when designing and developing your next input device – please download our **"Design Guide To Your Perfect User-Interface"**.

>>> DESIGN GUIDE SERIES #2

ACHIEVING HARMONY BETWEEN MAN AND MACHINES IN DESIGN

It's important to understand why design can have a significant impact on the development of the perfect machine – and the perfect user interface.

Many product engineers approach building a new machine or device primarily from a mechanical, functional point of view. They want to make sure the product works and fulfills its intended purpose. They care about design only insofar as it impacts functionality.

However, no machine can be maximally effective in achieving its objectives if it's not designed in a way that also facilitates success for its human operators. In other words, if its human users aren't successful in what they're trying to do with the machine, the machine won't be successful. Thus, the human-machine interface (HMI) is particularly critical to get right, and every aspect of the design should harmonize the relationship between the machine and its users.

As we've written before, "The marriage of design and mechanics yields optimal products."

What does this mean in the real world? Well, consider some simple scenarios in which poor design choices compromise product function and performance.

- Buttons aren't clearly labeled, or are too close together, so that users routinely press the wrong one.
- Inputs are insufficiently responsive, so that it takes multiple tries to get the machine to perform correctly.
- The interface is confusing, unclear, hard to read, or hard to interpret, leading users to make mistakes or to unnecessarily slow down their operation of the product, reducing satisfaction and productivity.
- Users can't tell if their inputs were accurately captured, so they have to slow down or stop to check.
- Alerts don't catch the user's attention because they're too quiet or are hard to see, or they don't trigger the right behavior in the right way (e.g., a fast, correct response in an emergency situation).
- Design interferes with operation. For example, the batteries or power source can't be changed without powering down the device, or even taking the device apart.

How can product engineers avoid these kinds of design failures?

Always start by defining strategic goals and work backwards, but make sure the goals address the human user's needs too. It's not just about what the machine does; it's about what its human user needs in order to be successful with the product or machine.

>>> DESIGN GUIDE SERIES #2

ACHIEVING HARMONY BETWEEN MAN AND MACHINES IN DESIGN (CONT'D)...

Since almost every design-related choice point will have multiple options available (see our **"Design Guide To Your Perfect User-Interface"** for a thorough look at all the options available in components and specifications), clearly articulated goals can serve as a compass to guide design decisions. For example, requirements around input responsiveness and tactility might drive the decision between a touchscreen and a membrane switch for the interface. If every option has consequences both functional and aesthetic, then weighing them against the ultimate end-goal can help clarify which option to choose.

We'll get more into the nitty-gritty of design options in future posts in the series. In our next post, though, we're going to do a deeper dive into the human element of machine design.

Visit Relevant Blog Post Here:
>>Achieving Harmony Between Man and Machine in Design

THE PSYCHOLOGY OF USER EXPERIENCE AND ITS IMPACT ON HMI DESIGN

In our previous post in this series, we noted that it's key to think through how the device or human-machine interface (HMI) will be used and for what purpose. From there, designers must consider how the marriage of mechanical engineering and design engineering can support that goal.

In service of that idea, we also noted that it's critical to think about the machine's human dimension and particularly about harmonizing the HMI. Today, we're going to take a deeper look at that question and how it intersects with human psychology. Specifically:

- How does the device trigger or facilitate desired behaviors in its human users?
- How does it minimize or eliminate undesirable behaviors or outcomes?
- What kind of user experience does it create?

If the physical components of an HMI (whether a membrane switch, capacitive switch or touchscreen) make it hard to operate the machine correctly and as desired, the design will cause problems and frustrate users. These issues can range from trivial (e.g., constantly pushing the wrong button to increase or decrease volume) to tragic (causing users to miss catastrophic safety alerts). It will also affect whether the user likes using the product – a critical element of design (and market) success.

Facilitating desired behaviors:

Users must be able to operate the device or machine effectively and safely, and the operator must be able use telemetry from the interface effectively to make good operational decisions. For example, think about driving a vehicle. The steering wheel, braking system, and all of the telemetry provided by the dashboard serve as the HMI. Drivers might apply the brakes in response to information from the speedometer, alerts generated by the dashboard, or other data. Or proximity sensors and related alerts might push the driver to swerve if another car is nearing. In both cases, the interface has helped them to drive more skillfully and responsively.

