3M™ Multi-Touch System PCT2000PX Series Integration Guide

For Projected Capacitive Technology (PCT) Systems

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

3M

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Contents

Chapter 3

Installing a Multi-Touch PCT2000 Series Sensor

Chapter 4

Installing the 3M™ Multi-Touch PX Series Controller

Chapter 5

Enabling Your Multi-Touch PCT2000PX Series System

About This Manual

Congratulations on the purchase of your 3M™ Multi-Touch PCT2000PX Series System. The PCT2000PX Series system incorporates 3M projected capacitive touch technology (3M PCT) and offers full multi-touch capabilities -- a must-have for next-generation, multi-touch applications.

The 3M™ Multi-Touch System PCT2000PX series provides customers with a leading edge solution that supports simultaneous touch events while rejecting palm events. It also includes a non-active, chemically strengthened cover glass which protects the underlying conductive elements as well as making it functionally impervious to surface scratches. The flat front surface solution eliminates dust and debris buildup at the edges of the display and helps increase system reliability.

Each 3M PCT multi-touch system ships with a 3M PCT sensor and 3M designed application specific electronics. Refer to information later in this guide for more details on your touch system. All other technical documentation is available from the 3M Touch Systems website at http://www.3m.com/touch/.

What You Need to Know

This manual describes how to complete the following tasks:

- Disassemble your display (if necessary)
- Mount the sensor to the display
- Install the touch controller

3M Touch Systems Support Services

3M Touch Systems provides extensive support services through our website and technical support organization. Visit the 3M Touch Systems website at http://www.3M.com\touch, where you can download touch software and drivers, obtain regularly updated technical documentation on 3M™ products, and learn more about our company.

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

- Display size, part number and serial number
- Current driver version
- Operating system used
- Information on additional peripherals

Technical Support is available Monday through Friday 8:30 a.m. to 5:30 p.m. with

limited call back service after 5:30 p.m. until 8:00 p.m. US Eastern Standard Time – 9 a.m. to 5 p.m. throughout Europe.

You can contact 3M Touch Systems 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 (Option 3)
- Email: US-TS-techsupport@mmm.com

Contact 3M Touch Systems

Contact information for all offices can be found on our website at: http://www.3M.com\touch/

CHAPTER 1

Getting Started

The 3M™ Multi-Touch System PCT2000PX Series can help you transform the human-computer interface experience. To begin installing your PCT2000PX Series System, take a few minutes to review this chapter. It is your roadmap to a successful installation. This manual describes how to retrofit a display with a touch sensor and controller. However, the principles apply equally well to systems integrated with sensors at an OEM level.

- The illustrations in this guide are representative of the components you will be installing. For precise layout and detailed dimensions, refer to the marketing drawings supplied by your sales representative.

- Pay close attention to the installation warnings and safety precautions. Disassembling a display can be a dangerous procedure. Be sure to follow all manufacturers' recommendations for assembly and disassembly of your flat panel display.

- Make sure you have the necessary equipment before starting the installation. Refer to *Supplies and Tools Needed for the Installation* later in this chapter.

- Set up a clean, comfortable, and spacious working area. Having sufficient room to work makes the installation easier.

- Test your display to ensure good working condition before you install the sensor.

- Identify the different components to install and review the summary of the installation procedure. It is important to know how all the pieces eventually fit together before disassembling your system.

Note: If any points within this guide are unclear to you, or further clarification is necessary, please contact your 3M Touch Systems representative.

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 *3M^{TM} Multi-Touch System PCT2000PX Series Integration Guide* is intended to instruct and guide you in the integration of a PCT2000PX Series Touch System into an existing flat screen display. These sensors are intended for indoor use only and are not designed for use in hazardous locations.

Explanation of Signal Word Consequences
⚠ **DANGER:** Indicates a potentially hazardous situation, which, if not avoided, will result in death or serious injury and/or property damage.
⚠ **WARNING:** Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury and/or property damage.
⚠ **CAUTION:** Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury and/or property damage.
NOTICE: Indicates a potentially hazardous situation, which, if not avoided, may result in property damage.

⚠ **DANGER**
• **To reduce the risks associated with fire and explosion:**   - Do not install or use in hazardous location.

⚠ **WARNING**

• **To reduce the risks associated with hazardous voltage:**
  - Plug power cord into appropriate grounded power source.
  - Do not use non-conforming replacement parts.
  - Do not attempt installation without appropriate experience in display assembly/disassembly.
  - Do not install without product documentation.
  - User should not service the display.
  - Turn display power off and unplug power cord prior to maintaining or servicing the display assembly.
  - Do not use a damaged power supply.
  - Do not use a power cord that is frayed or otherwise damaged.
  - Do not install or use in any outdoor environment unless NEMA standards (or similar appropriate standard) are followed.
  - Do not place wet or damp objects on the display.
  - Do not expose the display to rain or other sources of water, steam, or moisture.
  - Do not place foreign objects on the display or its cables.
  - Ensure that connecting the unit to the power source will not overload the power source.

⚠ **WARNING**
• **To reduce the risks associated with fire:** When using any cleaning solution, follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and on product label.

⚠ **CAUTION**

• **To reduce the risks associated with environmental contamination:**
   - Dispose of components in accordance with local, state, and federal regulations.
   - Dispose of the display according to applicable governmental regulations.
• **To reduce the risks associated with sharps:**
   - Do not attempt to pry sensor off display when servicing.
   - When handling the sensor, be aware that the sensor edges could be sharp.
 	
Handle the sensors with care to avoid breaking the glass. Be aware of cracked or broken sensors with sharp edges.

NOTICE

• **To reduce the risk of damage to assembly:**
   - Provide a path for electrostatic discharge.
   - The controller mounting hole nearest the sensor connector should be used to connect the chassis safety ground and must be attached by the shortest possible route to a good earth return in all applications.
   - Do not clean the backside of the sensor; the surface can be easily scratched. If you need to remove any debris from the sensor, use a filtered, deionizes air source.
   - Consult the display manufacturer to find out whether the original warranty will be affected if you install the sensor. Also, determine who will recertify the display.
 	
Certification will be necessary to comply with safety and EMC/EMI regulations.

Installation Considerations

3M Touch Systems recommends that only qualified display technicians install the sensor to the display.

Note: Consult the display manufacturer to find out whether the original warranty will be affected if you install the sensor. Also, determine who will recertify the display. Certification will be necessary to comply with safety and EMC/EMI regulations.

Supplies and Tools Needed for the Installation

Before starting the installation procedure, check that you have all items listed below.

Supplies Needed

- Safety glasses
- Small containers for holding loose parts (paper cups)

- Electrical tape (or black acetate tape)
- Clean soft cloth and glass cleaner for the display and sensor

- Replacement screws for mounting flat panel to bezel or chassis
- Ring lugs or crimps
- Nylon spacers and washers
- Polyimide tape

- Clean, anti-static pad
- Foam pad (optional)
- Gloves
- Felt-tip marker pen
- Cable tie-wraps
- Lead-free solder (RoHS compliant)
- Bezel Sealing tape – Test for suitability in your system
- Mounting tape -- closed cell acrylic foam 3M VHB 5952 and 5962 (double sided adhesive)

Tools Needed

- Flat-blade screwdriver with insulated handle

- Razor knife or single edge razor blade
- Wire stripper
- Ionized Compressed air

- Phillips head screwdriver
- Soldering iron
- Center punch
- Power drill
- Variety of drill, tap, and spade bits
- Dremel® tool or nibbler

Touch Sensor Care and Cleaning

The sensor requires very little maintenance. 3M Touch Systems recommends that you periodically clean the glass sensor surface.

⚠ WARNING

To reduce the potentially hazardous situations of fire and/or explosion associated with the use of alcohol or other solvents used for cleaning display screen, which may result in serious injury or death and/or property damage:

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

- 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 sensor.

> **NOTICE:**
> **To avoid cosmetic damage to the touch sensor and scratches on the black border:**
> Do not clean the backside of the sensor; the surface can be easily scratched. If you need to remove any debris from the sensor, use a filtered ionized air source.

Typically, an isopropyl alcohol and water solution ratio of 50:50 is the best cleaning agent for your sensor. Do not use straight isopropyl alcohol. Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents.

- It is important to avoid using any corrosive or caustic chemicals on the sensor.
- Always dampen the cloth and then clean the sensor. Be sure to spray the cleaning liquid onto the cloth, not the sensor, 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 sensor with care. *Do not pull on or stress flex tails.*
- Use the recommended cleaner and a soft, lint free cloth to clean the sensor. Make sure the glass is clean and dry before you attach the sensor.
- Clean only the front surface of the sensor. Only remove the protective liner from the touch sensor just prior to placing it on the LCD.

Note: Do not clean the backside of the sensor; the surface can be easily scratched. If you need to remove any debris from the sensor, use a filtered ionized air source. If you do happen to scratch the black border, we recommend using a Snowman® brand black paint marker to touch up any small scratches.

Preparing Your Work Space
Comfortable Work Area

Select a comfortable work area with adequate space and lighting. Make sure that the area is free of clutter and/or objects that could scratch the sensor and display. Leave the protective films in place as long as possible. 3M Touch Systems recommends an area of at least nine square feet. You will need this space to handle components safely and to set major components aside during the installation.

ESD Workbench

To minimize the possibility of ESD-related damage, use both a workstation antistatic mat and an ESD wrist strap.

A certified ESD workbench is required when handling sensors and electronics assemblies from out of box inspection through integration.

Protective Material

Place anti-static protective material on the work surface. A padded surface protects equipment from scratches during installation.

Small Containers

Have several small containers (such as paper cups) available to hold screws, washers, and other small components once you remove them.

Foam Pad

An ESD conductive foam pad is useful for holding the display while attaching the sensor. The pad makes the sensor easier to rotate for fastening screws, taping, etc.

Identifying the Components
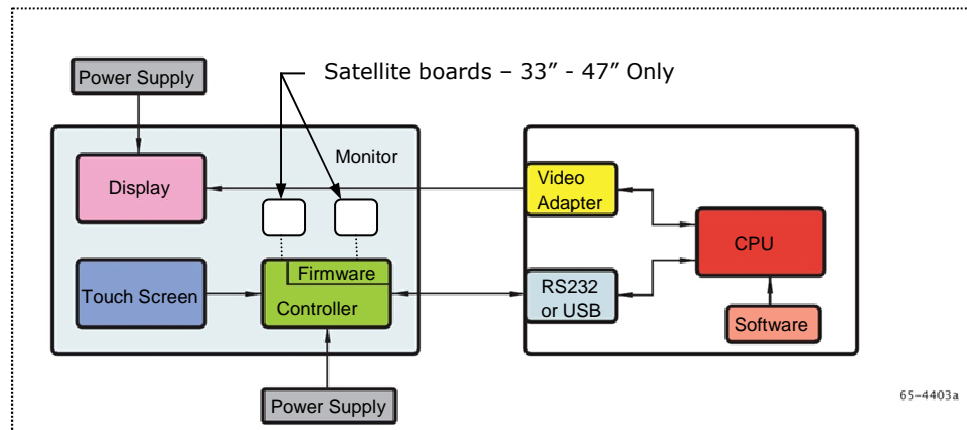
The following components are needed for a successful integration:

- A PCT2000 series sensor
- A PX Series controller
    - *33" – 47" Two satellite boards required*
    - *33 -47" Two additional communication cables required*
- A USB cable or serial cable
- A DC power cable
    - *33 – 47" Two additional power cables required*
- Software and technical documentation found on the web at www.3Mtouch.com.

