DESIGN MARK

ENGINEERED FOR PERFECTION

Design Guide

For
Membrane Switch Overlays
Control Panel Assemblies
Graphic Overlays

Over 30 years of design and production of membrane switches, graphic overlays, control panel assemblies and other user interface needs. Design Mark provides the depth of experience necessary to engineer solutions that meet and exceed your requirements. Proficient in difficult, demanding, and mission critical environments.

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Design Mark partners with your company's design team and other team members to be sure that communication is maintained through all phases of design, production and delivery of your membrane switch overlays.

- Membrane switch technology is an extraordinarily reliable human interface with multiple advantages .
- The sealed overlay makes the membrane switch the ideal environmentally reliable interface choice.
- Design Mark' membrane switches are custom engineered to provide a low tooling cost.
- Low cost, long life, low profile construction, and great flexibility in graphic and electrical design are a few of the reasons to prefer membrane switches.
- High tech look, smooth tactile feel, easy to clean surface, chemical and abrasion resistance, and ease of service or replacement are a few reasons why users prefer membrane switches.

Design and Manufacturing Services

Design Mark offers an immense number of options for every unique membrane switch assembly for a wide range of customers.

- Embossing
- Debossing
- Window cutout and lens coating
- Polyester and polycarbonate material
- Multiple tactile dome options
- Shielding options
- Static discharge shielding
- Radio frequency interface shielding
- 100% testing requirements
- 100% cosmetic inspection requirements
- Resistor options
- Tactile and non-tactile options

- Multiple connector styles
- Backlighting
- Pressure sensitive and mounting adhesives
- Color matching technology
- Ultraviolet hardcoats
- Laser cutting
- Screen printed flex circuits
- Embedded LED's
- Environmentally sealed options
- Liquid sealed options
- Sub Panel assembly

Design Mark is the supplier of choice for hundreds of manufacturers and design teams. Call today and our engineering and design team will get your next project done.

Polycarbonate or Polyester

We can choose a variety of overlay materials for your overlay depending on the end user application and environment.

Polycarbonate is commonly used and is easy to die cut and print on, however may show signs of   wear after 100,000 actuations. If the environment the membrane switch is to be used is subject to chemicals, a hard coat should be used for protection.

Polyester is a more resilient material that shows no sign of wear after 1,000,000 actuations. It   also has superior resistance to chemicals and harsh environments. We provide a list of materials and their speci c properties on Page 9.

Added Durability

Both polycarbonate and polyester in their raw form are susceptible to scratching. We recom   mend UV or other forms of hard coating to increase the durability of your overlay.

Embossing

Embossing is often used to raise the keys o   the background of the overlay portion of the   membrane switch. The maximum height of the embossing is approximately 2 ½ times the thickness of the material. Ridge Embossing is used to raise the perimeter of the key to add a "border" e ect to the key and must be at least 0.030" thick with an inside radius of 0.030" to prevent overstretching of the material. Plateau Embossing is used to raise the entire key surface on the overlay and, again a radius of 0.030" must be maintained.

Embossing can be decorative like a logo or a border, or it can be functional as on a keypad. A male and a female die is created for a crisp emboss. Embossing adds functionality and aesthetically to the membrane switch.

Pillow Emboss

Ridge Emboss
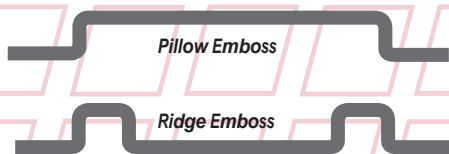
Faceplate Options

The more we know about the physical environment in which the membrane switch will operate, the better our engineers and yours can create a long lasting human interface that stands up to the environment. If there will be chemical spillage, lets talk. We can recommend the best material to use.

Windows may be added for LCD displays, the windows can be smoked or clear, printed color dyes can be added to produce red, green, yellow or other tinted LD displays.

You can choose a textured material, or choose a glossy material and add selective texture over the entire panel except for the windows. Tiny LED windows in most cases do not need to be free of texture, but you may specify clear untextured LED windows.

