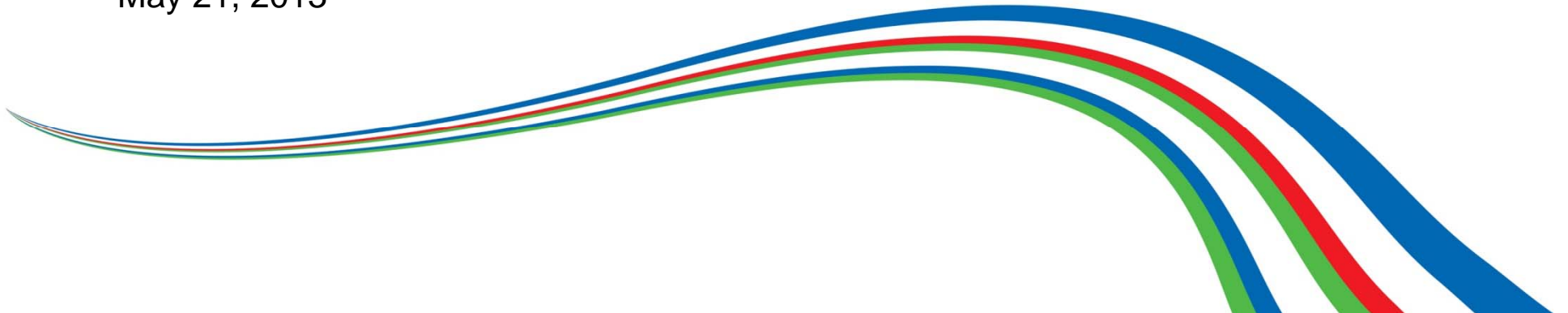




# PCAP Design Considerations for Outdoor and Marine Applications

**Mike Harris**  
May 21, 2013



# Introduction

- Mike Harris
- Product Manager, Ocular LCD, Inc.



# PCAP Design Considerations for Outdoor and Marine Environments

- Ocular Overview
- Sunlight Readability
- Birefringence
- Durability
- Water Performance



# Who is Ocular

## We are a Leader in Display Technologies

- Best-in-class character & graphic LCD's and touch panels for over 25 years
- Specializing in single touch and **TRUE multi-touch** projected capacitive touch panels manufactured with Ocular's **Low-Viz ITO** process
- The **largest PCAP panels** designed with Atmel maXTouch™ technology
- Strong heritage in **custom touch panel solutions** with **optical bonding** for extreme environments
- **Primary supplier** to market leaders in POS products
- Proven experience in specialized markets including:
  - Medical
  - Industrial Control
  - Infotainment
  - Marine
  - Gaming
  - White Goods



# Sunlight Readability



# Key Factors for Sunlight Readability of Touch Enabled Displays

## Display Choice

- Brightness
- Contrast Ratio

## Touch Panel Integration

- Optical (Direct) Bonding

## Touch Panel Enhancements

- Anti-Reflective Cover Glass
- Anti-Glare Cover Glass



# Dealing with Reflections

## Optical Bonding (PCAP to Display)

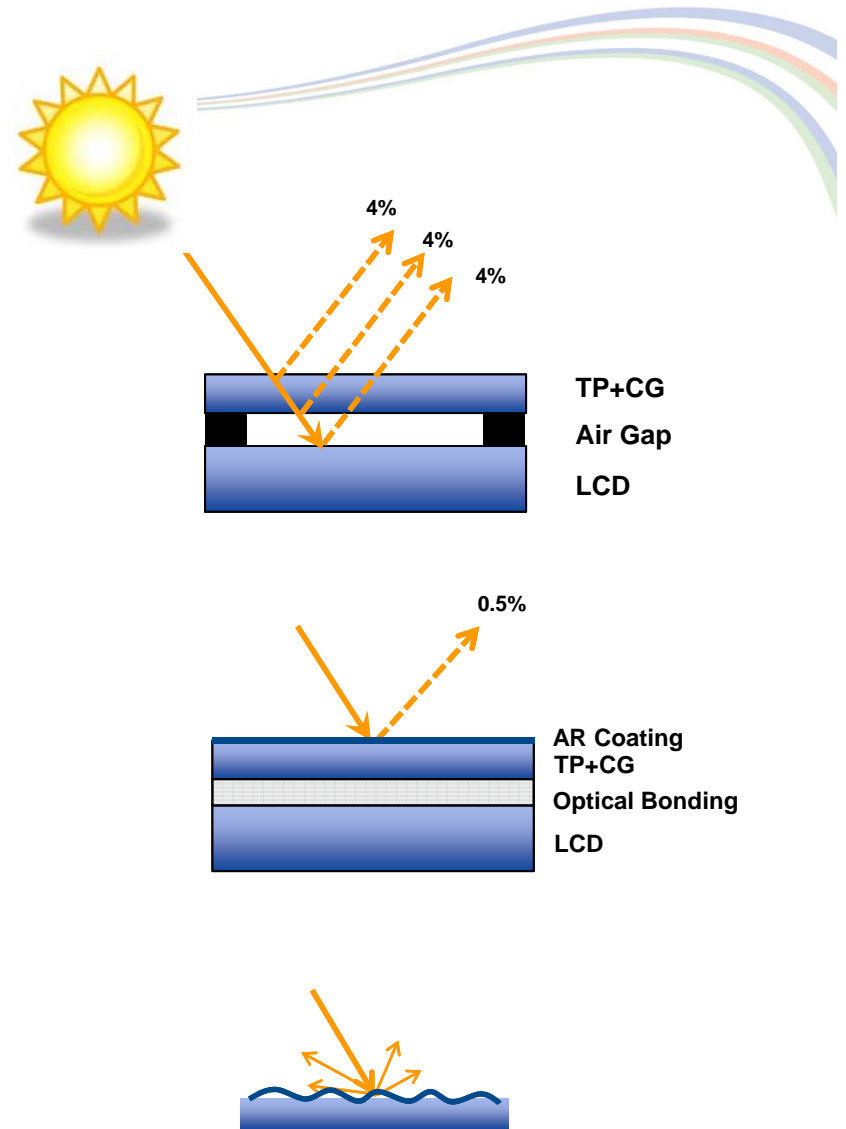
- Reduces internal reflections
- Improved Contrast Ratio (400%)