Save the invoice, shipping container, and all packing material in case you need to transport the equipment any time in the future.

Identifying the Sensor Design

Identify the sensor by the model number. PCT21nn series is glass film/film construction and PCT24n5 is a glass on glass design. Both designs are PCT technology.
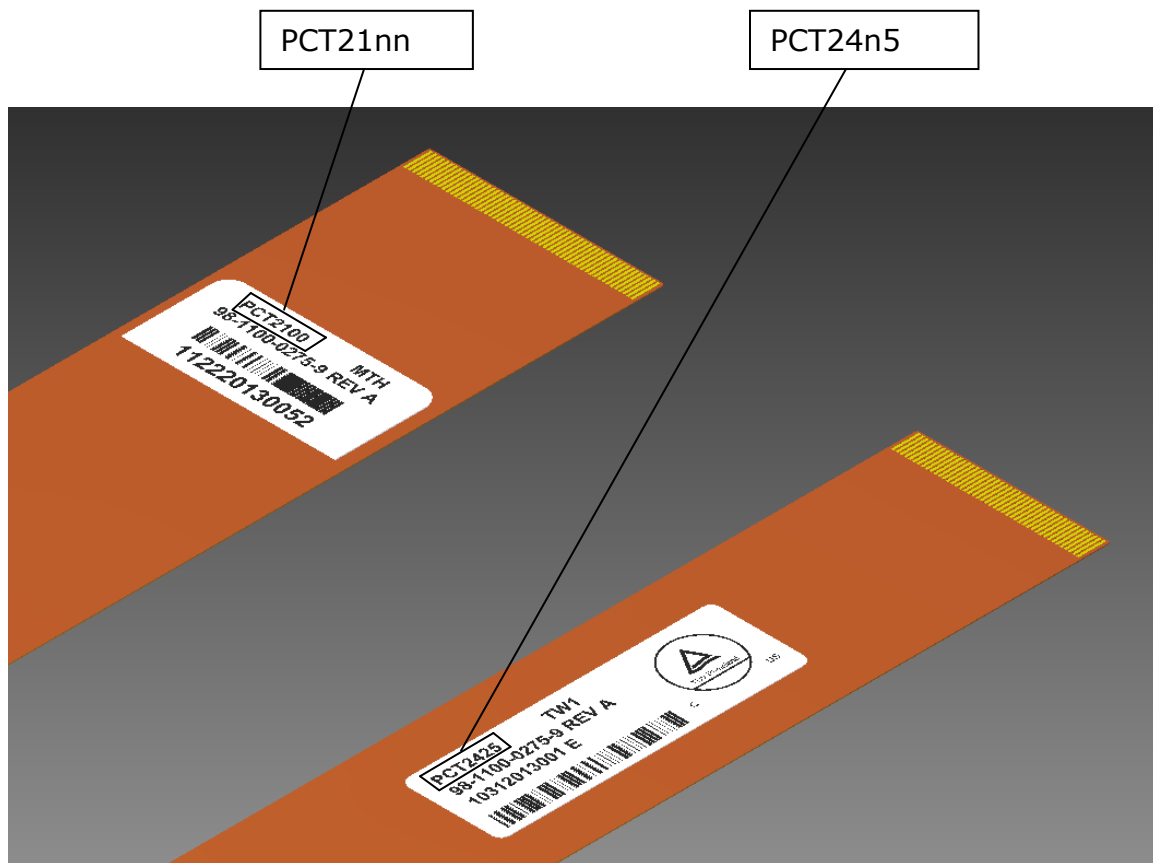
Important Notes for Video Displays

- In extreme temperature and humidity situations, you may observe condensation between the touch screen and the display. To minimize this condition, place the unit where it will be used and allow a 24-hour environmental stabilization period prior to powering on the display. Any noticeable condensation is temporary and will have no long term affect on the operation of the display.
- You are cautioned that any change or modification to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.
- When unplugging the power supply cord, hold the plug, do not pull by the cord.

- Do not connect or disconnect this product during an electrical storm.
- Remember to take into account that the operating temperature of the installation may be greater than the room ambient, and consideration should be given to installing the unit in an environment compatible with the maximum rated operating temperature.
- When installing the unit, ensure that it does not restrict the flow of air to any other equipment within the installation required for safe operation.
- Install the display in a well-ventilated area. Always maintain adequate ventilation to protect the display from overheating and to ensure reliable and continued operation.
- Do not expose this display to direct sunlight or heat. Passive heat may cause damage to the housing and other parts.
- Ensure the metal enclosure does not contact the touch sensor.
- Be sure to gasket the display to its enclosure properly to prevent damage to the touch sensor.
- The 3M touch controllers mentioned in this document, are USB compatible full speed devices.
- 3M does not warrant that we are USB compliant pursuant to USB specifications.

Testing the Display Video

Whether you are installing the sensor on a new or older display, you should make sure that the display is in good working condition and the video output is functioning properly. Your initial test should verify that the video functions properly before you install the sensor. You can also compare your results with the results you get after you complete the installation.

If the display is functioning properly, turn off your system, disconnect power plugs, and disconnect all cables from the display. You are ready to disassemble the display and install the sensor.

Summary of the Installation Procedure (32" or less)

You can install a 3M™ multi-touch sensor on most displays. Although each particular display may have some unique integration considerations, the basic installation process consists of the following steps:

- Test that the display's video works properly
- Disassemble the display (if necessary)
- Mount the sensor to the front of the LCD panel
- Install the controller
- Connect flex cables to controller
- Reassemble the display and connect to your computer system.

Example shown below is 32" or less.

See Chapter 4
for controller
mounting methods

65-4609a
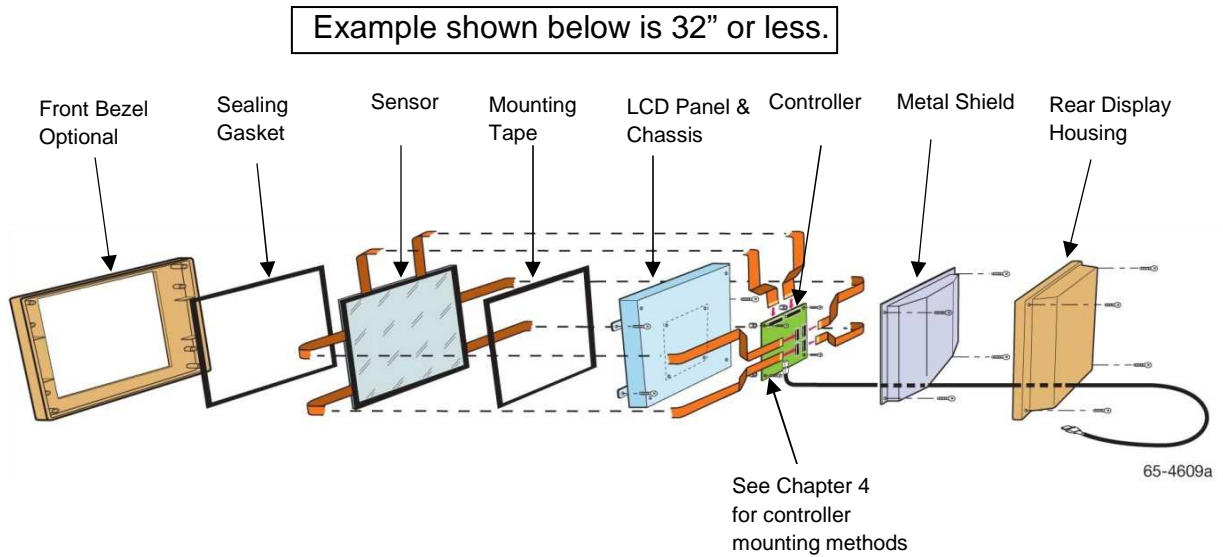
Summary of the Installation Procedure (33" – 47")

You can install a 3M™ multi-touch sensor on most displays. Although each
particular display may have some unique integration considerations, the basic
installation process consists of the following steps:

- Test that the display's video works properly
- Disassemble the display (if necessary)
- Mount the sensor to the front of the LCD panel
- Install the controller and satellite boards
- Connect flex cables to controller
- Connect power and communication cables between the main controller board and the two satellite boards
- Reassemble the display and connect to your computer system.

Example shown below is 33" – 47"

Front Bezel Optional

Sealing Gasket

Sensor

Mounting Tape

LCD Panel & Chassis

Controller

Metal Shield

Rear Display Housing

Satellite Board

Satellite Board

Power cable Controller 5 V

USB Cable

See Chapter 4 for controller mounting methods

Communication Cable

Power Cable

Satellite Board (Detail "B")

Communication Cable

Communication Cable

Power Cable

Power Cable

Power cable Controller 5 V

USB Cable

Main Controller Board (Detail "A")

See Chapter 4 for controller mounting methods

Communication Cable

Main Controller Board

Power Cable

Satellite Board

B

A

Satellite Board

Power Cable

Communication Cable

Power cable Controller 5 V

USB Cable

CHAPTER 2

System Design Considerations

Electrical Considerations

The front surfaces of displays carry potentials that fluctuate at the fundamental and harmonics of display scan frequencies. The PX Series controllers operate at a fixed frequency selected for best touch operation.
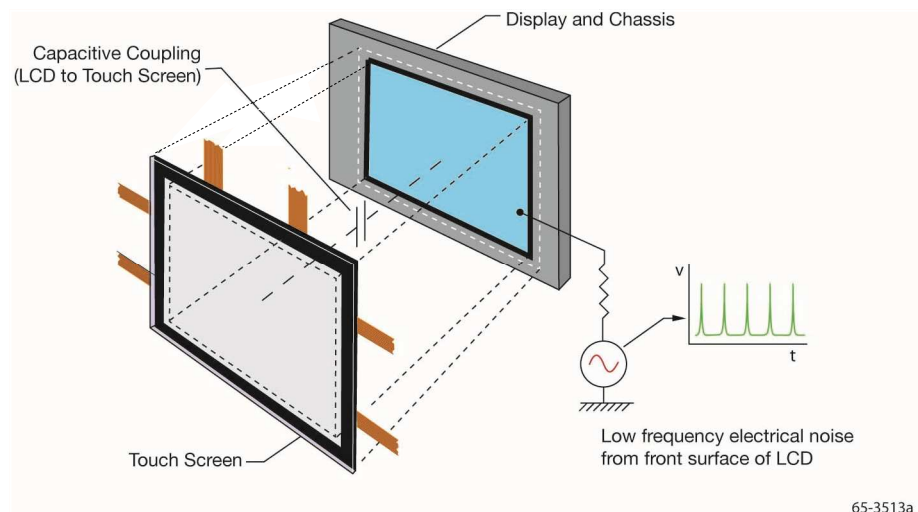
LCDs

In a projected capacitive sensor environment, be aware that some new types of LCD displays with high brightness, contrast, and LED backlight generate much more electrical noise than their predecessors. The excessive electrical noise generated by these displays may couple into the touch sensor and interfere with the controller signal-to-noise-ratio which could cause reduced performance.

A projected capacitive sensor attached to the face of a display acts as a large capacitor coupling LCD signals and adds capacitance to the touch sensor. The capacitor consists of 2 plates: one is the face of the display and the other is the sensor. In addition, some displays exhibit varying effective impedance to ground.

Displays should be equal to or larger than the installed sensor. Inadequately supported sensors may be susceptible to mechanical bending. Excessively large sensors are more susceptible to stray capacitance changes, when touches (mechanical distortions) are present.

Emissions

If radiated emissions are an issue in your integration, they may be reduced with one or a combination of the following solutions.

- System design should enclose the controller in a metal casing connected to the chassis ground.

