



5-Wire Resistive Touch Screen Integration Guide

3M Touch Systems, Inc.

Read and understand all safety information
contained in this document before using this product.

The information in this document is subject to change without notice. No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of 3M Touch Systems, Inc. 3M may have patents or pending patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. The furnishing of this document does not give you license to these patents, trademarks, copyrights, or other intellectual property except as expressly provided in any written license agreement from 3M Touch Systems, Inc..

The information provided in this document is intended only as a guide. For the latest detailed engineering specifications, please contact your 3M Touch Systems, Inc. Application Engineer. 3M Touch Systems, Inc. is committed to continually improving product designs, as a result, product specifications may be subject to change without notification.

NOTICE: Given the variety of factors that can affect the use and performance of a 3M Touch Systems, Inc. Product (the "Product"), including that solid state equipment has operation characteristics different from electromechanical equipment, some of which factors are uniquely within User's knowledge and control, it is essential that User evaluate the 3M Touch Systems, Inc. Product and software to determine whether it is suitable for User's particular purpose and suitable for User's method of application. 3M Touch Systems, Inc.'s statements, engineering/technical information, and recommendations are provided for User's convenience, but their accuracy or completeness is not warranted. 3M Touch Systems, Inc. products and software are not specifically designed for use in medical devices as defined by United States federal law. 3M Touch Systems, Inc.'s products and software should not be used in such applications without 3M Touch Systems, Inc.'s express written consent. User should contact its sales representative if User's opportunity involves a medical device application.

IMPORTANT NOTICE TO PURCHASER: Specifications are subject to change without notice. 3M Touch Systems, Inc.'s Products and software are warranted to meet their published specifications from the date of shipment and for the period stated in the specification. **3M Touch Systems, Inc. makes no additional warranties, express or implied, including but not limited to any implied warranties of merchantability or fitness for a particular purpose.** User is responsible for determining whether the 3M Touch Systems, Inc. Products and software are fit for User's particular purpose and suitable for its method of production, including intellectual property liability for User's application. If the Product, software or software media is proven not to have met 3M Touch Systems, Inc.'s warranty, then 3M Touch Systems, Inc.'s sole obligation and User's and Purchaser's **exclusive remedy**, will be, at 3M Touch Systems, Inc.'s option, to repair or replace that Product quantity or software media or to refund its purchase price. 3M Touch Systems, Inc. has no obligation under 3M Touch Systems, Inc.'s warranty for any Product, software or software media that has been modified or damaged through misuse, accident, neglect, or subsequent manufacturing operations or assemblies by anyone other than 3M Touch Systems, Inc.. **3M Touch Systems, Inc. shall not be liable in any action against it in any way related to the Products or software for any loss or damages, whether non-specified direct, indirect, special, incidental or consequential (including downtime, loss of profits or goodwill) regardless of the legal theory asserted.**

Copyright © 2005 3M. All rights reserved.

Document Title: *MicroTouch™ 5-Wire Resistive Touch Screen Integration Guide*
Document Number: 19441 (Rev. 13)

MicroTouch and the MicroTouch logo are either registered trademarks or trademarks of 3M in the United States and/or other countries.

Windows and/or other Microsoft products referenced herein are either registered trademarks or trademarks of Microsoft Corporation in the U.S. and/or other countries.

Overview

This document is written for electrical and mechanical engineers, design engineers, and system integrators who are responsible for designing, positioning, installing, and/or maintaining MicroTouch™ 5-wire resistive touch screen products.

This document includes the following information:

- Overview of the product, important safety notices, guidelines for cleaning and handling the touch screen, where to find more information, and how to contact 3M Touch Systems, Inc.
- Integration recommendations
- Basic steps for integrating a MicroTouch™ 5-Wire touch screen to a display

Important

If any information in this guide is unclear to you, or further clarification is needed, contact 3M Touch Systems, Inc. Technical Support Inc. (for contact details, see page 6).

Introducing the MicroTouch™ 5-Wire Resistive Touch Screen

The MicroTouch™ 5-Wire resistive touch screen is designed for applications that demand fast and accurate performance in response to various kinds of input (e.g., from a finger, gloved hand, stylus, or blunt instrument).