## Anti-Reflection Coatings

- Reduces Surface Reflections
- Multi-Layer (Broad Spectrum)
- Requires Anti-Smudge Protective Layer for Touch Applications

## Anti-Glare Treatments

- Surface Etching
- Diffuses Reflections
- Also Diffuses/Dims LCD Image



# Birefringence



# Dealing with Birefringence

## What is Birefringence?

- Polarization-Dependent Index of Refraction
- Common GFF Film Substrates Exhibit Birefringence
- Materials Under Stress

## Why is it a problem?

- Crossed Polarizers = Rainbow Effect
- LCD Polarizer + Polarized Sunglasses
- Polarized Internal Reflections

## Solutions

- All Glass Construction
- No Birefringent Adhesives



# Durability



# Factors for Outdoor Touch Display Durability



## Touch Panel and Display Integration

- Optical bonding of touch sensor to display eliminates condensation and haze between PCAP and LCD

## Ultraviolet Exposure

- Yellowing of Film substrates
- Yellowing of optical bonding material

## Surface Durability & Impact Resistance

- Long-Term AR coating durability issues
  - Hardness and abrasion resistance of topcoat (5H-8H)
  - Salt mist exposure
- Anti-Glare etching retains durability of glass
- Cover glass material impact resistance and hardness
  - CS Soda-Lime; CS Aluminosilicate
  - Having dedicated cover lens provides greatest # of options

# Summary of Sunlight Readability and Durability Factors

Design Consideration	Benefits	Trade-Offs	Applications/ Suggestions
Optical Bonding	Reduces Reflections Improves Contrast Eliminates Condensation May increase impact resistance	Cost Some materials may yellow over time with UV exposure	Recommended for all outdoor and marine applications
Anti-Reflection + Anti-Smudge	Maximum Reflection Reduction Maintains Image Quality	Coating may wear long term – finite # of rubs / touches Not as hard as glass Problems with Salt Fog Weakens CS glass	Highly dependent on product requirements and AR / AS quality. Some AR / AS coatings thoroughly tested for salt & UV exposure
Anti-Glare	Improves Sunlight Readability Maintains Durability of Glass Surface	Requires Brighter Backlight Sparkle Reduces Image Sharpness	Good for outdoor and marine applications.
Touch Panel Materials	GG structure best for optical transmission, low haze, and non-birefringence	Overall PCAP thickness Cost	GG structure great for outdoor and marine applications
Cover Glass (protective only, no touch electrodes)	Aluminosilicates have high abrasion and impact resistance CS Soda -Lime is low cost and widely available with different surface treatments	Aluminosilicates: limited availability with AR No AG yet, high cost CS Soda-Lime: greater thickness required	CS Soda-Lime with treatments is a good choice for many outdoor and marine applications

# Marine / Water Applications



# PCAP Design Considerations for Water Performance

## The Problem with Water – False Touches

- Water and Saltwater affect capacitive coupling of electrodes
- Depends on size / geometry of water drops
- Can 'look' like a light touch, or group of touches
- Saltwater in particular can look very similar to a touch



# PCAP Design Considerations for Water Performance



## Top 3 Design Goals

- **No False Touches From Water – Droplets & Pools**
- **No False Touches From Saltwater – Droplets & Pools**
- **Accurate Touch Reported When Water / Saltwater Present**

# PCAP Design Considerations for Water Performance



## The Solution

### Touch Controller Selection

- Ocular's Marine Capable Touch Panels Utilize Atmel's maXTouch® Controllers
- Superior Touch Performance and High Degree of Configurability

### Touch Panel Construction

- Unique Construction for Best Water / Saltwater Performance

### Touch Panel Tuning

- Water Only
- Water + Saltwater



**Thank You!**



Visit us at:  
[www.ocularlcd.com](http://www.ocularlcd.com)  
[contact@ocularlcd.com](mailto:contact@ocularlcd.com)