

# **Touch Screen Installation Guide**

Revised January 2010

# Safety Information

## WARNING



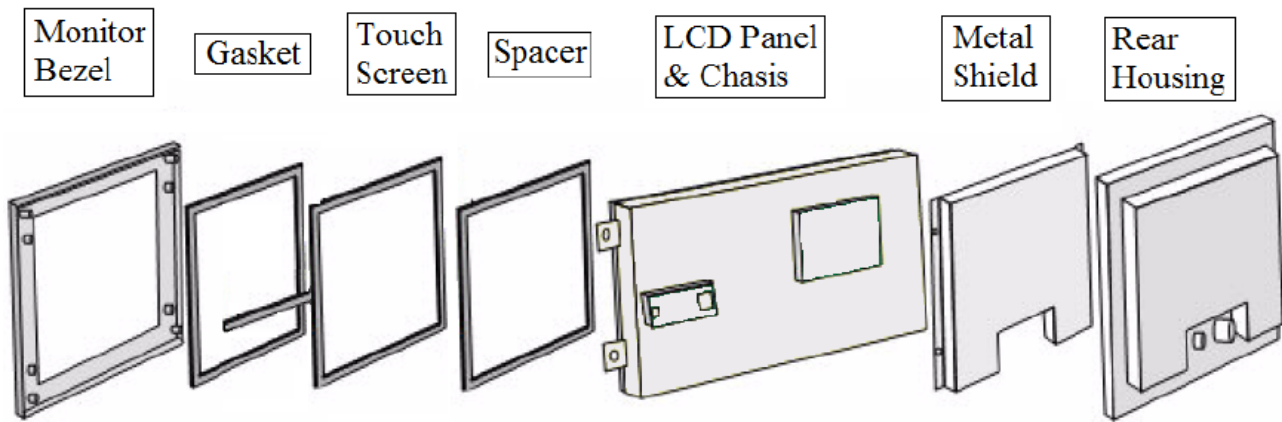
The touch screen installation procedure outlined in this document may require exposure to high-voltage components and handling of the LCD. This procedure can be dangerous and an accident is potentially lethal. Therefore, the procedure should only be performed by a qualified person with experience in assembling and disassembling the LCD monitors. If you do not understand the LCD monitor electronics, you may accidentally injure yourself, damage the LCD, touch screen, or the touchscreen controller. Read this entire chapter before attempting a touch screen installation.

Follow the procedure carefully, work with the power off and the unit unplugged, observe all warnings, and wear protective clothing. TVI Electronics is not liable for damage or injury resulting from the users actions.

## Installation Considerations

- Before installing the touch screen, be sure to account for the space needed by the touch screen and its flex tail.
- When installing the touch screen, be careful not to route the touch screen flex tail and power wires near the backlight inverter of the LCD panel.
- Because the touch screen edges are electrically active, they should not come in contact with any conductive materials. Avoid contact with metal brackets, conductive bezel paint, etc.
- The bezel may need to be modified to accommodate the sealing gasket and touch screen. When trimming the bezel, make sure that the mechanical integrity of the display is not compromised.
- Tail may be creased once and should be secured in place, to avoid continuous flexing.
- If it is necessary to remove the touch screen 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 solvents. Follow manufacturer's directions for suitable chemicals for your display.
- When reassembling the touch screen 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 touch screen.
- Perform a bench test of the hardware to ensure functionality before you start.

# Summary of Installation Procedure



You can install a touch screen on most monitors. Although each particular monitor may have some unique integration issues, the basic installation process consists of the following steps:

1. Unpacking the touch screen
2. Disassembling the LCD monitor
3. Determining the touch screen fit
4. Mounting the touch screen
5. Installing the touchscreen controller
6. Reassembling the monitor
7. Powering up the system

## Unpacking the Touch Screen

Handle the touchscreen with care. Avoid excessive handling and stress on the touch screen flex tail. The touch screen flex tail is not a handle. Never pick your touch screen up by the tail. It is an electrical connection and is not designed for high stress. Do not place constant stress on the tail. Provide adequate slack. Avoid lateral pulls that may overstress the outermost electrical contacts on the glass. Wear gloves to avoid getting fingerprints on the touchscreen. Remove protective plastic films on both sides of the touch panel.

## Testing the Monitor

The display must be in good working order before beginning the installation of the touch screen. Inspect the LCD monitor for cosmetic flaws or damage. With a new display, it is suggested that you test the display by running it overnight. Check for acceptable color, brightness, contrast, picture stability, and other QC tests.