Minimizing or eliminating undesired behaviors or outcomes:

The product design must also recognize the realities of working with humans. For example, inadequate alerting – too slow, too quiet, too subtle – will delay emergency response times. Humans need bright colors and loud noises to catch their attention! Intermittent or inadequate responsiveness in the interface will also compromise performance. Imagine if a car only slowed sometimes when pressing the brakes, or if the driver always had to slam the brakes even just to slow incrementally, leading to sometimes over-braking and sometimes under-braking. That wouldn't result in just an unpleasant driving experience, it could cause potentially catastrophic harm.

>>> DESIGN GUIDE SERIES #3

THE PSYCHOLOGY OF USER EXPERIENCE AND ITS IMPACT ON HMI DESIGN (CONT'D)...

User experience:

It's important to understand that both of the above questions impact how the user experiences the device. A mechanical engineer might only care about what the machine does, but the user also cares about how it feels. If information and operational controls are clear, easy to find, and easy to use, the experience will be more satisfying and less frustrating. Users will be more likely to use the device as intended and to produce desirable outcomes more reliably. They'll also like using the product more, which can impact market success. As Amy Bucher, a psychologist and Associate Director of Behavioral Science for Wellness & Prevention, Inc., a Johnson & Johnson Company, says, "Sleek technology and elegant functionality increase product appeal. But to really hook users with your product, help fulfill their psychological needs."

In our next post in this series, we'll look at how these questions translate into aesthetic and stylistic design considerations. In the meantime, if you'd like an additional in-depth guide into the precise components and specifications that should be considered when designing and developing your next input device, please download our **"Design Guide To Your Perfect User-Interface".**

Visit Relevant Blog Post Here:

>>The Psychology of User Experience and Its Impact on HMI Design

>>> DESIGN GUIDE SERIES #4

AESTHETIC CONSIDERATIONS FOR THE PERFECT HUMAN-MACHINE INTERFACE DESIGN

In our previous post of this series on designing the perfect human-machine interface (HMI), we discussed user experience and the psychological aspects of the HMI. Today, we're going to take a deeper dive into the dimension of product design with the most tangible impact on user experience: aesthetics.

Aesthetics may seem secondary to functionality, but don't underestimate its importance. Beyond just "look and feel," aesthetics will impact user experience, satisfaction, and even loyalty. That's because aesthetics impact usability as much as style and branding. Consider the following questions.

The look of it: does the HMI cultivate the right impression?

Think about Apple products, like the iPhone or iPad. These sleek, futuristic devices stand out when compared to more generic third-party products. That's partly why Apple customers are willing to pay a premium and stay loyal to a single brand. Further, visual appeal can materially impact not only the user's impression of the machine, but also the impression made on anyone else who sees it. All of this means that design aesthetics can have significant business implications.

The feel of it: does the HMI promote good user experience?

Even design choices that don't affect function can still affect usability. Hoffmann + Krippner's GT Technology, for example, promotes greater tactile feedback whenever a user pushes a membrane switch button. Such feedback makes the machine more pleasing to use, reduces errors, and saves time because users don't have to double-check their inputs for accuracy. In fact, virtually all aspects of aesthetic design – color schemes, embossing options, surface treatments, LED lighting options, etc. – can impact how successful users are when interacting with the machine.

The sheer experience of it: does the HMI please the user?

This question is actually about more than just ensuring that users have a pleasing experience with the device. The overall aesthetic experience of the device can influence whether it even works properly in the intended application environment. We'll talk more about this is the final post in this series; but for the moment, just know that aesthetic design choices can impact how much work it takes to interact with the machine, how long the equipment lasts, and how easy it is to use overall.

>>> DESIGN GUIDE SERIES #4

AESTHETIC CONSIDERATIONS FOR THE PERFECT HUMAN-MACHINE INTERFACE DESIGN (CONT'D)...

For example, touchscreens provide less feedback to the user unless you add acoustic or visual feedback elements. Display size and placement impact the ease with which users can operate the machine and gather information from it. Control configuration can affect precision of inputs. Lighting options affect visibility and clarity. Some options have longer lifespans than others. Some options have different power requirements. And so on.

Ultimately, building the perfect HMI is like piecing together a puzzle, and there's often no right answer to these questions – and seemingly no end to the available options. Because every choice has both advantages and disadvantages, it's imperative to ensure you understand your choices.

So, what are the specific aesthetic options that can impact all of these things? For more information about your choices, please download our **"Design Guide To Your Perfect User-Interface".**

Visit Relevant Blog Post Here:

>>Aesthetic Considerations For the Perfect Human-Machine Interface Design

>>> DESIGN GUIDE SERIES #5

WHAT ARE ELECTRONICS-RELATED CONSIDERATIONS FOR THE PERFECT HUMAN-MACHINE INTERFACE

In the previous post in this series on designing the perfect human-machine interface (HMI), we took a brief look at aesthetic and stylistic considerations when designing the HMI and discovered it's more important than just "how it looks." Today, we're going to dive into the guts of the machine: its circuitry and electronic components. Here, we need to understand what options exist to ensure that the machine and its HMI can fulfill its intended function.

