The Status of Touch
On the Desktop
& In Large-Format

Geoff Walker
NextWindow
June 10, 2010
(Display Taiwan 2010)
Agenda

- Introduction
- Touch on the desktop (15” – 30”)
- Touch in large format (> 30”)
- Conclusions
- About NextWindow
Is Touch Really Just About Mobile Devices?

Is this all there is?

Is touch really all about 200M mobile phones and everything else is more or less irrelevant?
No! Touch Is Spreading Everywhere

- Touch was everywhere at the 2010 CES show (USA)
  - There seemed to be a built-in assumption that all consumer devices should be touch-enabled
But…
There Are 13 Touch Technologies!

<table>
<thead>
<tr>
<th>Touch Technology</th>
<th>Mobile (2” – 17”)</th>
<th>Stationary Enterprise (10” – 30”)</th>
<th>Stationary Consumer (15” – 30”)</th>
<th>Large-Format (&gt;30”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Resistive</td>
<td>H</td>
<td>H</td>
<td>L</td>
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<tr>
<td>Analog Multi-Touch Resistive (AMR)</td>
<td>F</td>
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<td>F</td>
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<tr>
<td>Surface Acoustic Wave (SAW)</td>
<td></td>
<td>H</td>
<td>F</td>
<td>L</td>
</tr>
<tr>
<td>Traditional Infrared (IR)</td>
<td></td>
<td>H</td>
<td>F</td>
<td>H</td>
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<tr>
<td>Waveguide Infrared (from RPO)</td>
<td>F</td>
<td></td>
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<td>Surface Capacitive</td>
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<td>H</td>
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<td></td>
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<tr>
<td>Projected Capacitive (ITO &amp; on-cell) (P-cap)</td>
<td>H</td>
<td>F</td>
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<tr>
<td>Projected Capacitive (wires on film) (P-cap)</td>
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<tr>
<td>Optical</td>
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<tr>
<td>Acoustic Pulse Recognition (APR from Elo)</td>
<td>F</td>
<td>H</td>
<td></td>
<td>L</td>
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<tr>
<td>Dispersive Signal Touch (DST from 3M)</td>
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<tr>
<td>Embedded (in-cell)</td>
<td>F</td>
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<tr>
<td>Vision-Based (like Microsoft Surface)</td>
<td></td>
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<td>F</td>
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<tr>
<td>Force Sensing (no current supplier)</td>
<td></td>
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</tr>
</tbody>
</table>

**H** = High-volume  **L** = Low-volume  **F** = Future
Why Are There So Many Touch Technologies?

1. Proliferation of touch
2. Touch is an indirect measurement
3. There is no perfect touch technology
4. The drive for fundamental intellectual property
5. Vertical integration

Source: Gizmodo
Proliferation of Touch

- Self-service reduces cost
- Displays everywhere at low cost
- Touch user interfaces are simpler
- Direct manipulation is easier
- Everything is shrinking
- Touch makes globalization easier
- Expectation of touch everywhere

Source: ServiceTec
Touch Is An Indirect Measurement

<table>
<thead>
<tr>
<th>Touch Technology</th>
<th>What’s Being Measured</th>
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<tbody>
<tr>
<td>Resistive (all forms) &amp; Embedded (voltage)</td>
<td>Voltage</td>
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<tr>
<td>Surface capacitive</td>
<td>Current</td>
</tr>
<tr>
<td>Surface acoustic wave</td>
<td>Time delay</td>
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<tr>
<td>Projected capacitive, Embedded (charge)</td>
<td>Change in capacitance</td>
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<tr>
<td>Optical &amp; Infrared (all forms), Embedded (light) in high ambient</td>
<td>Absence of light</td>
</tr>
<tr>
<td>Embedded (light) in low ambient</td>
<td>Presence of light</td>
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<tr>
<td>Vision-based</td>
<td>Image</td>
</tr>
<tr>
<td>Acoustic Pulse Recognition (APR) &amp; Dispersive Signal Technology (DST)</td>
<td>Bending waves</td>
</tr>
<tr>
<td>Force sensing</td>
<td>Force</td>
</tr>
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</table>

