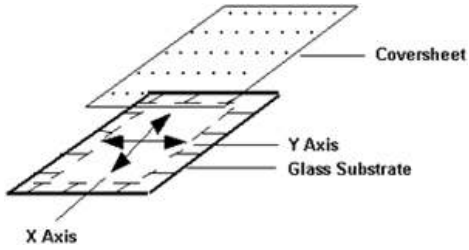
AccuTouch Technology Specifications

Mechanical • Optical • Cosmetic • Environmental • Electrical • Agency Approvals • Warranty • Documentation

1. Mechanical

1.1 Construction

The AccuTouch five-wire resistive touchscreens use a glass panel with a uniform resistive coating. A thick polyester coversheet is tightly suspended over the top of the glass, separated by small, transparent insulating dots. The coversheet has a hard, durable coating on the outer side and a conductive coating on the inner side.



When the screen is touched, the conductive coating makes electrical contact with the coating on the glass. The voltages produced are the analog representation of the position touched. The controller digitizes these voltages and transmits them to the computer for processing. AccuTouch five-wire technology utilizes the bottom substrate for both X and Y-axis measurements. The flexible coversheet acts only as a voltage-measuring probe. This means the touchscreen will continue working properly even with non-uniformity in the coversheet's conductive coating. The result is an accurate, durable and reliable touchscreen that offers drift free operation. AccuTouch screens are sealed against contamination and moisture. This prevents wicking of fluid between the coversheet and glass.

1.2 Cable and Connector

Cable typically exits from the left side, terminating in a five-position, 0.025 inches (0.635 mm) square post receptacle. The connector shall be capable of at least 100 insertions and withdrawals of a compatible male contact without affecting the electrical performance of the touchscreen. The cable to touchscreen interface shall be capable of withstanding a straight-line pull of 10 pounds, maintained for a period of five minutes.

The cable to connector housing interface shall be capable of withstanding a straight-line pull of eight pounds, maintained for a period of five minutes. The cable shall be capable of withstanding a forming bend of 180° over a cylinder of radius 0.0625 inches. This bend may be repeated up to 25 times.

1.3 Positional Accuracy

For all flat screens up to 18 inches in diagonal, standard deviation of error is less than 0.080 inches (2.032 mm). The maximum error is 0.180 inches (4.572 mm) in either axis. For flat screens larger than 18 inches in diagonal, the maximum error is 1% of the diagonal of the active area. Detected touch coordinates, after being mathematically fitted to actual touch coordinate patterns, shall not have a standard deviation of errors in excess of 0.080 inches in either axis. (Positional accuracy shall be reported in terms of the standard deviation for both the X and Y axis using Elo Test Software as the data collection and calculations tool.)

1.4 Touchpoint Density

TouchPoint Density is based on controller resolution of 4096x4096. This equates to more than 100,000 touchpoints/in^2 (15,500 touchpoints/cm^2) for a typical touchscreen when used with Elo controllers.

1.5 Touch Activation Force

When activated by a Standard Finger (Per Elo Document SD000444), the activating force is typically less than 4 ounces (113 grams).

1.6 Hardcoat Pencil Hardness

Meets pencil hardness 3H per ASTM D3363.

1.7 Abrasion Test

Meets Taber Abrasion Test (per ASTM D1044), CS-10F wheel, 500 grams.

1.8 Expected Life Performance

AccuTouch technology has been operationally tested to greater than 35 million touches in one location without failure, with a stylus similar to a finger.

1.8.1 Test Setup

Each touchscreen to be tested shall be subjected to the normal QC acceptance testing which shall included linearity, open and closed circuit resistance, and visual defects inspection. Each touchscreen shall be connected to a type 2216 combo controller and computer. The touchscreen under test shall be mounted to a fixture, which will hold the touchscreen under a pneumatic cylinder. The output piston of the pneumatic cylinder shall be fitted with a "standard finger" conforming to drawing SD000444. The air pressure on the pneumatic cylinder shall be adjusted to provide an actuating force of from 10 to 12 ounces on the "standard finger" when measured at the surface of the touchscreen. The pneumatic cylinder controller shall be adjusted to provide a touch rate of approximately 2 per second (100 to 135 per minute).