The MicroTouch™ 5-Wire touch screen has a flexible polyester top layer and a rigid bottom layer (sometimes called the “glass substrate”) separated by insulating spacer dots. The inside surface of each layer is coated with a transparent conductive coating and voltage is applied to the layers. A touch to the flexible top sheet creates electrical contact between the resistive layers, essentially closing a switch in the circuit.

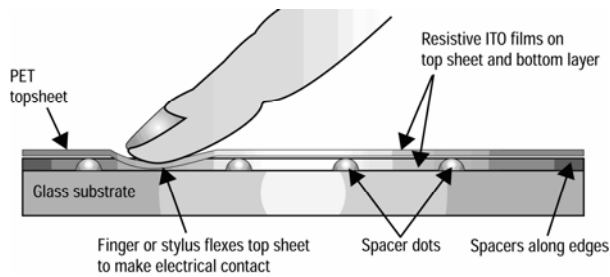


Figure 1: How it Works: MicroTouch™ 5-Wire Resistive Touch Screen

Depending on the controller electronics you use (the MicroTouch™ 5-Wire touch screen is compatible with 3M Touch Systems, Inc. controllers of the SC and EX II series), they either alternate the voltage gradient horizontally and vertically to get x then y touch coordinates or they simultaneously measure the current at each corner.

Important Safety Information

Read and understand all safety information before using this product. Follow all instructions marked on the product and described in this document. Pay close attention to the following installation warnings and safety precautions.

Intended Use

The *MicroTouch™ 5-Wire Resistive Touch Screen Integration Guide* is intended to instruct and guide you in the integration of a MicroTouch™ 5-Wire touch screen into your application. MicroTouch™ 5-Wire touch screens are intended for indoor use only and are not designed for use in hazardous locations.

Important

Given the variety of factors that can affect the use and performance of a 3M Touch Systems, Inc. Product (the “Product”), including that solid state equipment has operation characteristics different from electromechanical equipment, some of which factors are uniquely within User’s knowledge and control, it is essential that User evaluate the 3M Touch Systems, Inc. Product and software to determine whether it is suitable for User’s particular purpose and suitable for User’s method of application.

Explanation of Symbol



Attention: Read accompanying documentation

 **DANGER**

To avoid the risk of fire and/or explosion which will result in serious injury and/or death:

- Do not install or use this product in a hazardous location.

 **WARNING**

To avoid the risk of lacerations from glass breakage which may result in minor and/or moderate injury:

- Handle a touch screen with care to avoid breaking the glass.
- Do not use display if touch screen is damaged or broken.

To avoid the risk of electric shock which could result in serious injury and/or death:

- Do not use a damaged power supply or damaged power cord..
- You must be a qualified technician with experience in assembling and disassembling different types of displays. You must know the specifics of your display and have access to its documentation. There may be hazardous voltages present in the display. If you do not understand display electronics, you may injure yourself, damage the touch screen, or damage the touch screen controller.

To avoid the risk of fire and/or explosion which could result in serious injury and/or property damage:

- Do not install or use this product in a hazardous location.
- Do not use this product in any outdoor environment unless NEMA (or other similar) standards, such as IP rating, are followed.

 **WARNING**

To avoid the risk of electric shock which could result in serious injury and/or death:

- You must be a qualified technician with experience in assembling and disassembling different types of displays. You must know the specifics of your display and have access to its documentation.
- There may be hazardous voltages present in the display. If you do not understand display electronics, you may injure yourself, damage the touch screen, or damage the touch screen controller.

 **CAUTION**

To reduce the risks associated with improper disposal, which if not avoided may result in minor and/or moderate injury from ground water contamination:

- Dispose of components in accordance with local, state, and federal regulations.

To avoid the risk of glass breakage which may result in minor and/or moderate injury:

- Handle the touch screens with care to avoid breaking the glass. Be aware of cracked or broken sensors with sharp edges.
- Do not use damaged or broken touch screens.
- Dropping the display may cause glass parts to break.
- If you need to remove the touch screen for servicing, do not try to pry the touch screen off the LCD panel. You may break the glass and injure yourself or others.

 **CAUTION**

To avoid the potentially hazardous situations associated with the use of isopropyl alcohol which may result in minor and/or moderate injury or property damage:

- Follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and product label.

To avoid possible environmental contamination which may result in minor and/or moderate injury:

- Dispose of the product according to applicable governmental regulations.