The ideal method of detecting touch has yet to be invented!
There Is No Perfect Touch Technology

Example: Selecting the touch technology for a smartphone

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Resist.</th>
<th>P-Cap</th>
<th>APR</th>
<th>AMR</th>
<th>W-IR</th>
<th>Embed.</th>
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<tr>
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<td>L</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Multi-touch</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>High durability</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>High optical performance</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Flush surface</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>H</td>
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<td>Low power consumption</td>
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<td>Stable calibration</td>
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<td>H</td>
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<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Narrow borders</td>
<td>M</td>
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<td>H</td>
<td>M</td>
<td>M</td>
<td>H</td>
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<tr>
<td>Substrate independence</td>
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<td>Low cost</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Multiple suppliers</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>M</td>
</tr>
</tbody>
</table>

H = High (Best)  M = Medium (OK)  L = Low (Worst)
The Drive For Fundamental Intellectual Property

- The fundamental intellectual property (IP) on all four* of the traditional touch technologies has expired
  - New patents tend to be on enhancements

- Companies trying to establish a sustainable competitive advantage create new touch technologies

* Analog resistive, surface capacitive, SAW & IR
Vertical Integration

- LCD embedded (in-cell) touch
  - When touch was insignificant, LCD manufacturers ignored it
  - Now that it has become more significant, LCD manufacturers want to embed it into their products (in-cell touch)

“There is no perfect touch technology”
Touch on the Desktop

Source: Studio 41
Desktop Touch Before Windows 7

- Vertical-application monitors (1990s)
- HP TouchSmart AiO (2007-2009)

Source: 3M

Source: HP
The Significance of Windows 7

- Windows 7 fully enables desktop touch (Oct-09)
  - Touch & multi-touch is a highly visible characteristic of Win-7
    - Win-7 supports up to ~100 touch points
  - Touch API is easy for ISVs to use to touch-enable apps
    - Applications can define their own custom gestures
  - Most PC OEMs have launched multiple desktop touch products
    - ~90% AiOs, ~10% monitors
Consumer Desktop Hardware

- **AiOs & monitors with Win-7 touch**
  - 30+ products from 14 OEMs
  - Acer, Asus, Dell, ECS, Fujitsu, Gateway, HP, Ilyama, Lenovo, Medion, MSI, NEC, Samsung, Sony

- **AiOs with single-touch**
  - Estimated at 10

- **AiOs with no touch**
  - Estimated at 25

- **Monitors with single-touch**
  - None
Examples

HP  Medion  NEC

Sony  Dell  Lenovo
Desktop Applications

- Consumer software applications enhanced to take advantage of Windows-7 touch
  ✦ Estimated at 50
    - Art & creativity, media management, reading, games, educational…
    - Mostly consumption-oriented
  ✦ It will take until the end of 2010 or mid 2011 until there are a substantial number of applications available

- Enterprise vertical (e.g., CAD, GIS)
  ✦ Beginning to see some specialized applications

- Enterprise horizontal (e.g., Office)
  ✦ No significant applications yet
Market Growth Factors

- Touch on the desktop is best for **consuming** information rather than **creating** information
- Touch-enabled applications are slow to market
  - Consumers won’t buy touch-enabled hardware without compelling touch applications
- **Microsoft’s support for multi-touch**
  - Enhancements such as the Surface capabilities (in the latest Windows-7 SDK) may make a BIG difference for ISVs
- **Incremental BOM cost for touch**
  - Cost is much less of an issue in all-in-ones vs. monitors
- **Ergonomic issues may be significant on the desktop**
  - So-called “gorilla arm”
    - Reclining monitors? (viewing angle & palm rejection)
Forecasts

- **Touch penetration rate is the key measure**
- **Forecasts vary widely**

<table>
<thead>
<tr>
<th>Source</th>
<th>Date</th>
<th>Category *</th>
<th>2013 Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DisplaySearch</td>
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<td>Monitors &amp; AiOs</td>
<td>3%</td>
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<td>Morgan Stanley</td>
<td>6/09</td>
<td>Monitors &amp; AiOs</td>
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<tr>
<td>Credit Suisse</td>
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<td>Monitors, AiOs &amp; Notebooks</td>
<td>50%</td>
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<td>DisplaySearch</td>
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<td>Notebooks</td>
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<tr>
<td>Morgan Stanley</td>
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<td>Notebooks &amp; Netbooks</td>
<td>20%</td>
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</tbody>
</table>

