White Paper

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Touch Technology Selection Guide

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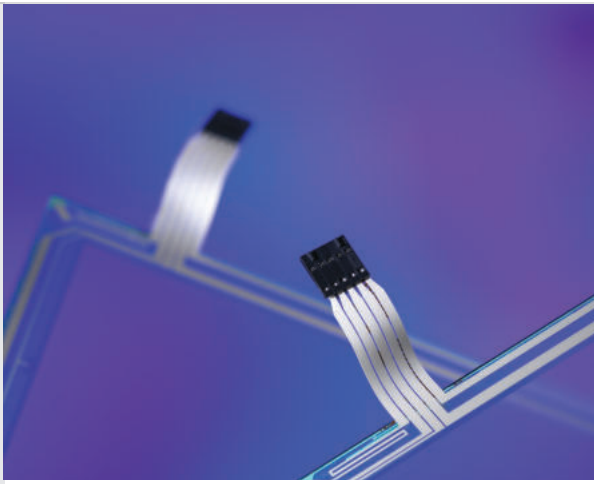
Introduction

Advances in touch technologies have been rapid and revolutionary. Newer technologies do not require an actual "touch" to operate a device. Approaches to human-machine interfaces (HMI) can sense finger or stylus movement before contact occurs or can detect the amount of applied pressure. In some cases, the technology can sense when contact is superfluous, such as a palm resting on the device. Overwhelmingly, there are many choices and options from both a product and supplier standpoint.

This white paper provides information on seven different touch technologies - detailing current suppliers and technology features. The Canvys® team can lead design engineers and acquisition specialists through the maze of different technologies and manufacturers, allowing for an ideal touch screen display solution.

This overview can help application design engineers understand the difference in touch technologies and determine which will be best suitable for their business/application. With cost and other constraints, this information can help make the right choice.

If you require more information than what is covered in this white paper, please contact our team at: info@canvys.com.



5-Wire Glass, resistive Touch
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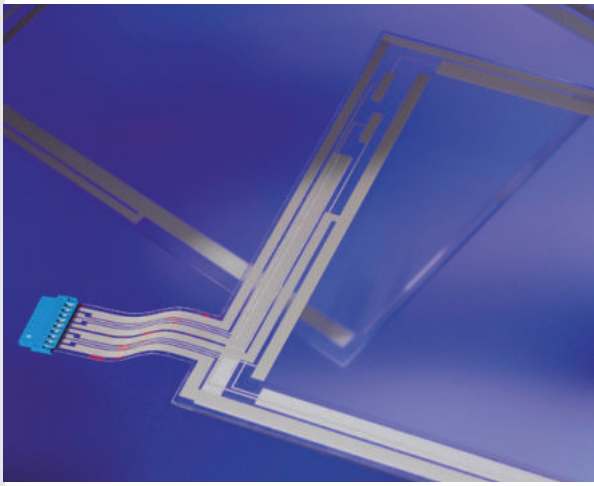
HMI - Human Machine Interface / Interaction

A user interface is the system by which people (users) interact with a machine. In the industrial design field of human-machine interaction, the user interface is the space where interaction between humans and machines occurs. The goal of this interaction is effective operation and control of the machine on the user's end, and feedback from the machine, which aids the operator in making operational decisions Examples include computer operating systems, hand tools, heavy machinery operator controls, and process controls.

Human-machine interaction engineering aims to produce a user interface that makes it easy, efficient, and user-friendly.

Source: Wikipedia - http://en.wikipedia.org/wiki/User_interface



8-Wire Glass, resistive Touch
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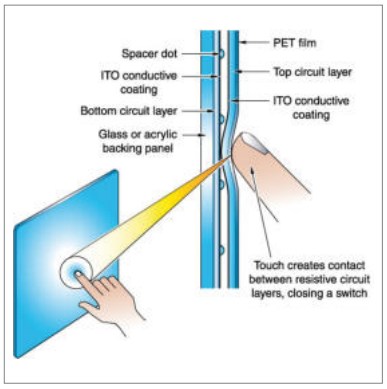
Touch Technologies:

- Resistive (4-wire/5-wire/8-wire)
- Surface Capacitive (SCAP)
- Projected Capacitive (PCap)
- Infrared (IR)
- ShadowSense™
- Surface Acoustic Wave (SAW)
- Optical Touchscreen

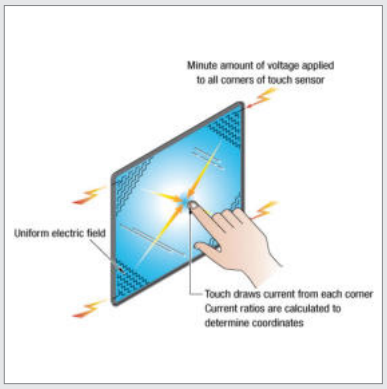
1 Resistive (4-, 5-, 7- and 8-wire)

Uses glass or acrylic substrate and spacer dots to create a field of resistors. Pressing the top layer makes contact in the resistor network, altering the sensed voltages at the corners or edges of the screen. Calibrated processing converts the voltages to touch location, often with 4096 points across each axis.