1.8.2 Test Procedure

Turn on test computer and monitor. Change directory to the test directory where the "TIC" program is resident and activate the "TIC" program. (This program receives the position information from the touchscreen controller, reports the date, time and position data; and displays it on the monitor; and stores it on the hard drive of the computer. It also compares the position data received at any time with the initial few positions reported and indicates any deviation from the original readings.) Watch the monitor and observe that the data is being taken and recorded. Check output each working day to ensure that the operation is continuing properly (NOTE: AccuTouch HL screens in certain situation will build up a significant amount of static energy on the coversheet. Periodically this static build up must be discharged as to not interfere with the touch test). A failure is recorded anytime the change in positional output data reaches or exceeds 150 counts (this value was chosen to allow for wear on the "standard finger" and on the pneumatic cylinder). At the completion of the test, remove touchscreen from the test fixture and send it to Quality Control for linearity testing and visual inspection. Report the results in the test data report. Send the test data (number of contacts, final positional data, start and stop dates, any unusual circumstances or test equipment failures) to the responsible Product Engineering Department for use in the preparation of the final report.

1.9 MTBF

AccuTouch touchscreens have a calculated MTBF of over 490,000 hours based on returns data and hours of usage. See method below:

- The current probability of survival is 0.989 (definition of reliability, R)
- The typical usage rate for 1 year in hours can be estimated as a median usage of 5420 hrs (t): between a minimum 8 hrs/day, 5 days/week, 52 wks/yr or 2080 hrs and a maximum 24 hrs/day, 365 days/yr or 8760 hrs.
- Using the basic reliability formula:
  R = exp -t/MTBF
  0.989 = exp (-5420/MTBF)
  ln (0.989) = 5420/MTBF
  MTBF = 5420/-0.011061
  MTBF = 490,012 hrs

1.10 Sealing

1.10.1 Dust Seal

When dirt and dust seals are necessary, open cell foam material, similar to that used between the touchscreen and the display, can easily be applied between the touchscreen and bezel. If the seal contacts the active area of the touchscreen, avoid compression of the seal sufficient enough to cause continuous touch between the touchscreen coversheet and glass. This can be monitored during installation by connecting an ohmmeter between pin 1 and 3 of the touchscreen cable.

1.10.2 Watertight Seal

A Watertight seal is achievable by applying a gasket around the inactive border region of the touchscreen. Elastomer gaskets of almost any type may be used to make a seal between the touchscreen and bezel in this region. In order to prevent unwanted touches caused by the gasket pressing on the active touch area, gaskets must be applied in the inactive border region of the touchscreen. Seals that meet NEMA 4 and 12, and IP 65 standards are recommended.

Open-cell or closed-cell foam gaskets manufactured without sulfur vulcanized elastomers are recommended. In some highly unusual situations associated with high heat and humidity, cell foam gaskets manufactured with sulfur vulcanized elastomers can migrate from these gaskets and attack the silver electrode pattern of the touchscreen. Examples of sulfur vulcanized elastomers include neoprene or

polychloroprene (CR), ethylene propylene rubber (EPDM), styrene-butadiene rubber (SBR), nitrile rubber (NBR) and natural rubber (NR). These elastomers can also be cross-linked without the use of sulfur.

To avoid confusion in selecting suitable gasket materials, elastomers that cannot be cross-linked using sulfur are recommended. These elastomers include silicones, polyurethanes and saturated polyolefins, which are cross-linked using high energy irradiation, peroxide or other chemical crosslinking reactions. Examples of vendors of these materials include Rogers Corporation (www.rogerscorporation.com) for silicone gasket materials (BISCO Cellular Silicones) and polyurethane gaskets (PORON) and Voltek, Division of Sekisui America Corporation, which supplies irradiation and chemically crosslinked polyethylene foams (Volara and Minicel).

Application Note

When necessary to achieve a robust, watertight seal, it is important to note the following:

Resistive touchscreen coversheets are inherently hydroscopic, and thermally responsive. They may have a different coefficient of expansion than the bezel, and as such, forces can be transferred to the coversheet which may, in extreme environmental conditions, affect the coversheet fit. It is important to consider your bezel compatibility, adhesive rigidity, and environment before integrating ANY resistive touch screen.

2. Optical

2.1 Test Environment

The test environment for optical inspection is critical. The following criteria are derived from the ASTM D618 Standard Practices for Conditioning Plastics for Testing.

2.1.1 Conditioning

AccuTouch touchscreens should be conditioned at 23 +/- 2°C (73.4 +/- 3.6°F) and 50 +/- 5% relative humidity for not less than 40 hours prior to test, in accordance with Procedure A of ASTM Practice D618.

2.1.2 Test Conditions

AccuTouch touchscreens should be set up for testing in an atmosphere maintained at 23 +/- 2°C (73.4 +/- 3.6°F) and 50 +/- 5% relative humidity.

2.2 Available Coversheets

Coversheets are available in high light transmission (HL, antiglare) version.