Touch Screen Care and Cleaning

The touch screen requires very little maintenance. 3M Touch Systems, Inc. recommends that you periodically clean the touch screen surface.

 **CAUTION**

To avoid the potentially hazardous situations associated with the use of isopropyl alcohol which may result in minor or moderate injury or property damage:

Follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and product label.

Typically, an isopropyl alcohol and water solution ratio of 50:50 is the best cleaning agent for your touch screen. You can also use straight isopropyl alcohol. In addition, 3M Touch Screen Cleaner CL680 has been tested and approved for this use. Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents.

- It is important to avoid using any caustic chemicals on the touch screen.
- Always dampen the cloth and then clean the screen. Be sure to spray the cleaning liquid onto the cloth, not the screen, so that drips do not seep inside the display or stain the bezel.
- Apply the cleaner with a soft, lint-free cloth. Avoid using gritty cloths.
- Always handle the touch screen with care. Do not pull on or stress flex tail.

Related Documents

There are other 3M Touch Systems, Inc. documents that you should consult.

- **Controller Reference Guide.** Consult the controller documentation for the 3M Touch Systems, Inc. controller that you are integrating with the MicroTouch™ 5-Wire touch screen. The touch screen is compatible with 3M Touch Systems, Inc. controllers of the SC and EX II system. Available for download at www.3Mtouch.com.
- **Software Guide.** Consult the online documentation that supports the 3M Touch Systems, Inc. software you are using with your application. Available for download at www.3Mtouch.com
- **Resistive Touch Screen Product Specifications:** This document is available from your sales representative or your 3M Touch Systems, Inc. field applications engineer.

3M Touch Systems, Inc. Support Services

Before Contacting Technical Support

When you contact 3M Touch Systems Technical Support, please be ready to provide the following information that is relevant for your touch product:

Whenever you contact Technical Support, please provide the following information:

- Display manufacturer and model number
- Touch screen part number and serial number
- Current driver version
- Operating system used
- Information on additional peripherals

Website and Email Support

3M Touch Systems, Inc. provides extensive support services through our website and technical support organization. Visit the 3M Touch Systems, Inc. website at www.3Mtouch.com, where you can download touch screen software and drivers, obtain regularly updated technical documentation on 3M Touch Systems, Inc. products, and learn more about our company. The technical support email address is US-TS-techsupport@mmm.com.

Telephone Support

Technical Support is available Monday through Friday 8 a.m. to 8 p.m. US Eastern Standard Time – 9 a.m. to 5 p.m. throughout Europe. Limited call back service available Saturdays and Sundays 9 a.m. to 5 p.m.

You can contact 3M Touch Systems, Inc. Technical Support (US only -- Eastern Standard Time) by calling the hot line, sending email or a fax.

- Technical Support Hot Line: 978-659-9200
- Technical Support Fax: 978-659-9400
- Toll Free: 1-866-407-6666

Worldwide Offices of 3M Touch Systems, Inc.

- | | |
|--------------------------------------|-----------------------------|
| ▪ United States 978-659-9000 | ▪ Hong Kong 852-2806 6111 |
| ▪ United Kingdom +44 (0) 1235-444400 | ▪ Italy +39 (0) 39-230-2230 |
| ▪ Australia 61-3-9582-4799 | ▪ Japan +81-3-5226-1131 |
| ▪ Canada 604-521-3962 | ▪ Korea 822-552-3198 ~ 9 |
| ▪ China 86-0755-82461336 | ▪ Singapore +65-6450-8851 |
| ▪ France +33 (1) 30-31-68-37 | ▪ Spain +34 934 15 6285 |
| ▪ Germany +49 2131-14-4003 | ▪ Taiwan +886-2-2704-9011 |

The most current contact information for offices of 3M Touch Systems, Inc. is available on the company website: www.3Mtouch.com.

Integration Recommendations

This chapter outlines factors you should consider when designing for the integration of a MicroTouch™ 5-Wire resistive touch screen into your application. The information is intended to help you make design choices that will contribute to an efficient and successful integration.

Important

Given the variety of factors that can affect the use and performance of a 3M Touch Systems, Inc. Product (the “Product”), including that solid state equipment has operation characteristics different from electromechanical equipment, some of which factors are uniquely within User’s knowledge and control, it is essential that User evaluate the 3M Touch Systems, Inc. Product and software to determine whether it is suitable for User’s particular purpose and suitable for User’s method of application..