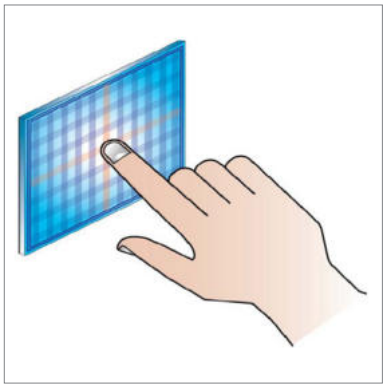
2 Surface Capacitive (SCAP)

A glass substrate with a transmissive conductive coating serves as the user-accessible capacitive plate. A touch object (finger or stylus) alters capacitance, and measured voltages are converted to touch coordinates.



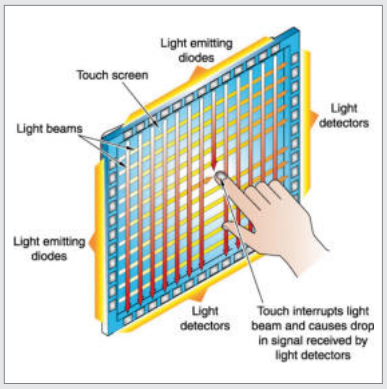
3 Projective Capacitive (PCAP)

A glass or polyester sheet with a conductive coating uses sensor elements on the surface material's underside. Touch is detected based on mutual or self-capacitance between rows and columns during the touch event.



4 InfraRed Beams (IR)

LEDs, invisible to human sight, create X and Y beams across the display surface type. Touch, or a near touch, breaks the IR beams and is detected in the X, Y location to provide relatively low-resolution single touch co-ordinates.



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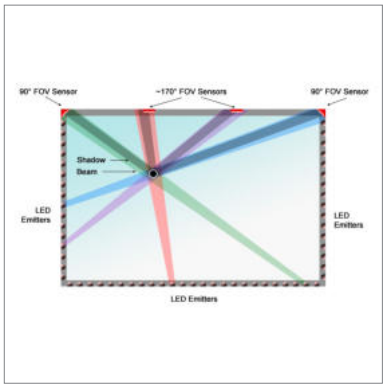
5 ShadowSense™

This technology is similar to IR but with 3 sides of LEDs and a single row of sensors. Rather than single beam breaks, the processing allows for up to six (6) simultaneous touch detections.



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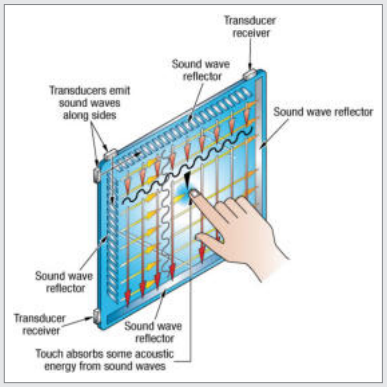
6 Surface Acoustic Wave (SAW)

Like IR, but with ultrasonic sound waves, transducers generate ultrasonic sound waves that are absorbed by touch obstruction.



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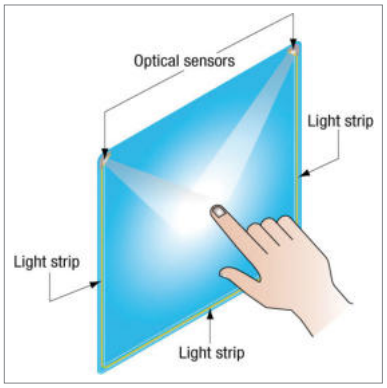
7 Optical (Camera)

A wrap-around bezel contains miniature cameras, with opposing reflectors, that sense touch or near touches across the screen. Multiple cameras provide multi-touch capability.



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Touch Technology Comparison Chart

Main Feature	Sub Feature	1 Resistive (4-/5-/8-Wire)	2 Surface Capacitive	3 Projected Capacitive (PCap)	4 Infrared (IR)	5 Shadow-Sense™	6 Surface Acoustic Wave (SAW)	7 Optical Touch
Operation / Input	2 Point (Dual touch)	◆	✗	▲	▲	▲	▲	◆
	2+ Point (Multi touch)	◆	✗	▲	▲	▲	✗	◆
	Gestures	◆	◆	▲	◆	▲	◆	◆
	Gloves	▲	✗	▲	▲	▲	◆	▲
	Stylus / Pointer	▲	◆	▲	▲	▲	◆	◆
	Handling of unwanted touches	●	●	●	▼	▼	●	▼
Environ-mental conditions	Surface robustness / vandal-safe	▼	▲	▲	▲	▲	▲	▲
	Water	●	▼	▲	▼	●	▼	▼
	Moisture	●	▼	▲	▼	●	▼	▼
	Chemical cleaner	▼	▲	▲	▲	▲	●	▲
	Other contamination	▲	●	●	▼	●	▼	▼
	Electro-magnetic interferences	●	▼	▲	◆	◆	◆	◆
Integration / Engineering	Complexity overall	▲	●	▲	▲	▲	▼	▼
	True Flat Design	◆	▼	▲	▼	▼	◆	▼
	Bonding	●	●	●	●	●	●	●
Maintenance	Calibration	●	●	▲	▲	▲	●	●
Misc.	Light transmission	▼	▲	▲	▲	▲	▲	▲
	Durability	▼	▲	▲	▲	▲	▲	◆
	Response time	▲	▲	▲	●	●	▲	◆
Pricing		▲	▼	●	●	▼	●	●

Legend	good	neutral	limited	poor	not possible
	▲	●	◆	▼	✗

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Touch Technologies: PCap, IR, and ShadowSense™

To better understand these technologies, the table below details some applications and their requirements. These requirements are evaluated according to the touch technology used, in the form of grades: (A = very good / F = failure). In addition, an application example is provided for additional clarity.