If the previous post was truly about design, today we'll begin to see the marriage between design and engineering in practice. The electronic elements of the machine are critical, for example, to ensuring optimal performance and data exchange. But how do you do that? There are many, many options when it comes to the circuitry that powers operation of the machine – see our downloadable design guide for more on the available possibilities – and every decision has enormous implications for how the product will ultimately perform.

How do the operating conditions impact how the electrical functions work?

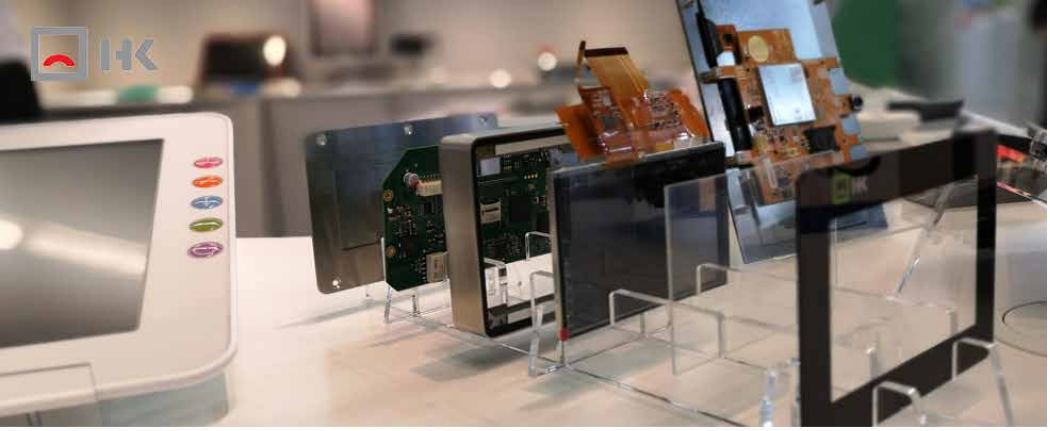
We'll discuss the impact of the operating environment in more detail in the next post in this series, but it's worth noting that the electronics can be affected by operating conditions. Aspects of the environment like temperature, humidity, or the presence of electromagnetic interference may require specialized design options (e.g., EMI shielding or IP-rated enclosures) to preserve optimal electronic function.

What kind of power delivery network is available, and what is the max power that can run through the circuitry?

Different functions may place different power demands on the machine; and different operating environments may limit or constrain power availability. That can have a determinative effect on which electronic options you choose and how (and even where) it's incorporated into the equipment.

What is the larger electronic ecosystem into which the machine will operate?

This is an especially important question if the machine will be used in an Internet of Things (IoT) deployment, where it will connect to and communicate with other machines while relaying its own data to a central database. In this case, the machine must integrate the appropriate communication capabilities into the device.



>>> DESIGN GUIDE SERIES #5

WHAT ARE ELECTRONICS-RELATED CONSIDERATIONS FOR THE PERFECT HUMAN-MACHINE INTERFACE (CONT'D)...

What physical space is available for the machine?

Size and volume requirements can conflict with space allocation, and re-sizing a machine to fit into available space can impact component selection and placement. Some HMI formats are relatively thicker or bulkier (like traditional circuit boards), while others can be thinner and even bendable (like printed foils).

What are the service demands required of the machine?

Different electronic options can affect manufacturability; durability and operating lifespan; future serviceability, maintenance, and repair; and futureproofing (e.g., making it easier to replace or upgrade components so the machine can continue to fulfill its function for as long as possible).

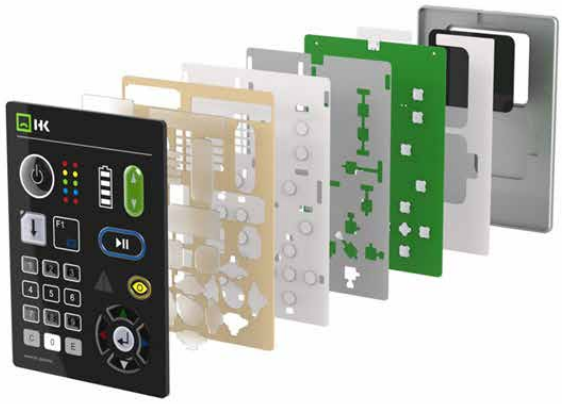
What are the secondary implications of your choices?