Non - Tactile Feel

Non-tactile keys can be used for an environment where quick and light actuation is needed during large amounts of data entry and discrete operation. Non-tactile keys can be any size and shape within 0.25 inches in diameter up to 8 square inches, allowing for design freedom when special end user applications are anticipated. They are more economical, but do not give the user direct feedback. LED's can be added to the design to provide visual feedback.
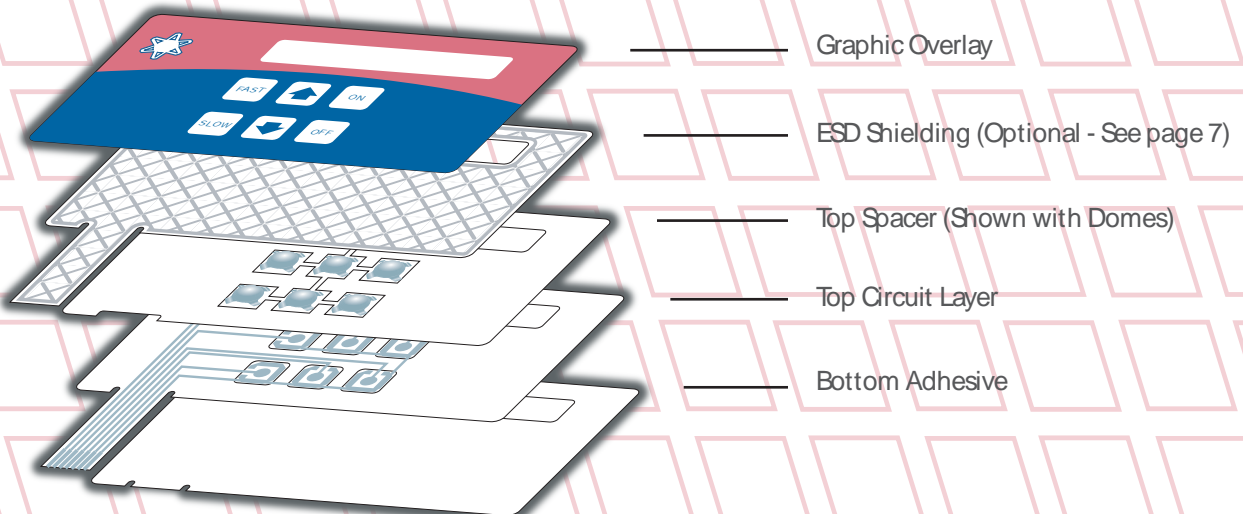
Tactile Feel – Stainless Steel Domes

Stainless steel domes offer the solid "click" when actuated that is preferred by designers and end users. They are almost always requested for printed circuit board or membrane switch assemblies and require no additional tooling cost as with polyester domes. Actuation force can vary from a slight 6 oz. of pressure to a stronger 24 oz. of pressure. In some cases 70 oz. domes have been requested for "heavy actuation" for applications where end users such as clean room technicians or fire fighters wear heavy gloves.

Tactile Feel – Polyester Domes

Tactile feel is also accomplished with hydroformed polyester domes (polydomes) which offer a mild response when pressed. Polydomes tend to relax and loose their tactile feel at temperatures above 55 degrees C or 131 degrees F.   Polydomes are more economical for higher quantities of individual switches or membrane switch assemblies because they do not have to be individually assembled.

Adhesives

Ideally the surface that the membrane switch overlay will bond to, will have a smooth non-textured surface. LSE (Low Surface Energy) surfaces, such as textured plastic or powder coated surfaces will require a stronger adhesive on the back layer of the membrane switch.   Design Mark uses 3M adhesives.

Graphic Overlay

ESD Shielding (Optional - See page 7)

Top Spacer (Shown with Domes)

Top Circuit Layer

Bottom Adhesive

Design Considerations

There are many materials that can be used in combination with on another to provide varying degrees of rigidity. Our complete assembly services can be utilized to combine materials with your circuit board or aluminum subpanel.