2.3 Light Transmission

Light Transmission testing is in accordance with ASTM D1003.

- **HL Products**: 80% +/-5% at 550 nm wavelength (visible light spectrum).

2.4 Visual Resolution

All measurements made using USAF 1951 Resolution Chart, under 30X magnification, with test unit located approximately 1.5 inch (38 mm) from surface of resolution chart.

- **Antiglare surface**: 6:1 minimum

2.5 Haze

Haze testing is in accordance with ASTM D1003.

- **Antiglare surface**: Less than 15%

2.6 Gloss

Gloss testing is in accordance with ASTM D2457.

- **Antiglare surface**: 130 ± 20 gloss units tested on a hard-coated front surface.

3. Cosmetic

3.1 Scope

This document applies to all standard AccuTouch touchscreens. Due to the subjective nature of cosmetic inspections, cosmetic inspection techniques are only applicable for incoming inspections of new touchscreen product. Cosmetic inspection techniques may not be applicable for product that has been excessively handled, integrated into final assemblies or has remained in the customer's inventory for more than 90 days. Cosmetic touchscreen issues do not effect the operational specifications of the AccuTouch touchscreen product.

3.2 Test Environment

The test environment for cosmetic inspection is critical. The following criteria are derived from the ASTM D618 Standard Practices for Conditioning Plastics for Testing.

3.2.1 Conditioning

AccuTouch touchscreens should be conditioned at 23 +/- 2°C (73.4 +/- 3.6°F) and 50 +/- 5% relative humidity for not less than 40 hours prior to test, in accordance with Procedure A of ASTM Practice D618.

3.2.2 Test Conditions

AccuTouch touchscreens should be set up for testing in an atmosphere maintained at 23 +/- 2°C (73.4 +/- 3.6°F) and 50 +/- 5% relative humidity.

3.3 Surface Quality–Circular Criteria

Surface quality criteria identify cosmetic irregularities appearing on or between the glass and plastic surfaces of the touchscreen. Elo surface quality criteria are consistent with the criteria used by the major LCD and display manufactures.

Circular criteria identify surface quality irregularities that are circular in nature. This includes dirt, particles, glass bubbles, digs, hard coat flaws, etc. Size will be measured across its diameter. Irregularly shaped circular defect diameters will be designated by the smallest diameter into which the defects could be completely contained, i.e. the length at the widest point of the defect.

3.3.1 Active Area

In the active area, no defect larger than 0.020 inches is allowed. There shall be no more than two defects in the range of 0.015 and 0.020 inches contained within a 2 inch diameter area. The sum of the diameters of all circular defects contained within a 2 inch diameter area shall not exceed 0.050 inches. Black- colored specks or dirt larger than 0.005 inches are not allowed.

3.3.2 Viewable DSCA Area

In the viewable DSCA (double-sided coversheet adhesive) area, no defect larger than 0.040 inches is allowed. The viewable DSCA area of the touchscreen is the area seen by the customer under normal use. Normally, the viewable area coincides with the active area, but depending on the customer's application, it could extend outwards. Therefore, the standard definition of the viewable DSCA area is the area 0.125 inches larger per side than the active area (adhesive edge) or the area between the active area and frit pattern whichever is smaller.

3.3.3 Outside Viewable Area

Outside the viewable area no circular defect will be accepted larger than 0.075 inches.

3.4 Surface Quality–Linear Criteria

Surface quality criteria identify cosmetic irregularities appearing on or between the glass and plastic surfaces of the touchscreen. Elo surface quality criteria are consistent with the criteria used by the major LCD and display manufactures.

Linear criteria are quality irregularities that are linear in nature. Linear defect size will be measured across the width of the defect at its widest point. Linear defects smaller than 0.001 inches will not be considered in the evaluation of cosmetic acceptability.

3.4.1 Active Area

In the active area, no defect having a width larger than 0.004 inches is allowed. The maximum length of a single defect, with a width between 0.003 and 0.004 inch is 0.500 inches. The combined length of multiple linear defects within a 2 inch diameter area shall not exceed the requirements shown below. The distance between two linear defects shall not be less than the separation shown below. When two linear defects are in different width categories, the largest width category shall be used to determine minimum separation.

Width Range	Maximum Length	Minimum Separation
0.0031-0.0040	0.500	0.250
0.0021-0.0030	1.000	0.150
0.0010-0.0020	1.500	0.050

3.4.2 Outside Active Area

No linear defect will be accepted having a width larger than 0.012 inches.