- USB cabling from controller should terminate at USB housing with a grounded shield connection.

- The use of a ferrite on the USB cable.

Note: Consult the display manufacturer to determine whether the original warranty will be affected if you install the sensor. Also, determine who will recertify the display. Certification will be necessary to comply with FCC class B and CE radiated and conducted emissions regulations.

Mechanical Considerations
Tail Routing

Note: If you cannot avoid running a sensor tails near or over the backlight inverter or power supply, try to run the tails underneath it. If possible, run the tails underneath the metal shield. In some cases you may need to shield the wires or cables to ensure the noise does not couple into the tails.

The sensor tails are not handles. Never pick your sensor up by the tails. They are electrical connections and are not designed for high stress.
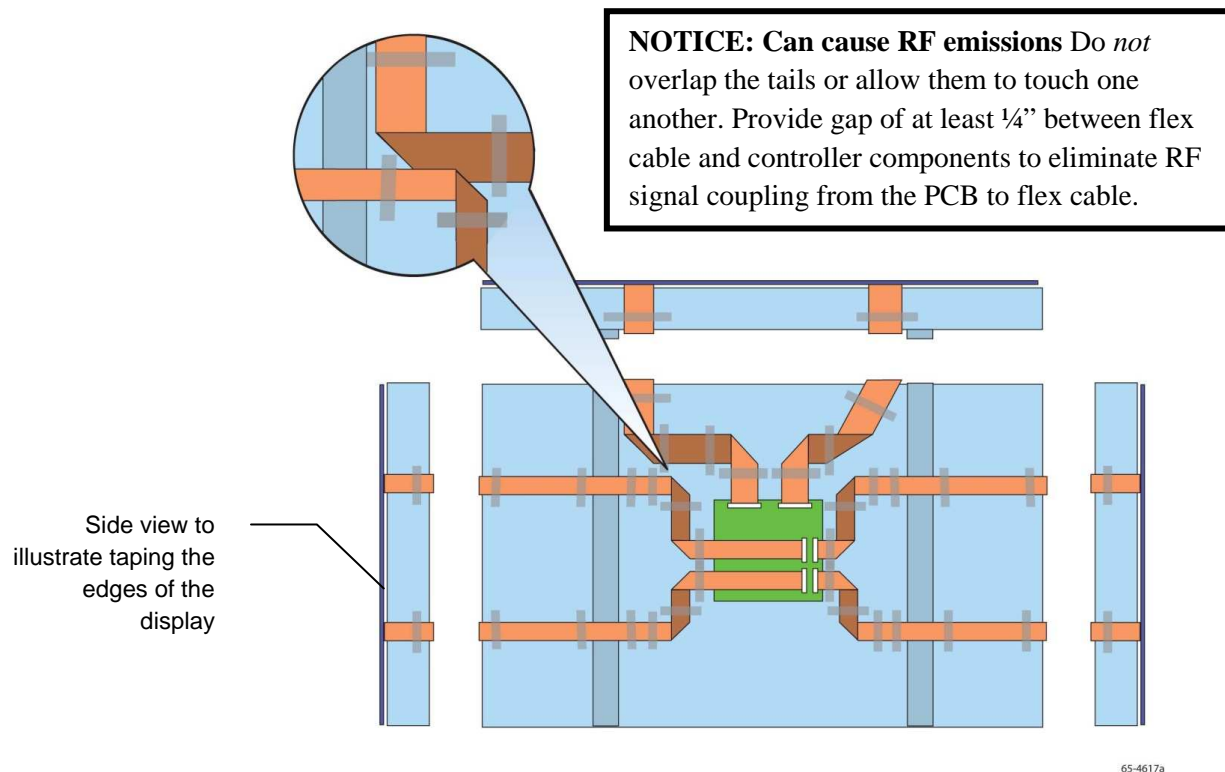
Always design your sensor integration with the flex tails exiting from the top or sides of the display. Avoid designing the tail exits from the bottom as spills could accumulate in the tail attachment areas and cause electrical shorting.

Do not place constant stress on the tails during handling or integration. Do not expose the tails to mechanical stresses because of the integration design. Provide adequate slack to ensure there is no strain on the tails. Avoid lateral pulls that may overstress the outermost electrical contacts on the glass. Be sure to tape tails in place.

The sensor tails should not move freely after assembly. Apply tape or another light adhesive to secure the tails in a manner that does not apply stress to the tails.

Apply tape or other insulating material to sharp edges to protect the tails. Route the cable away from sharp edges whenever possible. If this cannot be avoided, secure the tails so they do not move.

PCT21NN sensor tails are flexible, and may be creased *once in a single direction,* in multiple locations along the tail and then secured in position with a light adhesive tape. Avoid hard angular creases (45°) to the tails directly in the connection areas. PCT24N5 sensor tails must not be creased, but folded in one direction and taped.

NOTICE: Can cause RF emissions Do *not* overlap the tails or allow them to touch one another. Provide gap of at least ¼" between flex cable and controller components to eliminate RF signal coupling from the PCB to flex cable.

Side view to illustrate taping the edges of the display

65-4617a

Notes:

1. Do not cross over individual tails or allow them to touch – keep tails from overlapping.
2. The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.

On each tail there are folded areas. The number of these areas will differ depending on your particular product. These areas may be bent but not creased.

Note: 3M Touch Systems does not recommend metal sensor mounting brackets. If metal sensor mounting brackets must be used, be sure to keep tail bends away. Make sure that all metal brackets are grounded and not within the sensor's active area.

Integration Without a Bezel

If you are considering a bezel-less design, please contact your 3M Touch Systems Field Applications Engineer for additional details. Continue with the instructions in the section called Mounting Tape to LCD.

VHB tape stack to equal spacing not less than 0.107 inches (2.65 mm) between sensor and LCD

65-4618/4002a
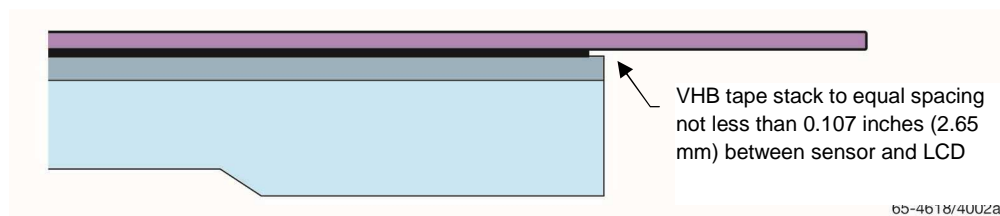
Sealing Gasket to Bezel

Single-sided tapes, adhered to the bezel, make for easy sealing of the sensor. Simply align and adhere the tape to the bezel edge. Gaskets should contact the sensor perimeter to ensure a good seal without interfering with the viewing area. Do not adhere the gasket to the sensor surface.
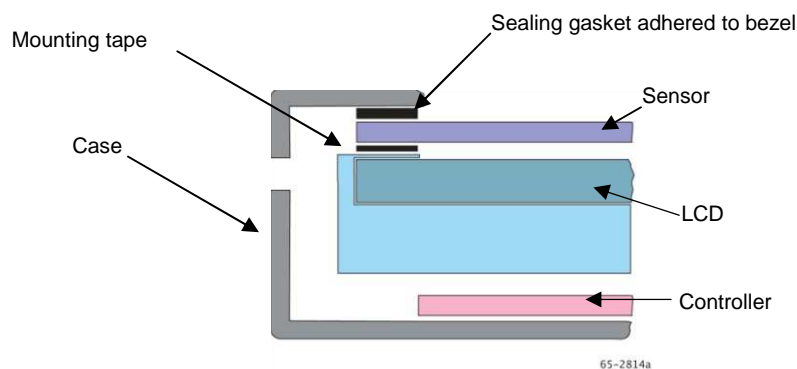

65-2814a

Attach sensor directly to LCD frame. Avoid mounting LCD and sensor independently to a common bezel. Stresses applied to the bezel may influence the gap between the sensor and the LCD. This may cause erratic operation and false touches.

Note: If you are considering a bezel-less design, please contact your 3M Touch Systems Field Applications Engineer for additional details.

Proper gasketing is critical to any successful sensor integration. All displays, regardless of environment, will be exposed to dust, dirt, spills, and grime and should be sealed with gaskets. Gasketing is relatively simple and straightforward. It can be either an o-ring or a flat, closed cell foam gasket applied around the perimeter of the bezel.

The compression of the sealing gasket should be evenly distributed to the glass surface. Be aware of and follow material manufacturer's recommended compression specifications. We recommend using non-acidic, pH neutral 3M brand tapes to seal your bezel and sensor. 3M foam tapes provide superior resistance to moisture and chemicals over other traditional cellular foam tapes.

Mounting Tape to LCD

LCD

Frame

65-4620a
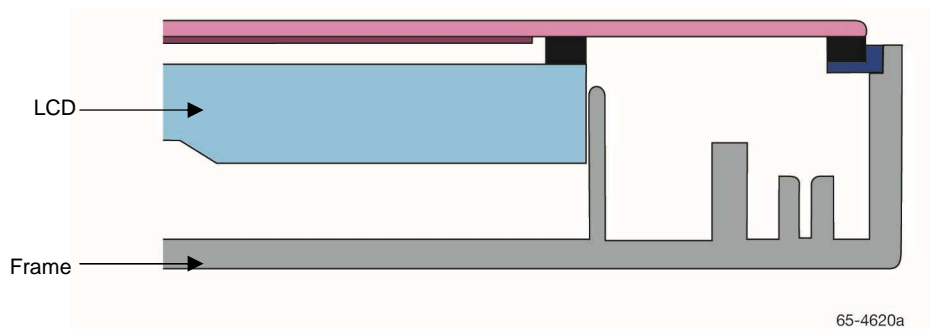
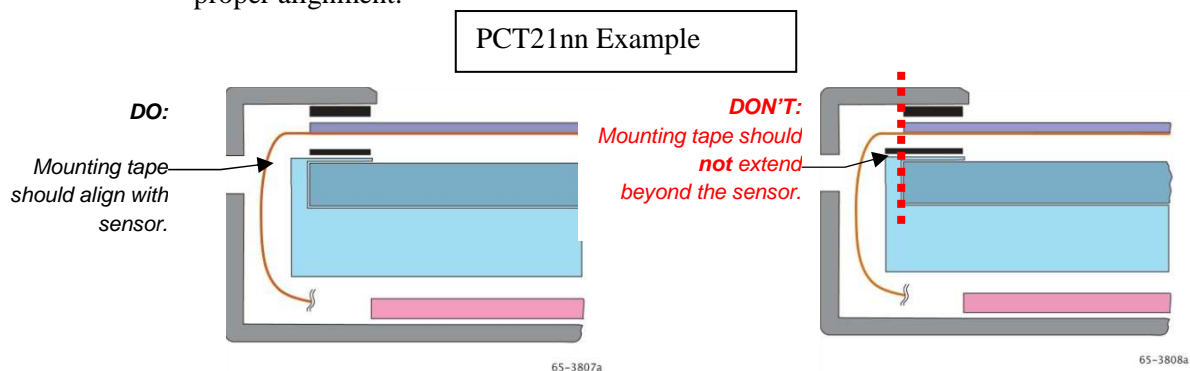The sensor must be mounted such that the spacing between the sensor and LCD does not vary due to compression or expansion from touch forces or temperature changes. The spacing between the sensor and LCD panel should be at least 0.107 inch (2.65 mm). For optimal performance, 3M Touch Systems has successfully used a stack up of 3M VHB brand 5962 and 5952 (3M Touch Systems part number 98-0003-3651-5) tape for this purpose. Failure to mount the sensor in this fashion may result in reduced performance. If you wish, you may use a standard 1/8 inch gasket as the nearest standard size.