Testing

Be sure to make us aware of any specialized testing the membrane switch may undergo or harsh environ-ments to which the overlay may be subjected.
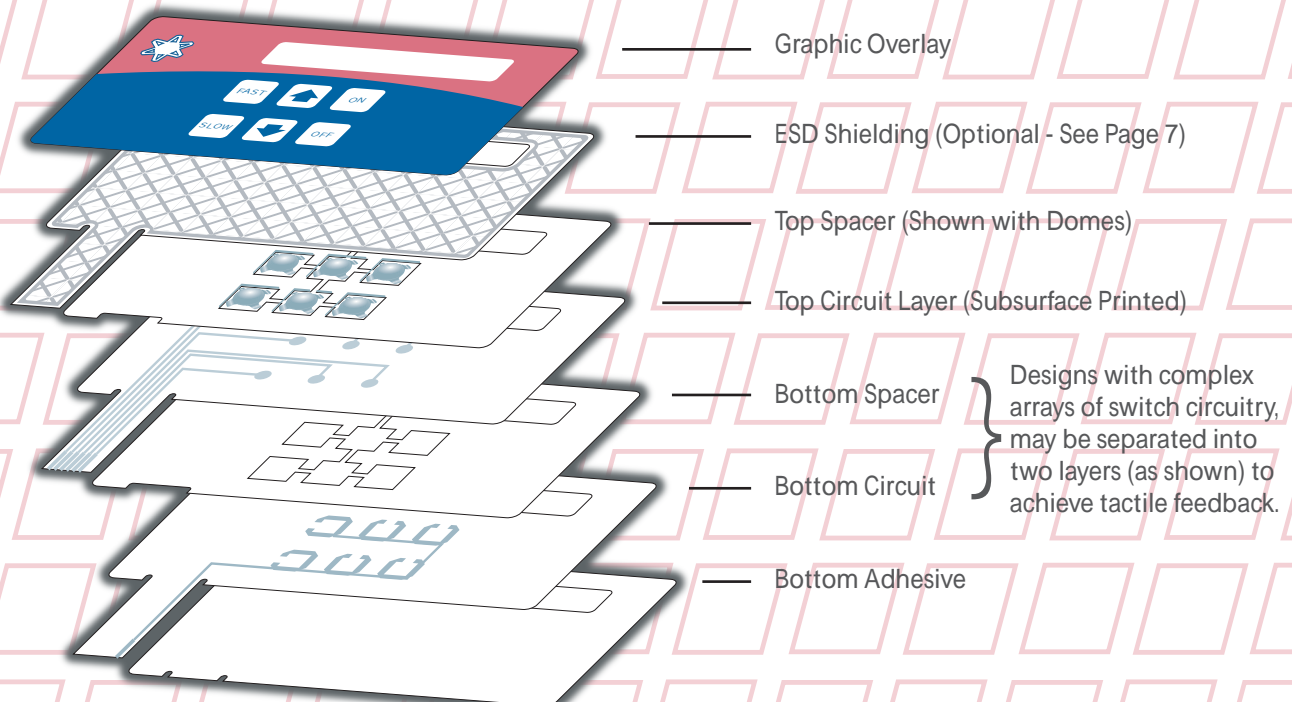
Materials Overview

Manufacturers of polyester and polycarbonate test their materials to determine the material's best attributes. Designers must consider the following questions when specifying materials for the graphic overlay and the layers beneath.

 - Will the overlay be exposed to sunlight?
 - Will the overlay be exposed to household chemicals?
 - Will the overlay be exposed to industrial chemicals?

The graphic layer of the membrane switch should not only be aesthetically pleasing, it must endure use in its environment. Since environments vary greatly, the proper faceplate materials must be chosen. Xymox has a variety of materials fully tested and categorized for almost any environment.

In most cases the faceplate for a membrane switch is printed on a polyester or polycarbonate material. Polyester is more resistant to chemicals found in industrial settings and is better suited for use with tactile feedback switches because it can withstand a greater number of activations. Polycarbonate is optically clear at any thickness and provides a crisper emboss.

Graphic Overlay

ESD Shielding (Optional - See Page 7)

Top Spacer (Shown with Domes)

Top Circuit Layer (Subsurface Printed)

Bottom Spacer

Bottom Circuit

Bottom Adhesive

Designs with complex arrays of switch circuitry, may be separated into two layers (as shown) to achieve tactile feedback.