# Disassembling the LCD Monitor

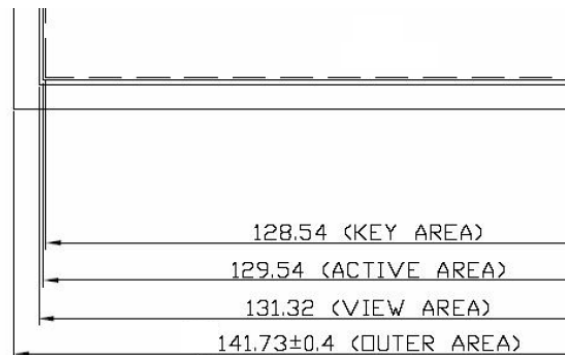
**Note:** The purpose of this document is to aid in the touch screen integration into LCD monitors. This document is for reference only and cannot be assumed to cover all LCD monitor products in detail. TVI Electronics cannot be held liable for any personal or property damage incurred through use of this document.

This document describes the basic tasks common to the vast majority of LCD monitor integrations. These instructions assume an audience of trained integration personnel.

## Definition of Terms

- **MONITOR:** The term "monitor" refers only to the monitor, television, or other display that is defined in specific monitor's integration.
- **BEZEL:** The term "bezel" refers to a specific part of the molded plastic cabinet of the monitor. The bezel is the part that covers the LCD, and separates from the rear case.
- **CASE:** The term "case" refers to a specific part of the molded plastic cabinet of the monitor. The case is the part that separates from the front bezel. The case normally covers the top, sides, back and bottom of the monitor assembly.
- **LCD:** Liquid Crystal Display. Also referred to as the Panel.
- **CONTROLLER:** The electronic device that converts touch data into RS-232 or USB information.

## Touch Screen Structure and Drawing Definition



Outer area: the outside dimension of the touch screen

View area: the transparent area of the touch screen

Active area: the operating area of the touch screen

Key area: the most proper operating area of some types of touch screen

# Recommendations for Disassembling the Monitor

Disassemble the display on a large, well-lit work surface. Leave space to set aside major display components. Group screws and other hardware in small containers or in specific areas on the work surface as you remove them, in relation to the part of the display where you are working. If you complete the installation process in one session (which may require several hours for your first efforts), it is unlikely that you will have trouble reassembling the display. Most display manufacturers connect the major components with detachable cables that have labeled and keyed connectors; these cables are of lengths that will usually connect to only one place. Also, screws are identifiable by type and size, and usually will not fit in the wrong place. The most difficult problem with missing or wrong hardware or connections will be with single ground cables that attach to obscure ground points on the metal chassis. When in doubt, make notes of the connection points.

## Removing the Rear Case

Disassembly usually starts with removal of the back case. For assistance with disassembly, consult your manufacturer's service manual.

To remove the rear case:

- Carefully lay the display on its face on the padded work surface and remove the screws that attach the rear case to the bezel or frame.
- Slowly pull the rear case upward.
- Disconnect any cabling that may be attached to the rear case
- While removing the rear case, note the clearance between the inside rear surface of the case and any of the monitor's circuitry. If there is not enough clearance to move this circuitry about 0.25 inch (6 mm) toward the rear of the case, you may be unable to successfully install a touch screen on the display and completely reinstall the back case.

## Removing the LCD

Continue disassembling the display until the face of the LCD is completely exposed. The degree of disassembly required will vary from display to display.

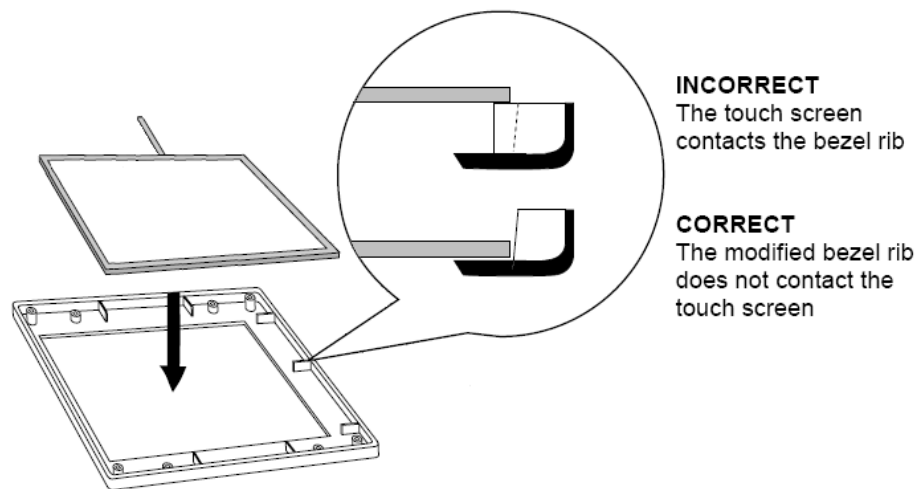
The next step will be to remove the LCD from the display's housing. Several cables may have to be unplugged from the LCD before it can be removed. Typically these cables are:

- The input video connector. A multi-conductor cable that is attached to the rear of the LCD panel.
- The back-lamp cables. One or two cables connected to the rear of the panel. These cables originate from the high voltage inverter.
- Various cables connected to the power switch, pilot light, front panel controls, etc. Other cables may have to be unplugged from the electronics chassis. The need for this may not be apparent until the chassis is removed, as instructed below. As you pull the LCD out of the frame, make sure to watch for other cables that need to be disconnected. After removal, set the LCD face up on a padded, static free work surface.

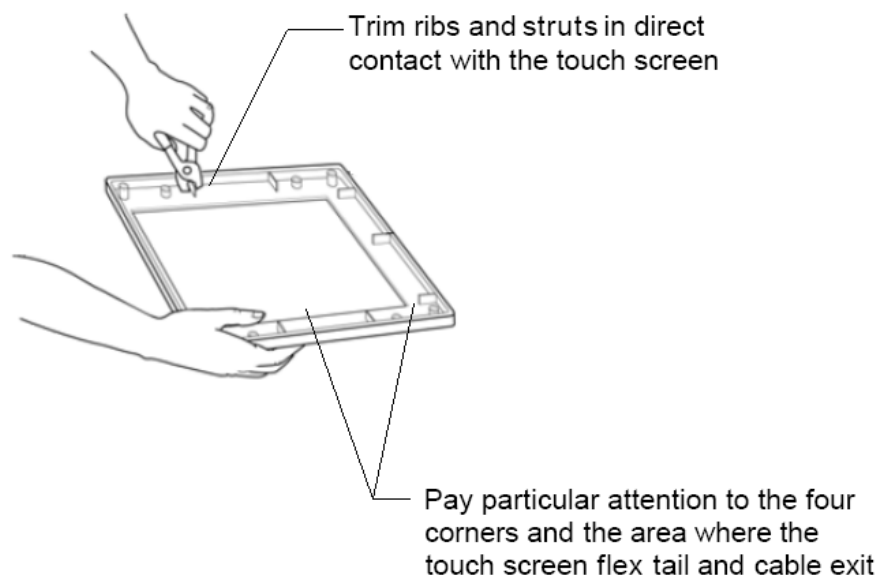
# Determining the Touch Screen Fit

1. Position the LCD so the face is accessible.
2. Next, determine if the touch screen will fit in the bezel without modifications to the bezel. Modifications, if necessary, should be done without seriously compromising the mechanical integrity of the display. To do this:
  - Lay the touch screen face-down in the bezel. Be sure to orient the touch screen so the flex tail exits from the correct side of the bezel. Refer to the mechanical drawing of the touch screen for details of your specific touch screen.

**If the touch screen will not fit flush against the lip of the bezel, do not force it.** An interference fit between the edge of a touch screen and some of the plastic ribs found in display bezels can pinch and break the small wires which carry the signals along the edges of the touch screen, or even result in fracture of the glass after reassembly.



- Note which ribs and struts of the bezel are in direct contact with the touch screen. It is often necessary to cut these ribs and struts inside the bezel. Pay particular attention to the corners as well as the area where the flex tail exits from the touch screen.



Cutting does not usually cause difficulties although the stiffness of the bezel may be reduced slightly. Try not to cut into the posts of any attachment screws. Generally, a total clearance between the edge of the touch screen and any ribs or struts of at least 0.25- inch (6 mm) in both axes is necessary. This prevents the interference fit problem discussed above and allows for variation in touch screen mounting position.

3. Check for adequate clearance of the cable from the bezel structure. The preferred orientation of the touch screen is with the cable exiting from the right side, when viewed from the front of the display. If the position of the cable causes difficulty, the touch screen may be rotated 180° on units (that incorporate a seal). Rotation will cause an inversion of the output coordinates, which will be compensated for automatically by driver software. The touch screen must have the reflector stripes on the surface facing the user.

Always design your touch screen integration with the flex tail exiting from the top or sides of the display. Never design tail exits from the bottom as spills could accumulate in the tail attachment area and cause electrical shorting.