- **2010 total AiO forecasts range from 5-6M to 10-11M**

*Arbitrary combination of device types makes individual device forecasts impossible and comparison of forecasts difficult*
# Desktop Touch Technology Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Optical</th>
<th>P-Cap</th>
<th>SAW</th>
<th>AMR</th>
<th>IR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size range 17” – 25”</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>H</td>
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<tr>
<td>Touch with any object</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Light touch</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Multi-touch</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Object size recognition</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
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<tr>
<td>Fast response and drag</td>
<td>H</td>
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<td>H</td>
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<tr>
<td>Low profile (flush surface)</td>
<td>M</td>
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<td>M</td>
<td>H</td>
<td>L</td>
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<td>High durability</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>H</td>
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<tr>
<td>High optical performance</td>
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<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>Narrow border width</td>
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<td>Insensitive to EMI &amp; RFI</td>
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<td>H</td>
<td>H</td>
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<td>Easy integration</td>
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<td>M</td>
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<td>Shipping in high volume</td>
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<td>High MTBF</td>
<td>H</td>
<td>H</td>
<td>M</td>
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<td>Multiple sources</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
</tbody>
</table>

H = High (Best)  M = Medium (OK)  L = Low (Worst)
Question #1

Do you agree that optical is the future of 15” – 30” stationary consumer touch?
How Optical Touch Works

- Controller Electronics
- Optical Sensors
  - Infrared LEDs
  - Emitted & Reflected IR Light
  - Optical Sensor View
  - Retroreflectors
- Glass Substrate

LED reflecting directly into the optical sensor

Touch Point

Optical Sensor Pixel Position

Light Intensity
Touch in Large Format

Source: AGreenLiving.org
The Significance of Multi-Touch

History
- The iPhone, Microsoft Surface and Windows-7 all focused attention on multi-touch; Windows-8 will take it even further

Outlook
- Since there still aren’t any clear applications for single users with more than two touches, multi-person gaming will probably drive multi-touch on large displays
  - Multi-user is more significant than one user with multiple fingers
  - Identifying which user is touching is still a problem
  - 4 users x 2 fingers each = 8 touches
- Reality is that point-and-click (single touch) is still very common on large displays
Large-Format Hardware

- **Touch display platforms**
  - LCD, plasma, front & rear projection (including touch tables), opaque interactive whiteboards
    - Touch is available integrated into displays and as an overlay
  - Incremental cost for large-format touch is still relatively high
    - NextWindow’s latest new product helps drive down the cost
NextWindow 2500 Series (New!)

- Kit of components for touch-screen; also available assembled on glass
- Fits screens from 30” to 52”
- Compatible with any display technology
- Thin borders & low profile
- Low cost
- Supports Windows-7 multi-touch
- Works with finger, glove or any object
- High optical quality
- Zero pressure required
- Unlimited touch durability
- One-time 4-point calibration
- USB powered
2500 Series Component Kit

- Camera
- Camera holder
- Flex cable (truncated)
- Controller
- Retro-reflector support (truncated)

- Camera
- Flex cable
- Controller
- Camera holder
- Retro-reflector support
Large-Format Applications

- Two market segments by size
  - #1: Information access, collaboration, interactive digital signage
    - 32 – 52 inches
  - #2: Education, training, conference rooms
    - 55 inches and larger

- Interactive digital signage
  - Least-established of all applications above
  - What’s missing is a business model that justifies the investment and monetizes the value of interactivity
    - Lawnmower sales example…
Market Growth Factors