Application Requirements	Qualification of touch technology Rating (A = very good / F = failure)			Application Examples
	PCap	IR	ShadowSense™	
True Flat / Zero-bezel display	A	F	F	Tablets, Medical Engineering (Cleaning, Disinfection)
Reason	Glass print possible, easy cleaning	Requires front / integration		
High light transmission	B	A	A	Medical Engineering
Reason	Limited by wire-grid of touch	No wire-grid		
Laminating / Bonding to panel	B	B	C	Medical Engineering (requires high light transmission)
Reason	Completely smooth surface		Housing	
Sunlight readability	A	F	F	Museum, Cash Point (ATM)
Reason	Fully functional	Limited functionality		
Touch activation with finger, gloves (med.)	A	A	A	Industrial Process Control
Reason	Touch activation possible			
Touch activation through thick work gloves	A	A	A	Industrial Process Control
Reason	Can be handled by only a few PCap manufacturers	Touch activation possible		
Touch sensitivity	A	A	A	Medical Engineering
Reason	Works without pressure, sensitivity depends on used glass (coated or uncoated)			
No faulty touch activation under flowing water	A	C	C	Industrial Cleaning of Monitors
Reason	–	Limited by touch sensitivity settings		
Touch activation with water drops or dirt on glass	A	B	B	Food Industry
Reason	Touch sensitivity settings			
No faulty touch activation with chewing gum on glass	B	D	A	Public Information System
Reason	Touch sensitivity settings	Limited by touch sensitivity settings	Touch sensitivity settings	
Touch activation possible despite scratches on glass	A	A	A	Public Information System
Reason	Touch activation possible			
Vandal-safe	A	B	D	Public Information System
Reason	Depends on thickness of glass, thickness is limited	Depends on thickness of glass	Depends on thickness of glass, thickness is limited	
Impact of electronic interferences	B	A	A	Production of Defibrillators
Reason	Requires high shielding	Requires low or no shielding		
Chemical resistance	B	B	B	Industrial Process Control
Reason	Glass surface	Glass with ABS frame		
Usability in moisture-prone area	A	D	D	Food Industry
Reason	Density	Density and sensor		

Selection Factors

The selection factors can be divided into three groups. The information below provides factors to consider when choosing a touch technology. If more factors are required, our team can assess the scope and requirements of your project and make the best technology recommendation for the application.

Touch Selection Factors

USER INTERACTIONS

- Number of simultaneous touches
- Touch force / sensitivity
- Operation with fingers, gloves or other input devices

ENVIRONMENTAL

- Required sunlight readability
- Other weather conditions: humidity, rain, fog, …
- Sound/Vibration

FORM FACTOR

- Location of touch sensors
- Size of display
- Grade of ruggedness

1 User Interactions – How will the user operate the touch application?

- How many simultaneous touches are required?
  Some technologies were designed for multiple touches; others are limited to a single touch. The methods used to detect multiple touches also vary.
- Touch force may be an issue in two ways. First, how hard must the user press down in order for a touch to be sensed? Second, must the touch technology detect levels of pressure being applied by the user?
- Gloved operations may be limited by some technologies. Either the glove tips create false touches by imparting shadows, or the glove materials may affect the electrical properties being used by the touch system. Advances in technologies have overcome these limitations in surprising ways, so check first before assuming a given technology won't work with gloves.

2 Environmental

- Harsh sunlight applications may not fare well with some technologies. Since the sun's angle changes and thus, so do the background light levels, these factors can interfere with the sensors. Even indoor applications can be affected by sunlight if the unit faces a sunlit window.
- Likewise, sound or vibration based technologies may not be suitable for environments where pressure waves may be induced in the substrate by loud noises or vibrations.
- In addition, weather may affect technologies aside from the importance of sealing the enclosure properly. Rain drops may create artificial touches, or humidity and foggy conditions may affect the sensor mechanisms.

3 Form factor – What is the desired form, fit, and function of the application?

- External sensor technologies such as IR, optical, and ShadowSense™ require bezels above the touch surface to house the touch sensors. These may be problematic when integrated into sleek or flat-faced designs.
- Monitor screen size can influence touch technology selection. Large displays may not be as amenable to some technologies due to the physics of the touch sensing technologies.
- Ruggedness also affects the touch choices. If your goal is long-term operation, keep in mind that technologies where the screen cannot be bonded to strengthened glass may have trouble withstanding vandals and harsh environments.

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