Inegrating and the Size of Touch Screen and Display

When deciding on the overall dimensions of your touch screen, consider the following:

- It is easiest to mount the touch screen if it does not overlap the display’s mounting holes. If overlap is unavoidable, consider mounting the touch screen with a mounting plate (page 16).
- The active area of the touch screen should match the ‘active area’ of the display (Figure 2). The ‘active area’ of the display is the surface over which there are display pixels.

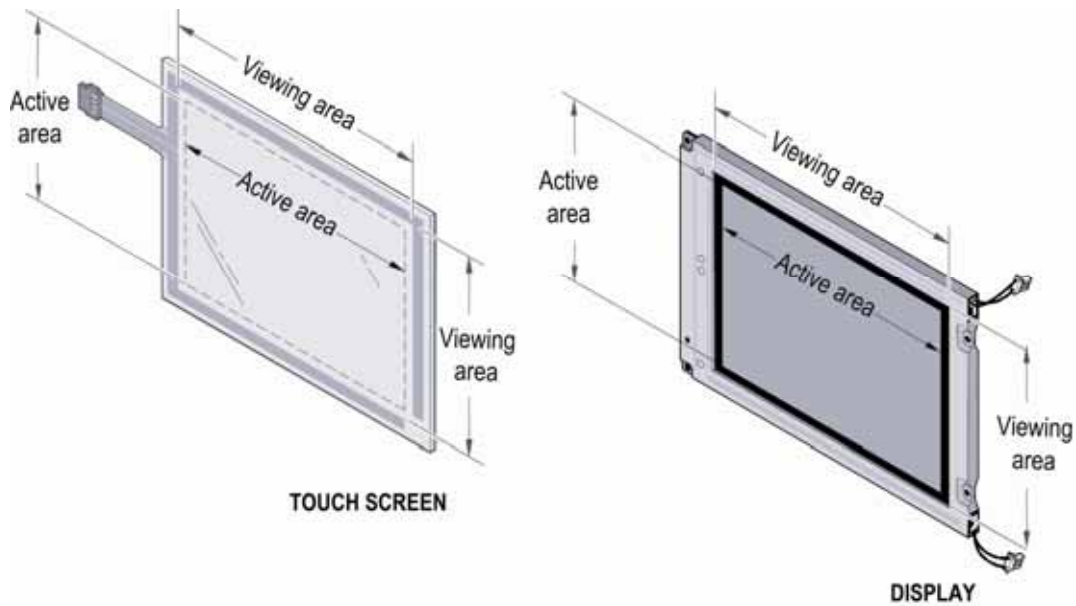


Figure 2: Active Area and Viewing Area of Touch Screen and Display

- The viewing area of the touch screen should be at least as large as the viewing area of the display (Figure 2).
- If mounting with a bezel, the viewing area of the touch screen should be slightly larger than the bezel opening of the display to allow for assembly tolerances. The bezel should be positioned so that its inner edge is located between the active area and viewing area of the touch screen (Figure 3).
- The overall size tolerance (length and width) of the glass substrate is ± 0.015 inches (0.4 mm). 3M Touch Systems, Inc. uses the glass substrate of the touch screen for registration of the other layers.

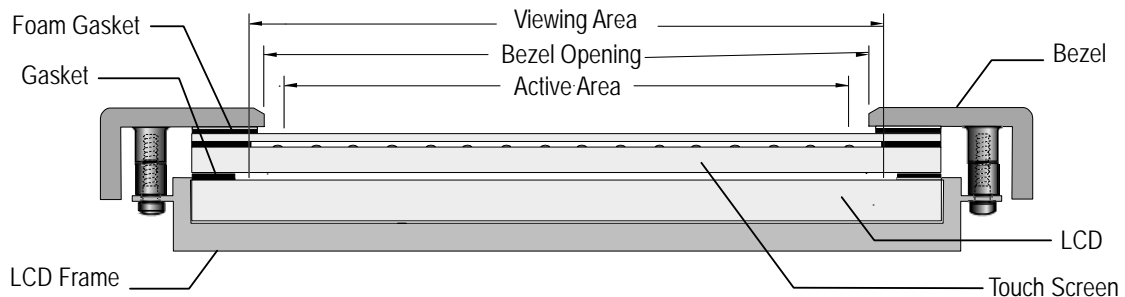


Figure 3: Positioning Bezel's Inner Edge Between Active and Viewing Areas

For an up-to-date list of MicroTouch™ 5-Wire touch screen sizes, visit the Touch Screen Selection Database at www.3Mtouch.com. If you cannot find the touch screen size and construction that you need, contact your sales representative.