Circuitry Drawing or Matrix

We will create the switch circuitry from your drawing, or create one for you. If you have schematic prefer-ence or require a speci c trace route we will accommodate your requests. Many customers supply what is called a "Pi n Out Matrix", which is a graph representation of which key traces, to which trace path, leading to the tail exit location.

We must allow 0.100" between keys to provide room for traces to travel and for proper adhesion between the layers of your membrane switch assembly. We design the key positions to the tail exit positions of the printed circuitry without crossovers and added expense.
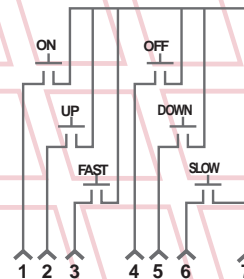
We must provide 0.100" of space between the traces and the edge of the overlay. Also, similar spacing must be around a display window.

The resistance of any closed loop in the circuit is normally between 50 and 200 Ohms, while typical resistance is usually less than 100 Ohms.

PIN OUT

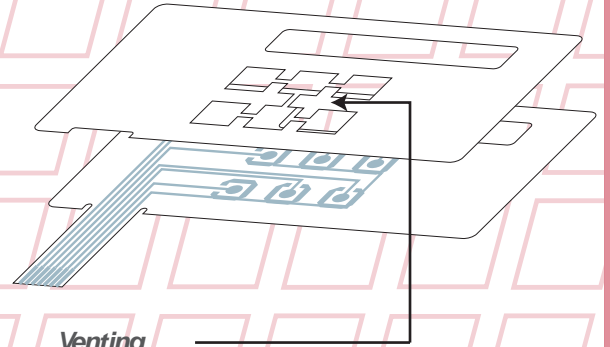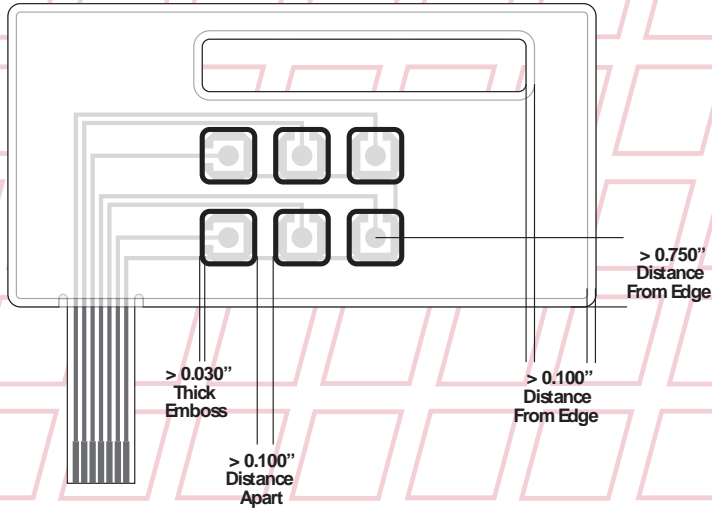|	1	2	3	4	5	6	7
SW1			●				●
SW2		●					●
SW3	●						●
SW4					●		●
SW5					●		●
SW6				●			●

SCHEMATIC

Shielding

ESD (Electrostatic Discharge)
EMI (Electromagnetic Interference)
RFI (Radio Frequency Interference)

Conductive inks printed in a grid pattern on a layer of polyester can be placed above the upper circuit layer. Grounding can be achieved by running a trace out to a separate tail or strap from the circuit layer.

Aluminum Foil can be die cut and placed above the upper circuit. Grounding can be achieved by running a strap with a hole cut through to allow for a lug nut to ground the membrane switch assembly.

I.T.O. (Indium Tin Oxide) can be used over the entire overlay for shielding. This is a material that is conduc-tive and clear, providing full protection for the overlay as well as the window areas of the overlay. It can be used in combination with foil or a printed grid pattern when a strong ESD, EMI and RFI barrier is required.