## Mounting the Touch Screen

When preparing the touch screen for mounting to the LCD, major considerations are:

1. Reasonable mechanical alignment with the display.
2. Mounting materials and methods.
3. A complete dust seal between the touch screen and the LCD.
4. A mounting technique that evenly supports the touch screen on at least two opposite edges.

*TVI Electronics recommends double-sided tape on all sides of the LCD.*

5. Creating enough space between the touch screen and the bezel to accommodate the touch screen. Adequate spacing can normally be accomplished by:

- trimming or milling the inside of the bezel.
- using spacers to move the LCD back in the chassis.
- using spacers to move the bezel away from the touch screen. A combination of moving the LCD back with spacers and trimming the bezel is the usual solution.

6. The seal between the touch screen and the display bezel.

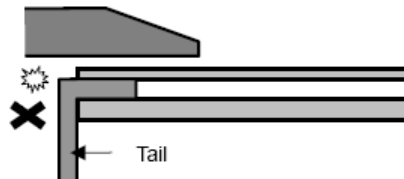
The last three considerations listed above should determine the nominal thickness of the spacers to be used.

Many monitors will have sufficient space in the bezel to allow the touch screen face to rest against the lip of the bezel, with the lip touching the active region of the touch screen. Assuming double-sided tape is used to attach the touch screen to the LCD the final spacing will be determined by the type of seal to be used. See "Sealing" on page 9, for an explanation of sealing methods.

Before mounting the touch screen, make sure that the protective plastic films are removed from the both sides of the touch screen. Clean the face of the display and the back of the touch screen with household glass cleaner. The space between the touch screen and the display face must be clean and free of any foreign objects.

Mount the touch screen as follows:

- Layer the double-sided adhesive tape to achieve a total thickness of 1/16-inch (1.587 mm); across the entire top, bottom, and sides on the rear of the touch screen. In general, the adhesive tape should be set back slightly from the edge of the active area of the touch screen. When the display is reassembled, the mounting tape should not be visible. Make sure that the double-sided adhesive tape butts in the corners to form a dust seal. Do not remove the liner from the exposed side of the adhesive tape yet.
- Practice aligning the touch screen on the LCD without removing the adhesive tape liner. The installation can tolerate some horizontal and vertical shift. However, rotational skew may interfere with proper mounting of the LCD touch screen in the bezel.
- The touch screen tail is 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. The tail must not be forcibly stressed or bent too hard to avoid the conduction in the insulated area and wire breaking.



The touch screen tail should not move freely after assembly. Apply tape or another light adhesive to secure the tail. Be sure to tape any sharp edges that the tail might come in contact with.

- When you have a good feel for the placement of the touch screen, clean the back side of the touch screen and the face of the LCD. Avoid all contact between the cleaning solution and the mounting materials as the cleaner may cause the mounting materials to eventually release from the glass. Remove all lint with a brush or compressed air. Remove the liner from the adhesive tape and align the touch screen on the display. Now press the touch screen firmly against the LCD.

## Inspecting the Mounted Touch Screen

- Inspect your results carefully for alignment, trapped dust or lint, and a good seal between the touch screen and LCD. If there is trapped lint, you may be able to remove it without removing the touch screen by capturing it with a thin wire. Poke the wire through the adhesive tape, and stick the lint to the wire. Pull the lint back into the tape and embed it there.
- If you must remove the touch screen from the LCD, cut the adhesive tape away with a sharp thin blade, such as an X-Acto knife. The touch screen glass will probably break if you try to pull it off by a corner or an edge. Shave the old adhesive tape from the touch screen and LCD with the knife. Adhesive residues can be removed with isopropyl alcohol, which will leave streaks and fingerprint smears. Use glass cleaner for the final cleaning prior to reapplication of new tape.



# Sealing

Sealing the touch screen is not required for operation; however, it is recommended to increase the resistance to dirt and moisture. All displays, regardless of environment, will be exposed to dust, 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. Proper gasketing is critical to any successful touch screen integration.

Install the seal as follows:

- Place the bezel face down on a padded surface, so that you can obtain access to the inside lip.
- 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 and ensure a good seal without interfering with the viewing area. To ensure tight fitting sealing joints, the gasket should be cut using a razor knife or single-edge razor blade.

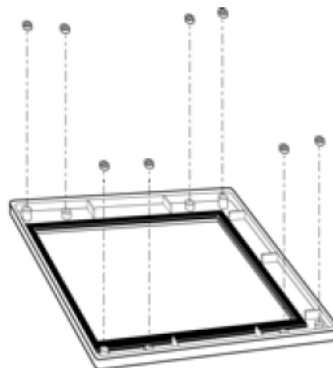


It is essential that the surface be clean and dry and free of grease or oils.