Creating a Smooth Sealing Surface on the Underside of Bezel

It is imperative that the MicroTouch™ 5-Wire touch screen integration be designed to ensure that there is a smooth sealing surface on the bezel's underside.

Any ridge, boss, or groove on the bezel that will compromise a smooth sealing surface should be designed out. Doing so will help ensure that there is even compressive force around the perimeter of the touch screen and that the touch screen performance is optimal.

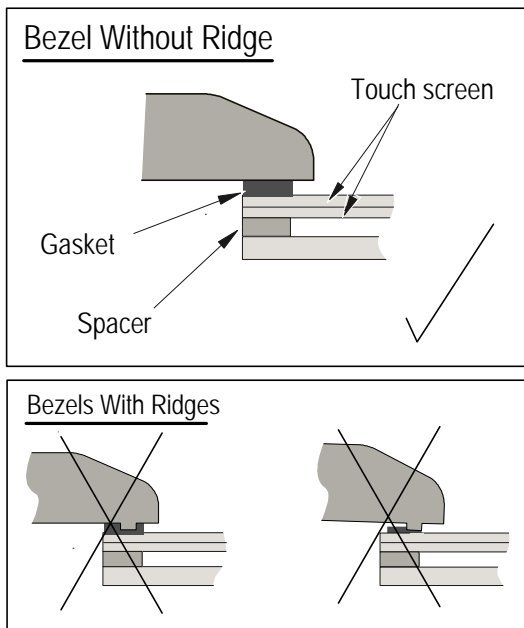


Figure 4: Desirable and undesirable bezel profiles (note how bezels with ridges can unevenly compress or even crush the gasket)

Optical Characteristics and Surface Finishes

Optical characteristics of the MicroTouch™ 5-wire touch screen differ depending on the type of finish applied to the surface of the screen. Optical features of each surface finish are summarized in Table 1.

The MicroTouch™ 5-Wire touch screen comes with a standard proprietary polyester hardcoat on the front surface of the screen (**HCG12**). This standard finish provides scratch-resistance, abrasion resistance, high clarity, has antiglare properties, does not show fingerprints easily, and provides a smooth surface for drag-and-drop and stylus applications.

The optional touch screen front surface finishes are:

- **Enhanced (E2):** Provides better transmission.
- **HCG10:** Offers superior anti-glare properties for high ambient light conditions (e.g., outdoor applications)

- **HCC01:** A high-gloss finish for applications that demand superior image quality. Be aware, however, that this finish is reflective and so may not be the best choice if the touch screen will be used in high ambient light settings (e.g., outdoors).

Table 1: Optical Characteristics of MicroTouch™ 5-Wire Surface Finish Options

Front Surface Finish	Optical Characteristics (%)			
	Transmission*		Haze*	Clarity*
	Glass <0.1" Thick	Glass ≥ 0.1" Thick		
Standard Hardcoat: HCG12	82	80	5	80
Enhanced (E2)	85	83	5	80
Superior Antiglare: HCG10	82	80	11	64
High-Gloss: HCC01	82	80	2	90

* Values are typical and were derived using BYK Gardner Hazegard Plus.

Whether the standard surface finish or one of the optional finishes is best for your MicroTouch™ 5-Wire touch screen will depend on the light conditions where the touch screen will be located after integration:

Using a Front Gasket

3M Touch Systems, Inc. highly recommends that a front gasket be used when integrating a MicroTouch™ 5-Wire touch screen.

A front gasket can help:

- Protect the touch screen from the effects of environmental change - provided that the integration is done properly.
- Contribute to an adequate seal for your application without interfering with the viewing area.
- Contribute to producing a smooth, uniform seal around the perimeter of the touch screen. (For more on the importance of a smooth sealing surface, see page 10.)

Important

Gaskets containing silicone should not be used with MicroTouch™ 5-Wire touch screens. There is the possibility of silicone leaching from the gasket and its reactivity creating the potential for damage to the electrical connections within the touch screen.

