WILSON HURD
Our Innovation, Your Solution

Touchscreen Design Guidelines

Touchscreens have successfully changed the way electronic equipment is used by simplifying the user experience and eliminating the need for buttons or keys. Utilizing both **resistive** and **capacitive** technologies, our touchscreens can be integrated into your panel with a wide selection of additional design features to fit any application.

Because every touchscreen we create is designed custom for your unique application, certain specifications are required for each design. This set of design guidelines was created to assist you with the design and creation of your custom touchscreen. Our highly skilled engineering team will carefully review your requirements to assist in designing the optimum switch for your application.

Things to Consider when Designing your Touchscreen:

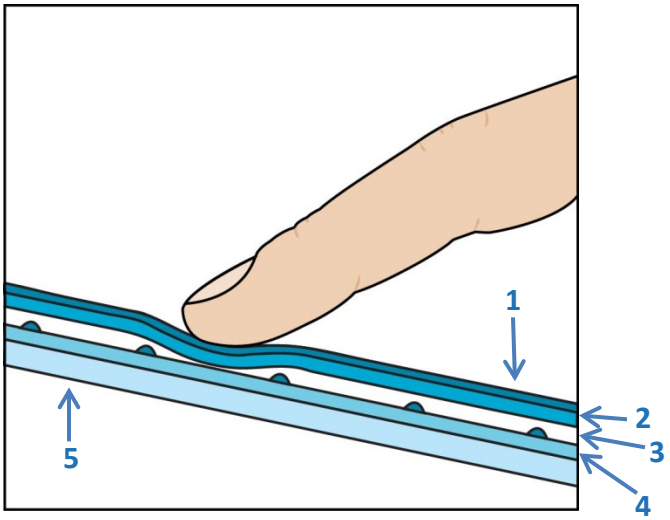
1. **Environmental conditions** *(indoor/outdoor, harsh environments, sunlight, etc.)*
2. **Software requirements** *(menus, interfaces, etc.)*
3. **Firmware requirements** *(controller, processor, etc.)*
4. **Appearance** *(screen size, material, etc.)*
5. **Certifications** *(ISO, U.L., etc.)*

Resistive Touchscreens

Resistive Construction: Two clear conductive layers (glass or acrylic substrate and polyester top sheet) are separated by insulating dots. A touch compresses the flexible top layer, causing electrical contact between the layers. A **voltage gradient** is applied to the top and bottom layer (X and Y axis) sequentially; the opposite layer is used as a voltage probe. The **controller** calculates the X and Y position based on the voltage level received by the probed layer.

Resistive Characteristics:

- Lower cost
- Low power consumption
- Compatible with any pointing device, including gloves
- PET top sheet provides shard containment if broken
- Liquid does not impact performance
- May require recalibration
- More prone to damage
- Top layer flexing causes wear
- Lower optical clarity



In the visual representation above, the layers shown are the following:

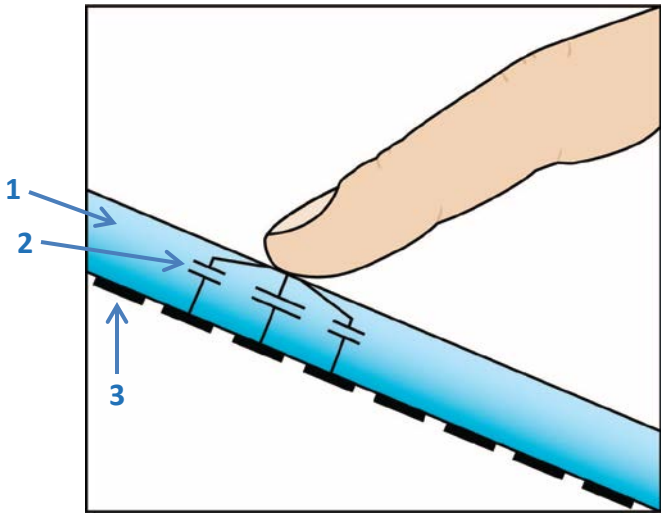
1. **Polyester top sheet**
2. **Top circuit layer**
3. **Insulating dots**
4. **Bottom circuit layer**
5. **Glass or acrylic substrate**

Capacitive Touchscreens

Capacitive Construction: Voltage is applied to the corners of the touchscreen. A pattern of **electrodes** around the periphery of the touchscreen distribute the voltage to form a uniform electric field across the conductive surface. A conductive device, such as a finger, draws a minute amount of **current** from the surface and the change in **capacitance** is measured at each point on the grid, allowing the touch position to be located.

Capacitive Characteristics:

- Clean, solid glass panel
- Superior optical performance
- No mechanical movement – extreme endurance
- Operates with finger, gloves, or active stylus
- Can handle environmental extremes
- Multi-touch and gesture capabilities
- Highly accurate
- Susceptible to **EMI**



In the visual representation above, the different parts of a capacitive touchscreen shown are the following:

1. **Lens**
2. **Capacitive coupling**
3. **ITO pattern**

Touchscreen Materials: Different types of glass and plastic can be used as a cover lens when designing your touchscreen. Glasses include **soda lime**, **chemically strengthened**, and **tempered**. Varieties of plastics that can be used are **polycarbonates** and **acrylics**.