- Remove the paper backing from the tape. Adhere a strip of gasket tape to each inside edge of the bezel opening. Do not adhere the gasket to the touch screen surface. Align one edge of the gasket to the edge of the bezel opening. If the gasket overlaps the bezel edge, you will create a gap that can collect dust, liquids, etc.
- Pay close attention to the bottom edge joints. Butt the gasket tape edges to create a tight fitting joint.

## Spacing the LCD from the Bezel

The last part of the touch screen mounting procedure is to determine the appropriate spacing of the LCD from the bezel, (with the touch screen attached), and to reinstall the LCD with the required spacers in place. **Do not clamp the touch screen between the bezel and the LCD without proper spacing as breakage will almost certainly occur.** The nominal thickness of the touch screen and the one layer of adhesive tape is 3/16-inch (5 mm).



During the spacer selection process, you may have to install the LCD with the touch screen attached in the bezel several times to obtain proper fit. When spacers for the desired gap have been selected, install the LCD. Select a screw that is long enough to compensate for the spacer thickness (provides at least three full turns into the mounting post threads) but not so long as to penetrate the surface of the bezel. Over-tightening the screws may strip or split the mounting posts.

## Inspecting the Attached LCD Panel and Bezel

Once you attach the LCD panel and the bezel, inspect your result as follows:

1. Check the front of the assembly for proper alignment and adjust if necessary.
2. 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 LCD panel. If the bezel is warped, loosen the screws.

**Note:** If the screws are too tight, you may damage the touch screen, damage the LCD, or bore right through the bezel.

3. Adjust the spacers or screws to get a secure attachment to the bezel without squeezing too tightly. Make sure the bezel ribs and struts do not contact the touch screen at any point. If necessary, remove the bezel and trim the ribs and struts. For more information, refer to *Determining Touch Screen Fit* earlier in this guide.

## Reconnecting the Bezel and Chassis

1. Reconnect all wires, cables, and switches.
2. Lay the touch screen flex tail along the outside area of the chassis.
  - Avoid contact with internal electronics that can affect the touch screen performance.
  - Do not route the touch screen flex tail near the backlight inverter of the LCD panel.

## Installing the TouchScreen Controller

TVI Electronics provides a full range of controllers, SLT-TP05 Series, designed to optimize the performance of analog resistive touch panels. The controller communicates with the PC directly through RS232 or USB port.

For TouchScreen Controllers Downloads, please refer to [www.tvielectronics.com](http://www.tvielectronics.com) website.

This chapter assumes you have already disassembled the display and mounted the touch screen to the front of the LCD panel. For information on completing these procedures, refer to *Disassembling the LCD monitor* and *Mounting the touch screen* earlier in this guide.

# Types of TouchScreen Controllers

TVI Electronics offers different types of SLT-TP05 Series TouchScreen controllers, 4- and 5-Wire RS232 or USB, that can be used to operate your touch screen. Although the interface of these controllers is different, the functionality and installation procedure is the same.

	4-Wire Resistive	5-Wire Resistive
Serial	SLT-TP05-RS232	SLT-TP05-RS232C-5W
USB	SLT-TP05-USB	TP05-5W-USB

## Disassembling the Chassis

1. Remove the screws securing the display control panel 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.
  - Note where each wire is attached and how each wire is routed.
  - Label each wire. Labeling the wires makes reassembling easier.
  - Most LCD 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 either internally or externally.

## Mounting the TouchScreen Controller Internally

Mounting the controller inside the display housing results in a neater, cleaner finish but requires internal space. Before you begin, make sure that there is sufficient room for the controller board inside the chassis.

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.

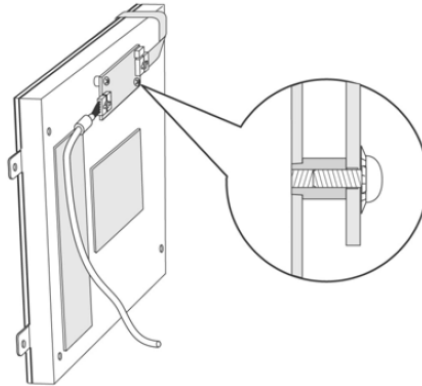
**Note:** The method and location selected in mounting a touchscreen controller internally depend on the mechanical design and assembly of the LCD display being integrated. There may be several alternatives for integrating the controller.