Note: It is essential that the user evaluate this product to determine whether it is suitable for their particular purpose and method of application.

Note: For optimal performance, the gasket tape must have a thickness of at least 0.107 inches (2.65 mm). Avoid using thinner tapes, unless you can be sure the distance between the LCD panel and sensor is 0.107 inch (2.65 mm). Do NOT use highly compressible tapes. Be aware that using thicker tapes may impact the optical performance of the sensor by increasing parallax.

Tape extending beyond the sensor edge may cause excessive stress on the tail connections. Apply the tape to the sensor surface, rather than the display, to ensure proper alignment.

PCT21nn Example

DO:

Mounting tape should align with sensor.

DON'T:
Mounting tape should not extend beyond the sensor.

65-3807a

65-3808a

Note: Be sure to align the tape to the metal edge

PCT24n5 Example

8 MM
STEP

Frame
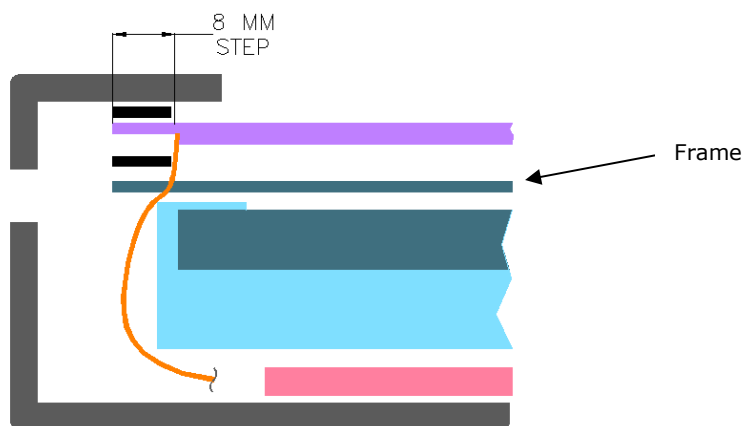
Metal Enclosures

Because conductive surfaces can present a stray capacitive loading to the sensor, you must be careful when positioning the sensor near metallic objects or materials. The following guidelines will help ensure a successful installation.

Do not let any metal — such as metal mounting brackets, screws or the display's metal housing — *physically* contact the front or sides of the sensor. This could be recognized as a touch.

In the design phase, avoid metal bezels whenever possible. If your current design has a metal bezel, ensure that it does not directly contact the sensor. The bezel should be appropriately grounded and very rigid. Use insulating tape or gasketing as a spacer.

Be aware that some plastic bezels have conductive paint that could act as a metal bezel so the same design rules apply in these instances.

Take measures to ensure that a metal bezel presents a constant and stable stray capacitive path to ground during operation.

Particulate Contamination

If the display design utilizes a fan for thermal management it is important to ensure that particulate contamination does not enter the display or the space between the LCD and Touchscreen. Using a filter (such as 3M Filter E792 part # 98-1100-0230-4) on any air inlets should prevent particulates from entering the display.

Touch System Location

Keep in mind the optics of the sensor. Remember that different sources of light such as outdoor (natural sunlight) and indoor (incandescent or fluorescent) can cause different effects when viewing the sensor.

Remember that lighting changes over the course of a day and depends on weather. Consider the brightness of an area and how it will affect readability of the computer display.

Consider using high brightness displays for better readability in bright ambient light conditions. Remember that sunlight comes in at different angles throughout the year. What might not be a problem in the summer could be an issue in winter.

Electromagnetic interference can cause problems with any electrical device. Be aware of devices that generate electrical fields, such as radio transmitters, mobile phones, pager transmitters, and security tag deactivators, and plan your installation accordingly.

Multi-Touch Application Support

Remember not all applications are multi-touch ready – Multi-touch behavior is a function of YOUR application. Check with your application vendor to determine if your software has multi-touch capability.

Designing Software Applications

With any touch application, the design can be crucial to the usability of the final product. Clear icons, bright contrasting colors, large buttons, button placement, and simple layouts will contribute greatly to the success of your installation.

Parallax, the effect of a target object appearing in different positions when looked at from different angles, is a common problem in many computer applications. The combination of the sensor in front of the display and differing heights of users can cause parallax. When designing your touch system software application, use the following guidelines to help reduce the effects of parallax.
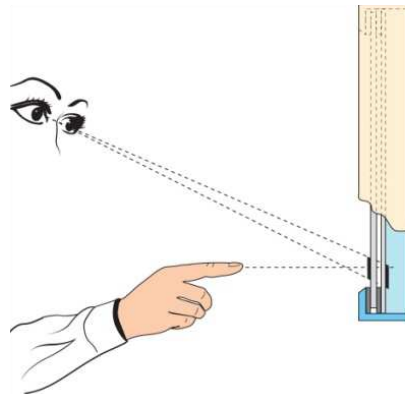
68-4408

- Design buttons to facilitate touch with your fingertip. Remember that a fingertip is much larger than a cursor.

Button graphic

Active touch area
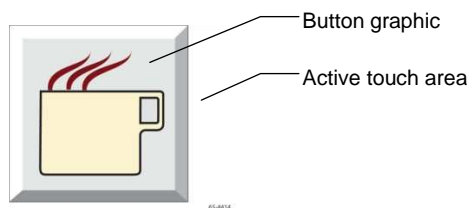
68-4454

- Place buttons horizontally whenever possible. One size does not fit all! Consider the varying heights of users and thus viewing angles when designing the application.

- Turn off the cursor. Users may inadvertently try to drag the cursor to the correct location on the sensor, emulating moving a mouse, instead of touching the button directly.

- Design your applications to work with a single touch to activate rather than a double-touch.

CHAPTER 3

Installing a Multi-Touch PCT2000 Series Sensor

This chapter describes how to install a PCT2000 series sensor in a display. You can install a PCT2000 series sensor on many different displays.

- The information in this chapter pertains to most displays.
- This chapter does not provide detailed instructions for any specific display.
- The procedures are only intended as guidelines and will vary depending on the display manufacturer.

Note: Given the variety of factors that can affect the use and performance of any product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is suitable for a particular purpose and suitable for the user's intended application.

Installation Considerations

NOTE - Damage to the PCT24n5 sensor can occur as the result of improper handling or electrostatic discharge (ESD). Always handle the sensor with care to avoid damage to electro statically sensitive components.

Before beginning the installation, review Chapter 2. Planning ahead ensures a successful installation. To summarize:

- Always use a properly fitted and grounded wrist strap or other suitable ESD protection when handling the sensor, and observe proper ESD grounding techniques.

- When handling the touch sensor, be sure to wear gloves to reduce the need to clean fingerprints off the sensor. Do not remove the static protective sheet until you are ready to put the sensor in place.

- Always lift sensor with two hands. Glass is thin and may crack if lifted with only one hand.

- Before installing the sensor, be sure to account for the space needed by the sensor and its flex tails.

- Ensure that the integration design does not subject the flex tails to pinch points and/or mechanical stresses.

- When installing the sensor, be careful not to route the sensor flex tails and power wires near the backlight inverter or power supply of the display.

- The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.

- The bezel may need to be modified to accommodate the sealing gasket and sensor. When trimming the bezel, make sure that the mechanical integrity of the display is not compromised.

- If it is necessary to remove the sensor from the display after it has been attached, do not pry it off. Carefully follow the instructions given.

- Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents. Follow manufacturer's directions for suitable chemicals for your display. Refer to the section on *Touch Sensor Care and Cleaning* for further information.

- When reassembling the sensor and bezel, do not over-tighten any corner. Do not over compress the sealing gaskets – take out the air but not beyond. Follow gasket manufacturer's recommendations for allowable compression ranges (typically 30 to 50%). Pressure should be evenly distributed across the sensor.

- Perform a bench test of the hardware to ensure functionality before you start.

Disassembling the Display

The process of disassembling the display is slightly different depending on the model of display; however, the components within the display housing are equivalent.

Note: This manual assumes that you have a display chassis attached to the front bezel, but since the internal components of most assemblies are basically the same, these same steps are applicable to all flat display installations.

Disconnecting the Power and Removing the Pedestal (if necessary)

Most displays consist of a flat panel supported by a pedestal. The pedestal may house the wiring for the display. Before the display casing can be disassembled, the power must be disconnected and the pedestal removed.

1. Look at the front of the display. Some displays have a small door that hides the brightness and contrast controls. It is a good idea to tape this door closed to prevent damage when handling the bezel.

2. Gently place the display face down on a foam pad or other scratch resistant surface so that the rear of the display and pedestal are accessible.

3. Disconnect the power and video cables attached to the rear of the display housing. These cables may run through the pedestal where they connect to the base of the display.

4. Remove the screws securing the pedestal to the display. Be sure to label these for re-assembly.

5. Remove the pedestal and set aside.

Removing the Display Housing

1. Place the display face down on a clean, anti-static pad. Remove the screws that secure the rear housing to the display, being sure to label them and set them aside.

   Note: The way in which the rear housing is attached to the display varies from model to model. LCD display manufacturers may use screws, quick-release latches, clips, or release buttons.

2. Lift off the rear housing to expose the display chassis. Remove any screws holding optional accessories (such as speakers or control buttons).

3. Remove the screws that secure the chassis to the front bezel. Carefully lift the chassis off the front bezel and set the bezel aside.

Fitting the Sensor

⚠ **Caution:** To reduce risk of cuts when handling the sensor which may cause minor or moderate injury, be aware that the sensor edges may be sharp.

The sealing gasket, mounting tape, and sensor add to the thickness of the display assembly. You will need to make sure there is enough space to reassemble the display once the gasket, tape, and sensor are fully integrated.

Checking for Adequate Space

1. Inspect the inside of the rear display cover.

2. Note the clearance between the inside surface of the rear cover and the rear of the display or chassis. You may be able to look through the vents and openings in the cover to check the available space.

3. You must be able to move the chassis about 3/16 inches (4.7 mm) into the rear of the housing. If there is not enough space, you may not be able to reassemble the display once the sensor is installed. Here are a few solutions:

   a. You can trim some plastic sections from inside the housing making sure you do not compromise the mechanical integrity of the display.

   b. You can reassemble with a gap between front and back housings. This gap is a result of the thickness added by the sensor.

Modifying the Bezel (If applicable)

You now need to determine if the sealing gasket and sensor fit into the bezel. You must have at least 4.7 mm. If necessary, you must trim the ribs and fins on the bezel that are in direct contact with the sensor or the sensor cable.

Note: When trimming the bezel, make sure you do not compromise the mechanical integrity of the display.

1. Place the bezel face down on an anti-static pad. Be sure to orient the top of the bezel closest to you.

2. Place the sensor face down against the inside of the bezel opening. Be sure to orient the sensor so the flex tails exit from the correct side of the bezel. Refer to your mechanical drawing or contact your 3M Touch Systems sales representative.

3. Align and center the viewing area of the sensor. Make sure the limits of the viewing area do not extend into the bezel opening.