> 0.750"
Distance
From Edge

> 0.030"
Thick
Emboss

> 0.100"
Distance
From Edge

> 0.100"
Distance
Apart

Venting

Venting is important to provide a place for the air under the domes to go when pressed. The channels between keys in the spacer layer(s) provide venting. This example is internally vented, which is suitable in most cases. If a slot is allowed to run out to the edge, it is said to be externally vented.

Here is a list of engineering specifications to be com*municated to Design Mark* .

- **Mec**hanical dimensions of finished pa**rt:**
  _____
  Tolerances (+/- .010")
- **Switch Type:**
  ☐ Non-Tactile
  ☐ Stainless Steel Domes
  ☐ Poly Domes on the Circuit
  Tail Exit Location_____
- **Tail Length_____**
- **Tail Connector:**
  ☐ Exposed Silver/Carbon for ZIF connector
  ☐ Nicomatic
  ☐ Berg Clincher
  ☐ AMP
  ☐ Solder Tabs
  ☐ Other, Specify_____
- **Schematic and/or Pin Out:**
  ☐ Design Mark
  ☐ Customer Supplied
- **EF / ESD /EMI Shielding:**
  ☐ Aluminum Foil
  ☐ I.T.O Clear (Indium Tin Oxide)
  ☐ Printed Silver Grid
  ☐ Printed Carbon
  ☐ None required
  ☐ Other

- **Overlay Material**
  ☐ Gloss Polyester with hard coating
  ☐ Gloss Polycarbonate with hard coating
  ☐ Velvet texture Polyester
  ☐ Velvet texture Polycarbonate
  ☐ Other_____
- **Windows or Lens Coating**
  ☐ Anti Glare (LED, VF, LCD)
  ☐ Velvet texture (Enunciator, LED)
  ☐ Gloss, Water Clear (LCD)
  ☐ Window Insert
- **Subpanel**
  ☐ Thickness_____
  ☐ Material_____
  ☐ Drawing specified material
- **Artwork**
  ☐ Design Mark
  ☐ Customer Supplied
- **Colors**
  ☐ Number of Colors: _____
  ☐ List Colors:_____
  ☐ Match Sample
- **Switch Sealing Requirements**
  ☐ Standard splash resistant
  ☐ NEMA 4
  ☐ Other, Specify_____

sensi

Flexible Connector Tail

The position of the tail should be considered when designing the membrane switch.	The tail is formed from the circuit layers, therefore no feature requiring a track can be between the tail and the exit point.

The easiest exit location for production is an edge exit. This is produced by bringing the tail straight out from the edge of the part.

There is also the inside exit, which is produced by bringing the start of the tail inside the overlay area, then replacing some material between the tail exit and the edge.	A water tight NEMA 4 type perimeter seal can be employed when necessary. This works well with an overlay that ts in a recessed panel.

Sharp bends should be avoided. We recommend an inside radius of 0.100" when the tail must bend at a right angle, for example.

Using a ZIF type connector will reduce cost as the tail will not need a dedicated connector.	When using a ZIF connector, you should specify the connector or the requirements for the connector.

A male or female connector (Berg Clincher or Nicomatic) can be tted to the end of the tail. Also,

Solder Pins can be provided.

Color Matching

Design Mark can match to Pantone, Federal Standard, RAL, Munsell, and/or your color sample. While PMS (Pantone Matching System) colors are a common color reference, we can match any color speci ed.

Artwork

Design Mark' graphic design team has decades of experience creating new images and is cognizant of how colors contrast with one another, to provide maximum legibility of the text, symbols and your logo. Our graphics team prepares accurate lms needed to cleanly and sharply represent your vision of how the overlay is to appear.

Our customers should specify type styles, colors, sizes of copy and provide artwork created in a vector based computer program such as Adobe Illustrator or CorelDraw. One should take the precaution of providing the artwork with a "type as outlines or curves" layer to prevent typeface substitution from one application to another when the artwork is opened.

We will need drawings that clearly show the dimensions of all physical characteristics and elements on the switch (windows, keys, through holes, text size, font used, etc.).

Borders around windows and edges should be thick enough to allow for tiny amounts of misregis	tration that may occur when cutting and printing material. Instead of a 1 point border use a border of 0.060" or eliminate the border.