The following illustrates one mounting method that may work for some LCD display products.

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

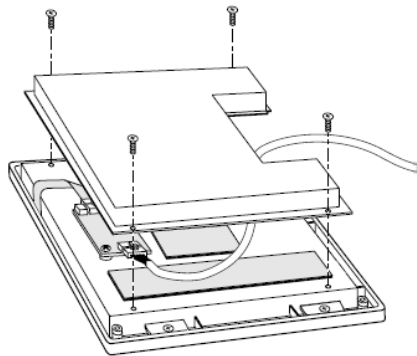
1. Mount the controller board to the housing using two metal screws.
2. Insert a spacer between the controller board and the metal shield as shown in the following diagram. These spacers will prevent the board from shorting out.

**Note:** Ensure that the two controller mounting holes are connected to the chassis ground of the LCD display.



3. Plug the touch screen into the controller board using one of the controller interconnect cables (four-wire or five-wire):
  - Connect the male end of the cable to the touch screen tail. Make sure that the pins are oriented in the correct direction.
  - Connect the female end of the cable to the controller.

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



## Modifying the Display for the Controller Cable

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

1. Select a location on the rear of the display's cover for 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. Drill a hole using a 3/4-inch spade bit.

## Installing the Controller Cable Grommet

You will need to install 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 monitor

Once you drill the holes in the display cover for the touchscreen controller cable, you are ready to reassemble the display. Reassembly is generally in reverse order of disassembly.

1. Check the LCD panel mounting for proper adjustment.
2. 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.
3. Align the display cover for reattachment to the chassis and thread the controller cable through the hole.
4. 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. Do not tighten the screws beyond the "just tight" position.
5. Label the monitor with information about the touch screen installed, along with the model and settings of any internal touchscreen controller. For example:

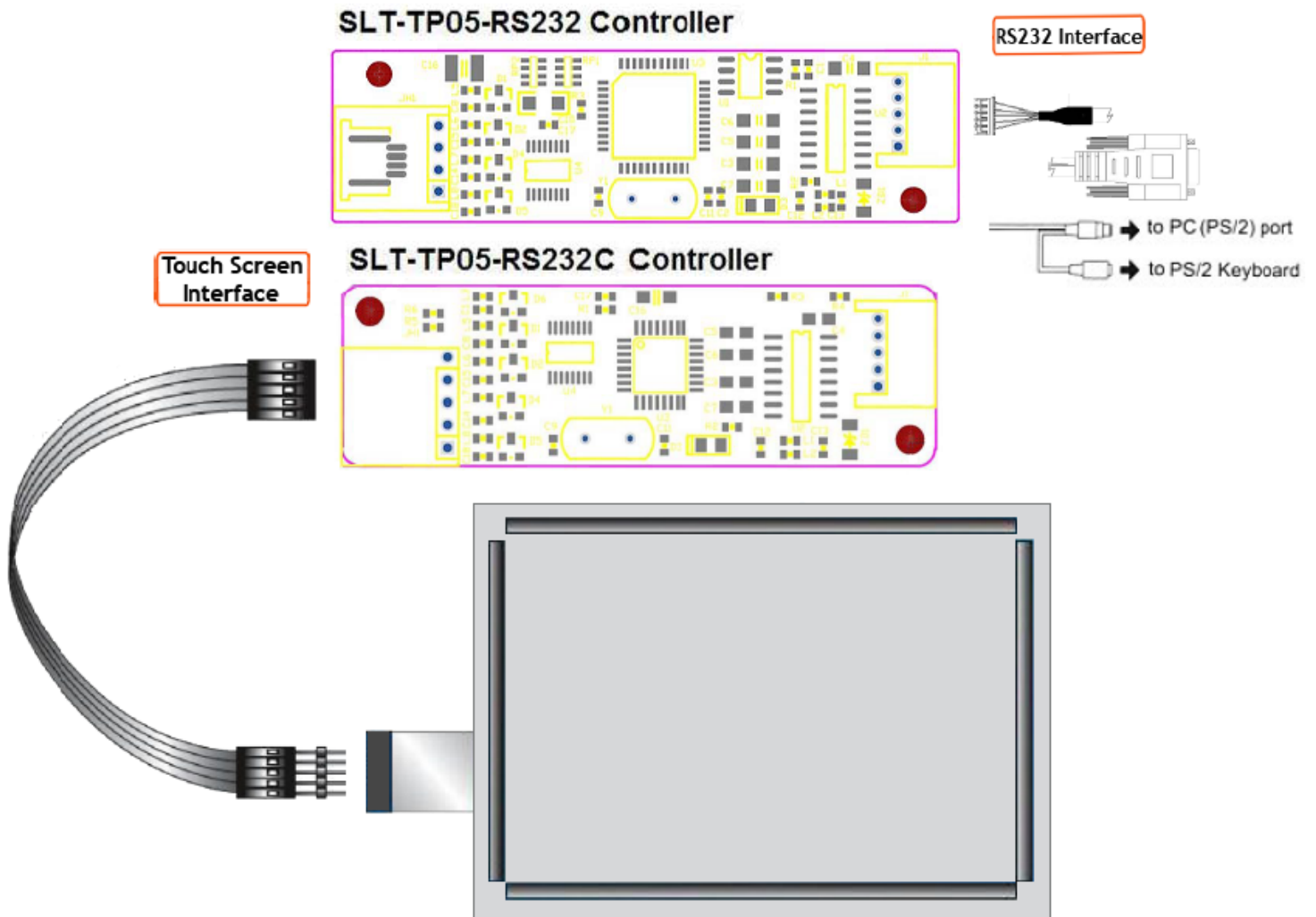
Contains: SLT-TP05-USB TouchScreen Controller  
Protocol: USB 1.1 Low Speed Model