Choose material for your front gasket that:

- Is conformable and compressible
- Is pH neutral
- Does not have chemically active, corrosive, and/or recycled materials made from unknown element.

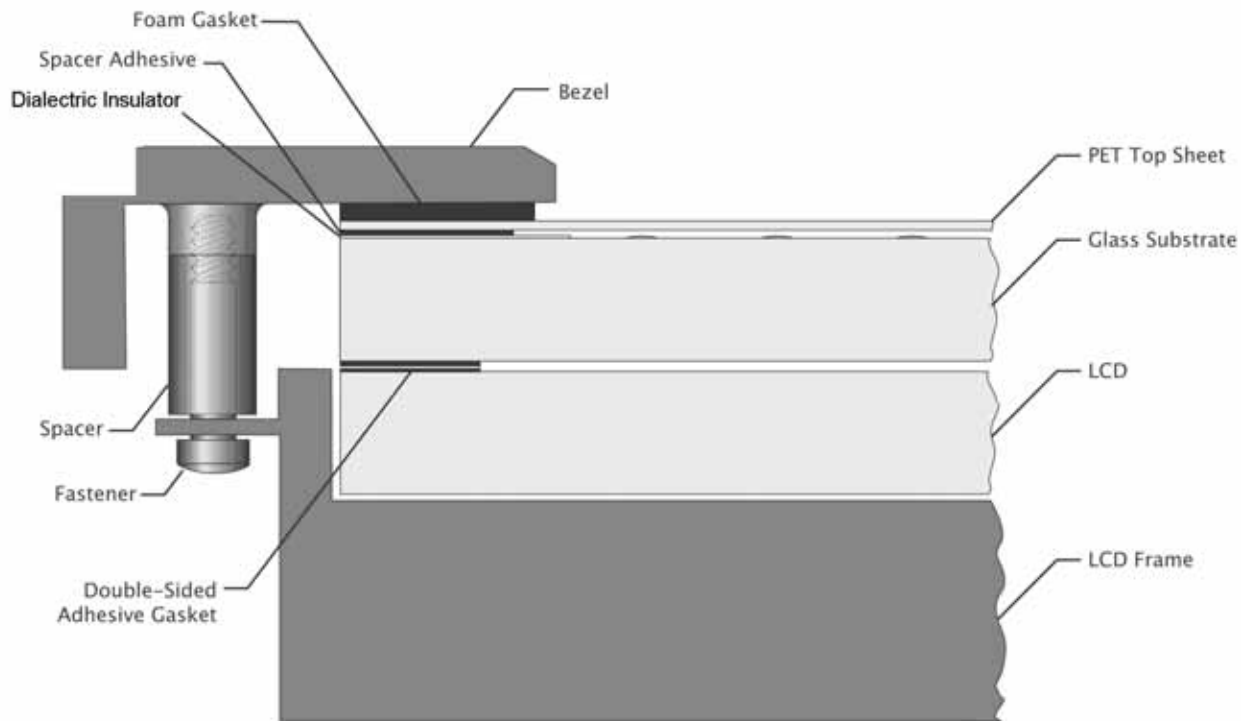


Figure 5: Example of gasketing and other design recommendations

Preventing Screen Distortions

3M Touch Systems, Inc. recommends mounting the touch screen so that it is supported from the rear side. Do not adhere the front surface of the touch screen to the bezel.

Observing this recommendation will help prevent the creation of touch screen distortions (e.g., bagging, stretching, pillowing) that may develop due to the inability of the touch screen adhesive to allow the polyester top sheet to expand and contract in response to changes in temperature and humidity.

Applying Force to the Top Sheet

When mounting the MicroTouch™ 5-Wire touch screen, make sure that any compressive force applied to the top sheet of the touch screen is:

- Uniform and evenly applied.
- Of relatively low force. Avoid continuous pressure greater than 3 psi (0.2109 Kg/cm²) and pressure concentrations greater than 5 psi (0.3515 Kg/cm²). Never apply so much pressure that indentations are made on the top sheet.
- Restricted to the part of the touch screen that is in the spacer adhesive area.

Evaluating Tensile and Shearing Forces Before Using PSA

Pressure sensitive adhesives (PSA) are commonly used in the design and assembly of resistive touch screens. Such adhesives achieve their holding strength from their flow and conformance to the microscopic texture of the surfaces in contact.