4. Note the ribs and fins of the bezel that are in direct contact with the sensor. Pay particular attention to the corners as well as where the flex tails exit from the sensor.
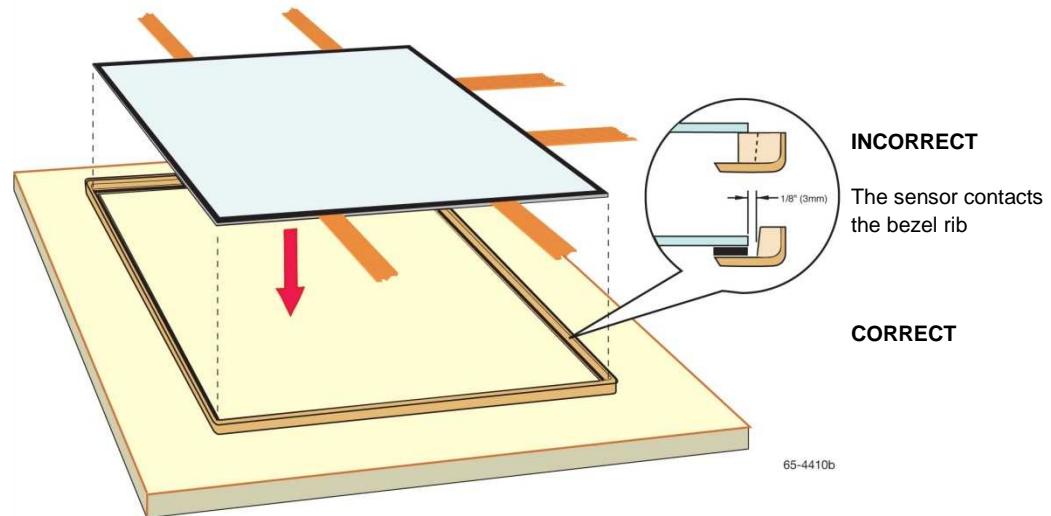
INCORRECT

1/8" (3mm)

The sensor contacts the bezel rib

CORRECT

65-4410b

Note: The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.

5. Carefully cut out a notch in each rib and cut back each fin that contacts the sensor.

- Make sure you remove only enough material to facilitate the installation of the sealing gasket and sensor.

- Make sure you clean any excess material or shavings from the cutout area.

- Make sure you preserve the structural integrity in the rest of the rib area.

65-4411a
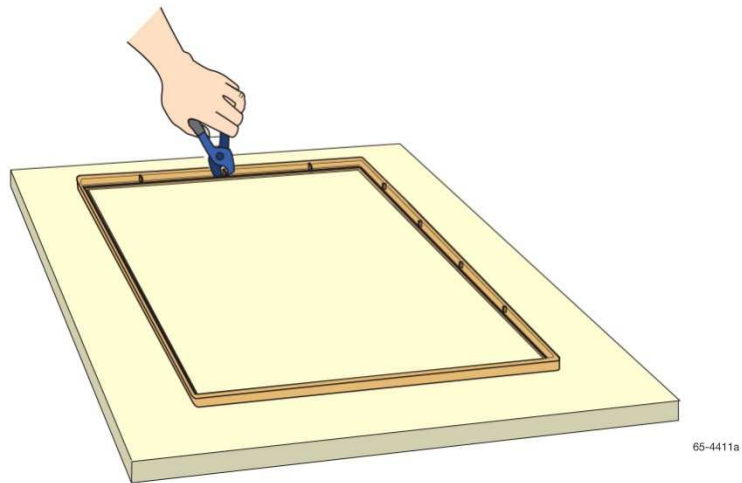
Mounting the Sensor to the Display

Before you begin this process, please review the *Mechanical Considerations—Mounting Tape to the Display* section in Chapter 2 for additional important information on this subject.

Note: For ease of maintenance, put a border of polyimide tape (or a similar strength tape) around the perimeter of the display in order to provide a surface to adhere the 3M mounting tape that will be easy to remove if the need arises.

Stacked strips of high-density foam mounting tape (3M Touch Systems part number 98-0003-3651-5) with adhesive on both sides should be used to attach the sensor to the LCD metal frame. These strips should not form a full seal – allow for ventilation (1-2 mm gaps) at the corners as shown below. Because new displays can run significantly hotter than their predecessors, you should allow air to escape to avoid damaging the LCD with temperature and pressure equalization issues.

Failure to mount the sensor in this fashion may result in reduced accuracy at extended temperature ranges.
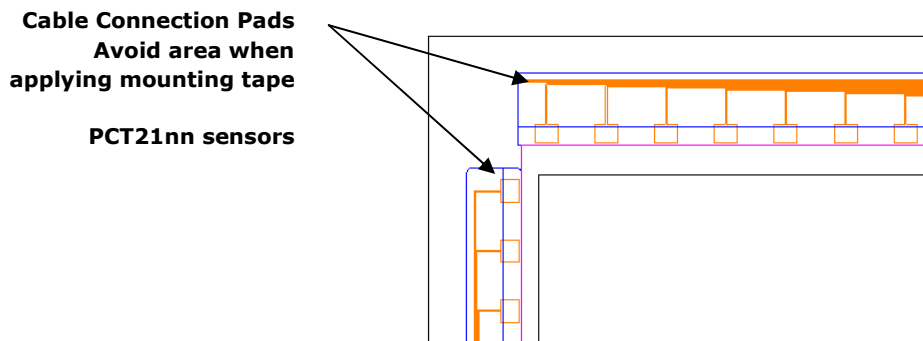
Leave small space (1-2 mm) to enable ventilation

Leave small space (1-2 mm) to enable ventilation

65-4623

Cable Connection Pads
Avoid area when
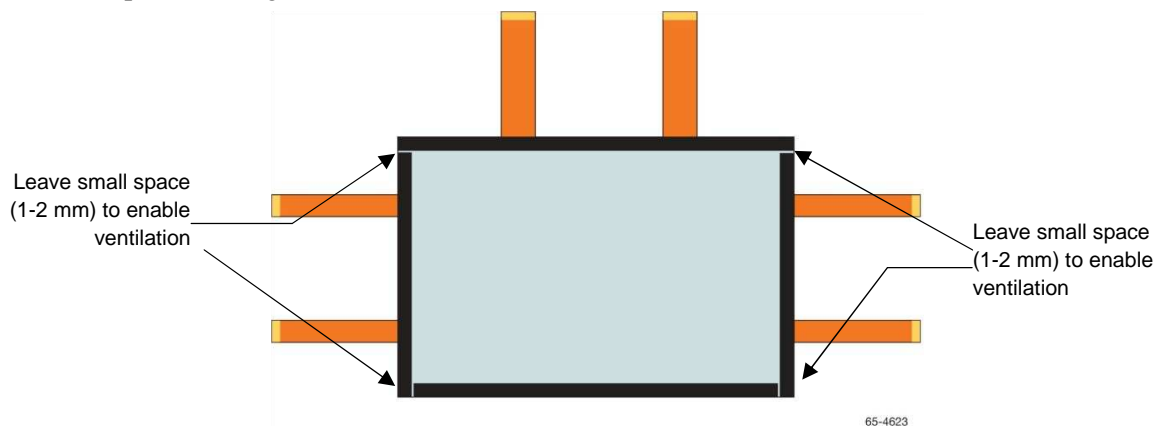**applying mounting tape**

PCT21nn sensors

Note: The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.

Notice: For optimal performance, the gasket tape must have a thickness of at least 0.107 inches (2.65 mm). Avoid using thinner tapes. Do NOT use highly compressible tapes. Be aware that using thicker tapes may impact the optical performance of the sensor by increasing parallax.

Notice: To reduce the risk of damage to the LCD films, make sure the tape (either polyimide tape or VHB tape) does not touch the surface of the display. Ensure that the tape is aligned with the **frame** of the display (not in the viewing area).

The foam tape serves the following purposes:

- Holds the sensor in place on the display
- Maintains a constant space between the sensor and the display (0.107 in (2.65 mm))
- Cushions the display and glass surfaces
- Prevents dust and other contaminants from getting in between the display and sensor surfaces

Practice Positioning the Sensor

Practice positioning the sensor on the display until you are comfortable with how the sensor should be aligned. If you are unsure of the correct positioning, contact your customer service representative to request a detailed drawing.

- Lightly tape the tails to the front surface of the sensor to keep them out of the way

- Place the display face-up on the foam pad, being careful of the tails.

- Wearing gloves, position the sensor on the display and adjust to your liking. If you are unsure of the correct positioning, contact your customer service representative to request a detailed drawing.

- Only remove the blue protective liner from the back of the touch sensor just prior to placing it on the LCD.

Note: The sensor tails are designed to be flexible, and it may be creased *once in a single direction,* in multiple locations along the tail and then secured in position with a light adhesive tape. Tails should not be placed under mechanical stress. Refer to *Tail Routing* in Chapter 2.

Sensor Care and Cleaning

The sensor requires very little maintenance. 3M Touch Systems recommends that you periodically clean the glass sensor surface.


⚠️ WARNING

To reduce the potentially hazardous situations of fire and/or explosion associated with the use of alcohol or other solvents used for cleaning display screen, which may result in <u>serious injury or death</u> and/or property damage:

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

- 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 sensor.

Typically, an isopropyl alcohol and water solution ratio of 50:50 is the best cleaning agent for your sensor. Do not use straight isopropyl alcohol. Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents.

- It is important to avoid using any corrosive or caustic chemicals on the sensor.
- Always dampen the cloth and then clean the sensor. Be sure to spray the cleaning liquid onto the cloth, not the sensor, 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 sensor with care. *Do not pull on or stress flex tails.*
- Use the recommended cleaner and a soft, lint free cloth to clean the sensor. Make sure the glass is clean and dry before you attach the sensor.
- **PCT21nn sensors - Clean only the front surface of the sensor. PCT24n5 sensors – Both front and back surfaces can be cleaned. Only remove the protective liner from the touch sensor just prior to placing it on the LCD.**
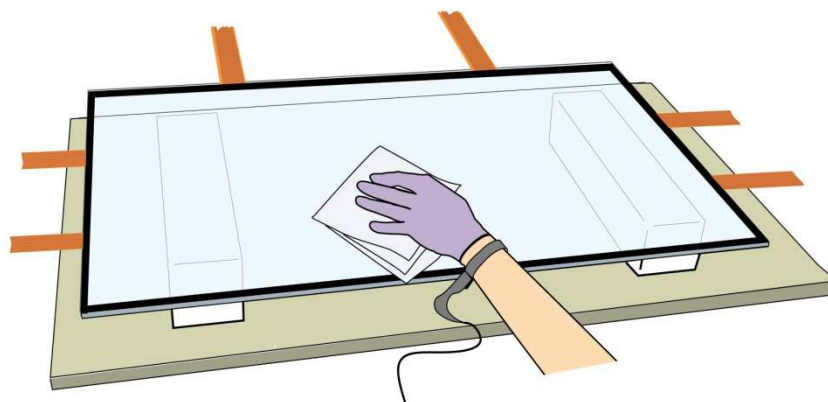
65-4409b

NOTICE:
To avoid cosmetic damage to the touch sensor and scratches on the black border: Do not clean the backside of the sensor; the surface can be easily scratched. If you need to remove any debris from the sensor, use a filtered ionized air source. If you do happen to scratch the black border, we recommend using a Snowman® brand black paint marker to touch up any small scratches.

Note: The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.

Flex Cable Cleaning

3M Touch Systems recommends that you clean the flex cable contacts prior to inserting into the connector.

⚠ **WARNING**
To reduce the potentially hazardous situations of fire and/or explosion associated with the use of alcohol or other solvents used for cleaning display screen, which may result in serious injury or death and/or property damage:
•   Follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and product label.
•   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 sensor.

Typically, an isopropyl alcohol and water solution ratio of 50:50 is the best cleaning agent for your flex cable contacts. Do not use straight isopropyl alcohol. Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents.

- It is important to avoid using any corrosive or caustic chemicals on the flex cable contacts.