## Connecting the Serial TouchScreen Controller

1. Connect the RS-232 cable to connector J1 on the touchscreen controller.
2. Connect the RS-232 cable's DB-9 female connector to a 9-pin serial COM port on the back of the computer. If the computer's serial COM port is a DB-25 type, use a 9-to-25 pin serial port adapter.
3. Disconnect the keyboard cable from the back of your computer and plug it into the power tap PS/2 cable.
4. Plug the power tap PS/2 cable into the keyboard socket on the back of your computer.

Refer to the *Serial TouchScreen Controllers Electrical Connection* diagram below.

## Serial TouchScreen Controllers Electrical Connection

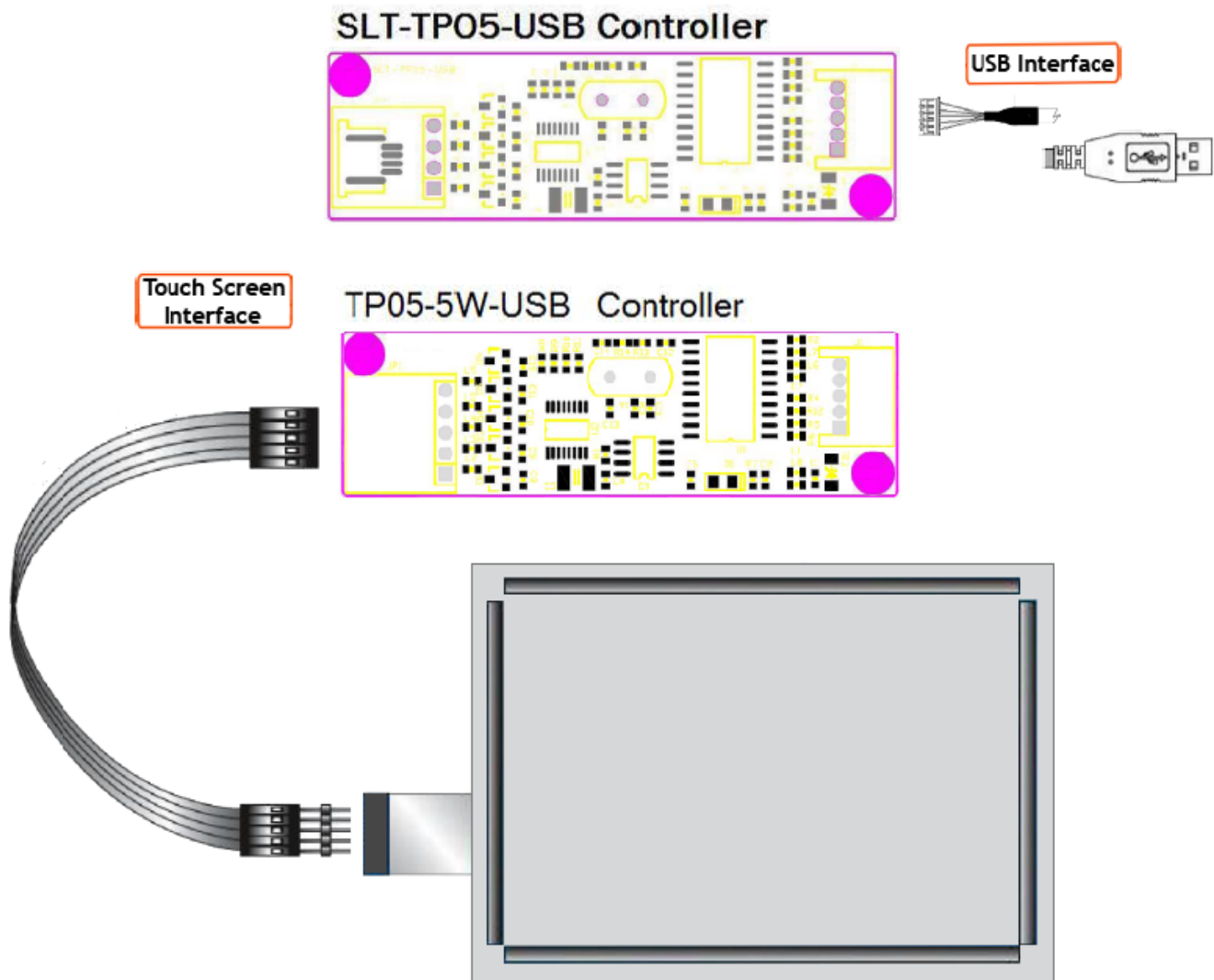


## Connecting the USB TouchScreen Controller

Connect one end of the USB cable to connector J1 on the controller and the other end of the USB cable to the USB port on the back/front of your computer.

Refer to the *USB TouchScreen Controllers Electrical Connection* diagram below.

## USB TouchScreen Controllers Electrical Connection



## Electrical noise

There could be circumstances under which the controller could experience interference from electrical noise. This is because the controller resolves voltages down to millivolts. At this resolution level, electrical noise can adversely affect the performance of a touch screen system. For example, LCD displays generate noise that could interfere with touch screen controller performance due to the close mechanical coupling of the display to the touch screen.

Here are some suggestions to get the optimum performance from the touch screen system:

- Mount the controller close to the touch screen.
- Mount the controller away from transformers, AC sources, and high voltage switching noise.

- To minimize the risk of EMI interference, never run the touch screen tail near or over the LCD backlight inverter. Although the tail is shielded, the noise generated by an inverter is broadband and can contain frequencies close to the signal frequency.
- Route the controller-to-touch screen cable so that it will not pass near any sources of AC or high voltage switching noise. If the connecting cable must be routed near this type of noise, try shielding it with a piece of grounded aluminum or copper foil.
- If necessary, isolate the power and ground lines using a ferrite core. A couple of wraps around a bead core with a minimum of 100 ohms at 100 MHz may offer a solution.