Drawings

We use AutoCAD 2010 LT to help us to generate drawings quickly for our customers. We	suggest that a DWG le with a PDF copy of the le be supplied. As an alternative, customers may supply a DXF le to help us with membrane switch design process. Be sure to provide dimensions and all size information on drawings to expedite your design.

Customer Supplied Samples

No drawings available? We can duplicate your sample part. We will dimension and document your part; match the colors with our Minolta color-eye; and produce new artwork. Contact our sales department for information.

When screen printing begins, colors are carefully formulated and tested for accu	racy. Our screen printers have extensive experience printing on the substrates used for overlays and have acquired a library of color matches.

Embedded LED's

Small surface mounted LED's are used to add annunciators to the switch. This is obtained by adding spacer layers to the membrane switch to accommodate the area needed for the LED's.

Conductive silver epoxy is used to mount the LED to the circuit and embossing can be added to the LED window. Caution should be taken not to bend the membrane switch in the areas where LED's are located while the membrane switch is being installed. Sti eners can be added to the membrane switch to add rigidity.

Backlighting

We can provide Electro Luminescent backlighting using panels incorporated into the membrane switch assembly. This is a good solution where ambient light levels are low and provides uniform lighting over a large area of the overlay. LED's can be used as well for more localized backlighting solutions.

Fiber optic panels o er great exibility to the designer generating no heat or EMI. Panels are durable in that shock, vibration and hazardous environments do not pose a problem. Panels are made with a re ective backing that increases their lighting e ect. Standard LED colors include green, white, blue, red, amber and yellow-green. The remote LED light source is smaller than many EL or CCFL inverters.
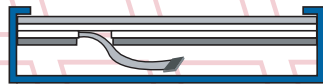
Bezel Mounting With Support

Surface Mounting With PC Board

Subpanels

We have full assembly capabilities and can assemble the overlay to a subpanel if so desired. It is important for the dimensions of all openings and windows on the subpanel to be considered when designing the overlay. General guidelines should insure that the subpanel is not visible after overlay assembly.

Bezels

The design of the chassis or the enclosure is integral to the success of the overlay. Employing an adhesive or O-ring to seal the switch from the external environment. Front mounted overlays that t in a recess can be protected from harsh external environments.

I /O or "Tail"

The connector tail can be any length and can be designed to wind around the circuitry within the instru - ment or control panel assembly. Try to exit the tail near the connection on the electronics within the instru - ment or device.

Keypad array patterns can be split up on more complex circuits and multiple overlapping tails can be designed into the overlay by adding layers.
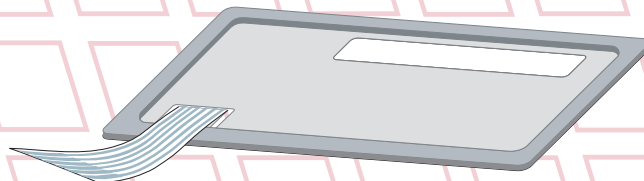
Gasket With Tail Exit

Request For Quote

Thank you for giving Design Mark the opportunity to quote your upcoming project.
Please complete the information as completely as possible so we can provide you with an accurate quote.
If you would like to speak to a customer service person directly, please call 1-856-853-9100.
If you would like a quote on **an** electronic product, please e-mail Design Mark (rfq@Design Mark.com).

Customer Information:

Name : _____

Company Name : _____

Address : _____

City : _____

State : _____ Zip : _____

Telephone : _____

E-mail : _____

Quote Information: _____

_____

General Project Type :

Membrane Switch _____ Label _____ Graphic Overlay _____ Elastomer Keypad _____

Touch Screen _____ Other _____

Prototype Required? : Yes _____ No _____

Part Size : _____

Quantity : _____

Required Ship Date : _____

Is a design le available? : Yes _____ No _____

Intended use : _____

Number of colors : _____

Surface Type : Gloss _____ Semi-Gloss _____ Matte _____ Other _____ _____

Number of holes and cutouts : _____

See Page 7: Anything else about your needs we should know? _____

_____

_____

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