- Always dampen the cloth and then clean the flex cable contacts. Be sure to spray the cleaning liquid onto the cloth.

- Apply the cleaner with a soft, lint-free cloth. Avoid using gritty cloths.


Attaching the Touch Sensor to the Display

Once you feel comfortable with the alignment and positioning of the sensor, you are ready to permanently attach the sensor to the display.

1. Apply stacked strips of the double-sided acrylic foam tapes, 3M VHB 5952 and 5962 (3M Touch Systems part number 98-0003-3651-5), around the perimeter of the display. Refer to the *Mechanical Considerations* section in Chapter 2 for additional details.

Note: To distinguish the front surface of the sensor, understand that the solid black border printed on glass is the back surface of the sensor. The printed pattern and tail attachments are visible on the underside of the sensor.

65-3810a
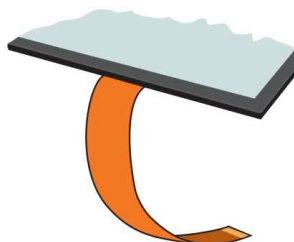
2. Pull off about 2 inches of the tape liner from the end of each strip and fold at a 90 degree angle.

3. Carefully remove the release liner from the back side of the Touchscreen. Use ionized air to eliminate static build up during release liner removal process. Avoid any direct contact to the back surface of the Touchscreen.

4. You are now ready to attach the sensor to the display. It is recommended that at least two people complete this step. Hold the sensor so the flex tails exit correctly and place it on the display.

5. Holding the sensor firmly in place, slowly pull out the remainder of the release liner. Repeat this with all four sides.

6. Press firmly down around the perimeter of the sensor to ensure that it is fully attached to the display

Inspect the Mounted Touch Sensor

After you mount the sensor to the display, inspect your results carefully and check that the sensor is installed properly.

• Set the display in its standard upright position.

• Look at the front of the display, and ensure the sensor flex tails exit from the correct location.

• Check for proper alignment. Make sure the sensor is not off center or crooked. If the sensor is not correctly aligned with the display, you must remove and remount the sensor before you can continue with the installation.

• Look for dirt or lint trapped between the display and the sensor, as these particles will be visible later.

If any part of the inspection fails, you must remove and remount the sensor.

Repair or Removing the Touch Sensor (if needed)

⚠ CAUTION
To reduce the risk of glass breakage which may result in minor or moderate injury: • Do not try to pry the sensor off the display. You may break the glass and injure

> yourself or others.

1. Use a razor knife or a single edge razor blade to carefully cut through the mounting tape.

Note: Use caution when removing the mounting tape as you could damage the tail bonds.

---

2. Start at the top of the screen and work down the sides.

3. Be careful not to scratch the display or the sensor.

4. Be sure to support the sensor as it comes away from the display.

5. To remove the foam tape and adhesive residue from the back of the sensor, follow solvent manufacturer's precautions and directions for use when using any solvents. Follow manufacturer's directions for suitable chemicals for your display.

6. Repeat the procedure for properly attaching the sensor to the display.

Adding a Sealing Gasket to the Bezel (if needed)

1. Place the bezel face down on an anti-static pad.

2. Use a die-cut gasket or cut strips of the closed cell, compressible foam sealing gasket tape to fit the inside edges of the bezel opening to form a **full perimeter** seal. To ensure tight fitting sealing joints, the gasket tape should be cut using a razor knife or single-edge razor blade.

    It is essential that the surface be clean and dry and free of grease or oils.

65-4413
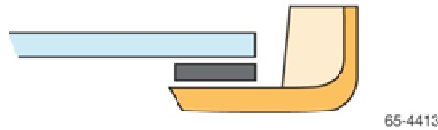
3. Remove the paper backing from the tape. Adhere a strip of gasket tape to each inside edge of the bezel opening. Align one edge of the gasket to the edge of the bezel opening. If the gasket overlaps the bezel edge, it will be visible from the front of the display. If the gasket is spaced away from the bezel edge, you will create a gap that can collect dust, liquids, etc.

4. Pay close attention to the bottom edge joints. Butt the gasket tape edges to create a tight fitting joint.

Adding Spacers to the Bezel (if needed)

You may need to insert nylon spacers and washers over each bezel post to accommodate the additional space of the sealing gasket and sensor. The spacers provide safety clearance for the sensor and prevent conductive materials on the bezel from contacting the sensor. **Do not omit these spacers and washers.**

You need to determine the correct amount of space to add to the bezel. At a minimum, you must add enough space to adjust for the thickness of the sensor, the mounting tape on the back of the sensor and the gasket seal.

Following is an example of adding spacers to the bezel to accommodate the extra space created by the sensor. In this example, assume a sealing gasket, mounting tape, and a sensor.

1. Insert a temporary post, such as a cable tie wrap or toothpick, in each bezel hole.

2. Place an insulating nylon spacer over each temporary post. The size of this spacer will compensate for the thickness added by the sealing gasket, mounting tape, and sensor. The size of your spacer may be different to provide additional spacing and support

65-4415
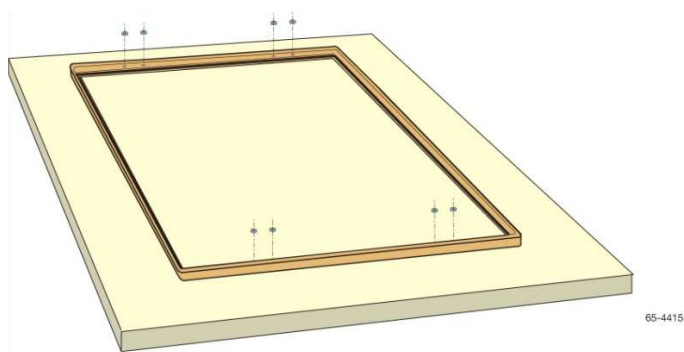
3. Align the screw holes (or tabs) over the temporary post. Each LCD hole/tab must rest on top of the spacer and washer above the bezel screw hole.

4. Adjust the display so that it is centered in the bezel and remove the temporary posts.

5. Select a replacement screw for the factory installed bezel screws. 3M Touch Systems recommends that you replace the factory display screws with longer screws to accommodate the sealing gasket and sensor thickness and prevent the glass from breaking by forcing too short screws to work.

   The replacement screws should be the same type and size as the factory screws, but 3/16-inch to 1/4-inch (4.76 to 6.35 mm) longer. The size depends on the amount of space you added between the bezel and display.

65-3806a
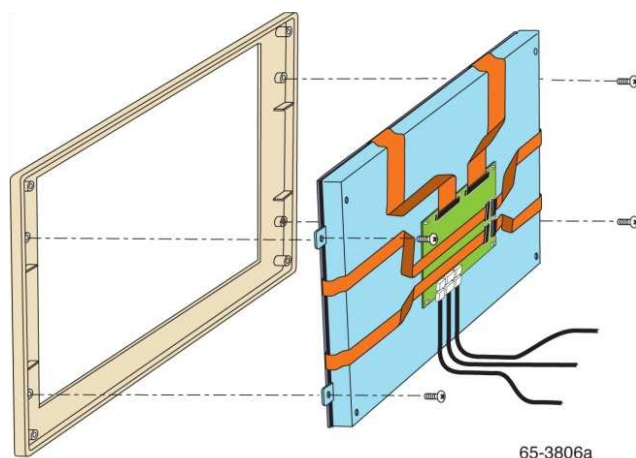
6. Install the replacement screws as follows:

   a. Thread the screws into the holes that connect the display to the bezel.

   b. Work diagonally from one corner to the opposite corner.

   c. Do not over-tighten any one side or corner. Pressure should be evenly distributed across the sensor.

d. You must be able to complete at least three full turns of the screw into the original threads.

e. If you install the screws correctly, the screws should be seated properly and be a little tighter than finger tight. A close fit will prevent liquids and/or particles from damaging the internal electronics, however, the screws should not be so tight that they add stress to the display or the sensor. If the bezel starts to warp when you tighten the screws, stop and loosen the screws.

Inspect the Attached Display and Bezel

Once you attach the display and the bezel, inspect your results as follows:

*   Check the front of the assembly for proper alignment and adjust if necessary.
*   Check that each bezel screw is seated properly and a little tighter than finger tight. The screws should not be so tight that they add stress to the display. If the bezel is warped, loosen the screws.

Note: If the screws are too tight, you may damage the sensor, damage the display, or bore right through the bezel.

*   Adjust the spacers or screws to get a secure attachment to the bezel without squeezing too tightly. Make sure the bezel ribs and fins do not contact the sensor at any point. If necessary, remove the bezel and trim the ribs and fins. For more information, refer to *Fitting the Touch Sensor* earlier in this chapter.

Reconnecting the Bezel and Chassis

*   Reconnect all wires, cables, and switches.

*   When replacing the bezel or fitting the LCD module into the chassis frame be careful not to catch or pinch tails.

Installing the 3M™ Multi-Touch PX Series Controller

This chapter describes how to install the 3M™ Multi-Touch PX Series controller for your PCT2000 series sensor. This chapter assumes you have already disassembled the display and mounted the sensor to the front of the display. For information on completing these procedures, refer to Chapters 2 & 3.

This chapter covers the following information:

- Mounting the controller
- Supplying power to the controller
- Connecting the controller to the computer

PX Series Controller

The PX Series multi-touch controller is used to operate your multi-touch sensor.

PX Series Multi-Touch Controller Specifications

Communications protocols	USB 2.0 (12 MHz) or Serial RS-232
Form factor	Will differ depending on your product, reference your specifications or contact your 3M Touch Systems representative.
Sensors supported	PCT2000 series sensors
Installation options	Internal only

Disassembling the Chassis

1. Remove the screws securing the display control panel cover to the chassis. Be sure to save and label these screws for reassembly.

2. Take a moment to inspect the display's internal hardware before you disconnect any wires.

   a. Take a digital photo or note where each wire is attached and how each wire is routed.

   b. Label each wire. Labelling the wires makes reassembling easier.

   c. Most display manufacturers connect the major components with detachable cables that have keyed connectors and labels. In addition, cables are of such lengths that they usually connect to only one place. However, not all displays have easy and intuitive cable connections. When in doubt, make notes of all connection points.

Once the chassis has been disassembled, you can mount the controller and connect it to a sufficient power source following the instructions below for powering the controller.

Mounting the Controller Internally

Care must also be taken when attaching the controller board internally, as the boards can short out if they are not attached properly. Additional space will also be needed between the controller board and the metal shield to prevent shorting of the board. Refer to the *3M Multi-Touch PX4nn Controller Reference Guide* (TSD-40847) or Multi-Touch PX5nnn Controller Reference Guide (TSD-45153) for additional details on specific controllers.

Note: These drawings are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative for more information.
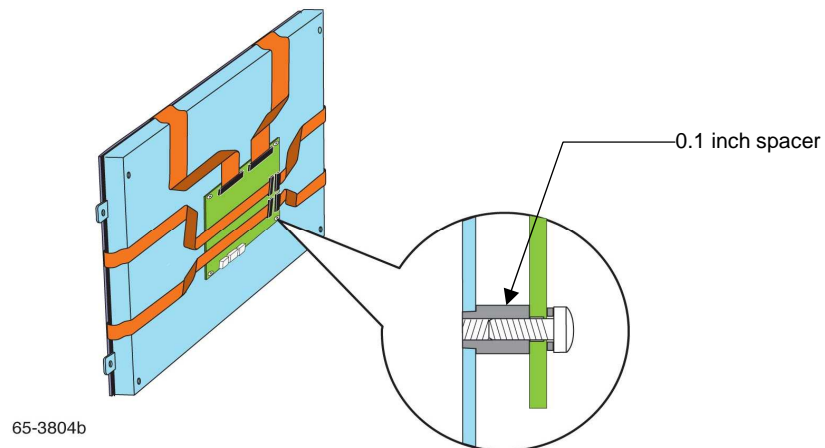
Completing Controller Mounting

Note: The method and location selected in mounting a controller is dependent on the mechanical design and assembly of the display being integrated. There may be several alternatives to integrating the controller. The following illustrates one mounting method that may work for some display products.