- Try grounding the metal frame of the display device.
- Try adding an EMI shield. The EMI shield consists of a transparent conductor placed between the display device and the touch screen.

## Powering Up the System

Before you power up your system, make sure all cables are connected properly and all cable screws are tighten.

To start up your system:

1. Turn on your monitor and computer.
2. Adjust the contrast and brightness to suit your personal preference and working environment.
3. Make sure the video image is centered within the screen area. Adjust the horizontal and vertical controls on the monitor, if necessary.

The touchscreen controllers have a light-emitting diode (LED) that provides the status of the touch screen unit. Under normal conditions, the LED indicator light is off. When the finger touches the touch screen, the LED indicator light is on and remains in this state until the finger leaves the touch screen. If the other state occurs, please check the hardware connection.

You are now ready to install the touch screen software and test the installation.

## Installing and Using TouchKit

TouchKit includes the software driver that lets your touch screen work with your computer. TouchKit currently supports touch screen drivers for many operating systems, including Windows 95 / 98 / ME / NT4 / 2000 / XP / XP Tablet PC Edition / Vista, Windows CE2.12 / 3.0 / .NET (4.0, 5.0, 6.0), DOS, Linux and iMac. You must be sure to install the touch screen software for your operating system.

For TouchKit software drivers, refer to [www.tvielectronics.com](http://www.tvielectronics.com) under TouchScreen Controllers Downloads.

For more information on installing and using the TouchKit software, refer to the



After the software is installed, restart your computer to load and activate the touch screen driver. To complete the setup of your touch monitor, make sure you calibrate the touch screen.

## Calibrating the Touch Screen

Calibration aligns the touch screen with the underlying video. Specifically, calibration defines the dimensions of the image area of the touch screen, determines the edges of the screen's image, and locates the center of the touch screen. You must calibrate the touch screen and test the calibration to ensure the successful operation of the touch screen.

For more information on calibration, refer to the or the User's Guide included inside of each zip file for every operating system.