Coatings: If your touchscreen will be exposed to harsh environments, **hard-coats** can be applied to add durability. If your touchscreen is made of glass or another reflective material and will be in an environment exposed to high amounts of natural or artificial lighting, **anti-glare**, **anti-reflective**, **polarized**, and **UV resistant** coatings can be applied to increase readability.

Firmware & Software Support: When it comes to the firmware and software of your custom touchscreen, we try to make the design process as simple for you as possible:

- You retain full control of the look and feel of your **interface**, while we handle the processing overhead for graphics, and touch tracking.
- We perform quick menu development through image files, graphical coordinates, or real-time instruction. You can easily customize menus at any time.
- Our interrupt-driven processor solution responds quickly to handle events and accept external inputs, to augment touchscreen inputs.
- Our system flexibility allows interfacing with multiple protocols, to mediate complete redesigns due to customer requirement changes (screen sizes or technology change), or lack of current part availability. Revision changes would be transparent to the end-user.
- Our engineers have included built-in software libraries to enable your product development through simple function calls.

Touchscreen Design Guidelines

Product Integration: We can provide you with essential components, or a complete turn-key solution combining your touchscreen with other technologies available from Wilson-Hurd including **membrane switches**, **PiezoPanels**, or **capacitive switches**.

Technical Data:

- Capacitive multi-touch and gesture support *(not available for resistive touchscreens)*
- **Optical bonding** capabilities
- Support for various communication standards, including: **SPI**, **I2C**, **UART**, and **USB**

Specifications:

Type	Specification
Display Interfaces	24-bit parallel, LVDS, and HDMI
Screen Sizes Supported: Resistive	2.2" – 22"
Screen Sizes Supported: Capacitive	3.5" – 17"
Operating Temperatures	-30°C *(-22°F)* to 80°C *(176°F)*

GLOSSARY

Acrylic: A transparent and shatter resistant thermoplastic material.

Anti-Glare Coating: Coating applied to touchscreens that diffuses external sources of reflection, increasing the touchscreen's readability.

Anti-Reflective Coating: Coating applied to touchscreens that bends both internal and external light sources increasing the touchscreen's readability.

Capacitance: The property exhibited by two conductors separated by a dielectric, whereby an electric charge becomes stored between the conductors.

Capacitive Coupling: The transfer of energy within an electrical network by means of the capacitance between circuit nodes.

Capacitive Switches: Detects the presence or absence of a conductive object, such as a finger, by measuring changes in capacitance.

Capacitive Technology: An insulator coated with a transparent conductor.

Chemically Strengthened Glass: Glass that is placed into a potassium salt bath, causing the sodium ions in the glass surface to be replaced by potassium ions.

Controller: A device that interfaces with a peripheral device.

Current (A or I) Unit, Amp: The flow of electricity, i.e., the characteristic drift movement of carriers such as ions, electrons, or holes. I=E/R

Electrodes: A conductor through which electricity enters or leaves an object, substance, or region.

EMI: Electromagnetic interference

Firmware: The combination of persistent memory and program code and data stored in it.

Hard-Coat: A coating applied to the surface making it impervious to particular chemicals and at the same time adding scratch resistance.

HDMI: High-Definition Multimedia Interface

I2C: Inter-Integrated Circuit

Interface: A device used so that two or more independent systems can meet and act on or communicate with one another.

ITO Pattern: A transparent conductive pattern of precisely etched indium tin oxide.

Lens: The supportive, transparent layer of a touchscreen.

LVDS: Low-Voltage Differential Signaling

Membrane Switches: A composite of two thin pliable films, conductive in nature, separated by a dielectric. When an outside force acts upon the upper film it closes, making contact with the lower film.

Optical Bonding: The process of laminating touchscreens to the LCD using silicone gel or a different adhesive.

PiezoPanels: A user-interface that incorporates Piezo crystal technology, which produces voltage when pressure is applied.

Polarized Coating: A coating that aligns waves of light into one or more planes of direction.

Polycarbonate: A plastic material often used for overlays due to its excellent clarity, stability, printing, and die cutting characteristics.

Polyester: A plastic material often used for overlays, also known as polyethylene terephthalate (PET).

Resistive Technology: Two clear conductive layers coated with a resistive material and separated by insulated dots.

Soda Lime: A chemically stable, durable type of glass made by melting raw materials.

Software: A set of machine-readable instructions that directs a processor to perform specific operations.

SPI: Serial Peripheral Interface

Substrate: A layer of film in a laminate. In flexible circuitry, the plastic film to which the electrically conductive materials is laminated or screen-printed.

Tempered Glass: Glass that is processed by thermal or chemical treatments to increase its durability.

Touchscreens: A transparent electronic screen applied over a display that allows an individual to input information by touch or location on a grid.

UART: Universal Asynchronous Receiver/Transmitter

USB: Universal Serial Bus

UV-Resistant Coating: A transparent coating that blocks ultraviolet light.

Voltage (V or E): Electromotive force, or difference of potential; E=IR, where I is current and R is resistance.

Voltage Gradient: The voltage per unit length along a resistor or other conductive path.