3.5 Surface Quality–Inspection Method

Inspection will be accomplished by looking through the touchscreen at the inspection light. The inspection light will consist of U.S. standard cool white fluorescent, F2, lamps which are mounted 3 to 4 inches behind an acrylic diffuser, producing light energy of approximately 375 Lamberts. The outer surface of the inspection light will be covered with equally spaced horizontal black stripes, approximately 2 inches wide, and covering roughly 50% of the light's outer surface. The element will be held 6 to 12 inches from the face of the inspection light, and will be viewed at a distance of 12 to 18 inches. Move touchscreen slowly up and down while viewing all areas as they pass from light to dark then back to light. Inspection will be performed using the un-aided eye, excluding prescription eyeglasses or contact lens. Measurement of defect size may be aided by magnification.

3.6 Surface Quality–Passable Criteria

The AccuTouch polyester coversheet has a durable hardcoat and antiglare coating on the outer surface, and conductive metallic coating on the inter surface. The combination of lighting conditions, inspection viewing angle, background, etc. may reveal additional defects that are inherent with the material and coatings. The following defects will pass if they fade in front of a light box:

- Stain
- Discoloration
- Infringement patterns (optical characteristic caused by fluorescent lights)
- Streaks
- Stress
- Scuffs

3.7 Coversheet Fit Criteria

Coversheet fit criteria pertain to the degree of tightness of the coversheet to the touchscreen glass. The following criteria is based on flat screens.

3.7.1 Proper Fit

Proper fit is characterized by a tight fitting coversheet. Place a plastic straight edge diagonally across the entire surface of the coversheet. Apply pressure in one corner in the area over the adhesive. The straight edge should rest on the opposite corner for an acceptable fit.

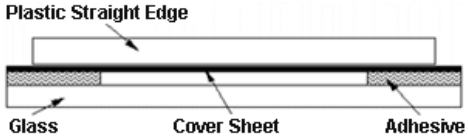


Figure 1. Proper Coversheet Fit

It is acceptable for the coversheet in the active area not to touch the straight edge when the straight edge is extended across the sensor on top of the adhesive.

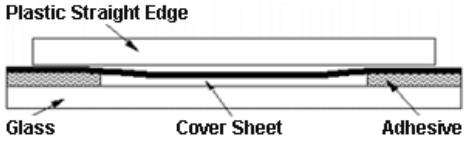


Figure 2. Proper Coversheet Fit

3.7.2 Excess Air Criteria

The excess air criteria are characterized by a coversheet with air trapped in the space between the coversheet and the glass. Place a plastic straight edge diagonally across the entire surface of the coversheet. Apply pressure in one corner in the area over the adhesive. The straight edge should rest on the opposite corner for an acceptable fit. If the straight edge does not touch the opposite side of the sensor, because of the trapped air under the coversheet, the screen should fail for improper fit.

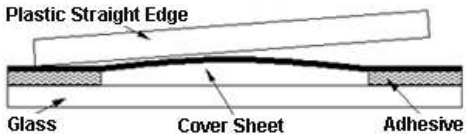


Figure 3. Improper Coversheet Fit—Puffy

3.7.3 Ripple Criteria

Ripple criteria are characterized by a wave or ridge in the coversheet that usually extends from a high point on the screen for example the cable contact area. Place a plastic straight edge diagonally across the entire surface of the coversheet. Apply pressure in one corner in the area over the adhesive. The straight edge should rest on the opposite corner for an acceptable fit. If the coversheet drops below the straight edge and then rises and falls multiple times, the touchscreen should fail for improper fit.

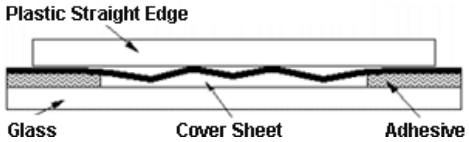


Figure 4. Improper Coversheet Fit—Ripple

3.7.4 Stroke Length Criteria

The stroke length criterion is a measurement of the distance from the glass surface to the bottom of the coversheet. The required stroke excursion to activate the touchscreen shall not exceed 0.020 inches as measured a minimum of 1 inch into the active area from the edge of the double-sided coversheet adhesive. If the coversheet displacement is more than 0.020 inches the screen fails.

4. Environmental

4.1 Temperature

- **Operating**: -10°C to 50°C
- **Storage**: -40°C to 71°C

Functionality is not adversely affected within these operating guidelines.

Application Note: When AccuTouch touchscreens are stored in temperatures below 0°C, Elo recommends pre-conditioning the touchscreen temperature above 0°C prior to handling or removing the touchscreens from their original packaging.