Pressure sensitive adhesives are not intended to support large tensile and shearing forces that may be created by improper application of overlays and bezel ridges.

Observing Minimum Bezel Clearances

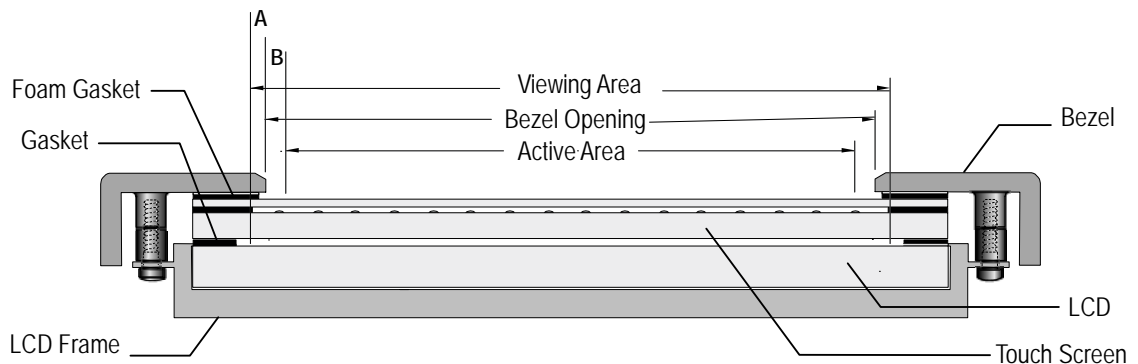
3M Touch Systems, Inc. recommends designing your integration of the MicroTouch™ 5-Wire touch screen with the minimum bezel clearances shown in Table 2.

Important

If mounting in a bezel, the viewing area of the touch screen should be slightly larger than the bezel opening of the display to allow for assembly tolerances. The bezel should be positioned so that its inner edge is located between the active area and viewing area of the touch screen (see Figure 3 on page 9).

Table 2: Recommended Minimum Bezel Clearances

Minimum Clearance Areas	A: Between edge of viewing area and bezel	B: Between edge of active area and bezel
Small Screens – Outer dimensions less than 12" (300 mm)	0.03" (0.8 mm)	0.03" (0.8 mm)
Large Screens – Outer dimensions 12" (300 mm) or greater	0.05" (1.3 mm)	0.05" (1.3 mm)



Bending and Routing the Tail

Follow these guidelines for routing and bending the touch screen tail:

- Do not crease the tail. Creasing can harm the product and will void the warranty.
- Store an un-integrated touch screen with the tail lying flat. Do not bend the tail until it is time to do the final integration.
- Avoid making multiple bends in the tail.
- Position the touch screen tail so that its bend radius is greater than 1/8" (3 mm).
- If bending the tail is unavoidable, minimize the risk of creating upward pressure on the touch screen by securing it with strain relief (e.g., a front gasket). The tail should not pull, push, or put any tension on the top sheet of the touch screen.
- To minimize the risk of EMI interference, never route the touch screen tail past unshielded, high-voltage sources (e.g., LCD backlight inverter).
- The touch screen tail should not move freely after assembly.

Installation Procedures

You can install a 3M Touch Systems, Inc. touch screen on most displays. Although some displays may call for unique integration considerations, here are the basic steps for installing a MicroTouch™ 5-Wire resistive touch screen system:

Important

Consult the display manufacturer to find out whether the original warranty will be affected if you install the touch screen. Also, determine who will recertify the display. Recertification will be necessary to comply with safety and FCC or EMC regulations.



To avoid possible damage to the controller, you must provide a path for electrostatic discharge. The controller mounting hole near the sensor connector should be used to connect to chassis safety ground and must be attached by the shortest possible route to a good earth return (chassis) in all applications.

Basic Steps

1. Test that the display's video works properly.
2. Disassemble the monitor (if necessary).
3. Mount the rear of the touch screen to the front of the monitor's display panel. For more on the mounting procedure, see later in this chapter.
4. Install the touch screen controller (internally or externally). For information on mounting the controller, consult the appropriate resistive controller reference guide.
5. Reassemble the monitor.
6. Connect the monitor and touch screen to your computer system.
7. Install software and calibrate the touch screen to the video display. For details on installing MicroTouch™ software and calibrating, consult the 3M Touch Systems, Inc. manual for your software at www.3Mtouch.com.