In order to mount the controller board to the housing, four holes must be drilled.

1. Mount the controller board to the housing using the established mounting holes with four 4-40 metal screws with small washers.

2. Mount the board using PEM nuts to provide space below for components and through-hole pins. Insert a 0.1 inch spacer between the controller board and the metal shield as shown in the following diagram. These spacers will prevent the board from shorting out.

0.1 inch spacer

65-3804b

Note: The controller must be properly grounded through the mounting holes. Ensure that the four controller mounting holes are connected to the chassis ground of the display. Do not use double sided tape to mount the controller.

With the controller board properly mounted, all cables connected, and excess wiring cable-tied, the metal shield can be attached.

As mentioned earlier, it may be necessary to make changes to the metal shield and the rear display housing to accommodate the power cable. Usually it is necessary to make a hole in the shield and the housing so that the power cable can be routed through, however some models may have an existing opening that can be used.

With a sufficient opening, the sensor cable can be fed through and the metal shield reattached.

Note: If a hole is drilled in the metal shield to accommodate the sensor cable, be sure to fold back the edges or install a grommet so that the cable does not fray on the sharp edges.

65-3811a
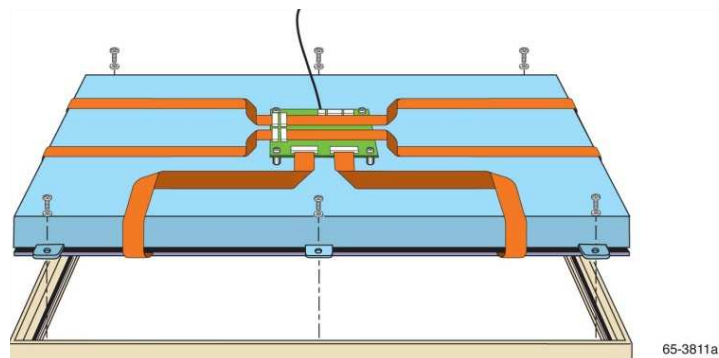
Note: When routing the power cable through the metal shield and rear display cover, be careful to avoid the inverter and other high noise sources.

Connecting the Touch Sensor

Once the controller is securely mounted, plug the sensor flex tails into the controller board, making sure that the pins are oriented in the correct direction.

Note: Connecting the sensor tails correctly is an important part of the integration process, read through this entire section before you attach the tails to the controller. It is critical that you insert the tails carefully and correctly prior to powering your controller.

To minimize the risk of electromagnetic interference, never run the sensor tails near or over the backlight inverter or power supply. The noise generated by an inverter is broadband and can contain frequencies close to the signal frequency that could disrupt system operations.

The sensor tails are not a handles. **Never pick your sensor up by the tails.** They are electrical connections and are not designed for high stress.

Do not place constant stress on the tails during integration. Do not expose the tails to mechanical stresses because of the integration design. Provide adequate slack to ensure there is no straining on the tails. Avoid lateral pulls that may overstress the outermost electrical contacts on the glass.

Note: Do not cross over individual tails or allow them to touch – keep tails from overlapping.

NOTICE:

Do *not* overlap the tails or allow them to touch one another.
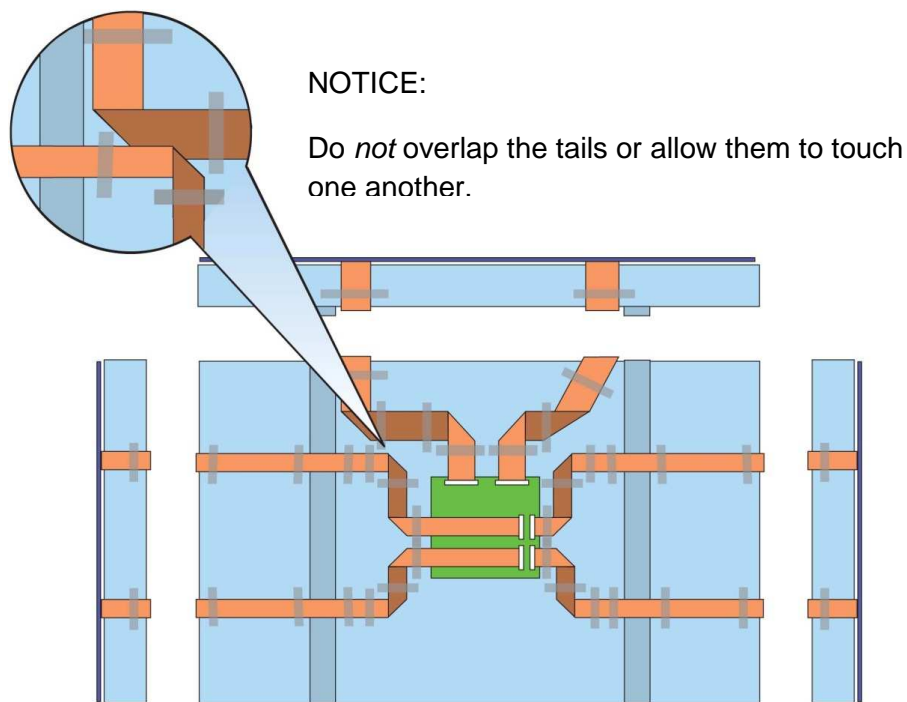
65-4617a

On each tail there are folded areas. The number of these areas will differ depending on your particular product. These areas may be bent but not creased.

The sensor tails should not move freely after assembly. Apply tape or another light adhesive to secure the tails in a manner that does not apply stress to them.

Apply tape or other insulating material to sharp edges to protect the tails. Route the cable away from sharp edges whenever possible. If this cannot be avoided, secure the tails so they do not move.

Note: 3M Touch Systems does not recommend metal sensor mounting brackets. If metal sensor mounting brackets must be used, be sure to keep tail bends away. Make sure that all metal brackets are grounded.

Apply tape around the sharp edges on the chassis so that when you wrap the tails over the edge, they won't tear.
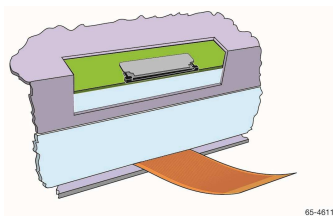

65-4611

Note: ZIF connectors can be fragile. Do not force these connectors open. These ZIF connectors are not removable; they must be opened/released to connect or disconnect a cable from them.

Take the tail straight from the sensor and carefully align with the ZIF connector.

Gold side of
connector should
face up as you
insert the tail
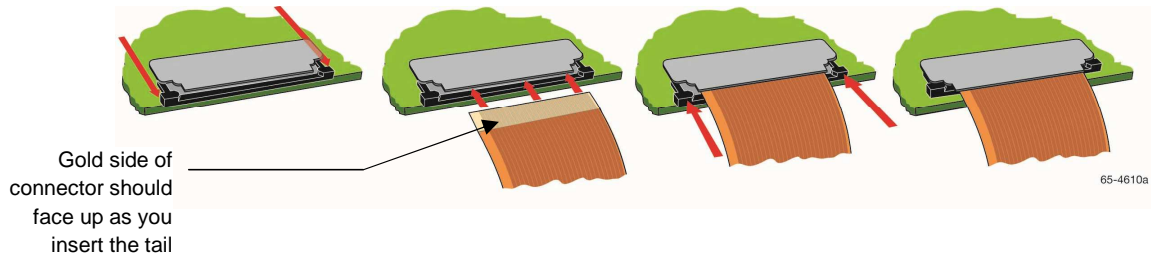
Pull out each clip individually to insert the ZIF tail into the connector. Then push the clips back in place simultaneously to lock the tail in place. Do not forget to open the clips if you wish to remove the tail at a later time. It is critical that these connectors be locked so that the tails will not fall out.
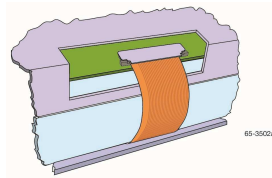
Connect the tail and lock into place.
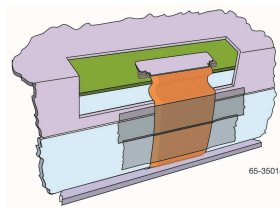
Tape the tail into place so there is no stress on the tail and its connection.

You may tape the length of the tail to the chassis to minimize any movement or stress on the tail and its connection.

Your chassis should look similar to the illustration below when all tails are correctly connected and taped in place.

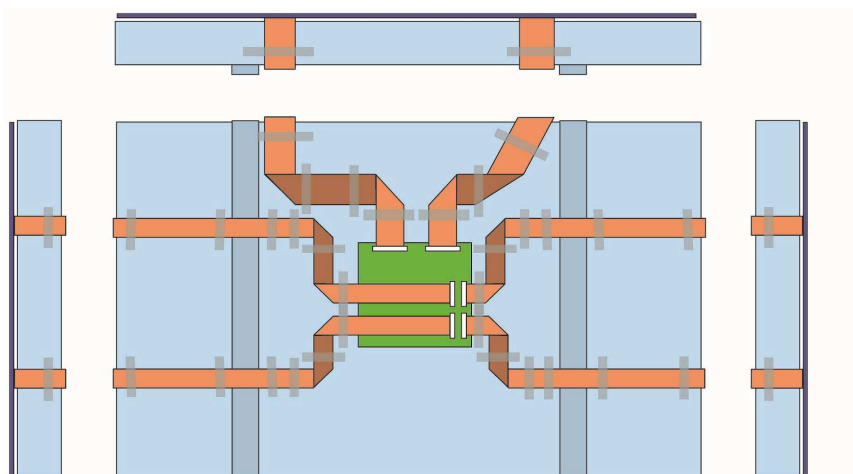**Note:** The illustrations are meant to be representative. Your product may look different. Reference your marketing drawing or contact your 3M Touch Systems sales representative.

Troubleshooting

If you did not connect the sensor's tails correctly, you may not get the full advantage of your touch screen size. Typically, on initial power-up, the controller will automatically detect the correct size of the touch sensor. If this does not happen, you can issue a Restore Defaults command and reboot your controller to reset the calculated dimensions. Refer to the *3M Multi-Touch PX4nn Controller Reference Guide* (TSD-40847) or Multi-Touch PX5nnn Controller Reference Guide (TSD-45153) for additional details on the Restore Default command.

Establishing the Data Connection

The PX Series controller can operate in either USB or serial mode – no need for different controllers. However, you cannot operate in both modes at the same time. If you try to connect both USB and serial cables, the controller will default to USB mode only.

USB Connection

In USB mode, the controller uses a 3M Touch Systems USB communication cable (P/N 7319420) PC 99 compatible or equivalent interconnect. One end of this cable plugs into the USB connector (P1) on the PX Series controller. The other end has a Type-A connector, and plugs into a USB port on your PC.

When creating a custom cable, use the Molex 51004-0500 mating connector. The following table describes the interconnections of the 3M Touch Systems USB cable.