- Continued display & touch-screen cost reduction
- Increased use of touch everywhere
- Market segment growth drivers
  - Interactive information: Increased digital data availability
  - Education: Government – increased spending; Corporate – ROI studies
  - Interactive digital signage: Business model
- What about TV?
  - Touch on small-screen TVs (all-in-one TV-monitor)
  - Gestures, not touch, on big-screen TVs except in special cases
Large-Format Forecast

Large-Format Touchscreens in Interactive Information, Education, Training, Conference & Signage
(transparent touch only)

97% CAGR

Units Shipped/Year

Data from iSuppli’s Emerging Display Technologies 4Q-2009 Special Report
# Large-Format Touch Technology Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Optical</th>
<th>IR</th>
<th>P-Cap (Film)</th>
<th>SAW</th>
<th>APR</th>
<th>DST</th>
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<tbody>
<tr>
<td>Touch with any object</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
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<td>Light touch</td>
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<td>L</td>
<td>M</td>
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<td>No unintended touch</td>
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<td>H</td>
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<td>Multi-touch</td>
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<td>L</td>
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<tr>
<td>Touch-and-hold</td>
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<td>Object size recognition</td>
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<td>Flush surface (low profile)</td>
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<td>H</td>
<td>M</td>
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<td>Resistant to contaminants</td>
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<td>Insensitive to EMI and RFI</td>
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<td>H</td>
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<td>Works with plastic substrate</td>
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<td>Simple sensor manufacturing</td>
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<td>High MTBF</td>
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<td>H</td>
<td>M</td>
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<td>Multiple sources</td>
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</tbody>
</table>

**Explanation:**
- **H** = High (Best)
- **M** = Medium (OK)
- **L** = Low (Worst)
Question #2

Do you agree that optical is the future of large-format touch?
Conclusions

- Desktop touch and large-format touch are emerging
  - Desktop touch is dependent on Win-7 application programs
  - Large-format touch is dependent on continued penetration of interactive displays into education, and a business model for interactive digital signage

- There are 7 different touch technologies in the combined desktop & large-format space
  - Large number of choices adds confusion
  - There is no perfect touch technology, but optical is the strongest contender in both areas

- There are business opportunities at all levels of the supply chain
About NextWindow

NextWindow
- Develops & manufactures optical touchscreens
- Currently focused on two touch-screen markets
  - Windows-7 consumer monitors and all-in-one computers
  - Large-format display applications such as interactive digital signage
- Global presence
  - New Zealand (HQ), Singapore (Ops), USA, Taiwan, Korea, Japan
  - Manufacturing in China, Thailand and Malaysia
  - 119 employees, 55 in engineering
- Brief history
  - 2000: Founded by CTO and private investors
  - 2003: First product to market (optical touch for large displays)
  - 2005: Entered USA market
  - 2006: First major volume contract signed (HP TouchSmart AiO)
  - 2008: Entered Taiwan market with ODM focus
  - 2009: Engaged with many PC OEMs & ODMs on Win-7 products
  - 2010: Acquired by SMART Technologies
Suggestion #1

Come see the future of touch at NextWindow in Booth B019!
Thank You!

Geoff Walker  
Marketing Evangelist & Industry Guru  
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Pleasanton, CA 94566  
1-925-272-4529  
gwalker@nextwindow.com
Appendix

Products on display at Display Taiwan 2010
1900 OEM Touch-Screen

- High-volume OEM components
- Microsoft Windows-7 multi-touch logo
- Kit, on-glass or glassless
- 15” to 30”
- Highly durable
- Low cost
- Easy integration
- USB interface
2500 OEM Touch-Screen

- High-volume applications
- Standard sizes from 30” to 52”
- Low cost
- Microsoft Windows-7 multi-touch ready
- Low profile & narrow border
- Kit or on-glass
- USB powered (no external power supply)
2150 OEM Touch-Screen

- Standard sizes from 30” to 103”
- Passive illumination & reduced components yields higher MTBF
- Microsoft Windows-7 multi-touch ready
- Kit or on-glass
- USB powered (no external power supply)
2700 Touch-Screen Overlay

- Integrates over almost any large display
- Adds touch to any computer application
- Protective overlay guards against abuse
- Microsoft Windows-7 multi-touch ready
- Fully compatibility (no proprietary drivers)