Choosing the right electronic components can be like working with puzzle pieces where all the shapes keep moving. For instance, you might want the flexibility of a printed foil or membrane switch that allows for use with a curved surface, but if you also want backlighting using side-LEDs, you need a circuit board. Or you might prefer the stability and mounting options that come with the circuit board, but if you need ultra-thin circuitry due to space constraints, you might favor printed electronics.

How do you piece together this puzzle? For help figuring out the right electronic components for your machine and HMI, please download our **"Design Guide To Your Perfect User-Interface".**

Visit Relevant Blog Post Here:

>>What are Electronics-Related Considerations for the Perfect Human-Machine Interface



>>> DESIGN GUIDE SERIES #6

THE IMPLICATIONS OF APPLICATION ENVIRONMENT WHEN DESIGNING THE PERFECT HUMAN-MACHINE INTERFACE

In the previous post in this series on designing the perfect human-machine interface (HMI), we looked at the nitty-gritty of machine design: its electronics. Today, in our final post of this series, we're going to assess the operating environment and its implications for HMI design. Some questions that you might need to evaluate include the following.

Does it need to be able to weather outdoor conditions?

If the machine is going to be exposed to the elements, including rain, sunlight, and temperature fluctuations, it can have profound obligations for how the machine is housed and how its delicate components, like its HMI, are protected. This kind of setting will necessitate that the machine be fully sealed, likely IP-rated, and will require an enclosure that can withstand the conditions.

Will it be exposed to extreme conditions?

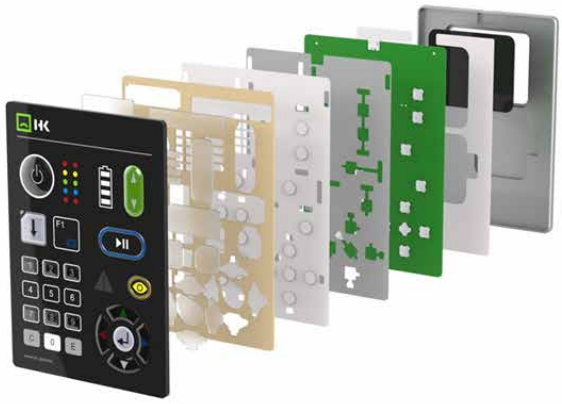
Whether outside or indoors, if the machine is expected to perform under particularly difficult or unusual conditions – like exposure to temperature extremes, radiation, cleanroom environments, and so on – it needs to be built with that scenario in mind. Ultimately, the machine is only going to be able to endure the conditions that its weakest component can handle.

Will sanitation or hygiene be a consideration?

For some industries, it's critical to ensure the ability to clean and sanitize the machines, particularly where the human operators might touch it. This includes both food production and medical environments. Different options can profoundly affect this aspect of the machine. For example, porous materials like rubber are difficult to disinfect and make good homes for microbes. By contrast, a machine that's easy to disinfect even with strong cleaning agents at a wipe will be preferable in this kind of environment.

Does the operating environment affect how the user will interact with the machine?

For example, if the machine is going to be placed in environments where human users are wearing personal protective gear, like heavy work gloves, that will make some interface options less helpful. For example, some types of touchscreens won't be able to detect inputs from gloves. In those cases, a physical switch, like a membrane switch, would work better. It's not just touch, either; if users have to wear goggles or other protective gear around their face, such protective gear can limit visibility, which may mean the HMI needs to be even brighter, larger, or somehow more visible than it would otherwise be.



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THE IMPLICATIONS OF APPLICATION ENVIRONMENT WHEN DESIGNING THE PERFECT HUMAN-MACHINE INTERFACE (CONT'D)...

Does the operating environment introduce risk to the human user or the machine?

This question has two dimensions – safety to both operator and to the machine itself. Machine design should help to protect both users and the machine itself from breakdown or other harm. If operating in a high-risk environment, designers need to consider what build options will protect both the machine and its users. They may need plastic enclosures rather than metal, for example, to prevent static charge buildup. Or they may need to use materials that are fire resistant or retardant. IP-rated enclosures may be necessary to seal the machine from its external environment. And so on.

How do you understand the design implications of your intended application environment? For help understanding your options, please download our **"Design Guide To Your Perfect User-Interface".**

Visit Relevant Blog Post Here:

>>The Implications of Application Environment When Designing the Perfect Human-Machine Interface

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