Table 1. USB Cable for PX Series Controllers

PC Side (USB Type A)		Wire	Controller Side (5-Pin Molex)	
Pin	**USB Assigned**	**Color**	**Pin**	**Description**
1	+5Vdc (VBUS)	Red	1	+5Vdc VBUS power
2	Data (DN)	Gray	2	Data (DN) differential pair
3	Data (DP)	Green	3	Data (DP) differential pair
4	0V	Black	4	Power return
5	Cable Shield Shell	Charcoal Gray	5	Outer cable shield around signal and power lines. Chassis (earth) ground

Serial Connection

For serial mode, the PX Series controller uses and 3M Touch Systems RS-232 plug and play cable (P/N 7319630) or an equivalent interconnect.

One end of this cable plugs into the RS-232 connector (P3) on the PX Series controller. The other end, which has a 9-pin D connector, can plug directly into a serial port on your PC extender card. The following table describes the interconnections for the 3M Touch Systems RS-232 cable.

When creating a custom cable, use the Molex 51004-0800 mating connector. The following table describes the interconnections of the 3M Touch Systems serial cable.

Table 2. Serial Cable for PX Series Controllers

PC Side (9-Pin D)			Controller Side (8-Pin Molex)	
Pin	**RS-232 Assigned**	**Jumpered to:**	**Pin**	**Description**
1	Data Carrier Detect (DCD)	4 and 6 DTR and DSR	8	DCD, DTR, DSR
2	Receive Data (RXD)		2	Transmit Data (TXD)
3	Transmit Data (TXD)		3	Receive Data (RXD)
4	Data Terminal Ready (DTR)	1 and 6 DCD and DSR	8	DCD, DTR, DSR
5	Signal Ground		5	Power supply ground
6	Data Set Ready (DSR)	1 and 4 DCD and DSR	8	DCD, DTR, DSR
7	Request to Send (RTS)		1	Request to Send (RTS)

PC Side (9-Pin D)			Controller Side (8-Pin Molex)	
Pin	RS-232 Assigned	Jumpered to:	Pin	Description
8	Clear to Send (CTS)		4	Clear to Send (CTS)
9	Not Used			Do not ground
Sleeve	5V (not used)		6	DC power jack (Not Used)
Pin	Ground		7	Cable shield connected to ground. DC power jack ground

Supplying Power to the Dual-Mode Controller

Note: USB-only controllers are standard USB +5V bus power.
33" or larger require separate power

Supply power to the PX Series controller using the 2-pin power connector P3. Pin 1 is the leftmost pin on the header. Use a locking mated connector (Molex 5100-0200 (for 4 or 5 ASIC) or 22-01-3027 (for 6 or 7 ASIC)). Pin 1 (square hole) is 5V. Pin 2 is ground. Be sure to match the pin designations on the connector.

The USB controller is designed to use USB bus power (that is, tap power from the USB port).

The source must deliver the current defined in the controller specification in Appendix A, with a maximum ripple and noise of 50mV peak-to-peak. The current is either supplied by the Vbus in bus powered devices or the 5V input on self-powered devices. Typical currents are defined below:

	Max Current, 3Sigma, 5VDC Input				
Interface	**PX473** **PX4711**	**PX463** **PX461**	**PX453** **PX451**	**PX443** **PX441**	**PX4611**
Dual Mode	402 mA	366 mA	314 mA	238 mA	-----------
USB	384 mA	362 mA	310 mA	238 mA	780 mA

NOTICE

To avoid possible damage to the controller:

You must provide a path for electrostatic discharge. The controller mounting hole nearest 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.

Powering the Controller

To power your controller, you need to tap a +5V power source within the display. It is helpful to locate this power source before beginning the controller installation. A multi-meter or the display schematic can be used to locate an appropriate power source on the display's main board.

Note: You can connect *both* USB and serial cables to the display. Choose one or the other to connect to the PC. If both are connected, the controller will default to USB operation.

After deciding where to mount the controller, it is necessary to determine how the controller will be powered. Note that the controller must be properly grounded through the mounting holes.

Note: Your system may be susceptible to conducted radio frequency interference (CRFI). If you see a problem, 3M Touch Systems recommends placement of a ferrite on the third wire ground of the AC power cable. You will need to ensure that the solution passes conducted immunity standards.

Component P3 is the power connector. Pin 1 is +5V power and Pin 2 is ground.

The power source must meet the following requirements:

- Maximum voltage drop allowed: 50 mV
- Peak to peak noise: 100 mV
- Voltage regulation: ± 2%

To determine the display's voltage drop at the power source conduct the following test:

1. Measure voltage across the power source contacts

2. Connect sensor to controller, and controller to power source.

3. Power up the display and allow it to warm up for at least 10 minutes

4. Measure voltage across the power source again

The difference in voltages before and after the wires were connected cannot exceed 50 mV. If this voltage drop is exceeded, you must find a different tap point location.

Note: Some components on the controller can be hot. This is normal and will not affect operations.

Modifying the Display for the Controller Cable

1. Select a location on the rear of the display's cover to thread the controller cable. You need to be able to thread the cable from outside the display in through the opening.

2. Use a center punch to place a dimple at the selected location.

3. If necessary, drill a hole using a 3/4-inch spade bit.

Installing the Controller Cable Grommet

You will also need a grommet to place around the controller cable. The grommet seals the opening between the cable and the display cover.

Attach the grommet around the controller cable. Carefully insert the grommet into the mounting hole using a blunt tool.

Reassembling the Display Cover

Once you drill the holes in the display cover for the controller cable, you are ready to reassemble the display.
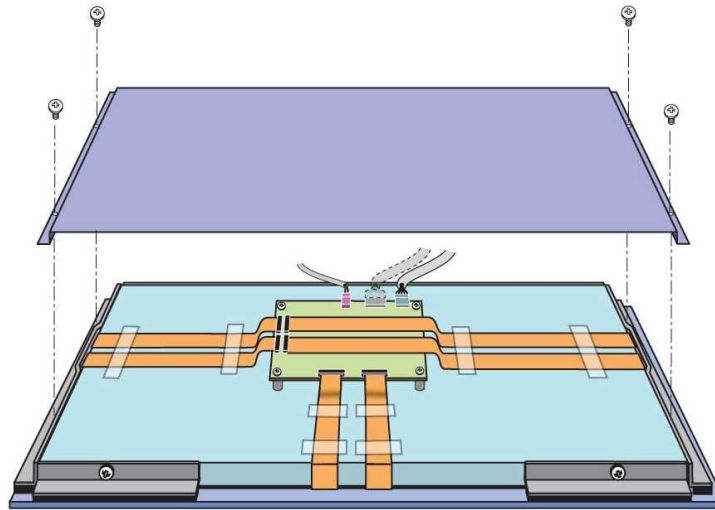
65-4504b

1. Check the display mounting for proper adjustment. Make sure all wires are properly attached, including the sensor's green wire to the chassis ground.

    Check for video and power cables that originate inside the display. If these cables exist, be sure to thread them through the appropriate opening in the display cover. These will be reconnected through the pedestal.

Note: When routing the sensor flex tails through the metal shield and rear display cover, be careful to avoid the inverter and other high noise sources.

2. Align the display cover for reattachment to the chassis and thread the controller cable through the hole.

3. Remount the cover to the chassis assembly and attach the housing screws you removed when you disassembled the display or use new longer screws as required.

Note: Do not tighten the screws beyond the "just tight" position. Nylon threads strip easily.

CHAPTER 5

Enabling Your Multi-Touch PCT2000PX Series System

Windows® 7 USB Compatibility

3M multi-touch PCT technology works seamlessly with the Windows® 7 operating system. The Multi-Touch system supports USB HID for direct communication. The Multi-Touch PCT2000PX Series System leverages all the multi-touch functionality that is native to Windows® 7. Plug the display in to a system running Windows® 7 and you'll quickly enter the world of true multi-touch functionality.

The Multi-Touch PCT2000PX Series System is compatible with Windows® 7 and is Windows® 7AQ certified for full multi-touch support. Refer to Microsoft's Windows® 7 documentation for additional information.

All Other Platforms

When using a Windows® 7 serial connection or for Windows® XP, Vista or Linux® operating systems (either USB or serial), 3M provides MicroTouch MT 7 Software for multi-touch drivers. This guide includes information installing the touch controller driver and setting the video alignment.

In the Appendix of this guide, you will find the communication protocols necessary to talk directly with the system electronics. This enables software developers using other operating systems such as Microsoft® Windows® Vista or Linux® to write their own drivers and optimize their applications.

Multi-Touch Application Support

Remember not all applications are multi-touch ready – Multi-touch behavior is a function of YOUR application. Check with your application vendor to determine if your software has multi-touch capability.

Installing 3M™ MicroTouch™ Software

Remember that Windows® 7 does not require any additional software to enable multi-touch functionality.

However, for Windows® XP, Vista or Linux® operating systems, 3M™ MicroTouch™ Software enables your Multi-Touch PCT2000PX Series System to work with your computer. 3M™ MicroTouch™ Software includes a control panel for setting your touch sensor preferences and a diagnostic utility. If you are experiencing problems with the touch sensor, you can use the diagnostic utilities provided to test the system.

For more information on installing this software and using the control panel, refer to the 3M™ MicroTouch™ Software User Guide on the accompanying CD or on the corporate website at www.3m.com/touch.
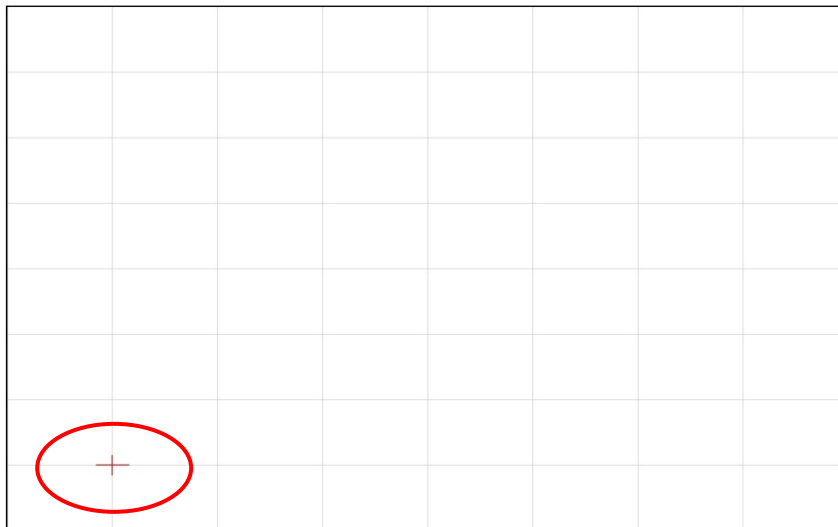
Video Alignment

The Multi-Touch PCT2000PX Series System does not require video alignment if you are able to accurately touch icons on the sensor. If after integrating the system you cannot do this, the touch sensor's active area may not be correctly aligned to the underlying video. To compensate for any variability in touch sensor placement during integration, you should perform a video alignment of the sensor to the display to ensure touch accuracy.

There are three ways to perform a video alignment. Regardless of the operating system, after you connect your touch display:

- If you are using Windows®, you may calibrate by accessing the Software Diagnostic Utility (SDU) found on our website.

  Launch the SDU. Select the Tools menu and highlight Calibration. The screen below appears and you should touch the 2 targets as they appear. Press Escape to cancel Calibration.

- If you are using 3M™ MicroTouch™ MT 7 Software, launch the MT 7 Control Panel and follow the instructions on the Main tab. You'll be asked to touch 3 targets.

- If you are writing your own drivers, you should provide your own video alignment tool.

Use the Paint program (Start → Programs→ Accessories→ Paint) to determine if you have multi-touch operation. Retest the accuracy after you perform a calibration.