Mounting Directly to Display and with Mounting Plate

The MicroTouch™ 5-Wire touch screen must be rear mounted. In other words, the touch screen must be installed behind the bezel of the display.

You may choose to mount the touch screen directly to the display or to a mounting plate.

Mounting Directly to Display

1. Align and adhere the back of the touch screen to the metal frame of the display, using an adhesive gasket.
2. Secure the touch/display assembly to the product's bezel using the display's mounting holes.

Important

3M Touch Systems, Inc. recommends mounting the touch screen so that it is supported from the rear side. Do not adhere the touch screen to the bezel.

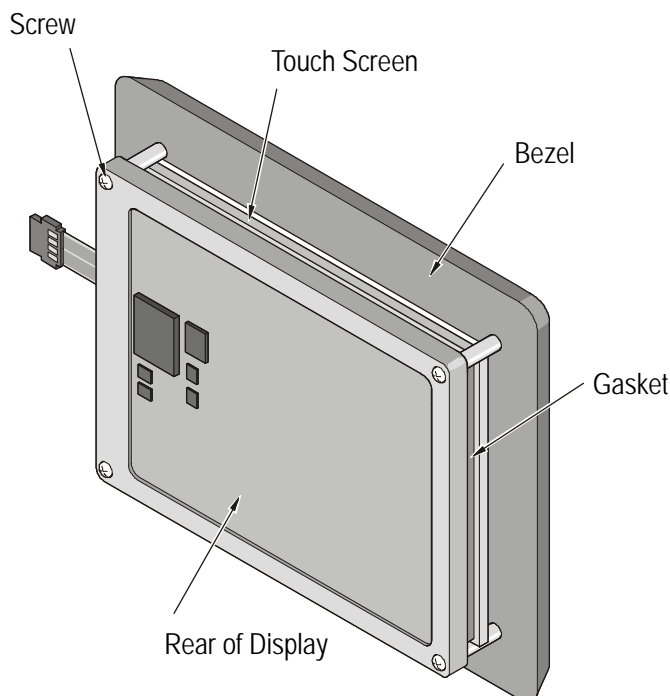


Figure 6: Example of Mounting Touch Screen Directly to Display

Mounting with a Mounting Plate

There are at least two scenarios in which you might choose to use a mounting plate:

- If the touch screen covers the display's mounting holes.
- If you need a mounting method that will allow several holes to be made to accommodate various displays.

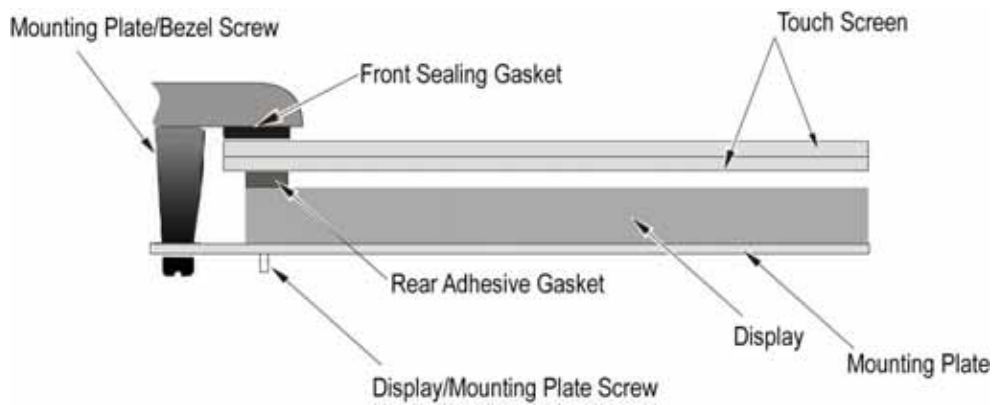


Figure 7: Example of mounting touch screen to display with mounting plate

Here are the steps for mounting the MicroTouch™ 5-Wire touch screen using a mounting plate (for an illustrated example, see Figure 7):

1. Attach the display to a mounting plate.
2. Align and adhere the back of the touch screen to the display/mounting plate, using an adhesive gasket.
3. Secure the assembly to the product's bezel.

Important

3M Touch Systems, Inc. recommends mounting the touch screen so that it is supported from the rear side. Do not adhere the touch screen to the bezel.