4.2 Relative Humidity

- **Functional operating limits**
  - Standard design: 90% RH at max 35°C
  - Enhanced design: 90% RH at max 50°C
- **Functional storage limits**
  - Standard design: 90% RH at max 35°C for 240 hrs, noncondensing
  - Enhanced design: 90% RH at max 50°C for 240 hrs, noncondensing

4.3 Thermal Cycling

The touchscreen shall be capable of functioning normally after the completion of fifty thermal cycles from room conditions to 70° C, back to room temperature; and then to -40° C and back to room temperature at a rate not to exceed 2º C per minute and with a one hour soak at each temperature extreme.

4.4 Immersion

The touchscreen shall be capable of functioning normally after having its lower edge immersed in water containing 5% isopropyl alcohol to a height one third of the overall height of the touchscreen, for a period of six hours.

4.5 Water Spray

The touchscreen shall function normally and not be damaged by running water applied to the active area.

4.6 Chemical Resistance

The active area of the touchscreen is resistant to the following chemicals when exposed for a period of one hour at a temperature of 70°F (21°C):

- **Industrial Chemicals**: Acetone, Methylene chloride, Methyl ethyl ketone, Isopropyl alcohol, Hexane, Turpentine, Mineral spirits, Unleaded Gasoline, Diesel Fuel, Motor Oil, Transmission Fluid, Antifreeze.
- **Food Service Chemicals**: Ammonia based glass cleaner, Laundry Detergents, Cleaners (Fantastic, Formula 409, Joy, etc.), Vinegar, Coffee, Tea, Grease, Cooking Oil, Salt.

4.7 Altitude

- **Operating**: The touchscreen shall be capable of operating at an altitude of 10,000 feet above sea level.
- **Storage**: The touchscreen shall be capable of being stored without damage at an altitude of 50,000 feet above sea level.

4.8 Vibration

The touchscreen shall not be damaged by being subjected to a vibration of 0.01 inches peak to peak excursion, at a frequency of 5 to 455 Hz, for a period of 15 minutes in each of three axes.

4.9 Shock

The touchscreen, in its standard shipping container, shall be capable of withstanding the drop test of Project 1A of the National Safe Transit Association Program Pre-shipment Test Procedures (10 drops from a height of 30 inches).

5. Electrical

5.1 Electrostatic Discharge Protection

The touchscreen withstands 20 discharges of 15KV, distributed randomly across the active area of the touchscreen with proper transient protection, per EN 61000-4-2 (1995)

5.2 Contact Bounce

Measured from the beginning of the touch pulse shall not exceed 15 milliseconds.

5.3 Open Circuit Resistance

Greater than 20K ohms, when measured from the signal contact (pin 3) to any drive contact (pins 1, 2, 4, or 5) on the connector, with no force applied to the active surface. Although typical open circuit resistance measurements are in the millions of ohm range, Elo controllers are designed to distinguish resistance values less than 10K ohms to filter false or near touches.

5.4 Closed Circuit Resistance

Shall be less than 3000 ohms when measured between the signal contact (pin 3) to any drive contact (pins 1, 2, 4, or 5) on the connector when the touchscreen is actuated anywhere within the Touch Active Area with a Standard Finger (SD000444) exerting a force of 10 to 12 ounces.

5.5 Breakdown Voltage

The touchscreen, with no force applied to the active surface, shall be capable of withstanding a difference of potential of 50 volts DC, between the signal contact (pin 3) and any drive contact (pins 1, 2, 4, or 5) on the connector for a period of 5 minutes.

6. Agency Approvals

6.1 UL Safety Certifications

UL Compliance: AccuTouch touchscreens and controllers are UL and cUL recognized components (File E162681) and TUV Rheinland (File S9577193 and S9577140).

6.2 Ball Impact Compliance

When properly installed, meets UL 1950 standard.

6.3 Fire Retardation Compliance

Meets UL-746C, 0.75-in flame test.

6.4 CE Compliance

Systems incorporating Elo Touchscreens, controllers, and cables can be approved for CE marking. Where appropriate, Elo touchmonitors are marked CE compliant, and are typically CISPR22 Class B.

6.5 FCC Compliance

Systems incorporating Elo touchscreens, controller, and cables have been approved to FCC Class A compliance. Elo touchmonitors are typically FCC Class B verified.

6.6 Agency Approval Certificates

- Agency approval certificates for all Elo controllers and touchscreens (443K PDF)
- RoHS Certificate of Compliance for touchscreens (134K PDF)

7. Warranty

5 Years

8. Documentation

AccuTouch Product Manual (505K PDF)